

OCTOBER 1982 \$1.50

# Popular Mechanics

**IN COLOR**

**WHERE THE  
RUSSIANS ARE  
HEADING IN SPACE**

## **CARS: ALL THE AMERICAN '83s**

**Detroit Says Muscle...  
Flash... Convertibles!**



**1983 FORD  
MUSTANG**

**STEREO: PM Picks  
The 3 Best Systems**

**PLANS: Build Our Sturdy  
Workbench Designed  
For Your Garage**

**Low-Cost Space:  
How To Add  
An Enclosed Porch**

**INSIDE: 25 Ways to  
Fix Up Your Car**

**WOODWORKING**  
**Our Master Craftsman  
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**Complete Guide To Nails,  
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### On the cover

Ford's 1983 Mustang is one of the cars that Detroit hopes will lead a domestic recovery in the new model year. PM's color features on all the new models from Ford, GM, Chrysler and AMC begin on page 100.  
—PM photo by Dean Russell (Ford Motor Co.)

# Popular Mechanics

OCTOBER 1982

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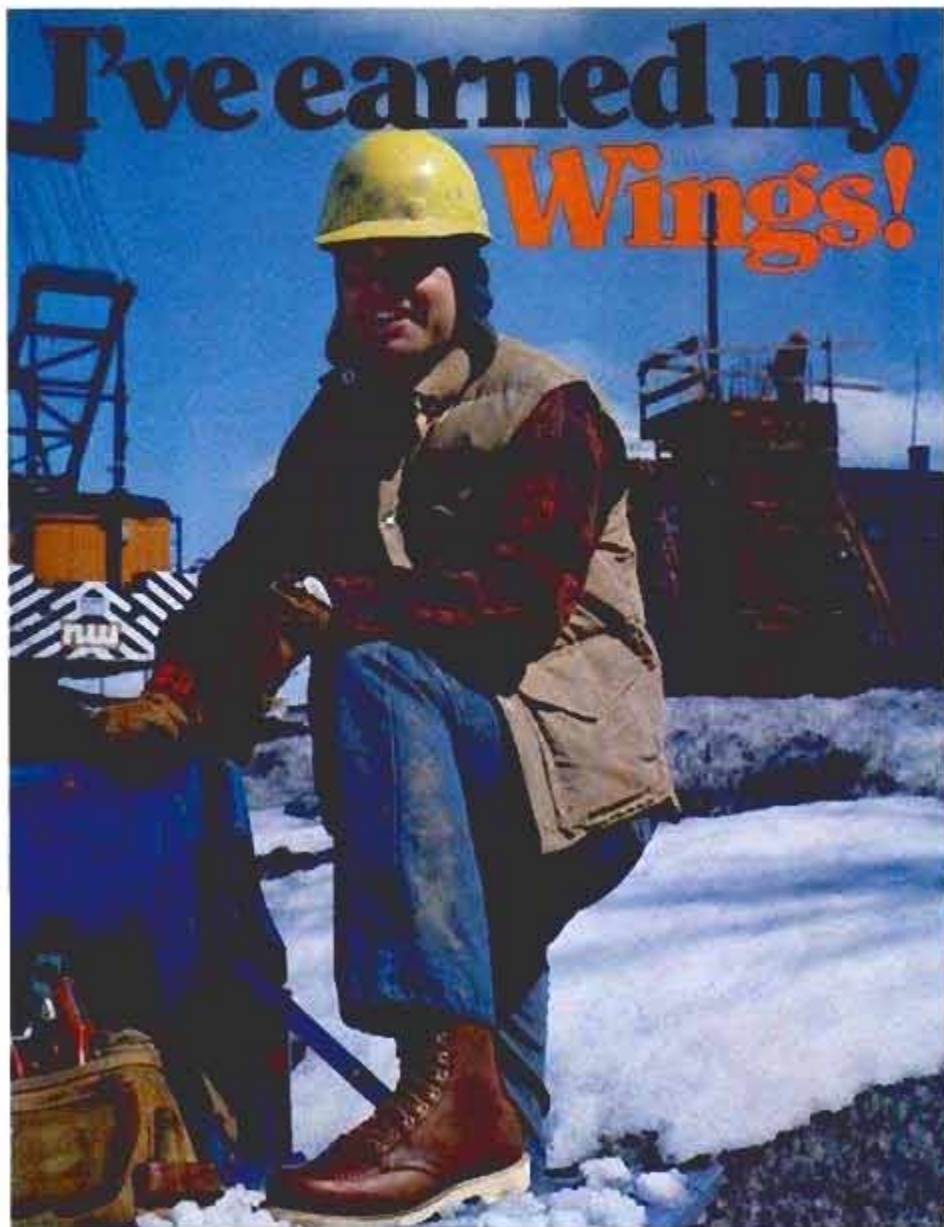
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# LETTERS TO THE EDITOR

## Well, they sure were tough, anyway

Robin Nelson's story on reactivating our World War II battleships (*The Born-Again Battlewagons*, page 73, June '82) was great reading. I served on the USS *Iowa* (BB 61) and believe that bringing back these mighty ships is, ton for ton and dollar for dollar, the best defense bargain that has come down the pike in a long, long time.

But you made one crucial error: The armor belt on these battlewagons is more than 17 inches thick, not the 12 inches that you stated.

ALVIN R. BROOKS, USN (RET.)  
SANTEE, CALIF.

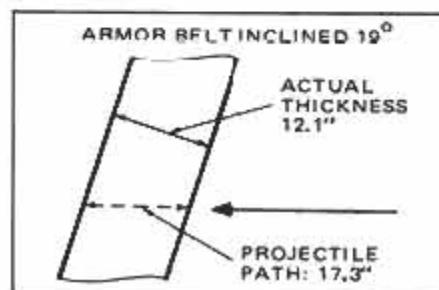
Your story was outstanding. It is well to remember that no U.S. battleship was ever sunk in war action and no aircraft carrier was sunk while being screened by battleships. Those great dreadnoughts were so invincible that shells would bounce off their 17-inch-thick armor (not the 12 inches you said) like tennis balls off a wall.

HENRY M. DUPREE, USN (RET.)  
SAN DIEGO, CALIF.

We got a barrage of mail on the armor question, much of it from readers who served on *Iowa*-class battle-

ships. *Actually, we didn't goof, but the Navy has an unusual way of calculating armor thickness. At the outset of the war, there was concern over the apparent lightness of 12-inch armor, so the word was put out that these battleships were protected by a 17-inch armor belt.*

*Here's how the Navy figured it: Although the armor belt actually was—and still is—only 12.1 inches thick, it was inclined at an angle of 19°, so*



*that a shell striking a hull broadside would have to pass through 17.3 inches of steel (see sketch). To this day, the Navy still insists that low-class ships have the "equivalency" of 17-inch armor. Whether this bit of mathematical subterfuge fooled the enemy isn't known, but it seems to have comforted our own seamen.*

## Rocket motorcycles?

Your article *PM Rides The World's Hottest Bikes* (page 61, July '82) covered six "rocket ships," not ordinary motorcycles. The average biker isn't going to own one of these expensive Japanese machines.

How about equal time for American, British and German bikes? Where was that good old favorite, Harley Davidson? It's interesting, however, to read about the latest in bike technology because I realize that the more advanced features of today may eventually be incorporated in the cycles that common folk will be riding tomorrow.

FRED HEWES  
KETTLE FALLS, WASH.

*Auto Editor Tony Assenza replies: Your last sentence says it as well as*

*we could—it's one reason we cover high-tech developments in many fields. Also, not all of the bikes we mentioned are expensive. You can buy some of them for \$3,000. The cheapest Harley goes for \$5,000.*

## Free 'stone' for fences

Your excellent article on rock walls (*Build A New England Stone Fence*, page 84, July '82) left out one important source of material: broken pieces of cement sidewalks and other paving that have been removed on remodeling jobs. These slabs are generally 4 to 5 inches thick and reasonably flat on the bottom, making them easy to stack.

We have a hillside lot with hundreds of feet of retaining walls built with this material. You can usually

get all you want free by asking local contractors or going to dumping sites.

VERNON L. LINN  
SUMAS, WASH.

## No five-dollar words

Bless you, Mort Schultz! I just finished trying to read my new \$18 Celebrity shop manual when I picked up the July '82 issue and found your Saturday Mechanic article *Troubleshooting GM's Computer Command Control* (page 49). I didn't need a college degree or have to wade through five-dollar words to understand the workings of CCC.

Your article tells me you've actually experienced what you write about. Please continue this kind of detailed, down-to-earth reporting.

W. B. DAVIS  
ST. ALBANS, W. VA.

## Double-duty toybox/bench

Thought you might like to see a picture (below) of the toybox/bench we built from your plans (*3 More Great Projects With A Scandinavian Flair*, page 122, May '81). We made it for our 5-year-old son, who finds it both useful and fun (as you can see).

STEVE HAWLEY  
NORTH LAND, FLA.



*PM's toybox/bench built by reader Hawley. A playful 5-year-old demonstrates ample storage space under lift-up seat.*

*Thanks for letting us know. For others who may be interested, photocopies of the article, which also includes plans for making a dictionary stand and multilevel table, are available for \$2.50 postpaid from Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.*

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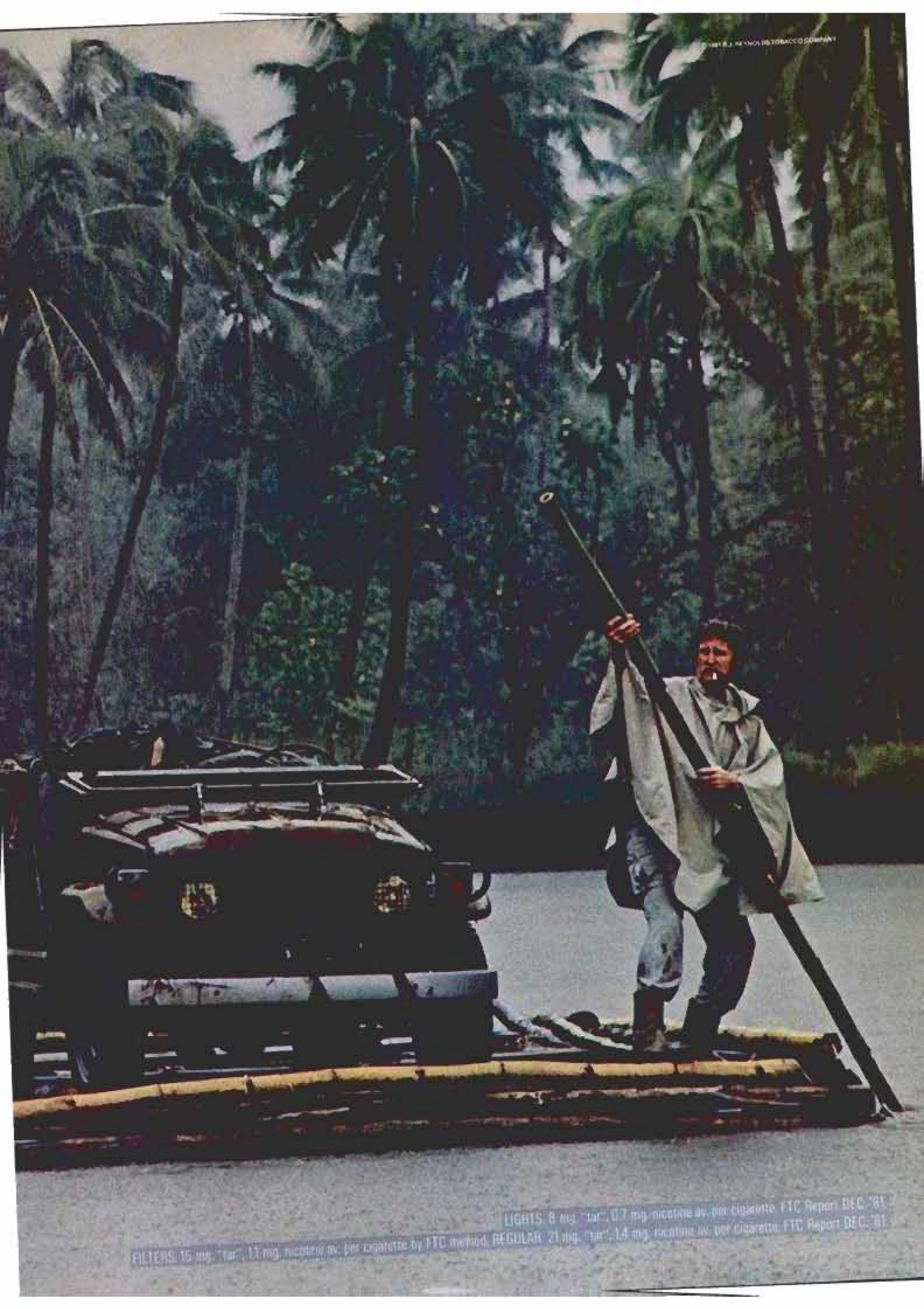
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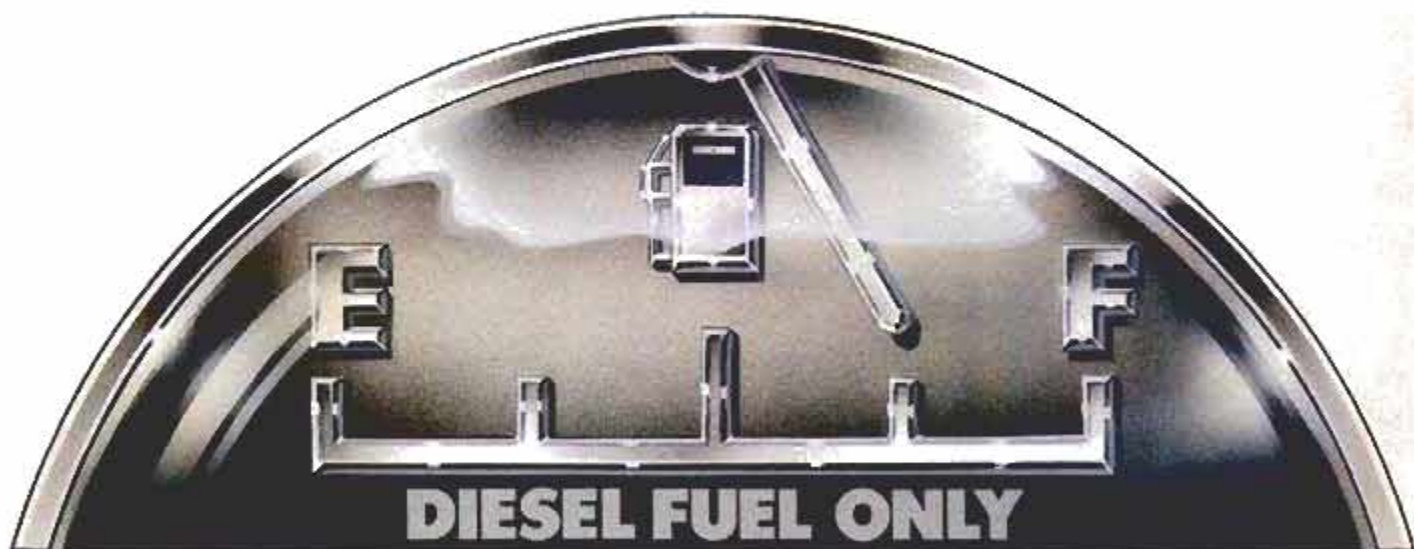
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G2500 diesel van	EST. HWY.	30	EPA EST. MPG	20
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4-wheel-drive diesel Jimmy	EST. HWY.*	27	EPA EST. MPG*	19
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Use estimated MPG for comparison. Your mileage may differ depending on speed, distance, weather. Actual highway mileage lower. Estimates lower in California. Some GMC trucks are equipped with engines produced by other GM divisions, subsidiaries, or affiliated companies worldwide. See your GMC truck dealer for details. \*GMC projections of 1983 mileage estimates. See your dealer for actual EPA estimates.



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# GMC

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## Motor racing in the sky



PHOTO: PHIL BERRY

*On his Pikes Peak run in the Audi Quattro, John Buffum set new Pro Rally record time.*

It's an uphill drag race, except all those switchbacks keep getting in the way. If you're driving, you'd better be good or you'll drop off the edge and find yourself skydiving, but without even a drag racer's parachute. In a hill climb, the cars run against the clock, so there's no way for the competition to bump you off the mountain, where you'd quickly accelerate at 32 feet per second squared. This year at Pikes Peak, the Colorado competition that's been on the motor-sports calendar since 1916, no one took the fast way down and a lot of new records were set. Undisputed king of the hill is Bill Brister who was the fastest ever up the 14,110-foot summit with an 11-minute, 44.82-second run in his Wells Coyote. The starting line, which is at the 9,000-foot mark, also saw John Buffum in the Audi Quattro grab gravel and hit the top in 12:50.52. That's a Pro Rally record. Another record run was made by Ralph Brunning, who set a 12:50.28 stock car

time in his Chevy Monza. Younger Unserers were running in the 60th Annual Pikes Peak Hill Climb on the mountain that has seen dozens of victories by Bobby Al and assorted forebears. In the Open Class, Al Jr. screamed up in 11:54.30, which makes him the fastest Unser ever up



*Fastest ever up Peak was Bill Brister.*

the Peak—no mean feat. Watching all these cars goin' against gravity and the clock may not compare to settin' on the edge of your seat for 500 miles of NASCAR drafting, but don't knock it—at least 'til you've been to the mountain.

## Sold before it's seen



*Mercedes sport coupe for '84 is our idea of the perfect size for modern touring car.*

It's got to be a really exciting car to be so anxiously awaited that buyers put down their deposits while the assembly line is still being set up. Right now, the wait is on for the Mustang convertible and new Corvette, for example. And we suspect that Mercedes buyers will be preordering the 1984 W201 coupe when they see it pictured here. The coupe (and a wagon) will probably follow by some months the four-door sedan

which goes on sale here next year (see "Mini Mercedes," *Imports & Motorsports*, page 14, July '82). We love the scale of this 175-in.-long jewel, especially compared to Mercedes' other coupe, the 380SEC S-class, which is just too huge for our definition of a sport coupe.

## Marshmallow memories

Since Peugeot is doing such a nice job supplying us with silky smooth French cars, we won't moan—too much—about not being able to get Citroens anymore. But, ah, those DS saloons with their front-wheel drive and self-leveling hydropneumatic suspensions; they opened our eyes to the dazzling world of cars 20 years



*Citroen BX hatchback: notch below CX.*

ago. Recently, we reported on the magnificent CX and the compact Visa (*The Cars We Can't Get Here*, page 112, Apr. '81). Now there's a smart new model that's sure to provide that dreamy, marshmallowy Citroen ride.



*BX is lightweight for its size through heavy use of light alloys and plastics.*

The BX only went into production last month, so we'll have to wait to see exactly how soft the ride is. Meanwhile, we'll just reminisce about driving that old friend's daddy's DS. **PM**



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# EDITOR'S NOTES

*John A. Littleton*

PM's favorite cover artist, Ed Valigursky, has a new place for painting. It's the handsome new double-deck porch (page 118) he recently added to his home in New Jersey. True to Popular Mechanics tradition, Ed did most of the carpentry himself—and, of course, finished the job by applying the stain and paint.

Now we have our own kind of cover artist: A man who paints paintings on a porch he painted himself.

What it all proves is that there's no limit to what we expect in the way of do-it-yourselfing around here.



Cover artist paints outside . . . and inside his porch.

When over half a million fans show up for any one aviation event, you can be sure Americans still love airplanes. It happened again at Oshkosh, Wis., this year—and PM was there. Like last year, we brought along almost 100 aviation-oriented friends of the magazine.

The event was the annual EAA (Experimental Aircraft Assn.) Fly-In. Some 12,000 planes were there: private craft, homebuilts, ultralights, warbirds.

We celebrated at a lunch featuring Dr. Igor Bensen as speaker. He's the inventor of the famed Bensen Gyrocopter and, more to the occasion, the "Airborne Octopus" that appeared on our September cover.

We did some flying, too, before and after the Oshkosh event. Shel Gallagher, special features editor, was in the air much of the Fly-In week getting pictures for our upcoming article on new homebuilts. I took off a week earlier at the Dayton Air Show in the back seat of a Navy Blue Angels jet. And Robin Nelson, technology editor, zoomed off in several instrument-laden craft to do this month's *Singles*. Anyone? (page 91).

We're producing one bunch of stories that, no matter how much you enjoy reading, we had more fun researching!

PM



At Dayton: Plane captain and onlookers (left to right) Shel Gallagher, PM staff; friend see me off in back seat of Blue Angels A-4 Skyhawk.



At Oshkosh: Dr. Igor Bensen (second from right) admires "his" September PM cover with me and onlookers (left to right) Shel Gallagher, PM staff; Gil Maurer, president, Hearst Magazines; Percy Wood, retired president, United Air Lines.



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MAG-40

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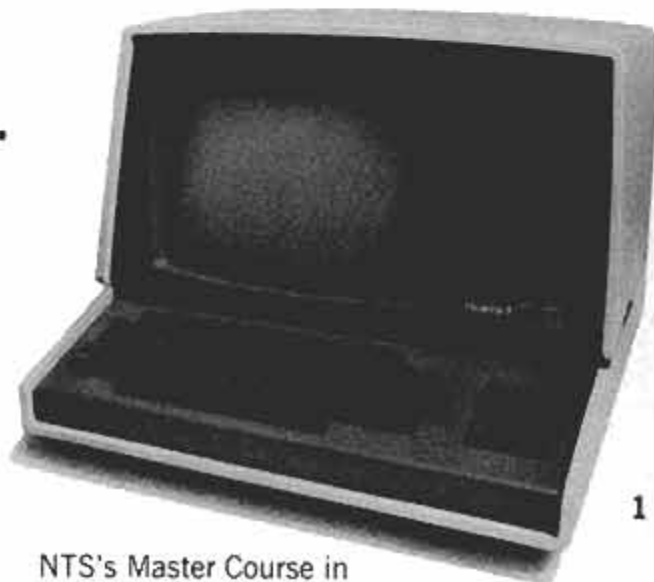
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For example, three microcomputer/microprocessor courses are available to the Electronics Beginner—Tech Writer—Analog Technician & Engineer. For your "hands-on" training, each course includes its associated microcomputer for you to assemble and keep. You will not only become acquainted with the fundamentals of troubleshooting, but also learn to communicate with a computer using

high-level BASIC programming language and Disc Operating Systems (DOS) software.

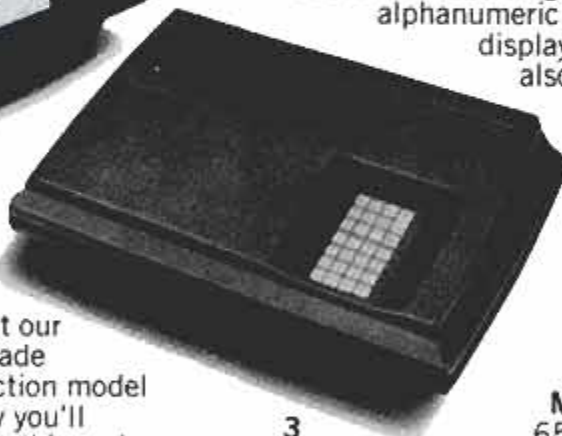
It's also important to note that our microcomputers are not home-made training devices. They are production model micro-systems, identical to many you'll encounter in the field. We believe this makes your training a lot more exciting and relevant.



NTS's Master Course in Microcomputers includes the **NTS/HEATH HN89A Microcomputer (#1 above)**. It features floppy disc storage, "smart" video terminal, two Z80 microprocessors, 32K RAM memory expandable to 64K. Choice of HDOS or CPM operating system.



The **NTS/Rockwell AIM 65 Dedicated Microcomputer (#2)** is included in our Microcomputer Technology Course. It is a single board unit featuring an on-board 20 column alphanumeric printer with 20-character display. This 6502-based unit also has 4K RAM memory, (expandable,) 8K monitor ROM and 8K advanced BASIC interpreter on ROM. Application Functions: Central Processor—Controller/Monitor—Development System.



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# PM LOOKS AT A KEROSENE HEATER



Unit is compact and smart-looking in simulated wood grain. Controls are at the front.

**B**ecause a quality kerosene heater gives good heating value per fuel dollar, more and more people are turning to them these days. The Toyokuni heater shown is a deluxe version with battery-powered electric starter, removable fuel tank (a feature I like a lot) and an automatic extinguishing device. Performance

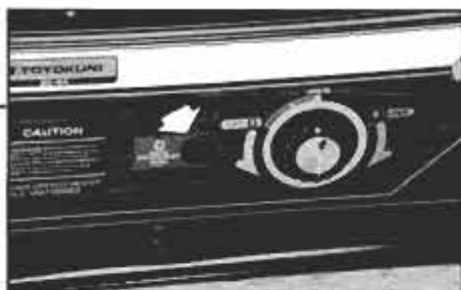


One-gallon fuel tank is removable. Thus, refueling can be done safely out-of-doors.

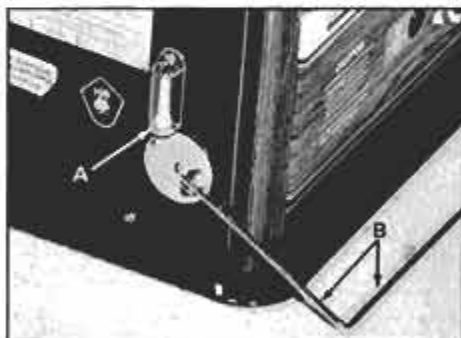
has been first rate and safety is excellent because I observe all safety rules outlined in the manufacturer's instructions.—H.W.

#### SPECIFICATIONS—HEATER

Model: Toyokuni 80-EA	B.T.U./hour: 9,800
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Heater features an automatic extinguisher (arrow); you simply push the button and the flame is put out immediately.



Plumb bob (A) must be aligned in circle for maximum flame efficiency. The outrigger at front (B) prevents the unit from being tipped over to the front.

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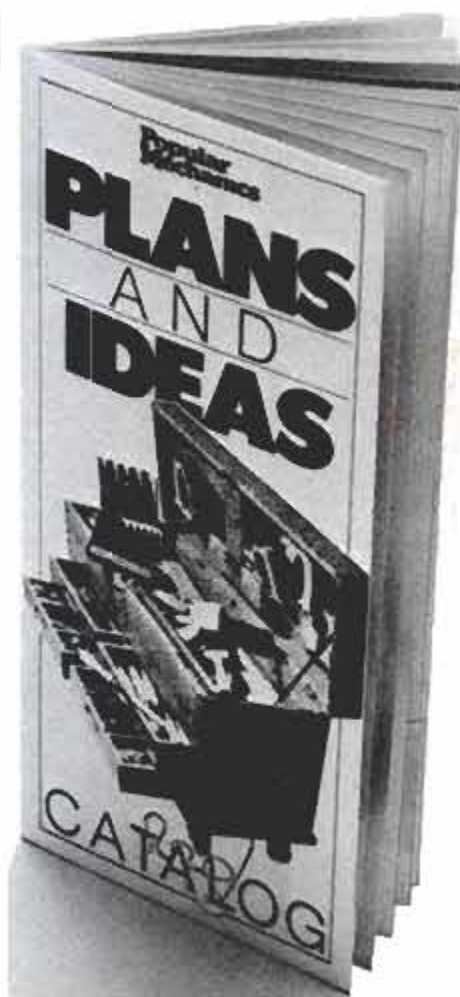
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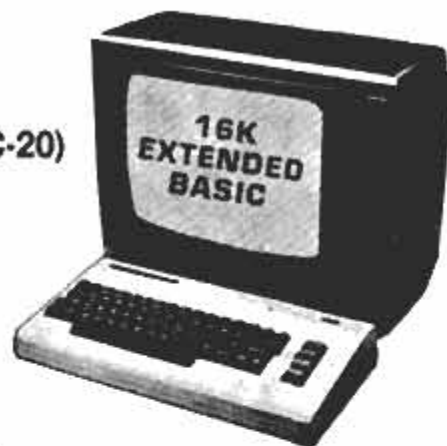
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## Mighty macho memories

If you're a car fanatic, you talk about horsepower. If you're into computers, the buzzword is K-power, as in "He's got 128K." This means the fellow's computer has about 128,000 bits of RAM memory. Note the slang: "He has . . ." not "His computer has."

Having a lot of RAM memory in the personal computing subculture is like walking into a bar with Miss Universe on your arm. People who would never once have considered inviting you to join them suddenly think you're a great guy.

Just about every personal computer has additional plug-in memory. This added memory can go far beyond what the computer was designed to use. There are many computers that were bought with 4K of memory and are now fleshed out with 256K of bulging brainpower.

It all seemed pretty confusing. Just why were people using all this additional computer memory?

We called Saturn Systems, Box

8050, Ann Arbor, Mich. 48107, makers of big-memory attachments for the Apple II. They shipped us a 128K card (\$599) for review.

We plugged it into our 48K Apple II and, suddenly, we were among the 176K elite. After we'd called everyone we knew in the subculture to tell them, we settled in with the manual to find out what was so great about a big-headed computer.

First, we set up their Pseudodisk program. A regular floppy disc machine stores about 120,000 bits of information on a disc. If you have a program stored on disc, your computer reads it. This can take a few seconds. Or, if your computer is searching a very long file on disc for some data (such as a name and address), the search can take up to 20 seconds or so.

Pseudodisk sets up the RAM memory card so your computer thinks the memory is a floppy disc. You move your files from the mechanically ac-

cessed floppy disc into the expansion memory.

Once the information is in memory, the time savings become apparent. No more waiting for the disc head to seek the right track—just *pow*—the data is at your fingertips.

Of course, like all RAM memory, a quick power outage can leave your computer with amnesia. So it's a wise move to back up any information you'll need on a real drive.

Other utility programs from Saturn allow you to use their card with the popular Visicalc program (which functions as a super calculation aid) on very large projects. You can use the additional memory in your own long programs, as well.

This card also speeded up word processing. In a long document, there was no need to wait for a disc to get from beginning to end. But, again, you must back up to a real disc.

The design of these cards is tricky. Computers like the Apple are designed with a 64K limit. Saturn and others get around this by something called bank selecting. The computer only sees 64K of memory at a time. Software helps it to jump from one 64K area to another.

We found the additional memory to be one of the most useful additions to a personal computer. Besides, I like to think the pretty secretaries in the office are whispering about me; "I hear he's got 176K of RAM."

## Watch wrists

Seiko has announced a wrist TV. A tiny liquid-crystal screen straps around your wrist. Headphones plug into the power supply which you carry in pocket or purse or slung off your belt.

Resolution is said to be 31,950 picture elements. And the picture is supposed to hold up in sunlight.

But we can't help wondering at the utility of it all. Can you imagine staring at your wrist for a two-hour *Dallas* special? We're not entirely sure the human body is designed to accept this new device.

So the next time you see a fellow staring at his watch, he may really be watching *60 Minutes*. **PM**



## Titling trick

When the credits or title of a movie or TV show scroll by, it can involve some expensive special effects. But you can achieve a similar effect in your own video or even celluloid films. The video camera shown above is mounted on a tripod and faces a list of written words or artwork on the wall. Just lower the camera gently with the tripod crank to scroll away.

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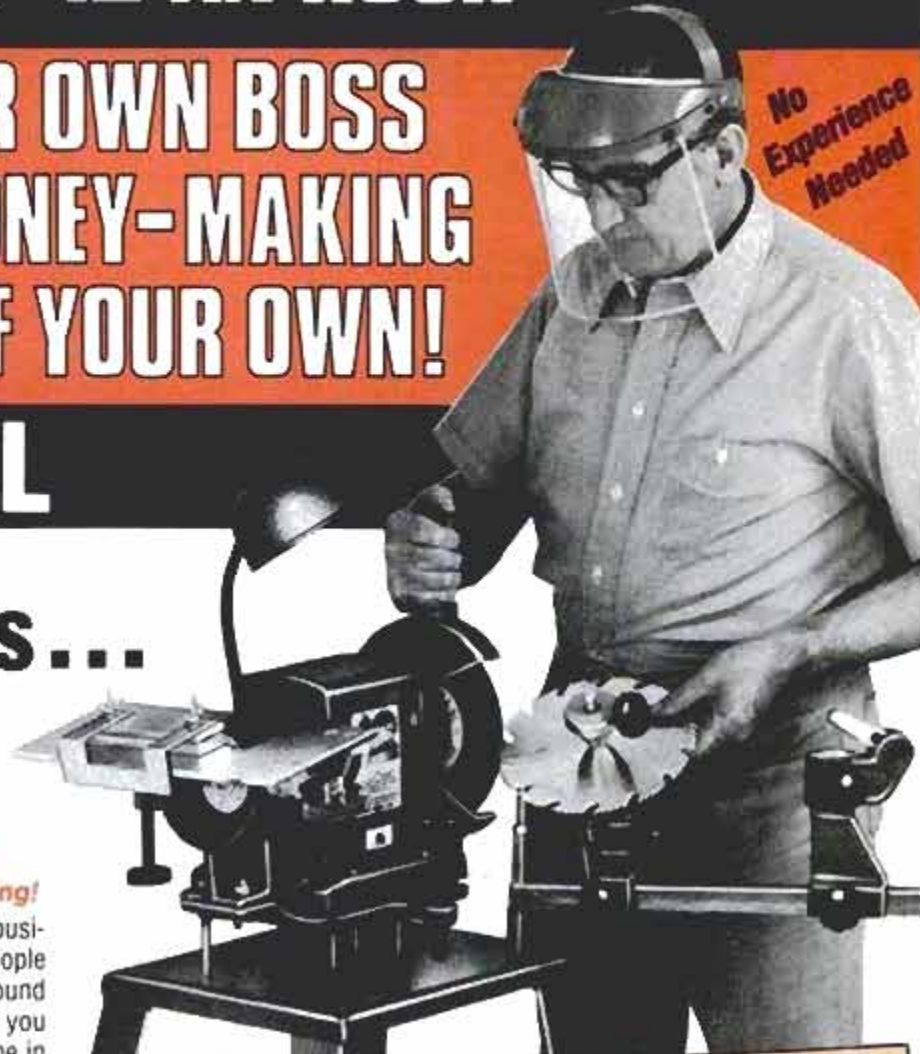
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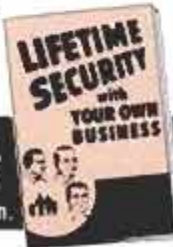
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DETROIT  
LISTENING POST

## GM product confusion

If you're a regular reader and a little confused about what's going on at GM, you're not alone. Given all the strange, sometimes conflicting rumors bouncing about in Detroit, I'm beginning to think that no one, from the corporate management on down, really *knows* for sure what's coming when.

Example: Because of fairly stable gas prices and the resulting resurgence in big-car demand, Cadillac Div. wants to keep its current full-size deVille (C-car) around at least through '85, despite the fact that Buick Div. and Olds Div. will be getting all-new, downsized fwd C-cars for '84.

Example: For the same reason, Chevy wants to keep its rear-drive B-car (Impala/Caprice) for a year or two after Buick and Olds versions are replaced by the smaller fwd B-cars. (Pontiac has already dropped its B-cars for '82.)

Example: Chevrolet also is lobbying for a one-year exclusive on the all-new fwd N-body, which is scheduled to replace the current G-car personal

coupes (Monte Carlo, Grand Prix, Cutlass Supreme, Regal) for '85. This would mean that Pontiac, Olds and Buick would have to wait until model year 1986 for their own N-car versions.

Actually all of the Detroit Big Three are increasingly nervous about downsizing and/or discontinuing their traditional rear-drive intermediate and large cars—the same models they can hardly *give away* every time there's a panic, artificial or otherwise, in the fuel situation.

The fact that sales of such cars are on the rise once again demonstrates *again* the fickleness (and short memory) of the American car-buying public—and the extreme difficulty of planning what will go into the product lineups three and four years in advance.

Some have felt GM has acted hastily in planning to convert virtually everything it builds, except the sporty Camaro/Firebird and Corvette, to fwd by mid-decade. Now the corporation itself obviously is having second and third thoughts.

## Japanese Chevettes?

Another area of seeming confusion at General Motors has been what to do in the subcompact class below the new fwd J-cars. So far, the technically ancient rear-drive T-cars (Chevy Chevette/Pontiac 1000) have held their own reasonably well in a market segment overflowing with high-tech fwd machinery from home and abroad—mostly because they're simple, reliable and (above all) cheap to buy and run.

But it's been widely reported that a new fwd subcompact imported from GM's Japanese partner Isuzu will replace the venerable T-cars in mid-'84. *Not true.* GM has indeed contracted for delivery of some 100,000 '84-model Isuzu minis—slightly smaller than the current Ts with engines in the 1.3 to 1.5-liter range—beginning a year from next April, and another 200,000 '85s. But these are intended to *supplement* the supply of home-built subcompacts, not replace them.

GM also plans to import "well under 100,000" cars a year from motorcycle and micro-minicar builder Suzuki for '85 and beyond. These little commuters will weigh only about 1,400 pounds and be powered by an 800-cc, three-cylinder engine.

Further confusing the issue are continuing talks between GM and No. 1 Japanese carmaker Toyota. If these discussions come to anything, it will probably be a Toyota-designed subcompact built in a now-idle U.S. plant beginning in 1985 or '86. This car presumably will be shared by both companies in the U.S. market, and GM's version of it could well be the long-awaited T-car replacement.

Naturally the Isuzu and Suzuki deals aren't going down well with the hard-pressed UAW folks, who understandably believe that the U.S. industry's new products should be built here, not imported.

But GM insists these are only stop-gap measures intended to keep its dealers viable in the econocar market until cost-competitive new domestic products can be produced—just as the Isuzu-built Chevy LUV filled GM's minitruck gap until the new S-trucks could be put into place. The compa-

(Please turn to page 26)

## Road blocks



Bud Moore (left) and Len Wood, who field a Thunderbird in the National Assn. for Stock Car Auto Racing (NASCAR), take possession of the first newly minted 351-cu.-in. Cleveland engine block. Long out of production, the legendary Cleveland has been born again by Ford SVO (Special Vehicle Operations) and will be available to any racer with \$1,195. Time to come out of the closet, Chevy?



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## DETROIT LISTENING POST

(Continued from page 24)

ny's engineering staff has all sorts of baby-car prototypes running around right now but says that none of them could yet be produced in America inexpensively enough to compete with the Japanese imports.

### '83½ Corvette

One thing certain at GM is the excitement being generated by pending introduction of the all-new Corvette

(see artist's rendering in *GM Pulls Into The Fast Lane*, page 81, Aug. '82) now tentatively set for next March. We've talked about it before but promised to keep you current as new details come to light.

According to Chevrolet, skidpad tests on the planned optional Goodyear 255VR16 "unidirectional" tires, which have specific tread patterns for each side of the car, have recorded cornering forces as high as .95 Gs! That compares to about .83 Gs for the current state-of-the-art Camaro Z-28 and Firebird Trans Am and would

easily make the new Corvette the fastest-cornering production car in the world!

Standard treads will be Goodyear Eagle GTs mounted on aerodynamic, flat-centered, cast-aluminum wheels. Suspension is independent all around with fiberglass transverse-leaf springs front and rear and a new five-link rear configuration. Wheelbase is 96 inches, and weight is kept to about 3,000 pounds with extensive use of aluminum, especially in suspension and four-wheel disc-brake components.



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### Ford future electronics

Ford claims world leadership in automotive electronics, and seeing what the company's microchip manipulators have come up with for '83 (see "Saturday Mechanic Looks At The '83 Fords," page 162) and what's up their sleeves for future years, that's a tough claim to dispute.

Look for electronic chassis controls—to automatically adjust ride, handling, trim height and load capacity—as early as next year on some cars. Also electronically controlled transmissions (a feature already on the '83 Renault/AMC Alliance) by '85.

But the real Buck Rogers stuff comes in the '85-'90 time frame, depending on when it's ready and when Ford's marketing mavens think we're ready for it:

How about a car that listens and reacts to voice commands such as "turn off the lights," "turn on the wipers," or "raise the antenna"? They already have a test Continental rigged to do these things, and we've seen it work.

How about a car that responds to a hand-held transmitter (like a TV-set remote-control) to let you lock or unlock the doors, open the trunk, flash the lights, blow the horn or set off an alarm from inside your home or office or across a parking lot? You could even use it to locate the car when you've forgotten where you left it. The current prototype system works fine but is limited to about 200 feet in range. A refined version could be available in two years.

And how about a satellite navigation system that can pinpoint your car to within 1,000 feet anywhere in North America and display its location on a little TV screen on the upper console? Preprogrammed electronic maps would be used to guide you to any location. The screen also displays the status of remote-located entertainment and heater/AC systems and has touch controls to change or tune them. You have to see it to believe it!

PM

9-14-82

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swan neck and finial, waist and dial face doors, dial frame and sculptured basefront are pre-assembled. Complete instructions, all screws and hardware included. Glass is not included due to possible breakage in shipment. Each piece may be reordered separately.

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# ALL OUTDOORS



## Testing the testers

Though it is always a good idea, it's not always possible to try out personally every product you buy. When the dealer lets you steer a boat around the harbor, you get a quick idea if it will run, but that still doesn't show for sure if it will be fun and worth the money. That's why PM editors prepare detailed test reports: so you can get an evaluation of what expert drivers and crew have found.

Some measurements are personal

and as time-tested as day cruising in an antique-type runabout or a big sailing ketch. Included in PM's fleet were a handsome Grand Craft Speedboat reproduction of a 1931 Chris-Craft, a Pearson 365 sloop, Silverton 34 cabin cruiser, Formosa 51 ketch, a Mako 25 with twin Evinrudes, a Yar-Craft runabout using Johnson outboards, OMC sterndrives on a 4 Winns runabout, Grumman 5-Meter with Suzuki outboard, plus Bic sail-

## Sailboarding ashore

Boardsailors can bring their sails and skills onto a flat beach or parking lot with the \$700 Landsailer, imported



*Dry-land sailing using the rig from a sailboard is possible with a Landsailer.*



*Testers found the Grand Craft Speedboat replica a pleasure to ride and drive.*



*Mako fishing utility (foreground) and Formosa ketch gave power/sail tests.*



*For getting the feel of sailboarding, Bic boardsail simulators give a head start.*



*With Jet Ski instruction given first ashore and then afloat, the sport proved easy.*

from England by Windsurfing International, 1955 West 190th St., Torrance, Calif. Speeds up to 50 mph have been reported, using the sail and rig from a standard sailboard.

## High power—high price

A flashlight that may be the world's strongest and most expensive is made by Streamlight Inc., 1030 West Germantown Pike, Norristown, Pa. It's about \$475, and operates off a 12-



*Beam of Streamlight/1 Million is said to almost blind intruders at 500 yards.*

and subjective, but are also factors that determine if the product is worth the price. So every so often, we like to turn users into testers to see how they feel about various craft.

Recently in Detroit, at the noted Grosse Pointe Yacht Club, we got several hundred friends together to try out some of the latest in power and sail. We wanted to see how both beginners and experienced boating people would enjoy activities as varied as new surf-sailing and jet-skiing,

boards, Kawasaki Jet Skis, Surf Jets and Wetbikes.

What our enthusiastic, life-jacketed test team showed was that power and sail pleasure boating are equally popular, when available; good instruction is the key to getting well started at board sailing and jet-skiing; larger craft are worth their size on a blustery day; comfortable accommodations have more appeal than all-out speed; and boating can be among the most satisfying of pastimes.

volt car or boat battery or a \$150 rechargeable pack. But the Streamlight/1 Million is said to light a newspaper for reading seven miles away. **PM**

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To find out more, see your local Armed Forces recruiter or write Armed Forces Opportunities, P.O. Box C 1776, Huntington Station, N.Y. 11746.

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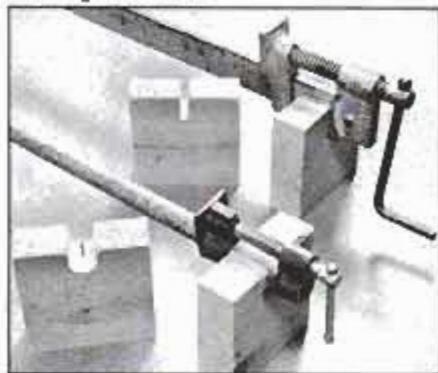


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## HINTS FROM READERS

### Clamp holders



These holders, cut from a 2x6, can support bar or pipe clamps so your hands are free to glue and arrange parts. The holders allow the clamp handle to be turned freely as you tighten the clamp. The holders are made of 1½ x 4½ x 4½-in. stock. To make one, cut a slot slightly larger than the clamp bar or pipe into one edge. If you're using the blocks with pipe clamps, hammer a 2-in. finishing nail so it projects ½ in. from the rounded slot, as shown. Then bore a small hole in the pipe clamp to receive the nail. The hole in the clamp goes over the nail to keep the clamp from rolling.—Robert J. Gurrero

### Restore a carrying case



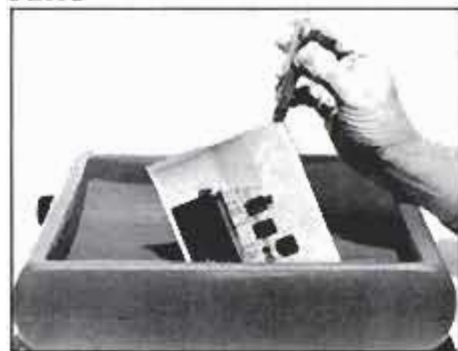
For a quick way to repair scuffed areas on a typewriter or similar case, follow these three simple steps: First, spread white (wood) glue over the scuffed spots and under the edges of any loose covering material; smooth the glue with a spatula or similar flat tool. Let the glue stand overnight; then sand smooth any high spots. Second, color the glue-sealed areas with a felt-tipped marker of the appropriate color. Third, apply shoe polish of the same color to the entire surface and buff if needed. Use a flexible adhesive if the repaired area is likely to be flexed.

—Walter E. Burton



# PM PHOTO HINTS

## Jaws



Plastic tongs are great, but what can you use as a backup when they break? I found a wooden clothespin, the kind with a spring, holds wet prints securely.—*Robert Hertzberg*

## Borderless prints



To make borderless prints on an enlarger's easel, adjust the hold-down guides to fit snugly around print paper, without overlapping edges. From under each corner, attach a strip of masking tape, sticky side up, to hold the paper fast.—*Louis Hochman*

## Temperature tamer



Keep solutions at the right temperature with hot water or ice cubes in a plastic bag that's closed tightly with a rubber band. It's quick and contamination-free.—*Robert Hertzberg*

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# How To Pick The Right Fastener For The Job



The small sampling of fasteners and accessories above shows just a few of the items that can be used to join objects together.

PM offers tips on the many varieties of not-so-common nails, as well as a host of other fasteners.

by William Beyer  
and David A. Warren

Whether it's reshingling a roof, fastening a plate-glass mirror to a wall or hanging a lightweight kitchen utensil to the range hood, we're confronted with problems of fastening items in place on a daily basis. Knowing what fasteners are available, from the modern hook-and-loop products to the centuries-old common nail, will help in selecting the best fastener for a specific job.

The nail, for example, is not so common anymore. It has become specialized, with a different type for every conceivable use (see *Types of Nails And Their Uses*, right).

Nail points are shaped to suit spe-

## TYPES OF NAILS AND THEIR USES

**Common nail:** general purpose nail; used for construction and carpentry.

**Box nail:** lighter than the common nail; joins a thin piece of wood to a thick one, as in box construction.

**Duplex head nail:** temporary holder; it's driven the depth of lower head, leaving upper head projecting for removal.

**Concrete nail:** hardened shaft; fastens furring strips and sole plates to concrete.

**Roofing nail:** large, roundhead, galvanized nail; holds roofing materials. Some have a lead or rubber washer for a watertight seal on metal roofing material.

**Finishing nail:** slim head that can be set and filled over; used for cabinetmaking and holding house trim in place.

**Casing nail:** looks like a finishing nail, but with a slim, tapered head. Used on casing around doors where holding strength and invisibility are needed.

**Cut flooring nail:** long, thin, rectangular nail; used to blind-nail flooring through edges without splitting.

**Spiral nail:** for tight flooring joints. Tends to turn like a screw when driven; more commonly used than cut nail.

**Siding nail:** aluminum, to prevent rusting; available in colors to match siding.

**Paneling nail:** hard, thin and ribbed; colored to match paneling shades.

**Capped nail:** spiral-shank nail with a metal or plastic cap about 1 in. square; used for applying insulation sheathing to a new home before siding.

**Common brad:** small, wire nails of uniform thickness with a small head; used to nail parquet flooring, and attach moldings to furniture. It's usually sunk and filled.

**Barbed dowel pin:** looks like a headless nail, but with a barbed shank; used as a pivot, to align parts and to join things to be separated later.

**Upholstery nail:** large, decorative, umbrella-shaped head; used to attach upholstery fabrics where nails will show.

**Tack:** used to hold carpeting or upholstery fabrics in out-of-view places.

**Staple:** U-shaped nail; used to hold wire or screening. Some have insulated shoulders for holding electrical wiring.

**Steel corrugated nail:** often called a "wiggler" nail; used by furniture makers to strengthen a glued joint made by two edge-joined surfaces in the same plane.

**Skotch connector:** wasp-shaped bar with four pointed nails on either side of the bar which straddles a joint.



The lag screw (left) is used in heavy construction. It and the two adjacent screws are wood screws. The remaining two screws with coarser threads are intended for use in metal.



Heads of these screws are (from left): cross-slotted Phillips, oval, round, flat and panhead. Oval heads are partially countersunk into a surface; flatheads are driven flush (fully countersunk).



Three common nuts used with bolts are (from the left): locknut, wingnut and hexnut. The locknut, which is similar to the hexnut in its hexagonal shape, has a nylon insert which locks onto the threads of a bolt. The wingnut is used in situations where a nut must be loosened and tightened frequently by hand. Both the hexnut and locknut must be wrench-tightened.



Three common washers used with nuts are (from the left): flat washer, internal-tooth lock washer and split lock washer. A flat washer tends to turn as the nut is turned, aiding loosening or tightening. The internal-tooth lock washer is often used with a wingnut to keep it tight. The split washer presses against the metal which also serves to hold a nut tight.



The three most common bolts you'll find in hardware stores are (bottom to top): the machine screw, available in smaller sizes; the carriage bolt, which has a square shoulder under its head; and the hexbolt, which is found in larger sizes.

#### TYPES OF SCREW HEADS AND THEIR USES

- Flat:** a popular type; head can be countersunk and hole filled with wood putty to conceal head.
- Oval:** can be countersunk, but is generally left with rounded top surface showing.
- Round:** commonly used; left fully exposed as a decorative element.
- Fillister:** shaped like stacked checkers so that it can be countersunk easily.
- Pan:** looks like an upside-down frying pan, narrower at the top and flat on top and bottom.
- Truss:** thin, wide head.
- Headless screw:** has a slot cut into the shank; can be countersunk easily.
- Lenil:** cylindrical head.
- Blind:** round on top with slightly tapered sides.
- Hex (six-sided) and square:** found on lag screws; turned with a wrench.
- Dowel screw:** no head; has a point and screw threads on both ends.

cific jobs. Point types are: needle, diamond, chisel, blunt and cut. The last is used for masonry. A sharp point facilitates penetration. However, the duller the point the less chance you have of splitting the material. This is because a blunt nail cuts down through the material (wood fibers) instead of wedging its way through. That's why blunt-pointed nails are used for flooring

and wood shingles. However, blunt nails have less holding power than sharp ones.

A nail's holding power also varies with the amount of surface area in contact with the wood. A square-shank nail, for example, will hold better than a round one because it has more outside area. Grooved, spiraled and barbed nail shanks are designed for greater holding power,

too. Shanks can also be etched or coated to increase holding power.

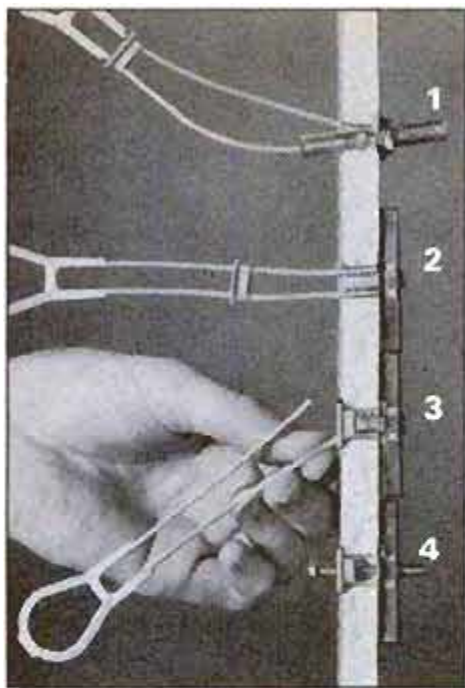
Powered nail drivers are becoming commonplace, especially when there is a need to drive a number of nails into concrete. The tool utilizes a shell, loaded with gunpowder, and it "shoots" a casehardened nail into the concrete.

Staples can also be driven in rapid succession. Some hand staplers used in upholstery, for example, are spring-loaded to drive a staple when the spring is released. The hammer staplers used in roofing drive a single staple with each blow. For homeowners, there are hand- and electric-powered staplers to choose from.

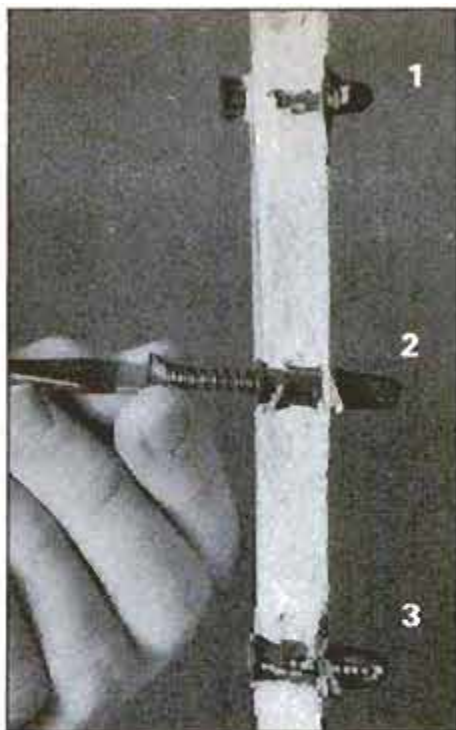
Rivets are helpful fasteners for joining sheet-metal parts, such as radiator-cover sections. Rivet tools for odd jobs are available with special rivets that can be applied entirely from one side. These rivets come in sizes up to 1/4-in. dia. and 3/8-in. grip range (thickness of materials being joined). You must predrill a hole for the rivet before installing it.

All screws are either wood screws or sheet-metal screws. Some of the materials used to make screws include steel, brass, stainless steel and aluminum.

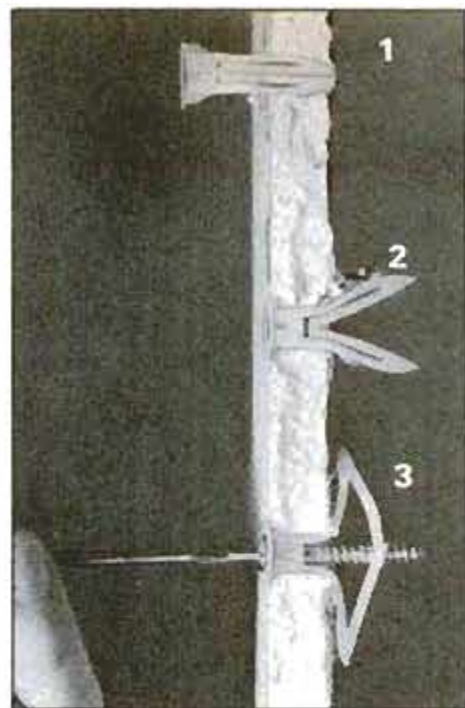
Screw heads are either single-slotted and tightened by conventional screwdrivers, or cross-slotted and



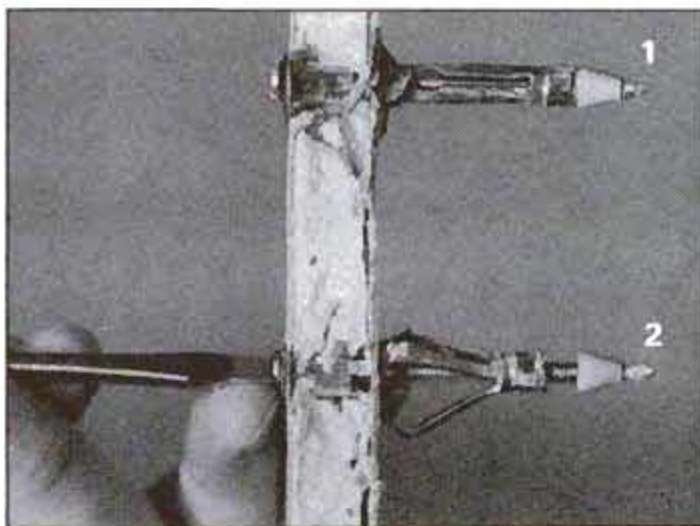
This metal U-channel system from Mechanical Plastics holds heavy items. Push the channel through a bored hole (1) and pull back to position. Slide the washer-sleeve along a ratched strip (2). When sleeve is in the hole, snap off strip at the sleeve (3). Finally, install the fastener (4).



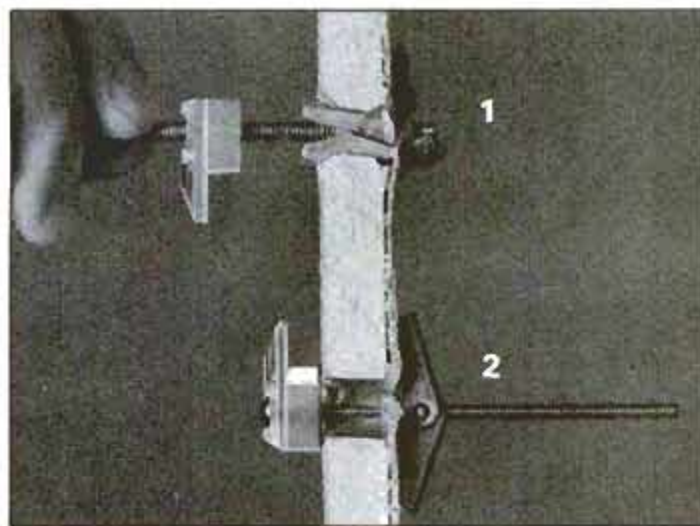
Plastic wall anchors work effectively in plasterboard and paneling. Bore a hole and tap in the anchor (1). Turn a screw into the anchor (2). The screw forces the anchor to expand, ensuring a tight fit (3).



The Toggler, manufactured by Mechanical Plastics, folds to pass through a hole bored in plasterboard (1). An accompanying pin poked through the hole forces the fastener to expand (2). It will hold a screw and other item firmly in place (3).



Expansion bolts are commonly used to anchor heavy items to hollow walls. The ones shown from Stanley Hardware are driven into the wall with a hammer (1). To use other types, you must bore a hole first. As the bolt is turned, the slotted shield (legs) expands (2) and presses against the back of the wall.



The sprung-wing toggle bolt is another fastener that holds heavy items to hollow walls. Remember to attach the item you are mounting before you put the toggle into the wall (1). Once inside the wall, the wings spring open (2). There's no way to remove the bolt without losing the toggle inside the wall.

tightened by Phillips screwdrivers to permit maximum driving pressure. Thumbscrews, on the other hand, have enlarged, flattened heads; you can turn them between your thumb and forefinger.

### Nuts and bolts

Nuts, bolts and washers are generally used for fastening metal parts together. Machine screws or bolts, as they are called, fall into this category, along with carriage and stove bolts.

Carriage bolts have large, rounded heads and square shoulders un-

derneath. The shoulder fits a square hole and keeps the bolt from turning as the nut is drawn up. Stove bolts are made with slotted heads, either round, flat or oval.

Nuts come in two basic shapes, hexagonal and square. A cap nut, covering the end of a bolt and used in situations where the end is visible, is a variation on the hexagonal shape. Two nuts with exceptional shapes are the wingnut, which has two flat protrusions for hand-turning, and the knurled nut, which is cylindrical and knurled for tight gripping.

Another nut, the castle nut, has

one end which looks like a castle rampart. It's used with a cotter pin which locks it onto a drilled bolt. A locknut has a nylon gripper fitted into one end through which the bolt passes.

Washers serve several purposes. A flat washer eases tightening and lock washers add an extra measure of holding power.

There are three types of lock washers: a spring-lock split washer, which resembles one turn of a spiral; an internal-tooth washer, which has teeth around the inside of the hole; and the external-tooth washer. This



Hang Stanley's hardware cabinet on a wall or place it on a table. The cabinet holds packs of Stanley fasteners sold individually in hardware stores. Each pack is held securely, yet glides out easily.

last type is best because the teeth are farther from the bolt shank and can withstand greater torque.

### Wall and ceiling fasteners

Anchors and toggles help screws and bolts hold things to walls and ceilings. Wall anchors are plastic, fiber, nylon, lead or zinc. As a lag-screw is turned into the anchor, it expands and presses against the hole bored in the wall. Lead and zinc are generally used in masonry walls. Plastic anchors are good, general-purpose wall anchors for paneling and plasterboard.

If the object to be attached is heavy, use a toggle system. Traditional toggle bolts have metal

sprung wings that thread onto the bolt. The wings fold to pass through the bored hole and into the hollow of the wall. There they spring open and press against the back side of the wall as the screw is tightened.

An expansion bolt, often called a Molly (Bostik's trade name), is another type of wall anchor. As the bolt is turned, an outer metal cylinder expands in the hollow of the wall to grip the wallboard. These bolts are designed for specific wallboard thicknesses. There are two kinds of expansion bolts. One requires that you bore a hole through the wallboard; the other has a sharp pointed tip that you drive into the wall.

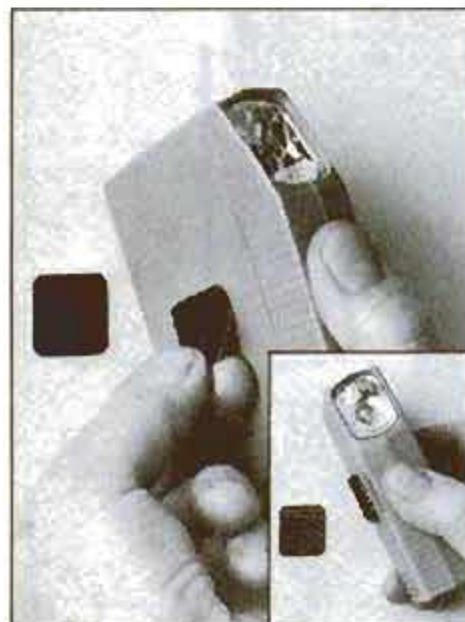
Hooks, screw eyes and hanger bolts form still another category.

Hanger bolts, which have screw threads at one end and bolt threads at the other, can be completely or partially concealed. When used on ceilings, hooks and eyes must be threaded into a joist or toggle system. Plasterboard alone isn't strong enough to hold much weight.

### Other fastening systems

Hook-and-loop materials are among the easiest fasteners to use. You can purchase adhesive-backed squares and strips of the materials at hardware stores under the brand name Velcro. There are two parts to the fastener: a material of tiny loops and one of microscopic hooks. When touched together, the hooks snag into the loops.

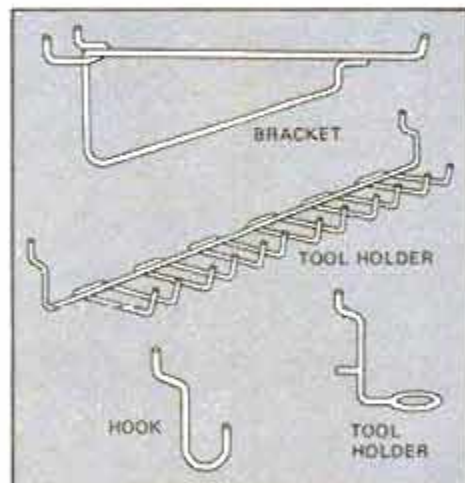
You could easily spend a small fortune in fasteners. However, here's a helpful rule you can apply when buying an assortment of wood screws: Multiply the screw number by  $\frac{1}{4}$  to find a useful length of that size. (The screw number refers to diameter.) For example, a common length of a No. 2 screw is  $\frac{1}{2}$  in. ( $2 \times \frac{1}{4} = \frac{1}{2}$ ). Following this rule, you'll get an assortment of convenient-length screws of different diameters. **PM**



Adhesive-backed Velcro squares are used to fasten light items, such as a flashlight, within easy reach. Apply the hooked Velcro to the wall, the looped material to the item. Press the two together (inset) and the object remains in place until you need it.



A Velcro strap is an ideal way to hang an often-used extension cord or other small objects. The strap tab is adhesive-backed. For heavier items, the tab has a hole for a nail, screw or other fastener.



This system of metal holders and perforated board helps organize a work area (left). Holders can be removed and repositioned quickly as needed. We nailed 1x2 wood strips between the board and wall to provide space for inserting the holders.

### MANUFACTURERS LIST

- Assembly Fasteners Inc., 6955 North Hamlin, Lincolnwood, Ill. 60645 (nylon insert locknuts; standard bolts; screws and nails in steel, brass, bronze, stainless steel).
- Bostik Consumer Div., USM Corp., 4408 Pottsville Pike, Reading, Pa. 19605 (Pop rivets, Molly fasteners, staples).
- D.R.I. Industries Inc., Box 20612, Bloomington, Minn. 55420 (full line of fasteners and compartmented organizers).
- Masonite Corp., Bellwood Products, 2601 Grant Ave., Bellwood, Ill. 60104 (Peg-Board).
- Maze Nail Div., W.H. Mize Co., 100 Church St., Peru, Ill. 61354 (specialty nails: zinc-coated, ring and spiral shanks, painted and tempered).
- Mechanical Plastics Corp., Box 328, Pleasantville, N.Y. 10570 (screw anchors and toggle bolts).
- National Nail Corp., 2964 Clydon, S.W., Grand Rapids, Mich. 49509 (specialties, such as plastic-cap insulation nails).
- Northwestern Steel & Wire Co., 121 Wallace St., Sterling, Ill. 61081 (standard, galvanized and cement-coated nails and staples).
- Stanley Hardware Div., The Stanley Works, New Britain, Conn. 06050 (full line of fasteners).
- Tremont Nail Co., Box 111, Wareham, Mass. 02571 (old-fashioned cut nails).
- Velcro U.S.A. Inc., 521 Fifth Ave., New York, N.Y. 10175 (Velcro hook and loop system).

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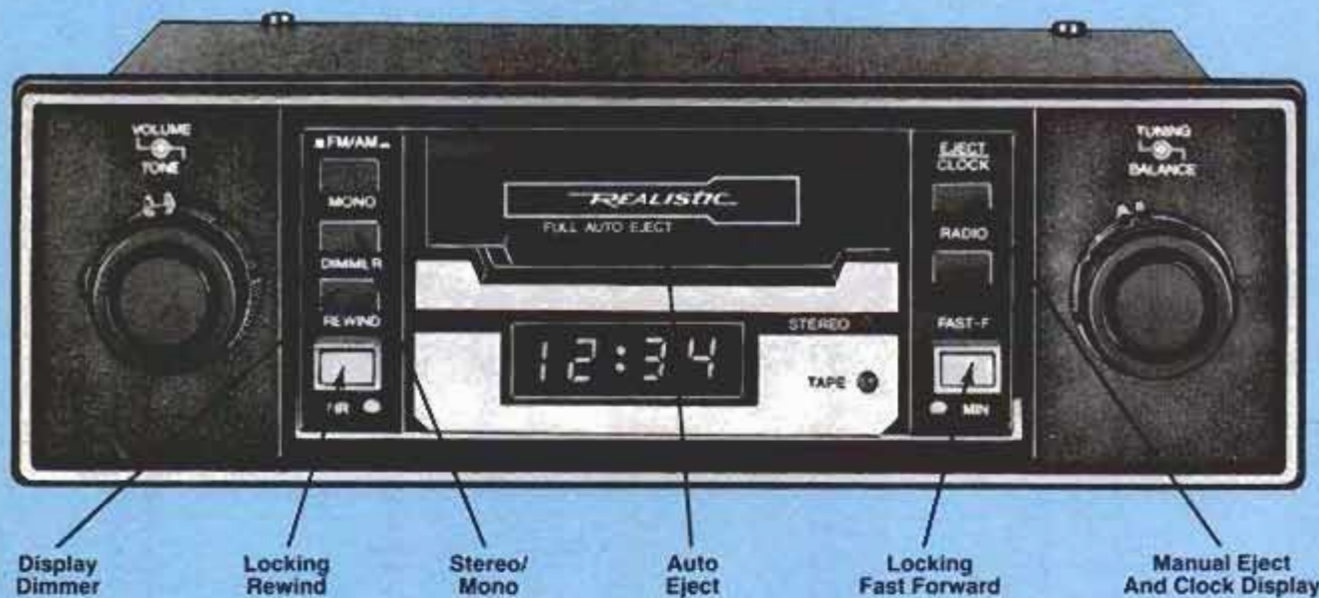
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# HOMEOWNERS' CLINIC



## Venting a shop gas heater

*My workshop is in a separate 20 x 24-ft. building which I now heat with a woodburning stove. Because I sometimes need instant heat, I am switching to a gas heater. Is there any danger from fire or explosion because of the open flame and the high amounts of sawdust?—David C. Cerri, Mishawaka, Ind.*

With just the right proportion of air and sawdust, there is a very slight chance of explosion. Also, the heater's jets could become clogged when the heater is not in use. Through-the-wall heaters are available that are vented to, and obtain their combustion air from, outdoors. Consult your local gas utility for more data.

## Latex over oil-base paint

*We have been living in our house more than eight years. The doors and moldings were painted originally in an oil-base paint; a few years later, we painted them with a water-base paint. In a few months, the paint began to chip off. We've tried repainting, but it still flakes off. What do you suggest?—J. Nerenstein, Sherman Oaks, Calif.*

According to my Sherwin Williams paint-chemist friend, you've got your work cut out for you. The pro says to remove the latex completely, which probably means stripping the entire door and trim. You could then repaint with oil-base paint over a good oil-base primer.

If you're certain that parts of the water-base paint have adhered completely, you can "rough up" the surface with fine sandpaper and then repaint with oil-base paint. Beware of this seemingly easier method, though, since the latex could still flake off at a later date.

If my home were insulated with UFFI, I wouldn't panic, but I would take some precautions. The CPSC states, "In many homes, there is a low level of offgassing of formaldehyde; therefore, the risk of injury to people living in these homes is reduced."

Even if you do have what is considered a high level of offgassing, there



**Materials that may be used to seal your home against possible formaldehyde gas are, left to right: water-resistant duct tape, low-permeance paint, caulk, joint compound and tape, and switch-plate gaskets. Vinyl wall covering also helps.**

## Sealing out house gas

*I read a news report stating that the U.S. Consumer Product Safety Commission (CPSC) has banned the use of urea-formaldehyde foam insulation (UFFI). That news item also mentioned that a small disc could be used to test for formaldehyde vapor.*

*The hundreds of thousands of us who had our walls and basements sprayed with this material need to know where to get this test item, and what to do if we have the vapor. Would you seal the walls with shellac or varnish, or is there another remedy?—W.G. Penrod, Bozeman, Mont.*

are ways to keep the gases from entering your living quarters. People vary in their susceptibility to formaldehyde. A "dangerous" (high) level may not harm a healthy person, while an "acceptable level" may be detrimental to individuals with past medical problems.

To solve the problem of formaldehyde vapor in your house, first determine the vapor level. Under "laboratories" in your classified directory, you will find the names of companies who will make this test. Tell them you want to determine the concentrations of formaldehyde in the air.

The preferred method of testing is the chromatropic acid procedure recommended by the National Institute of Occupational Safety and Health. The cost for this may vary from \$50 to \$500, depending upon the extent of the testing.

For a much less expensive method of determining vapor level, you can purchase a monitor and perform the test yourself. The 3M Co., Box 43157, St. Paul, Minn. 55164, among others, manufactures a monitor about the size of a half-dollar; it costs \$35 postpaid. Complete instructions are sent with the monitor. Basically, you open the sealed sack, clip the monitor to a lampshade (or other object) for 24 hours, reseal the monitor and mail it back to 3M.

Allow 7 to 10 days for shipping and 5 days in 3M's lab. The results are mailed back to you, listing the presence of formaldehyde in parts per million. Your physician or Public Health Dept. can interpret the results.

After you've determined the vapor level, you can use various aids to seal your living space from formaldehyde gases as shown in the photo at left. Essentially, you want to create an "envelope," separating your living quarters from the foam.

To seal off the vapor, fill all holes or gaps in the wall finish with joint compound or caulking. Remove baseboards and caulk the junction where the floor meets the wall. Caulk or spackle the space under the window and door trim where the plaster or wallboard falls short of the jambs. Install inexpensive gaskets, available from hardware stores, under the wall plates of electrical outlets. Apply a good water-resistant varnish to paneling. Paint the walls with a low-permeance paint; it helps seal gases outside the room. In other words, try to prevent the formaldehyde from entering your living quarters.

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.

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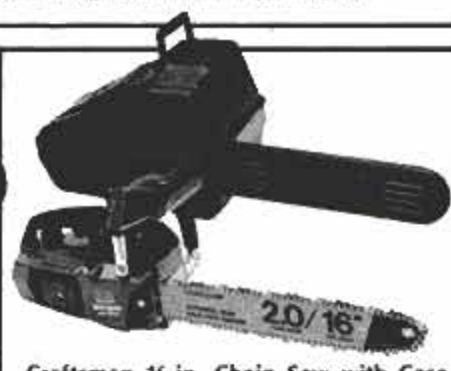
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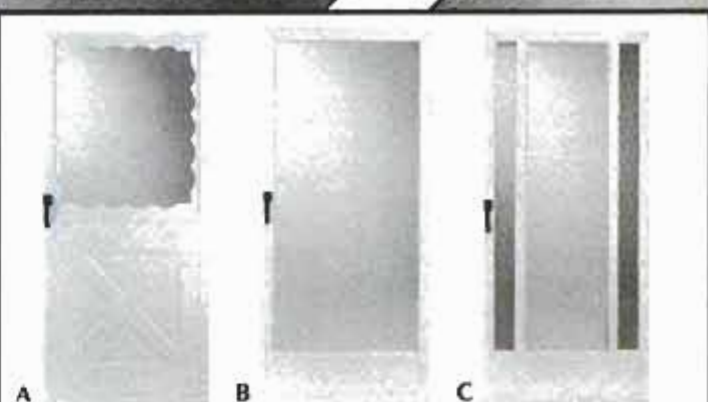
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## Consult a higher authority

*One day the transmission in my 1980 Chevrolet pickup slipped out of gear as I was driving along. I coasted to a stop and found I had no second or third gear—just first. The trouble, according to a dealer, was a governor-driven gear that wore out. The dealer volunteered the information that six other vehicles in this area have had the same problem, and a friend of mine told me a 1981 Chevy pickup owned by his father-in-law failed the same way. This is really worrying me, because the replacement gear I had installed is made of the same material as the old gear. Am I heading for trouble again?—Stanley Wendorf, Beaver Dam, Wis.*

I don't know. It depends on how long ago this happened, because replacement gears now available are not made of the same material as the

original gear. They only look like they are.

The new gear is a glass-filled plastic that is very hard and able to override the scale which builds up between it and the drive gear. This scale is responsible for wiping out the weaker original gears. The part number for the new replacement gear is 6261660. This trouble may strike any automatic transmission—the MV4, or THM 400, 350 or 200—used with any engine on any GM car built before the new governor-driven gear was put into service.

If you feel you shouldn't have to pay for this repair, call the Chevy zone office for your area and explain the situation to a service representative. In your area, the zone office is in Milwaukee. The number is 414-784-2570.

## Making a splash for itself

*My problem with the 2.2-liter engine of my 1981 Plymouth Reliant (K-car) is a wet distributor in stormy weather.*

*The car was recalled to replace the distributor protection shield with a larger one, but this hasn't helped. Consequently, I have to spray the distributor with silicone once a month to keep from stalling because of a drowned-out ignition. Is there no other solution?—Don Schmidt, Ligonier, Pa.*

Before you other owners of K-cars become unduly concerned, let me say that the recall for the distributor shield Don is talking about occurred early in the car's history. K-cars leaving the Chrysler factory have had the larger splash shield installed since soon after K-car production began. However, not many earlier K-cars have a new vented distributor cap (part No. 5213034) that allows condensation trapped inside the cap to dissipate. Lack of this cap may be a contributing factor in your case. Don, but I don't believe it's the main reason why your distributor is drowning out.

I think that you may be overlooking

a cracked distributor cap. The silicone spray you're using may be sealing the crack. You may also be spraying ignition cables which are damaged. In either case, this would account for the spray working a month; that is, while it seals the damage and prevents water from drowning out the ignition, until the silicone washes off completely.

I believe, therefore, that the permanent solution to your problem is to determine which ignition components (distributor cap or ignition cables) have failed and replace them.

Incidentally, the K-car has three additional splash shields protecting engine parts—one on the left side of the engine, one on the right side and one beneath to keep splash off drive belts. If part of a shield is broken off, or the whole shield is missing, road splash can be thrown on the distributor and ignition cables.

## Missing in Miss.

*My vehicle, a 1979 Ford E-100 van with a 302-cu.-in. engine, has an odd problem. The trouble occurs only when I accelerate to pass another car and then am forced to slow down to 20 mph or less. At this point, the engine starts missing badly. If I turn off the engine and then restart it, the missing disappears. Other than this, the engine runs smooth as glass. It should, since I've done many tune-ups to try and resolve this problem. What do you think?—Earl C. Gist, Tishomingo, Miss.*

I think the back pressure exhaust gas recirculation (EGR) valve is sticking in the open position, and the uneven combustion caused by exhaust

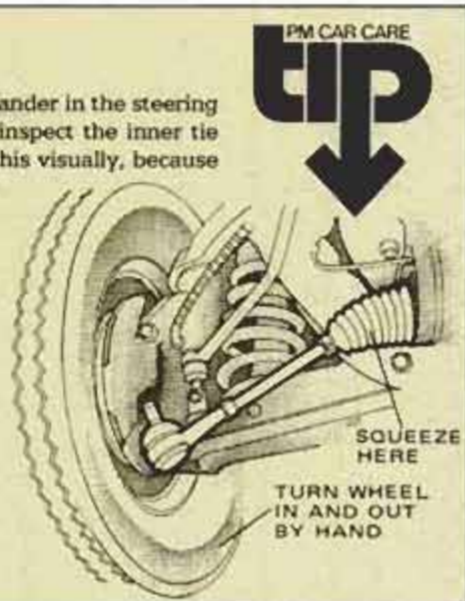
*(Please turn to page 50)*

## Sock it good

Whenever you notice any vibration or wander in the steering of a front-wheel-drive car, you should inspect the inner tie rod sockets immediately. You can't do this visually, because each socket (there are two, one on each side) is covered by a boot. It has to be done by feel.

Raise the car, squeeze the boot over the socket, as shown in the illustration, and turn the wheel out and in. If you feel looseness in the socket, replace the tie rods on both sides of the steering linkage.

The time to perform this test is as soon as vibration or wandering is detected. Putting it off will only result in premature tire wear and will cost you more money in the long run.





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## CAR CLINIC

(Continued from page 48)

gases flowing back into the engine is causing rough low-speed operation. When you shut off the engine, the pressure keeping the EGR valve open is removed, and the EGR valve closes and stays closed until the conditions that cause it to stick open are repeated.

To see if I'm right, drive the car until the symptom occurs. Then come to a halt and allow the engine to idle. If it is still running rough, pull the vacuum hose off the EGR valve and plug the hose. If this smooths out the idle, replace the EGR valve.

### For whom the belts toll

I own a 1978 Honda Civic CVCC station wagon that has a dealer-installed air conditioner. The car, which has logged about 37,000 miles, has two problems. First, the water pump fails after 12,000 miles. I'm now on the third one. Second, I've been told that to replace the two drive belts, one of the motor mounts has to be loosened, and the entire job takes four hours. Please advise.—Jeffrey Craven, Waldorf, Md.

Honda has had an improved water pump available since mid-1980, so there's a good chance your most recent replacement will last longer. The part number is 094147, which fits 1976-79 Civic 1500s and wagons.

As for the belt job, I think whoever told you it takes four hours to remove two drive belts is a slow worker or doesn't know the correct replacement

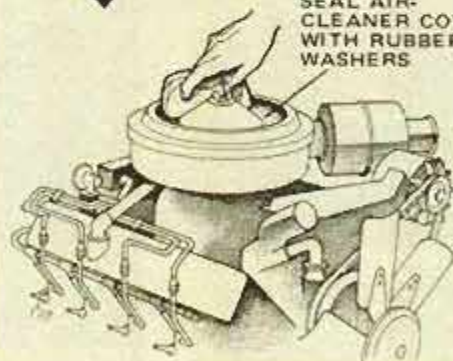
procedure. True, the motor mount has to be loosened, but according to the Honda warranty flat rate manual, the task from start to finish shouldn't take much longer than a half hour, assuming you have the Honda-approved air-conditioning unit installed in your car.

If I were you, I'd get another opinion or two.



### Wash tub

A Jan. '82 Car Clinic tip ("Oh, That Beautiful Grime," page 28) cautioned against washing a diesel engine. However, it noted, if you insist on cleaning, wait for the engine to be ice cold before bathing to prevent infection pump damage.



Dennis Michrina of Sterling Heights, Mich., adds that water trapped in the depressions around GM diesel air-cleaner cover attaching nuts can leak into the intake manifold. This can cause hydrolock in the back cylinders. When pistons smack against water, a lot of damage occurs.

If you still must wash a diesel engine, seal the cracks by putting rubber washers between the flat washers and air-cleaner cover. Wipe depressions dry with a rag after washing.

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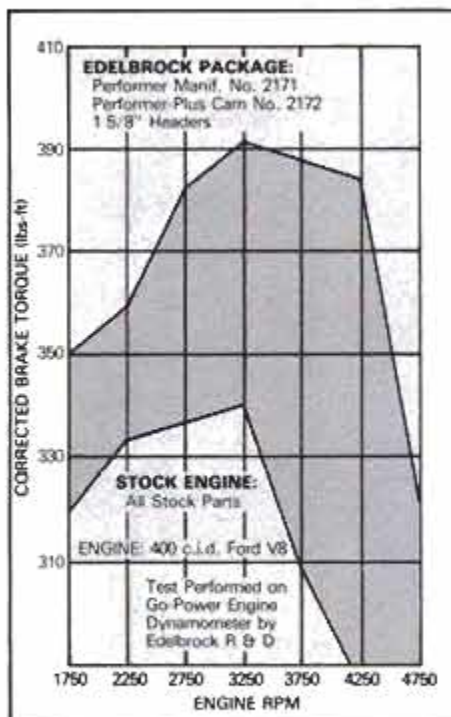
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**\*THE PACKAGE:** U.S. Automotive's, Lyn McQuilliams, installed a Performer 400 manifold, Performer-Plus camshaft, 4-bbl carburetor and dual exhaust on a customer's 400 c.i.d. Ford Bronco. The 3-second acceleration gain was from a dead stop to 100 yards! Says Lyn, "My customer was elated!"



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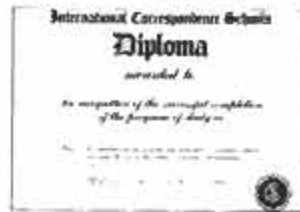


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### New scapegoat

*My 1979 Plymouth Volare is hard to start. Winter or summer. I have to crank it at least five times before it catches. Although I let the engine warm up for five minutes before driving off, it stalls when I slow down to make a turn. It then hesitates until I reach the parkway. Thereafter, for the rest of the day, the car runs beautifully. I've had the car to a Chrysler dealer and several diagnostic centers, but to no avail. Everyone blames the electronic system, but no one can fix it. Can you help me?—Claire J. Hackert, Brooklyn, N.Y.*

I'll lay even money that the trouble is a choke plate that's not closing as much as it should on cold-engine start-up. The reason may be a dirty or bent choke rod, damaged or dirty linkage, bad choke vacuum diaphragm, or dirty or damaged choke plate. But whatever the cause, it's easy to verify.

Start the engine (cold). Remove the air cleaner, so you can look at the choke plate. If the choke plate isn't closed over the carburetor bore, a choke system part is damaged. Incidentally, if the trouble is being caused by a choke linkage that's binding because of too much play—

that is, the choke linkage is getting hung up—you can cure it by installing a choke rod retainer clip (part No. 4095966).

The choke adjustment on this car is fixed, but the fast-idle cam, which controls cold-engine idle speed, can be adjusted. The fast-idle cam is attached to the carburetor throttle shaft where it has a series of graduated steps.

To check the idle adjustment, turn the cam until the adjustment screw is resting against the second step. Move the choke flap towards the closed position and measure clearance between it and the carb body. It should be .070 in. If it isn't, bend the rod that connects the cam to the choke flap until you obtain the correct clearance.

Too many technicians are too quick to blame problems on electronics. It makes you wonder what's happened to good, old-fashioned troubleshooting?

### 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.

### SERVICE TIPS

■ If you haven't had luck getting a GM 4.3-liter V6 diesel engine with Cruise Control to idle properly, listen up. To set low idle speed, disconnect the cable at the Cruise Control servo assembly to keep the cable from holding the throttle off the idle stop and converting a low idle speed into a high idle speed.

■ A driveability problem with an '82 Oldsmobile Delta 88 equipped with 3.8-liter V6 engine can probably be squared away by getting your dealer to consult TSB 82-T-8. If checks listed in the bulletin fail to clear up a "chug-gle" at 40 to 45 mph, the dealer is authorized to install a new PROM (part No. 17079014). Both parts may be used together.

■ A 1982 Chrysler K-car 2.2-liter engine with automatic transmission that runs rough in cold weather immediately upon starting may be fixed by installing a new choke vacuum delay valve (part No. 4173433). Suggest that your dealer see bulletin TSB 14-26-82. **PM**

# APPLIANCE CLINIC



## Cooling off an over-heated stove

*I have a Sears Kenmore electric stove model No. 155-455-7200, serial No. 82965. The temperature in the oven cannot be controlled with the thermostat. No matter where I set the knob, it goes directly to high heat. The door gasket is partly gone, too. I have electrical experience. Could I tackle the job myself?—E. Carlson, West Creek, N.J.*

Why not! Call Sears and give them your model and serial numbers. Order the thermostat, part No. K14025, and door gasket, part No. K15207.

To install the parts, shut off power to the range. Ask a friend to help you remove the range from the cabinet. Put a rug or other padding on the floor to prevent scratches.

The thermostat is mounted on the control panel above the oven door. Attached to the thermostat is a 36-in. capillary tube which goes to the rear outside of the oven cavity. You will have to remove the rear access panel

in order to get at this end of the thermostat.

When installing the new thermostat, don't damage or kink the capillary tube. Also, when disconnecting the wires on the thermostat, label them with masking tape to help you reconnect them properly.

To replace the door gasket, remove the door. Lay it down on the kitchen table (again covering the surface to prevent scratches). Loosen the four screws on the inner door panel. Slide the old gasket from under the panel. Install the new gasket and retighten the screws.

For further help on installing the thermostat, see the illustrated sequence on pages 90 and 91 of the *Popular Mechanics Home Appliance Repair Manual*. Get it at your local bookstore or send a check for \$25.90 (includes postage) to: Hearst Books, 224 West 57th St., New York, N.Y. 10019.

of warm water and vinegar to clean out the drain tube. Push the new heater wire back into the grooves. Make sure to leave a loop at the drain opening so it can be pushed into the drain tube.

## Runs dry on high

*I have a Sears clothes washer model No. 110-72450110. The tub continues to fill, even after the high-water level has been reached. The agitator starts, then the water is pumped out of the machine. The medium and low levels work fine. I replaced the water-level switch and the machine worked fine for three weeks. Now I have the same problem again. Do you have any suggestions?—Andrew Kuruc, Clifton, N.J.*

Sounds as if your problem lies in the timer assembly. The cams in the timer are probably worn or slipping, telling the machine the wrong thing to do during the cycle. The replacement timer is part No. 372561. It costs about \$36.25 at any Sears repair parts center.

## Curved drain tube

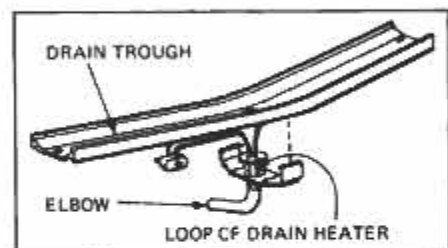
*I own a 1966 Admiral duplex refrigerator Model ND-2265, serial No. 5322383. In the refrigerator compartment, I was able to clear the drain by running a flexible wire inside the tube. The freezer side, however, can't be cleared. When it defrosts, the water runs inside the box and freezes into a cake of ice. How can I free this drain so the water will run out?—Albertino Azevedo, Mendon, Mass.*

Sounds like your problem is with the drain-trough heater. The heater is designed to warm the drain trough to prevent the defrost water from refreezing before it drains out of the cabinet. To check the heater, first remove the air baffle in the bottom of the freezer section in front of the drain. The heater is plugged into a harness receptacle below the drain trough. Unplug the heater at this point.

Make an ohmmeter continuity test between the plug prongs. If you don't get a reading, the heater is defective. The replacement heater is part No. 27525-11; it's approximately \$23,

plus tax, at an Admiral parts house or distributor.

To replace the drain-trough heater, remove the trough mounting screws and unplug the heater. Next, remove



**The drain-trough heater, directly below the drain trough, ensures that water from defrosting doesn't refreeze in drain.**

the spring clip which holds the drain tube to the bottom of the trough. Pry it loose at the front lip of the trough. Lift the trough straight up so the loop of the heater pulls out of the drain tube easily. Pull the defective heater out of the grooves on the bottom of the trough. Once you've removed the heater from the drain, use a solution

## Rattling refrigerator

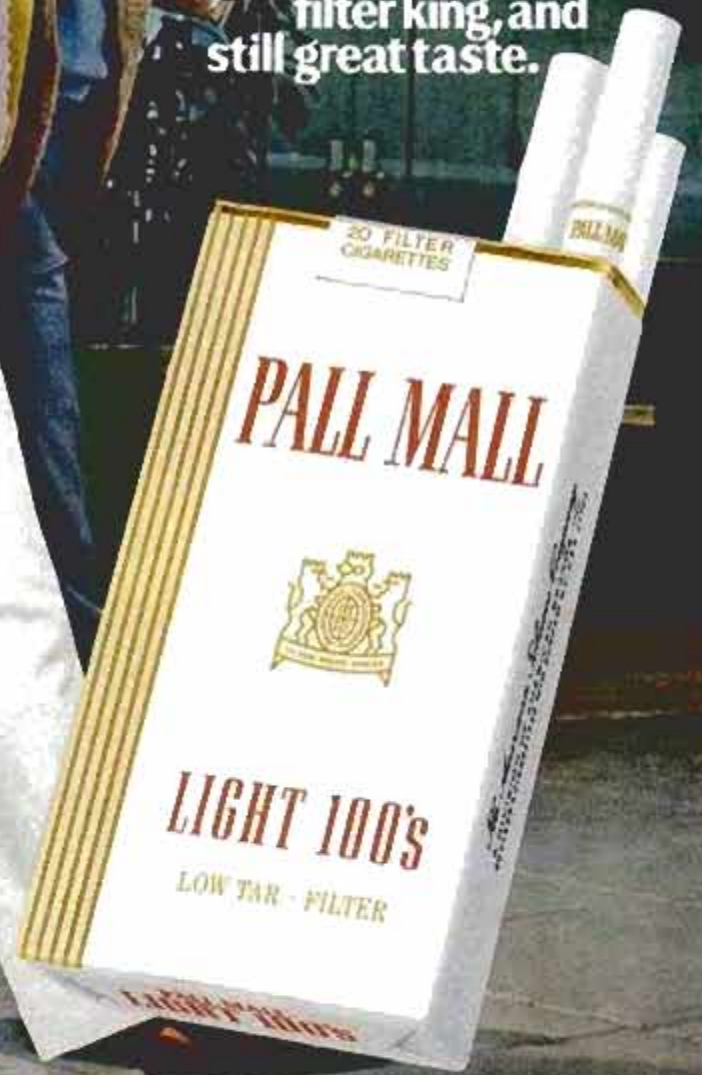
*The compressor of our 10-year-old Gibson Sovereign Frost Clear refrigerator Model 825716R1C, serial No. 0915422157, rattles when it's operating. It becomes louder when the compressor is shutting off. The Gibson serviceman told us that this condition couldn't be repaired. The refrigerator operates normally otherwise. Can anything be done?—Carmen Julian, Latham, N.Y.*

Because of the age of the refrigerator, it is no longer covered under the manufacturer's 10-year guarantee. Apparently, the internal compressor mounting springs inside the compressor have become worn or broken. This makes the internal mechanism bang against the outside of the shell of the compressor, causing the rattle. The only way to remedy this is to have the compressor replaced. **PM**

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

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"Money is very tight around here, like everywhere else; but my first Saturday, I didn't even have time to eat!"

My hired kids sold 271 birds at \$7.95, plus 185 more on Sunday. Netted \$1,700.00! I'm wholesaling too — A businessman approached me and ordered 1,800. And within five weekends, my brother's demonstrators in N. Carolina marketed 1,772 birds! This really works!" GREGORY E. THOMPSON, MARSHALL, MO.

"I was a 'doubting Thomas' but now have kids demonstrating in malls, on streetcorners and flea markets; drawing large crowds and excellent profits. I often earn at least \$1,500.00 per weekend. One full week I netted \$6,500.00!" DALE CAMPBELL, FRIDLEY, MINN.

## UNIQUE DISTRIBUTORSHIPS

Many offers in this magazine are good. Some very good. But our distributors *enjoy* their "work", earning more in a weekend than others earn in a month, pay no franchise fees, nil risk factor, almost nil inventory *no fixed investment or overhead* as mall, dept. store and "show" space rent is on % of sales; and many spots are *free* . . . Just send five or six kids to busy parks or city sidewalks. We assign an approx. 300,000 population area to each authorized distributor. First come, first assigned. Only 350 more in the U.S. and Canada and "the door's closed".

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If you wish, "check us out" first. Located in "Friendly Alberta" — just north of Spokane, Wash. — we're rated by D & B and most all commercial rating agencies; U.S., Canadian and International. We shipped over three million \$ in product, to happy U.S. distributors in 1981 & '82. But if your area's already taken, we'll return your letter and contents.

TYPE OR PRINT, *NEATLY!* Send check, money order, or Visa-Mastercard # with cardholder's name and expiry date. *Special Delivery* = 4 days to us, regular 1st Class (20¢) = 7 to 9 days.

If you're *seriously* interested, we urge you — we implore you — to request all three color models and test-demo them *together*, with the recording! The effect is *spectacular*. Thus, flying "three together" and playing the presentation tape is *the* actual demo method.



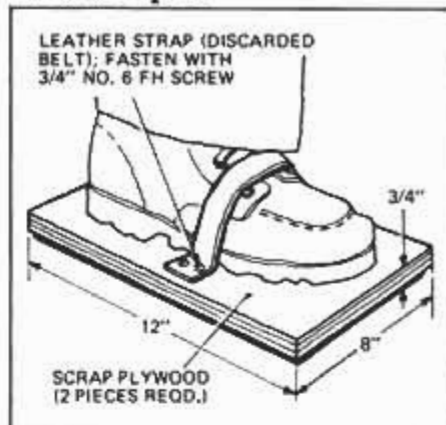
Costs include UPS and MANUAL of \$5.00 value:  
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# HINTS FROM READERS

## Foot stompers



In areas of moderate climate, you can seed cool-season grasses into dormant Bermuda grass in early October and November, to get a healthy-looking lawn that lasts throughout the winter. Mow the existing grass to about 1 in. and slice the soil 1/4 to 1/2 in. deep with a hand rake. Spread a layer of starter fertilizer over the lawn; then plant the seed and work it lightly into the soil, using a pair of foot stompers. The stompers take the place of a lawn roller to assure a firm seed bed.

I made mine of scrap plywood with straps, as shown above. All I do is put them on and walk over the topsoil until I'm satisfied that it has been tamped uniformly flat. Result: a lawn which is as thick as if it had been done professionally. You can also use the stompers for spring seeding and filling in bare spots at other times.

— William Slamer

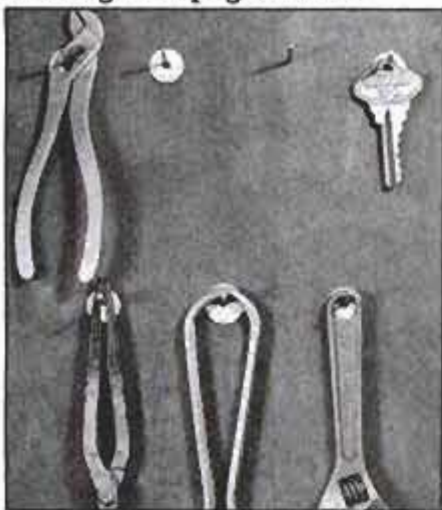
## Stainproofing tile grout

You can seal cement-based grout with lemon-oil furniture polish to prevent food spills and grease spots from staining tile counters and floors. This treatment also makes cleanup easier. Over a period of time, additional applications are recommended for heavy-use areas or tiles that are near heat.

Caution: This method might cause some darkening of the grout, and it could produce a shine on unglazed tile; so test the treatment in an inconspicuous spot first. American Olean, the tile manufacturer, suggests using liquid oil polish, rather than a spray, in these instances.

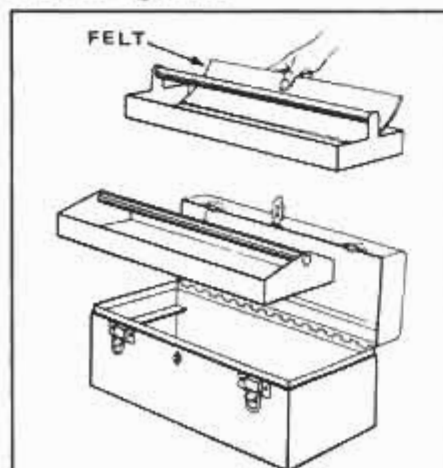
# HINTS FROM READERS

## Making tool pegs visible



To make your tools easier to locate where illumination is poor, add color accent to nails, pegs and other supports used to hang tools and keys. The simplest way to do this is to cut discs of brightly colored cardboard, punch holes in their centers and hang them on the supports. You can achieve the same effect by painting colorful circles around the tool supports. —Walter E. Burton

## Protecting tools



This method of protecting tools which are carried in a portable toolbox was suggested to us by PM reader Frank H. Burgmeier of the Hand Tools Institute: Line the bottom and the lift-out tray of your toolbox with felt. This simple procedure helps preserve the edges of cutting tools. It prolongs tool life and also lengthens the time between sharpening jobs. **PM**

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# THE PM WORKBENCH

## Carbide blades at steel-blade prices

This unique saw blade from Credo, Omark Industries, 2765 National Way, Woodburn, Ore. 97071, is unlike any other saw blade I've ever used.

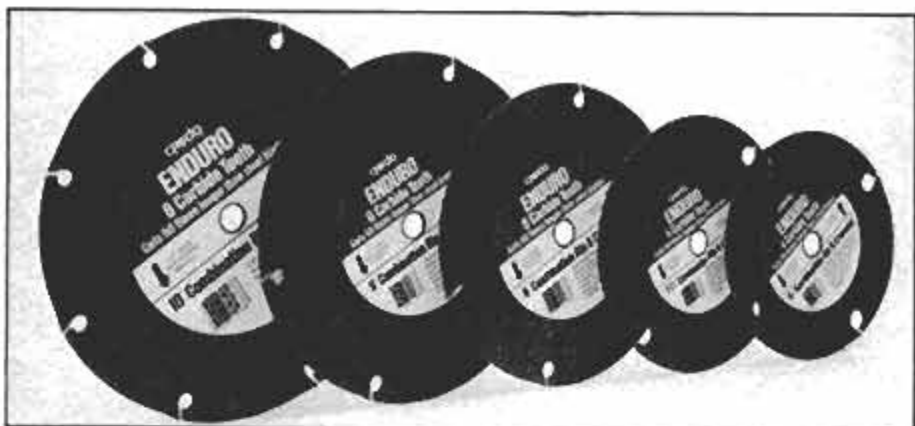
I recently put one through its paces on my table saw and in the portable saw shown. The blade's design—each tooth is preceded by a gradual ramp controlling the amount of wood exposed for the cut—minimizes rough cuts and, more importantly, kickback.

Available in most popular saw sizes, the Enduro carbide blade sells at steel-blade prices: 6½ in., \$7.10; 7-7¼ in., \$7.10; 8 in., \$9.52; 9 in., \$11.92; and 10 in., \$13.14. Since

teeth are claimed to last 50 times longer than the teeth on a steel blade, the carbide blade is a great value.—H.W.



Maker claims saw can start with blade butted against work. We tried it. It can, but don't try it with conventional blade.



Unusual carbide-tipped blade comes in most commonly used saw diameters. Cut is relatively smooth, but blade doesn't give smoothness needed for fine cabinetmaking.

## Help for finishers

If you're a woodworker—as many PM readers are—the time comes when you have to master the art of putting a finish on your furniture projects.

It is not at all uncommon for a very fine woodworker to produce a less-than-desirable finish, usually because of grain raising. Help for this problem comes in a can labeled Sanding Sealer. Manufactured by PlastiKote Co. Inc., Box 708, Medina, Ohio 44258, the product is available nationally, at paint stores and home centers. It's packaged in four container sizes: 1 pint, \$4.40; 1 quart, \$6.60; and 1 gal-

lon, \$19.60. It also comes in a 16-ounce aerosol for \$3.50.

The sealer is ideal for application between finish coats to minimize



Sanding Sealer finishing product is available for brush-on and spray applications.

grain raising, thus sanding. I tried it as a pre-stain sealer and it works like a charm.

One word of caution: The maker advises that Sanding Sealer *cannot* be



Author used aerosol version (top) to test product on sample piece of pine with a relatively wild grain—too wild if it were used in a furniture project. Mask was removed and board stained (above).

used with a polyurethane overcoat—either clear or color. It is safe for use with conventional varnish.—H.W.

## Update

I recently received a letter from PM reader John Whitacre of Chambersburg, Pa.; it's one of several letters that have come in on the same subject.

John asked about the belt system described in the story on John Opfer's Great Shop (*This Master Craftsman's Dream Shop Is In A Log Cabin*, page 108, Nov. '80). No, John, you didn't miss it, because it hasn't yet appeared in the magazine. At PM, we do the things we write about. Thus, we will install and work with the set-up in our own workshop before releasing any details to our readers.

—H.W.

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.

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Milwaukee, Wisconsin 53209



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# SCIENCE WORLDWIDE



## Britain's model air surveyor

What do you do when you must take regular aerial surveys, but the budget has been scaled way down and you can't afford a plane? The answer for the Thames Water Authority, which maintains 20 miles of water pipelines in suburban London, was to scale down the plane.

Oscar Addyman, water company manager and model-airplane flier, withdrew just a little more than



\$1,000 from the corporate coffers to come up with a remote-control craft that can take standard or infrared photos from the air. A wood box in the craft's belly contains a 35-mm camera with motor drive that's radio-linked to the ground. The entire package weighs 19 pounds.

Addyman's surveyor craft uses a



Model plane (above) took photo (left) at 400 ft. Circled vehicle indicates scale.

.25-cu.-in. engine to carry it 400 feet aloft. A mission, which takes about five minutes, uses less than \$5 worth of special model craft fuel and produces one roll of aerial photographs. (The number of photos depends on the timing of each exposure.) The daylight photo is of a stretch of conduit near London.

## Heart scare

Giving a patient a sedative by injection before heart surgery may create so much anxiety that the patient's heartbeat becomes dangerously irregular, according to preliminary findings of University of Michigan researchers. They recommend that heart surgeons consider giving sedatives orally, especially before bypass surgery. The Michigan medics emphasize that more research is needed to document the stress relationship.

## Evolution today

University of Maine zoologist Irving Kornfield, working with an EARTHWATCH research team, has discovered a rare case of evolution in progress. In running genetic tests on what had appeared to be two different kinds of fish—one a plant-eater

with fine teeth, and the other a snail-eater with crushing teeth—Kornfield has discovered the fish have identical genes. EARTHWATCH says the fish, Mexican *Chiclasoma minckleyi*, may have a recessive gene that determines the shape of the teeth.

It isn't unusual to find one-celled organisms in the midst of evolution. But Kornfield's discovery is a one-in-a-million case. It may help change the current trend of classifying animals by outward physical characteristics. Classification may soon be done by genetic makeup.

EARTHWATCH is a nonprofit, scientific research organization.

## Sasquatch watch

If you think you've seen evidence of a Big Foot, Sasquatch or other legendary monster, there's a new scien-

tific organization that wants to hear from you. The International Society of Cryptozoology was organized by scientists who have investigated such reports independently.

"We wanted to create a central information source," explains J. Richard Greenwell, a University of Arizona researcher and secretary of the group. Members have no preconceived notions about the truth of reports of monsters. As Greenwell points out, "There's got to be some kind of explanation, be it physical or psychological." Greenwell notes that many animals once considered mythical have turned out to be real. Gorillas, for instance, were considered legendary outside Africa until one was captured in 1855.

To report a sighting, or to inquire about previous sightings, write to the International Society of Cryptozoology, Box 43070, Tucson, Ariz. 85700.

## I whistle for animals

Will such a slogan appear on bumper stickers in the future? Researchers of the World Federation for Animal Protection in Austria believe that ultrasonic whistles—making piercing sounds heard by animals, but not by humans—can be used to chase deer and other animals away from highways. American researchers, however, are less enthusiastic about the effectiveness of such devices.

The federation tested a device called Sav-A-Life. The inch-long whistle, shaped like a megaphone, mounts on a car's bumper. As the auto moves, air rushes through the whistle, creating the ultrasonic noise. Clayton Anderson, whose Marcia Corp. distributes the whistle in the United States, says ultrasonics may reduce the number of highway accidents involving deer each year by hundreds.

So, we asked Steve Shurnake, a U.S. Fish and Wildlife Service psychologist, how his experiments with a number of devices were going. He told us the ultrasonics have worked "in some instances in our tests with rodents. But sometimes they didn't work. And I'm not sure I'd rely on them to protect animals." **FM**





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America's best-selling truck diesel is now available in tough Chevy Vans and Sportvans. Now you can get available 6.2 Liter (379 Cu. In.) V8 Diesel power in 1983 G20/30 Series Chevy Vans and Sportvans. It's already in service in over 100,000 full-size 1982 Chevy Pickups, 4WD Blazers, Suburbans and Step-Vans. That kind of acceptance says a lot about the performance and desirability of this diesel

power. The 6.2 Liter Diesel in a G20 Chevy Van offers you up to 24% better fuel efficiency than a 5.0 Liter (305 Cu. In.) 4-Bbl. V8 gas engine in the same vehicle. And the 6.2 Liter Diesel provides up to 33% better fuel efficiency than this gas engine in a G20 Sportvan. Consider these impressive mileage figures.

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Chevy's G30 Diesel Van. The Chevy Van advantage goes way beyond diesel power. The available 6.2 Liter Diesel G30 Chevy Van is rated at 240 lbs.-ft. of torque at 2000 RPM. So Chevy Van digs in and hauls hard under full loads (up to 3682 lbs., including passengers, equipment and



125" WB Diesel Chevy Van.

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cargo, in a properly equipped model). All long-wheelbase models have a big 296 cu. ft. of load space—and load length for a 14-foot ladder! What's more, a properly equipped G30 Chevy Van can move up to 12,000 pounds, including itself, passengers, equipment, cargo and trailer.

**Chevy's Diesel Sportvan.** Here's how Chevy moves people with style, comfort and convenience. There's stan-

dard seating for five, but the G20 Sportvan offers optional seating for eight and the G30 model offers optional seating for eight or twelve. In addition, quick-release rear bench seats help convert Sportvan from people-carrying to cargo-carrying in a hurry. **3-Year/50,000-Mile Power-Protection-Plus Limited Warranty on Diesel Engines.** Subject to deductible after

first 12 months/12,000 miles. See your Chevy dealer for full details.

\*Use estimated MPG for comparisons. Your mileage may differ depending on speed, distance, weather. Actual highway mileage lower. In Calif., Chevy Van 30 Est. Hwy. [20] EPA Est. MPG. Some Chevrolet trucks are equipped with engines produced by other GM divisions, subsidiaries, or affiliated companies worldwide. See your dealer for details.



125' WB Diesel Sportvan.

Optional Beauville Interior.



Sportvan with optional Travel Bed Package.



## TAKING CHARGE



# THE PM GARAGE



## Safety light is versatile, too

A flashlight that you keep in your glovebox may give you peace of mind, but on too many occasions aging batteries can't provide you with good illumination when you really need it.

Black and Decker's CarLight has no batteries to run down. The light plugs into any 12-volt cigaret lighter and combines a spotlight, warning flasher and worklight all in one unit. CarLight has a flashing or constant beam controlled by a three-way switch. A red lens snaps into place for warning light use.

We found CarLite handy to use and its illumination excellent; the only disadvantage is that it won't fit into



*Plug-in CarLight serves as a combination spotlight, warning flasher and worklight in one versatile unit.*

most gloveboxes. It's available for approximately \$13 at hardware outlets.

—John Lamm

## Interior cleaner

Fancy plush interiors may look attractive, but if little travelers should get carsick on long trips or use finger-paints to pass the time, it can be a real headache to keep those interiors clean.

We found one product. Happy Car Care, that was able to neutralize anything any kid was able to dish out—including crayon that was ground into the velour upholstery. The cleaner also overpowered grease spots deposited by a mechanic's soiled work clothes.



*Interior cleaner easily removes crayon and grease stains from velour seats.*

The cleaner is sold in 16-ounce spray bottles. The heavy-duty spray application top allows a direct stream or spray pattern. Happy Car Care is sold by direct mail for \$3.95 plus shipping from Macy and Co., Box 2488, El Modena, Calif. 92669.

—Cliff Gromer

## Portable polisher

Everybody likes to drive a clean, shiny car, but nobody likes the elbow grease that is needed to keep it that way.



*Polisher plugs into cigaret lighter and comes with four different attachments.*

ScrubMaster's little polisher for \$19.95 is just the ticket to take the drudgery out of exterior car care. The tool plugs into your car's cigaret lighter and comes with an 18-foot

power cord. Four attachments include: sponge wax applicator, buffer, wool polishing pad and tire scrubber.

The tool generates good torque for a high-gloss shine, but the small-size pads that are used mean that it takes a lot of time to cover the complete car.

ScrubMaster Electric Inc. is located at 340 Sunset Ave., Venice, Calif. 90291.—Cliff Gromer

## Valve spring compressor

Valve jobs and head work that require valve-spring removal on cars such as VW Rabbit and Vega need a special tool because the valve springs are recessed. Cal-Van's budget line valve-spring compressor (No. 575), which costs \$27, takes an adapter



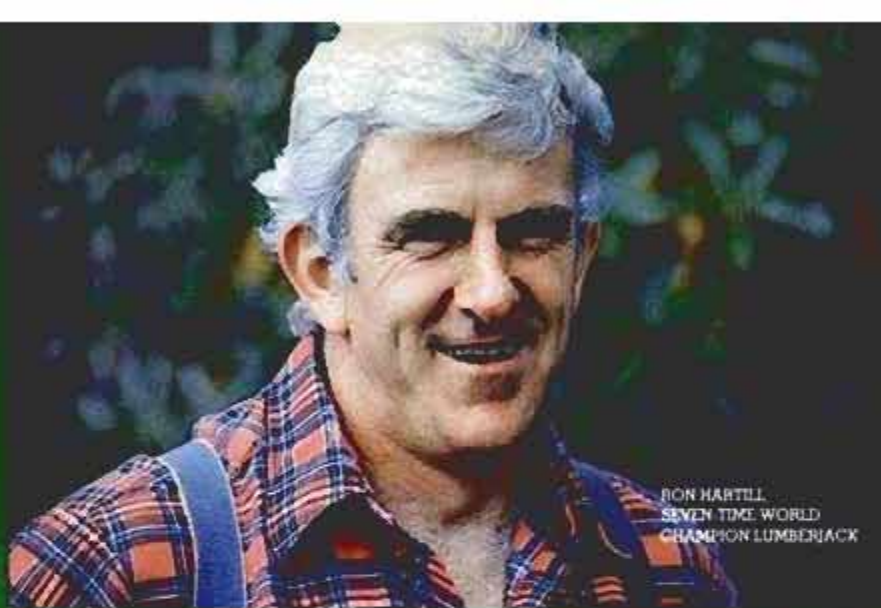
*Adapter for valve spring compressor enables you to work on recessed valve springs with a minimum of fuss.*

(No. 876-14) for recessed valve springs so you can use one compressor for both conventional and recessed spring applications.

We removed the compressor's conventional jaws and just screwed on the jaws for recessed springs. We were able to compress the springs to get at the valve keepers easily.

The adapter sells for \$14 at parts stores. Cal-Van Tools is at 1500 Walter Ave., Fremont, Ohio 43420.

—Paul Weissler



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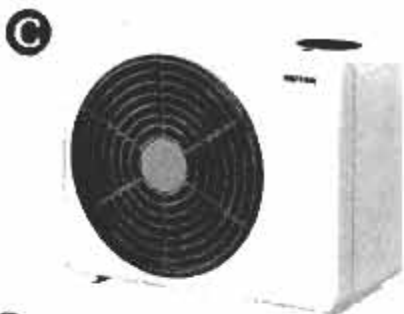
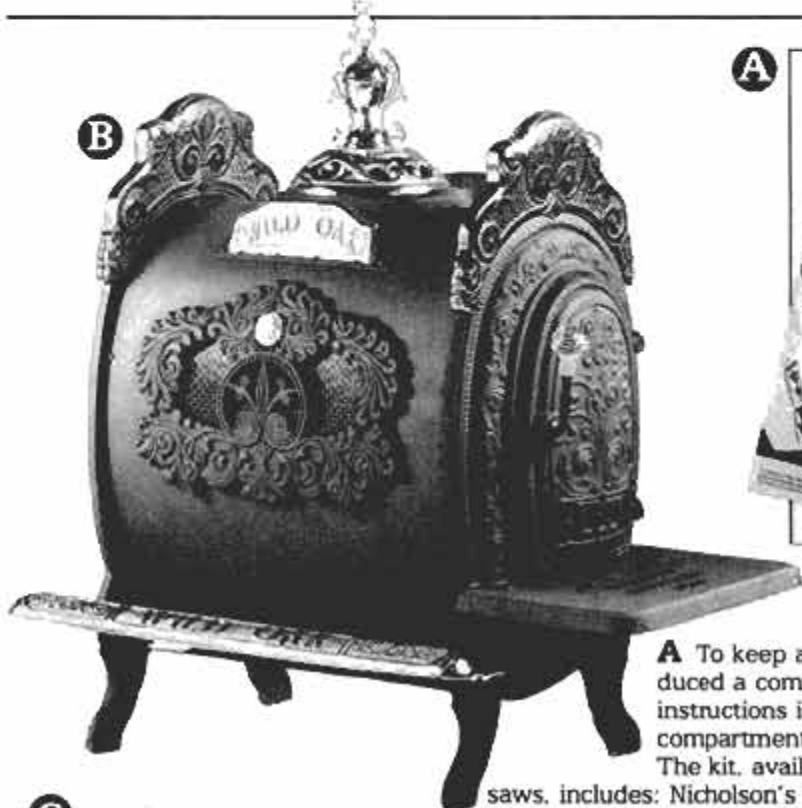
POULAN MODEL \_\_\_\_\_

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PM

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# NEW NOW FOR HOME & SHOP



**A** To keep an edge on your chain saw, Nicholson has introduced a compact chain-sharpening kit. It comes with detailed instructions in a handy storage pouch with transparent plastic compartments which you can carry with you to the work site.

The kit, available in three sizes for use with most popular chain saws, includes: Nicholson's file guide, depth gauge, round and flat files, and file grips and handles. Available at home centers, hardware stores and chain-saw dealers, the sharpening kit is about \$18.80. It's manufactured by Nicholson, the Cooper Group, Box 728, Apex, N.C. 27502.

**B** This Wild Oak stove is a combination of modern technology and old-world styling and beauty. According to Webster, the cast-iron wood-burning stove has a unique baffle system which creates a spiral flame path for extra-efficient heat transfer. Additional features include a custom firebrick lining, strengthened with stainless-steel fibers, and a window which permits closed-door, airtight burning while you enjoy the fire. The Wild Oak stoves are \$975 to \$1,075, depending on the options selected. They're from the Webster Stove Foundry, 1827 South Kingshighway, St. Louis, Mo. 63110.

**C** This portable electric circulating heater from Patton Electric Co. Inc., Box 128, New Haven, Ind. 46774, doubles as a cooling fan in warm weather. It's equipped with a five-function control, a "set and forget" adjustable thermostat, a cord storage area and a signal light. Though lightweight (under 4 lbs.) and measuring 7¼ x 9¾ x 11½ in., this attractive accessory provides the user with a choice of 750 or 1,500 watts for heating. This Heater Plus Fan, HF-15, sells for under \$50 at appliance stores.

**D** Two new space-saving shelving accessories let you utilize kitchen cabinet space more efficiently. One is a revolving pantry shelf kit with five rotating shelves which are adjustable in height and self-centering. Five back-of-the-door, basket-type storage units, whose heights can also be adjusted, come in a second kit. These units mount with snap-on clips to permit easy removal for cleaning. According to Merillat, both units are nonwarping and extremely rigid. The 18-in. revolving shelf kit is \$165; the 24-in., \$195. The door storage shelves cost \$58 and \$61, respectively. For information, write to Merillat Industries Inc., 2075 West Beecher Rd., Adrian, Mich. 49221.

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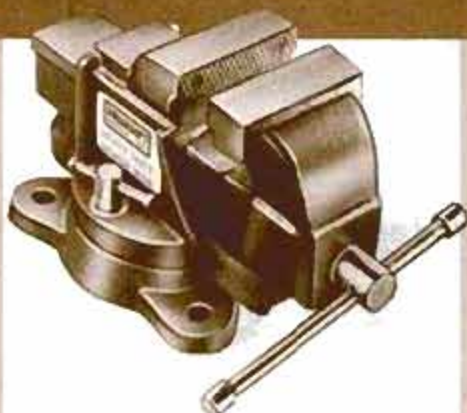
*Pat Summerall*



Master PLUMBER

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Chrome-plated brass centerset lavatory faucet. **27.95** With pop-up. **32.95**  
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**FSKARS Sharpens**  
Sharpen this 6" file knife any-time with its built-in sharpener in a sheath! Surgical stainless steel blade is dishwasher safe, may be worn or stored. 6290. **9.99**

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Vanguard® qt. thermos. 430. **4.44**  
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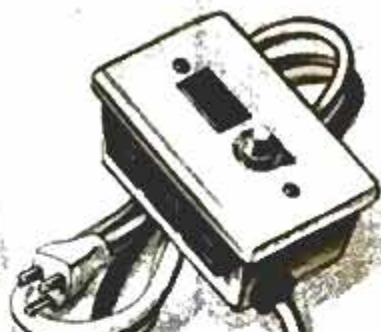
**DENNIS Weatherstrip**  
Install a barrier against dust, drafts. 36" triple seal vinyl and alum. door sweep. 905. **2.77**  
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Alum. & vinyl door set. 79-V. **7.99**

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Stock up now and save on 60-yd. masking tapes. C1221-4 ¾". **49¢**  
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Heat-resistant 2" x 60-yd. duct tape seals leaks. R92T. **4.44**

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Deluxe portable baseboard heater safely circulates comfortable hot water heat wherever warmth is needed. 750W unit has built-in thermostat. NP750. **79.99**

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Turn the clothes dryer into an extra energy source! Diverts moist, warm air into your home in winter. Close the valve for normal air flow HM1700. **5.99**





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A must for foreign travel, 5-pc. kit converts 220/240 foreign voltage to 110/120 U.S. for appliances up to 1600W. With travel case. CA1600 . . . . . **19.99**

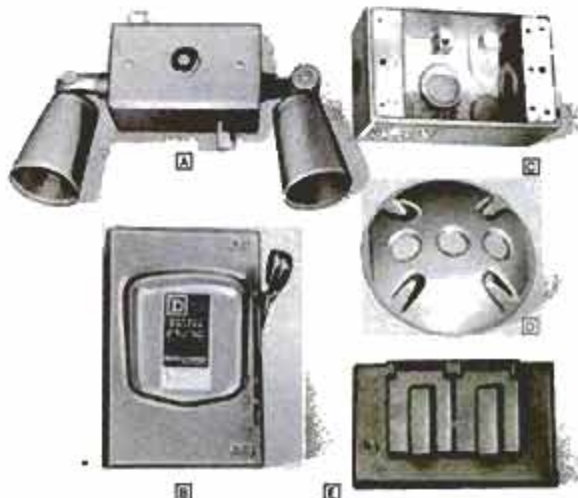
### SNAPIT Power System

Safely transforms 1 outlet into 6. Mini-breaker protects against overload. Shock-safe, unbreakable housing for wall mounting or portable use. 48725-6 . . . **11.88**

# now thru Oct 30



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



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Replace worn cords on lamps, fans, appliances, with 18/2 retractable extension, 12' recommended usage. White, brown. UL listed. 6002/8 . . . . . **3.49**

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Unclog sinks, tubs, toilets, more with water power, not chemicals. Attaches to hose, expands to fit pipe, then jets of water dislodge clogs. For 1-6" drains. 186. **5.99**



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Long-lasting blades chew up tough garbage, even bones, fast. Continuous feed operation, is sound insulated for quiet operation. Resists jamming and corrosion. 1/2-hp unit has quick-mount installation. TV103. . . . . **49.99**



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Utility and bar sink. K1559B. . . . . **39.95**



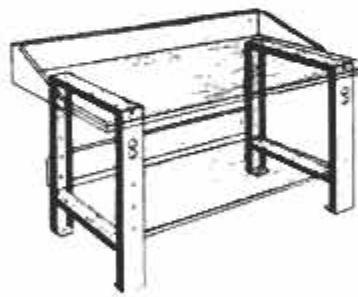
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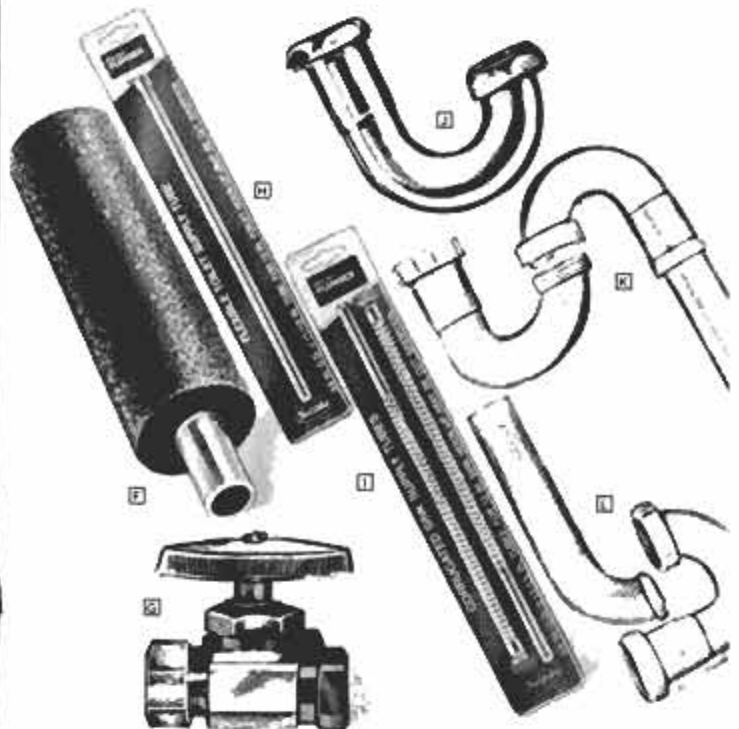


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# thru Oct 30



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Slip polyethylene foam on pipes to stop heat loss, sweating, freezing, reduce fuel costs. For 1/2" copper pipe. 338C50M. **2.99**  
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### True Value Energy-Saver

Energy-efficient water heaters pay for themselves in savings on fuel and installation costs. Thick foam insulation retains heat, uses less energy, gives you hot water when you want it! Your choice of 30-gal. natural gas or 40-gal. electric water heaters. 5-year warranty Each. . . . . **114.95**



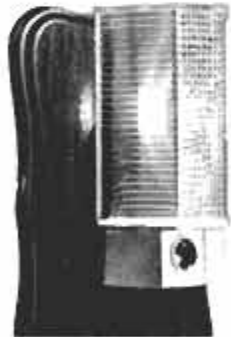
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Sturdy antique black bracket adds stylish support to bookshelves, hanging plants, curio display. 8x5 1/2" 152 Each. . . . **2.77**  
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Automatic night light "senses" night and day to turn on and off; varies the output of light proportionately to the degree of darkness. Uses 7W bulb. NL300. **2.88**



**Wet-Dry Vacuum** picks up everything from water to nails. With 6'x1 1/4" hose, 1 1/2" wand, 10" nozzle, squeegee shoe and plastic dolly. 6-gal. cap. MM600-6. **54<sup>25</sup>**

**Portable Workbench** is first with movable vise! Holds materials to 27" wide, folds to 5" flat. Has tilt adjustment, 5 open positions, 4-position legs and tool holder. MM1000. **49<sup>99</sup>**

**12-Piece 3/8" Drive Socket Set**, forged from alloy steel, contains 7 sockets, ratchet, 3/8" spark plug socket, speeder disc, more. SAE or metric. MMB12P/M. Each set **10<sup>99</sup>**

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# Professional

YOUR CHOICE

**6<sup>99</sup>**  
each



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

❑ **6-Drawer Chest** has 3 large and 3 smaller drawers, 4-section lift out tray. 15x26x13 1/2". MM1806. **92<sup>99</sup>**

❑ **3-Drawer Roller Cabinet** has large storage area, brakes on two casters. 33 1/2 x 26 1/2 x 18". MM1903. **117<sup>99</sup>**

❑ **Flat Top Tool Chest** with 3-section tote tray, socket divider plus pad-lock eye. 20" long. MM920. **12<sup>99</sup>**

❑ **7" Diagonal Pliers**, forged from alloy steel, is one tough tool for heavy-duty jobs. High leverage diagonal cutter is electronically hardened for superior strength and durability. Forged rivet for tough, precision fit. MM40-7C.

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❑ **Professional 24" Aluminum Level** has 6 unbreakable vials, 4 plumb and 2 level, sealed against dirt and moisture by heavy glass windows in die-cast frame. Convenient measuring rule on top in both English and Metric. 10106.

❑ **Professional Screwdriver Sets** feature chrome vanadium steel blades for tensile strength without abrasion, and precision ground tips. Large comfort grips fit your hand for greater turning power. Your choice basic 5-pc. set with 3 slotted and 2 Phillips screwdrivers or 4-pc. set with commonly-used Phillips screwdriver sizes. TS5, TS4P. Each.

❑ **3-Pocket Tool Pouch**, handcrafted of genuine top-grain cowhide, is as practical for the do-it-yourselfer as it is for the professional. Features easy-access main pocket for large tools, 2 plier pockets, 2 side slots for long screwdrivers, friction tape sling, knife snap and a 16" steel tape pocket. With extendable belt slots. Overall size: 8 1/2" x 9 1/4". MMLP438.



**7 1/4" Combination Blade** with hard chrome finish will rip, crosscut and miter in soft and hard woods. Chisel tooth makes it ideal for framing and cutting of heavy woods. 117739. **2<sup>99</sup>**

**4-Pc. Holesaw Set** cuts wood, plastics, composition materials for lock/deadbolt installation. Made of carbon steel, set has 1" woodbit, 2 1/8" holesaw, mandrel, wrench. 397760. **6<sup>99</sup>**



**Mini Hacksaw** handles any job a big hacksaw can do...and more! It's designed to adjust to work in close quarters. Heavy-gauge molded handle. Uses regular blades. MMHF10. **1<sup>99</sup>**

**6-lb. Splitting Maul** has a drop-forged hand-ground steel head fitted to a fire-hardened hickory handle for strength and balance. Bites deep into wood with light ease. MMS6MA. **11<sup>99</sup>**

# quality tools

Master<sup>®</sup> **MECHANIC** hand and power tools are sold exclusively by True Value Hardware stores and carry this customer satisfaction policy: If any Master **MECHANIC** tool fails to perform as you would reasonably expect, return it to any participating True Value Hardware or Home Center for immediate replacement.

YOUR CHOICE

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

☐ **17" Claw Ripping Bar** is high carbon steel forged for durability and strength. Has polished ripping blade, 3 nail pullers to extract deeply embedded nails and a 90° claw for tight spots. MM232.

☐ **12" Combination Square** gives the best angle on carpentry work. Markings are graduated by 8ths and 16ths on one side, 16ths and 32nds on other. Die-cast beam has level inscriber. 10245.

☐ **7-Pc. Drill Bit Set** is high speed steel, heat-hardened for maximum strength. Hardened power points bite deep for smooth, one-stroke drilling. Drill bit sizes range from 1/16" to 1/4". 121590.

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☐ **Professional-Quality Hammers** have highly polished striking heads, triple wedged handles in tapered eye. Handles are select, flame-treated hickory. Choose claw or ripping hammer. 816MM/RMM.

☐ **Single Bit Axe**, with its balanced hickory handle, is light enough for easy use, heavy enough to bite deep. Drop-forged from high quality tool steel and hand-ground to keep a keen edge. 35S8TT.

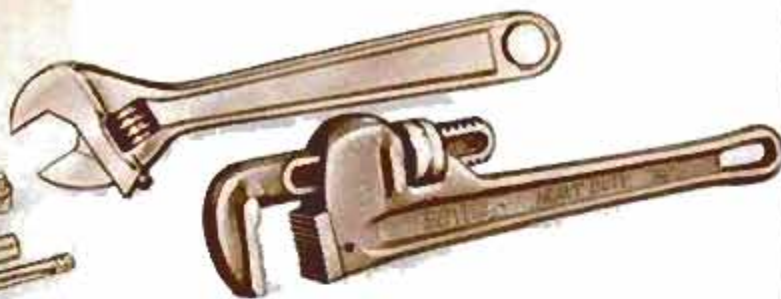
☐ **Precision Wood Chisels** make fast work of shaping wood or composition. 3-pc. set has 1/2", 3/4" and 1" blades, austempered and bevel-ground to keep keen cutting edge. Hi-impact grips. 300MM.

☐ **Professional Power Tape** has self-adjusting end hook for accurate measuring. 25"x1" no-seam epoxy-coated blade housed in rugged, Cyclocac<sup>®</sup> chrome-plated case. With removable belt hook. MMP425.



### National 1/4" and 3/8" Socket Set

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### Crescent Adjustable Wrench

No tool box should be without this 8" alloy steel wrench. Drop forged and heat treated for toughness and durability. Completely chrome-plated to resist corrosion. AC18V . . . **6.99**

### SEWESS 14" Pipe Wrench

Drop forged upper and lower jaws with full floating hook jaw assure instant grip and easy release. Won't jam on pipes. I-beam handle has handy hang-up hook. S145 . . . **9.99**



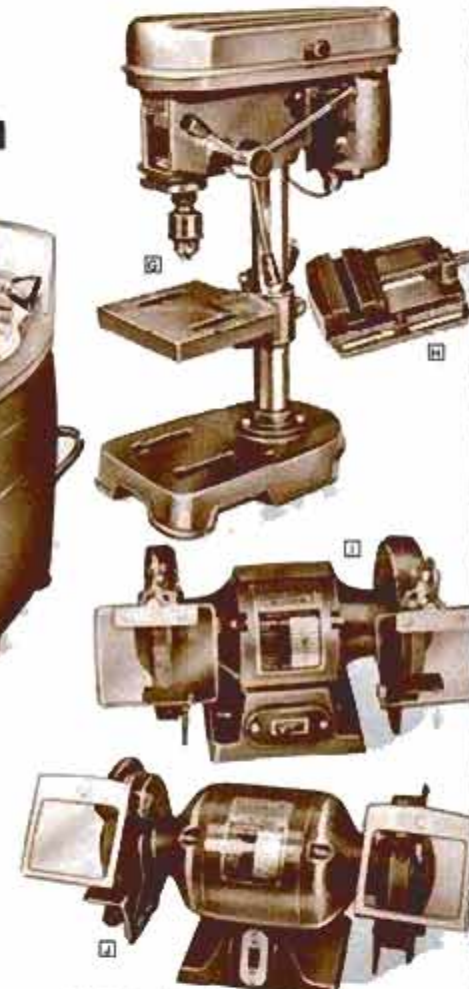
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**A**  
33.33  
-5.00 rebate  
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**C**  
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**B-D** **3/8" Reversing Drill**  
**A** 0-1200 rpm variable speed drill has trigger control speed lock, reversing switch to remove screws and jammed bits. 3/8" steel and 3/4" hardwood cap. **33.33** less \$5 factory rebate. 7190.

**B-D** **Dual Action Sander**  
**B** Variable 1/2 sheet sander has orbital action for fast material removal, straight line sanding for fine finishing. Flush sands on 3 sides. Only **34.50** less a \$5 manufacturer's rebate. 7436.

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**C** Routes, grooves, trims and decorates wood, plastics, compositions. Calibrated in 1/64" increments for accurate depth, removable chip deflector. **44.95** less \$10 factory rebate. 7614.

**WEN** **Wet Stone Machine**  
**B** An ideal way to sharpen, grind and hone because wet stone eliminates overheating and loss of metal temper. Built-in guides, 4x180° grit wheel, diaphragm pump system. 2900 **64.99**

**SKIL** **Sandcat Sander**  
**B** Combines the ease of control of an orbital sander and fast removal and low vibration of a belt sander. Ball and needle bearing construction, locking lever, plus 5 belts. 593 . . . **48.49**

**SKIL** **True Value Exclusive**  
**B** 7 1/4" circular saw has 2-hp motor, Vari-Torque clutch to prevent motor damage, and aluminum guards for use with metal and masonry blades. Cuts 2 1/4" at 90°, 1 1/4" at 45°. 6755 . . . **44.99**

**DURACRAFT** **3-Speed Action**  
**B** Ball bearing drill press uses 1/4-hp motor to drill through hard or soft woods, metals, plastics at 700, 1560, 3270 rpms. SP30 . . . **89.95**  
**B** 2" capacity drill press vise. DPV2 . . . **8.99**

**DURACRAFT** **High Speed Action**  
 Bench grinders do so much—stripping paint and rust, sharpening, cleaning and polishing tools—they're as practical for home as for professional use. 2-wheel design gives you 2 different grits at once. Adjustable tool rests support work at proper angle; see-thru shields protect user. Direct-drive motors with permanently lubricated bearings assure long life.  
**B** 5" grinder, 1/2-hp. UL listed. 33-5 . . . **27.77**  
**B** 6" grinder, 1/2-hp. UL listed. 50-6RX . . . **39.99**

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# PM SOFTWARE MONITOR

It doesn't matter how much money you spend on your personal computer—without the right software it is only an oddly shaped box with a keyboard. Now that the computer revolution has found its way into so many households, finding software is more important than ever before. Each month, we'll take a look at several outstanding programs for personal computers that will help you in everything from word processing to destroying on-screen enemy space fleets.

## Double your type sizes

*Screenwriter II* is a word processing package for the Apple II computer.

Most Apple II owners quickly come up against one of the more obvious limitations of the Apple: Its character line length is only 40 columns across the screen. There are a number of hardware solutions to this problem (such as Videx's Videoterm board) which plug into the Apple and widen its screen to 80 letters across a line. But these hardware fixes are expensive—around \$300 or so.

*Screenwriter II* is the first word processor for the Apple II which gives you an 80-column display without additional hardware. It even gives you lower-case letters for which you would otherwise need a less expensive (\$50) hardware accessory. So already, *Screenwriter II* can save an Apple II'er \$350 or more.

The display uses the Apple's high-resolution graphics to "draw" each

letter on the graphic screen, bypassing the way the Apple usually generates its character set. The visual result is not quite as sharp as that of an 80-column hardware attachment (see photo). At a dealer's, compare an 80-column card against *Screenwriter II*'s display. If you settle for a readable, as opposed to an ultraclear display, you'll save some big bucks.

*Screenwriter* has the usual find-and-replace features to change words throughout a document.

But *Screenwriter* features two surprising additions—spooling and macros. Spooling allows you to have your printer working while you're still editing an on-screen version of what is being printed. Macros let you define long words, or even phrases, so that they appear with one keystroke.

*Screenwriter II* will keep a lot of Apples wordstruck—at \$129.95 from On-Line Systems.

through your cassette recorder's speaker.

The game plays pretty much the same as the arcade's *Berzerk*. You run a little man through some maze-like rooms while being chased by robots. You control your man by keyboard.

The game is \$19.95 on disc or \$15.95 on cassette. It's from Big Five Software.

## Adventuresome Apples

*Knight of Diamonds* is out, and that's wonderful news for the thousands of people already addicted to the Apple adventure game of *Wizardry*.

This is the second scenario in the *Wizardry* universe and requires that you have characters who have progressed through the earlier scenario. No dull-witted wizards or scrawny



*Knight of Diamonds* is the second scenario in popular series of *Wizardry* games.



*Screenwriter II*'s display (above) features two type sizes. The large type is usual 40-column size. The smaller type is 80-column done without additional hardware.

## Killer 'droids

*Robot Attack* is one of the best of the new-style arcade programs for the TRS-80 Model Three computer.

One of the most exciting things

about this game is that it talks to you—and you won't even have to buy anything additional. While it's no Don Rickles, it will shout such things as "chicken!" and "lucky" at you

warriors will survive long in this new setup!

Like *Wizardry*, the maze is drawn in a three-dimensional view as you move through it. And the name and status of each of your characters is listed on the same screen.

Fighting (and there is a lot of it!) involves having your six-character party cooperate in a melee of brains and brawn against all comers. And, as in the first game, even a powerful character can bite the video dust.

*Knight* is the best sequel we have seen to an already popular computer game. We're now awaiting the third scenario and anxiously trying to strengthen our favorite wizard. *Knight* is on disc for \$39.95 from Sirotek Software.—Neil Shapiro

# Build This Inexpensive Magnetic Lathe Chuck

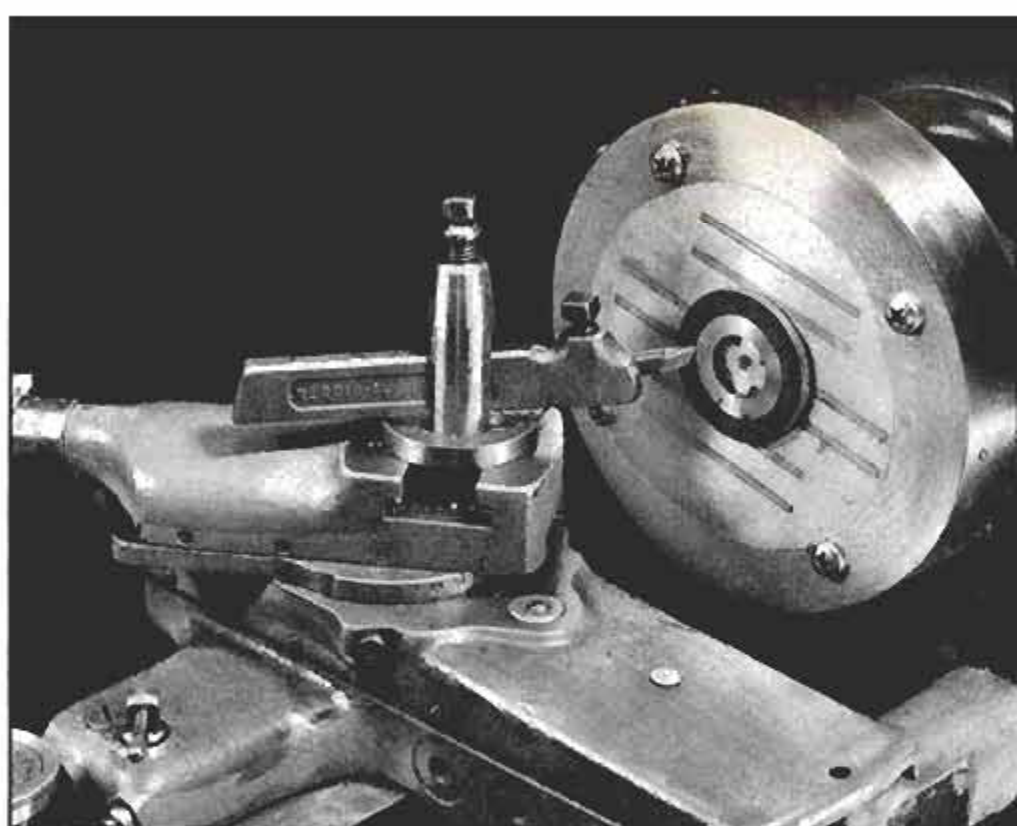
Here's a clever, inexpensive way to hold oddly shaped—or very thin—workpieces that would be distorted by conventional lathe chucks.

by Walter E. Burton

**D**oing the impossible turns on most hobby machinists—more than simply producing standard parts. Jobs like truing both faces of a steel washer to make them flat, parallel and to a precise dimension, for instance—try that on your lathe with a conventional chuck. It can be done, but most of us find we botch many parts and give up in frustration.

Of course, you are not the first to need a precision shim, spacer, or other thin but accurate turning. Pro machinists have long since developed the magnetic chuck to hold just such workpieces and make these seemingly impossible jobs easy, quick and profitable for their shops. For them, with many parts to produce and no time for elaborate setups or botched work, the cost of the tool that does the job means far less than what they can earn by having it. This line of thinking goes a long way toward explaining why commercial magnetic chucks cost so much—and why so few hobby machinists have them.

You may not want to invest the



Machining the impossible becomes easy when you can stick the workpiece to your lathe chuck by magnetism. Turn rings, precision spacers and tiny parts without distortion.

full price for a magnetic chuck, nor are you apt to find one at a garage sale. But, how about building your own for less than \$15? Magnets, beefed up with pole pieces that grip with 40 lbs. of force, do the holding, and the other materials are mostly scrap. What's more, almost all of the machining can be done on your lathe. A milling machine helps cut the slots in the faceplate of the magnetic chuck, but you can do this work by hand or with a drill press.

The only thing your magnetic chuck won't do as conveniently as a commercial model is to let go of the workpiece when the machining is finished. Professional versions have a system of levers to move their magnets, thus reducing the force holding the workpiece to the chuck. Yours won't do that but, while you may have difficulty pulling a workpiece off the magnetized surface with your fingers, pushing it away

from the magnetized part of the chuck face with a wood stick makes it easy.

Other magnetic chuck-machining tricks make it even easier and help keep ferrous chips from sticking to its workface.

With this type of chuck you can make washers, rings, shims and other shapes that must be held to close tolerances.

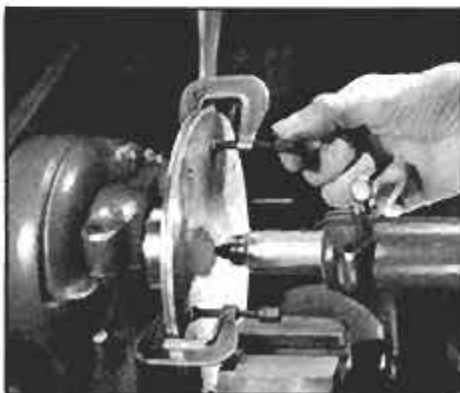
A magnetic chuck can hold thin ferrous workpieces for your lathe drill press or surface grinder. By making a wooden fixture for it, you can clamp the chuck to a workbench to hold parts for hand finishing, assembly, filing, and even engraving.

Using a magnetic chuck in a lathe calls for firm mounting on the spindle and the slowest practical turning speeds. Sometimes, rotating the spindle by hand after disengaging

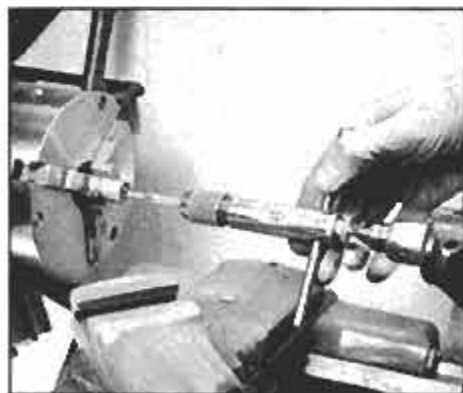
*(Please turn to page 78)*



Circle cutter with extended cross bar removes heavy aluminum disc from bottom of discarded pot to form chuck faceplate.



Center front plate over back plate and clamp so spacer mounting holes can be spotted, punched and drilled accurately.



Thread each end of the spacer hole 1/4-20 for plate-mounting bolts in back and work-securing fingers on front plate.



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benefits are: 1) It can withstand more than 2600° F., and can therefore burn coal without add-on equipment. 2) Its custom design allows it to closely hug the heavy plate firebox, and this allows a better heat transfer. 3) Its tapered shape guides the ashes down to the shaker grate naturally, thus promoting even burning of the live coals, or embers.

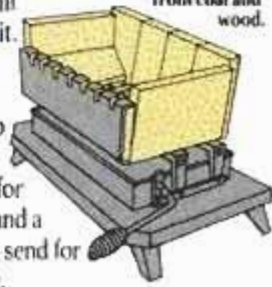
Another aid to even burning and the elimination of dead spots is the combination of a cast iron shaker and an external shaker handle.

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# Russo

**THE HOUSEWARMING STOVES WITH THE GLASS-VIEW®**

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## MAGNETIC LATHE CHUCK

(Continued from page 76)

the power drive produces the best work.

To work on brass, aluminum, plastic or other nonferrous material, simply cement the workpiece to a thin sheet of steel or iron. Backing pieces about 1/8 in. thick do this well. Adhesives like cyanoacrylates hold hard and then let go with a little carefully applied heat. This method also works well for small ferrous parts hard to center on the chuck without a backing piece.

While a magnetic chuck holds parts firmly for machining, it also collects most of the chips and holds them too. You can brush them off with a stiff bristle brush or wipe them away with a cloth or paper towel. Dampening the cloth or towel with water or thin oil may help snag the chips much as wetting a paper towel helps to pick up tiny glass fragments. Tape, sticky side out, can also remove chips and metal dust from the magnetized surface. Use a thin sheet of kitchen sheet plastic to help keep chips from sticking directly to the face of your magnetic chuck. While not greatly reducing the chuck's holding force, two layers of thin plastic also make it easier to remove a delicate workpiece.

Aluminum fingers, held to the face of the chuck with Phillips screws or bolts can be adjusted to keep the workpiece from slipping as you machine it. Try taking the lightest possible cut to minimize any tendency for the part to tip. Flat workpieces like washers are the most suitable. Having a large area in contact with the chuck face reduces any tendency to tip or shift.

Sudden tool movements can cause a workpiece to shift, even if precisely trapped by the stop fingers. So will a cut that attempts to remove too much material in one pass.

When holding a very thin workpiece, make certain it is neither warped nor bent before you start machining it. The force of the magnets can flatten out the warp which will show up again when it is removed from the chuck after machining.

Grit and chips from grinding operations can damage the surface of the magnetic chuck as well as the lathe bed ways. Catching them with a cloth or piece of aluminum foil—take care to keep it from becoming tangled in the machinery—keeps grit out of machine slides and bearings where they could cause rapid wear.

Four ceramic magnets (\$12 from Edmund Scientific, 101 East

Gloucester Pike, Barrington, N.J. 08007), a 6 1/2-in. aluminum disc that had not found a previous use in the shop and the bottom of a heavy aluminum pot became basic chuck parts. If the aluminum had not been handy, brass or steel could have been used for the discs forming the front and back plates of the chuck. An adapter to fit the spindle nose on my 9-in. lathe was turned and threaded from brass, but cast iron or steel would do as well.

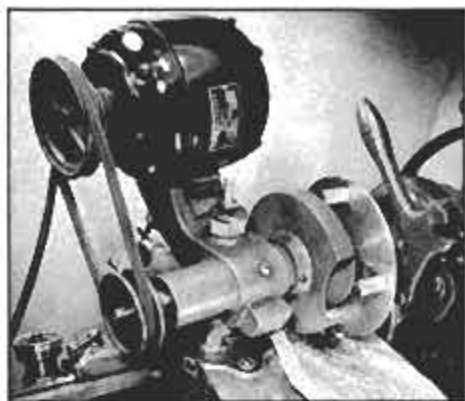
Center the back plate on the adapter and drill the three mounting holes through the plate and into the adapter with a No. 7 bit. Thread the adapter holes 1/4-20 and enlarge the holes in the plate to a 1/4-in. diameter. Use thread-locking compound on the bolts securing the adapter to the back plate.

Cut four 1 1/4-in.-long spacers from 1/4-in.-dia. mild steel rod. These separate the front and rear plates to make room for the magnets.

Center drill each spacer lengthwise with a No. 7 bit and tap each end of the hole 1/4-20 for 1/2-in.-long bolts. Center the 6 1/2-in.-dia. front plate over the 6 1/2-in. back plate and clamp them firmly so you can drill four 1/4-in. holes about 90° apart 1/4-in. in from the edge.

Mount the four spacers on the

(Please turn to page 80)



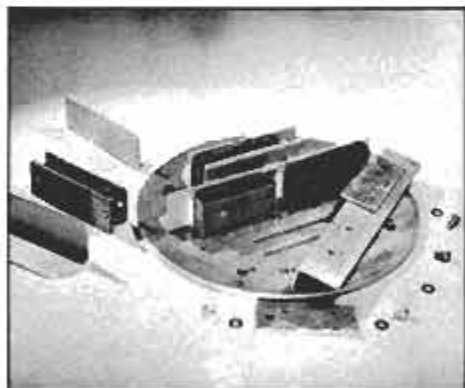
Toolpost grinder on lathe trims spacers to equal length. Aluminum foil under cup grinding wheel keeps grit off lathe bed.



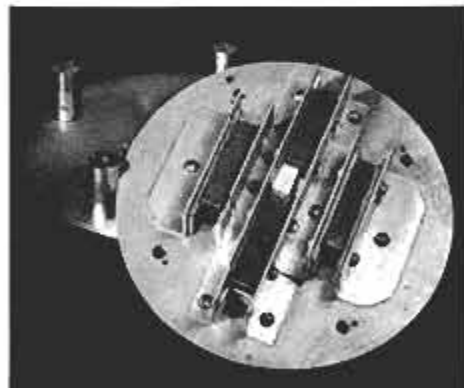
Saw blade in milling machine cuts slots in front plate for magnet pole pieces so they can grip workpieces with maximum force.



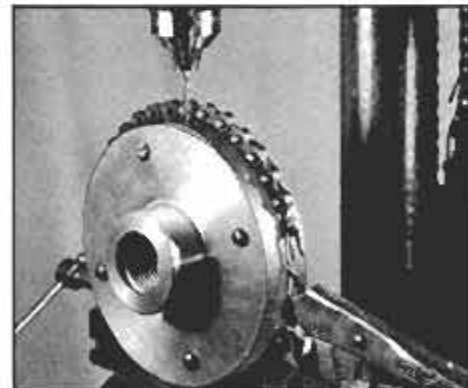
Flat file squares off the ends of each slot. Epoxy cements pole pieces in place and files gaps to finish faceplate flush.



Angle strips secure pole pieces and magnets on faceplate. Screws hold pole pieces which engage slots in faceplate.



Wooden block separates ends of center magnets, keeps them from shifting under centrifugal force when chuck is turning.



Clamp sheet-metal band enclosing magnets with chain pliers while drilling holes for self-tapping screws that secure it.

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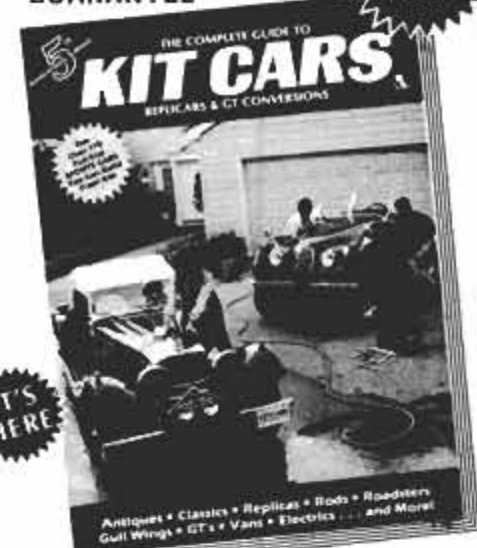
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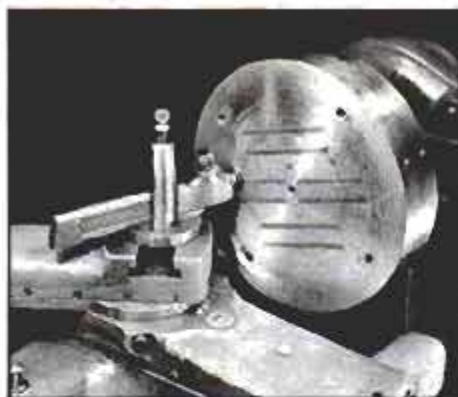


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A light facing cut truss and smooths front plate so workpiece held against it by magnets can be finished to close tolerances.

### MAGNETIC LATHE CHUCK

(Continued from page 78)

back plate using 1/4-20 x 3/4-in. bolts. Use Loctite or another anaerobic thread-locking compound to make certain these bolts do not shift. With the spacers solidly in place, grind the ends using a toolpost grinder. Make each spacer equal in length so the front plate is precisely parallel with the back plate.

Mount the top plate on the spacers with 1/4-5/8-in. bolts. Do not lock them. Remove one of these bolts and drill a new hole through the front plate into the spacer. Center it between the center hole and the outer edge of the spacer. Use a No. 36 bit and thread the hole for a 6-32 bolt. Enlarge the hole in the front plate with a No. 28 bit and a countersink. Secure the front plate the spacer with a 6-32 flathead bolt. Leave the center hole in the spacer empty. It will mount the stop finger when the chuck is complete.

Repeat this procedure for the other three spacers.

Assemble the chuck frame and turn both discs to the same diameter.

Remove the front disc and slot it for the U-shaped magnet pole pieces. These came with the magnets and increase their holding force from 4 to 40 lbs. by concentrating the field of force. Lay out slots 1/16 in. wide so the edges of the pole pieces will lie flush with the surfaces of the front disk. Arrange the magnets so two cross the center of the disc with one on each side. You can mill the slots or cut them by joining a row of drilled holes with a hand file. File the ends of each slot square. The pole pieces must rest flat against the magnet when in the slots.

Magnets must be oriented so their north surfaces face one way and their south surfaces the other. It is important to maintain the correct order.

The pole pieces of the two magnets



Stop fingers prevent workpiece from sliding under machining loads. Magnets hold ring against the faceplate for grinding.

mounted end-to-end across the center of the chuck come within about 1/4 in. of each other at the corner. The gap is bridged by two pieces of mild steel fastened with instant glue. These bridges do not extend through the face plate and serve to keep magnets in position.

Strips of 1-in. aluminum angle anchor the pole pieces to the plate. Length is not critical. The one for the center magnets could have been notched to bridge the gap, eliminating separate inserts. Brass screws attach the angle pieces to the front plate, steel screws mount the pole pieces to the angles.

Friction and magnetic attraction hold the ceramic magnets in place. Once the pole pieces are in place, fill the gaps with epoxy.

Make a rim band to fit around the front and back plates to keep chips and dirt out of the magnetic chuck and to strengthen it. Three 1/2 x 3/16-in. cleats 120° apart to keep it from shifting. Overlap the ends by about 1/4 in. and secure them with self-tapping screws. Use chain-locking pliers to tighten the band while drilling the holes for these screws.

After assembling the chuck and tightening the rim band, mount it in your lathe. True the face with a light cut. Pole piece chips will be held and must be removed after machining.

Stop fingers were made from 1/4-in. sheet aluminum to keep workpieces from sliding under machining forces. Mount these with 1/4-in. bolts. You can make special stops for specific jobs if necessary. They serve two purposes. Besides keeping the workpiece from shifting, they can act as a jig to replace it in the same position after measuring or inspection. Swing one stop out of the way or remove it so you can push the workpiece off the magnetized surface to free it from the chuck.

Not every home machinist needs a magnetic chuck, but once you build one, chances are you'll wonder how you got by without it.

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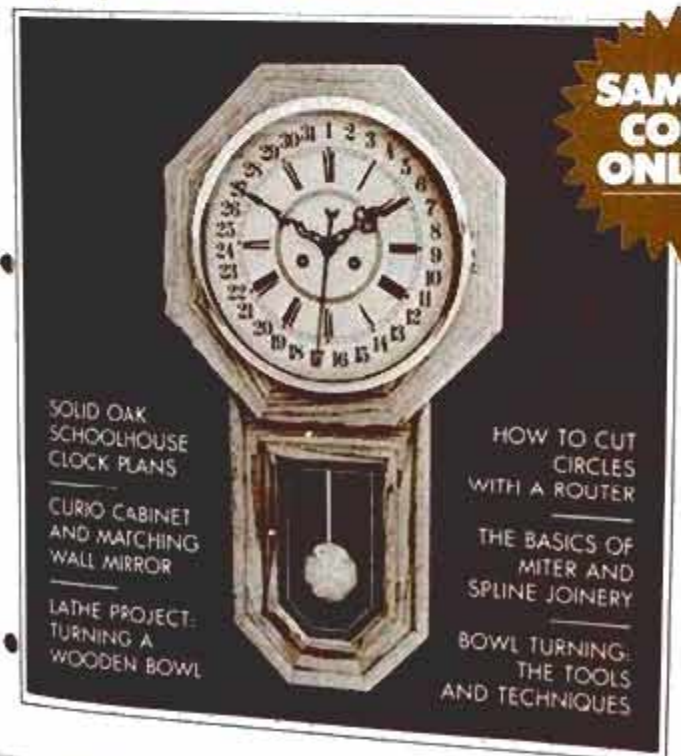
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# Driving The Porsche 944

The 924 replacement is a car even the Porsche purist can love.

by Joe Oldham

**O**kay, all you Porsche purists, you can stop picking on the 924 now. You can stop your carping about Porsche building a car that "really wasn't a Porsche." Yes, the 924 borrowed too many components from the Audi parts bins, most notably its engine. But all that's in the past. The two-liter 924 and 924 Turbo are no more. Their replacement, the 944, is a thoroughbred Porsche, fairly bristling with high-tech hardware, a "real" Porsche, one that even purists can love—providing, of course, they're not so pure as to want the engine in the rear.

One drive in the 1983 944 (yes, it's a 1983 model) will convince anyone of its breeding. Its performance levels are high enough for it to be able to hold its own even among the bluebloods of cars. In fact, the 944's performance levels are so high that

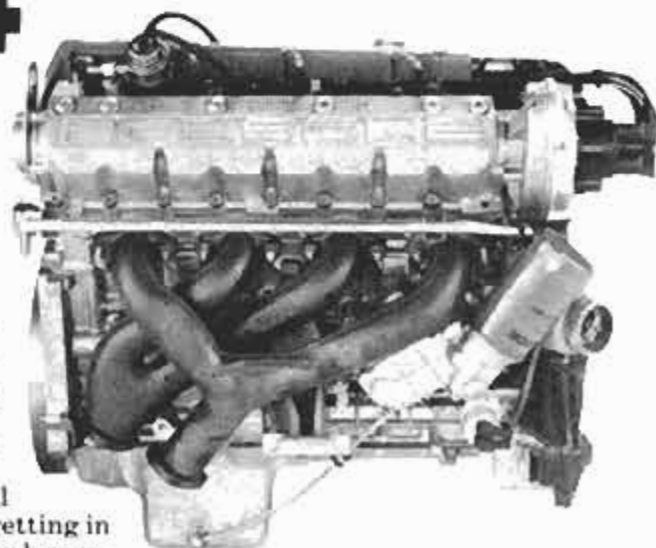
most people who buy one of these cars will never experience its outer limits. They won't be good enough drivers.

The 944 sits low, real low. And that makes getting in and out a little awkward, especially if you're on the bulky side. Once in, though, it's easy to find a comfortable driving position. The form-fitting buckets mold you all the way from your lower thighs right up to the upper part of your back. The seat shape, combined with the tweed cloth covering, makes it virtually impossible to shift around while you're driving. Instead, you feel like you're sitting on a Velcro fastener. Whether this is good or bad is up to you. Personally, I like a little looser fit. On long drives, it's restful to be able to shift

your weight slightly from time to time.

The 944's engine is so quiet that I didn't realize it was running the first time I started it up. Once underway, however, I never made that mistake again. I was always quite sure it was running. Here's a 2.5-liter, four-cylinder engine that will melt the tires in first gear, get rubber going into second, accelerate the car from zero to 60 mph in 8.1 seconds, compress your spine into the seat while doing it, top out at about 130 mph and deliver over 20 mpg—all with the air conditioning on and never breaking a sweat.

The engine capable of all this is made entirely of Reynolds 390 aluminum alloy. Two internal balance shafts counterbalance vibrations, and an overhead camshaft makes this engine as smooth as any Six or V8 you've ever owned. Porsche's Weissach engineers have included a computerized digital electronic engine control system which precisely controls the no-maintenance fuel-injection and ignition systems. And the engine rides in hydraulic engine mounts to further smooth out vibrations. The



The engine is made of Reynolds 390 aluminum alloy. No cylinder liners are used. Weight is low, yet power output is high. Engine delivers 143 hp at 5,500 rpm.

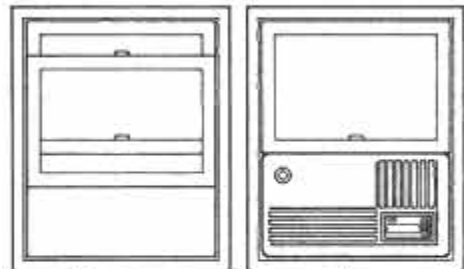
result of all this is a rating of 143 hp at 5,500 rpm and 137 ft. lb. of torque at 3,000 rpm. It feels like twice as much behind the wheel.

The engine acts like it wants to rev forever. Only the built-in rev limiter that cuts the ignition when you go over the redline was enough to save the engine on several occa-

*(Please turn to page 86)*



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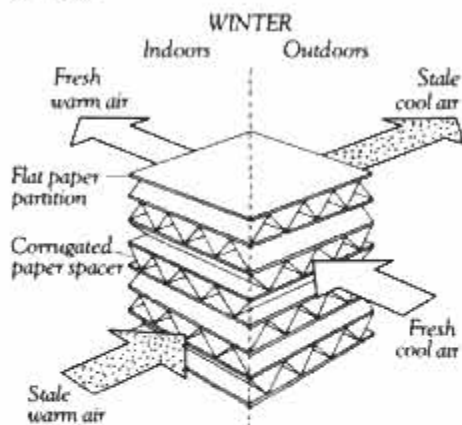
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## DRIVING THE PORSCHE 944

(Continued from page 84)

sions when I got overenthusiastic.

Backing up the engine is as sweet a five-speed transmission as you'll find. It's butter-smooth with short, precise throws that allow you to snick from gear to gear like a Formula One racer. The transmission is mounted in back at the rear axle for better weight distribution—it's exactly 50-50 front to rear—and, therefore, better handling. The front-mounted engine and the rear transaxle are linked by a rigid driveshaft tube. Rack and pinion steering, fully independent suspension, the four-wheel vented disc brakes and 215/60VR15 tires on 7×15 wheels represent the

In all, you get a tremendous feeling of confidence when driving the 944. I doubt whether there are a handful of cars in the world that can match 944's combination of acceleration, braking, handling and excellent road manners.

That's not all. The 944 also has the audacity to be fuel efficient too. EPA estimates are 23 mpg city, 36 mpg highway, for a 27 mpg combined rating. I drove the test car hard, not giving a damn about gas mileage, and still managed to rack up several 21-mpg tankfuls.

The extraordinary combination of performance and fuel economy can be partly attributed to the 944's slippery, wedge-shaped body, the result of extensive wind tunnel work. The drag coefficient is just



No matter how we abused the 944, it just kept coming back for more. Handling and stability remain excellent through any kind of corner, weather, or road condition.

latest refinement in Porsche's chassis development program which was begun in 1976 with the 928. While most of this hardware is carryover from the 924, it's all been recalibrated to handle the additional power of the new engine.

All the tech goodies translate into real world handling and stability of the highest order. This is a car that literally begs to be pushed hard. You'll reach your limits before the car will reach its. Jam it hard into a tight turn. Downshift, brake, power out. It almost doesn't matter what you do with the 944. The car just seems to motor on through, nonplussed, almost aloof from the hamfisted operator in the driver's seat. The car will make you look good, yes, even save you if you cross over the line.

I spent about three weeks with our test 944, which also had the optional stabilizer bars and 205/55VR16 tires on 7×16 wheels. These tires are even fatter and stickier than the stockers, and the sway bars virtually eliminate body roll except in the fastest corners.

0.35. While few other sports cars even begin to approach this figure, the 944's air drag rating is even more significant when its frontal area is taken into consideration. The fact is, the 944 is a very wide car, which would normally increase drag. It doesn't happen here, thanks to great attention to aerodynamic detail.

The flexible polyurethane nose incorporates a functional air dam which diverts air around the flared fenders of the car while permitting a low-drag, under-bumper intake for the radiator. Flush-mounted fog lights are located in the air dam. Other attention to aerodynamic detail includes flush windshield moldings and spoiler.

You don't feel deprived of luxury while enjoying all the 944's sport. Standard is a long list of equipment including air conditioning.

All this for \$18,500. Too much? It's actually a bargain when you compare what else you can buy for that amount of money. And nothing in its price range can touch it once you hit the road. **PM**

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# The Ultralight You Can Take Anywhere



Remove the wing, add pontoons, and the Jet Wing becomes an exciting 40-mph airboat.

**M**ost ultralight aircraft are content just to fly, but this latest model can turn itself into almost any kind of transportation.

Called the Jet Wing ATV (for all-terrain vehicle), it's basically a three-wheeled undercarriage, with 30-hp engine and prop, to which interchangeable accessories are attached. Mount a wing on it and it's a sport plane you can fly without a pilot's license under current FAA regulations. It cruises at 37 mph and can climb at 1,000 feet per minute—hot for an ultralight.

But this is just the beginning. Exchange the wheels for pontoons and the craft converts to a seaplane for use on water. With the wing removed, it becomes a speedy airboat, capable of more than 40 mph. Switch back to wheels and the wingless trike is now a prop-driven ATV that requires no traction on soft or slippery ground. And you can use the wing alone, without the trike, as a pure hang glider.

The basic landplane kit, with a 33-foot wing and wheels, is \$4,695 from Flight Designs, Box 1503, Salinas, Calif. 93902. A float kit for seaplane conversion is \$1,475; additional airboat fittings are \$460. Brakes are \$225, and a hang-glider harness is \$105. What's next? Possibly skis for snowmobiling and balloon tires for beach roaming.

—Shel Gallagher



Aloft, craft hits 37 mph, has hot climb.



On land, wingless trike is a zippy ATV.

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Turbocharged Mooney 231 flew coast to coast in 8 hours, averaged 24 mpg at over 300 mph.

# Singles, Anyone?



PM Technology Editor Robin Nelson (right seat) checks out a Mooney crammed with latest instruments.

PM photos, Peter Tenzer

If anything beautiful came out of the gas squeeze, it is today's luxury, single-engine planes.

by Robin Nelson  
TECHNOLOGY EDITOR

Not long ago, the proud owner of a new, single-engine airplane offered a ride to an acquaintance who happened to be an airline captain. "Hmmm," the DC-9 jockey mused as he squeezed into the smallish right-

hand seat, "got dual glideslopes, huh?" (He was referring to the primary and backup displays for Instrument Landing System approaches.) "I could go for that. Hey, you have color radar, too. Mine's monochrome—and what's that?"

The object of his query was an optional accessory called the Ryan Stormscope, which displays the relative positions of up to 250 lightning strikes on a radarlike screen. Clusters on the Stormscope are a far more positive indication of severe turbulence than big-plane weather radar can give.

Duly briefed, the captain could only marvel at an instrument panel the likes of which would provide similar novelty for flight crews of the majority of scheduled airliners plying U.S. domestic routes.

What's more, with an optional oxygen system or pressurized cabin, and turbocharged engine, there are single-engine planes that will go right up there with the jetliners at altitudes of over 20,000 feet. And the tape deck gives you *true* stereo, folks, not that through-the-tube stuff.

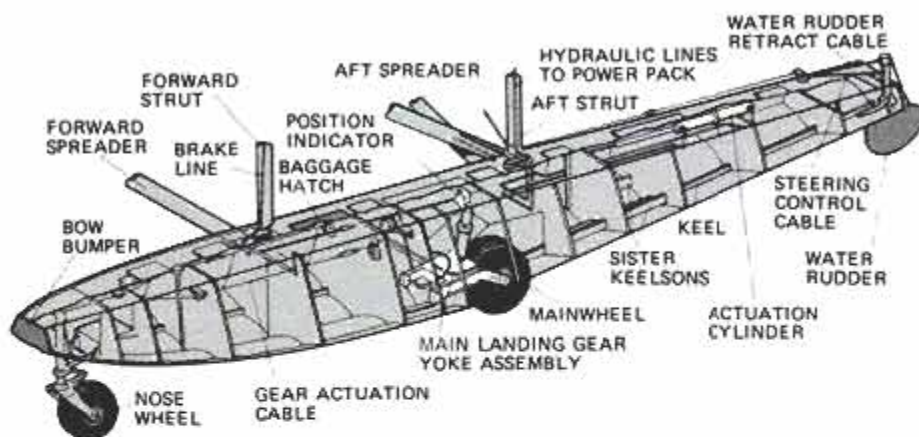
What this means for private or



Cream of the turbocharged '82 singles includes (from left) Beech Bonanza B35TC, Mooney 231, Cessna Pressurized Centurion II and Piper Saratoga SP. The 210-hp Mooney is low end at \$77,600 list; Cessna (310 hp) tops \$182,000. Deluxe avionics, radar, autopilot will add as much as \$40,000 to each.



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The floats and landing gear must be built to rigid FAA specs. All parts are assembled like an aluminum

yacht (see above) and add up to \$50,000 to the price of an airplane (assuming it has been built or retrofitted with a float-stressed airframe). There's a weight penalty, too—about 500 pounds over normal retractable landing gear.

But the flexibility to land on all tidal and most states' inland waters, plus scrounge for fuel at any Podunk airport makes for a luxury many owners can justify.—R.N.

quasi-business owners of these aircraft is that they were born at the right time. The one-mill flying machine available to the man in the street has never been safer, more versatile or more fun. And it may never get any better.

The super singles evolved partly as a result of the mid-'70s fuel crunch. Even afterward, there are some places in this country where aviation gasoline has never dropped much below \$2 per gallon. A high-performance, single-engine plane can get up to 19 mpg at economy cruise power (about 65 percent of maximum available). The best of the twin-engine planes barely scratch 10. The super single, then, is really a prefuel-crunch light twin squeezed into a smaller profile for economy's sake.

And with a larger, turbocharged engine, twin performance has not been compromised. For example, in 1980, a Beechcraft Bonanza A36TC flew 4,300 miles nonstop from New York City to Munich, West Germany, in less than 16½ hours. And last year, a Mooney 231 flew from San Francisco to Washington, D.C., in 8 hours. (Both had extra fuel tanks installed, but were stock, turbocharged aircraft in other respects.) The Mooney, in fact, averaged 24 mpg on that run; *your car* might do a little better, but not at the 302-mph ground speed the little bird averaged.

Speeds in that range, obviously, are wind-aided. But turbocharging gives the single-engine pilot the service ceiling to go up and find his wind. And it eliminates the density-altitude problems of yore, when there was no way certain aircraft could take off from some high-altitude runways on hot days.

Naturally, in the minds of people who sell airplanes, it makes no sense

*(Please turn to page 198)*





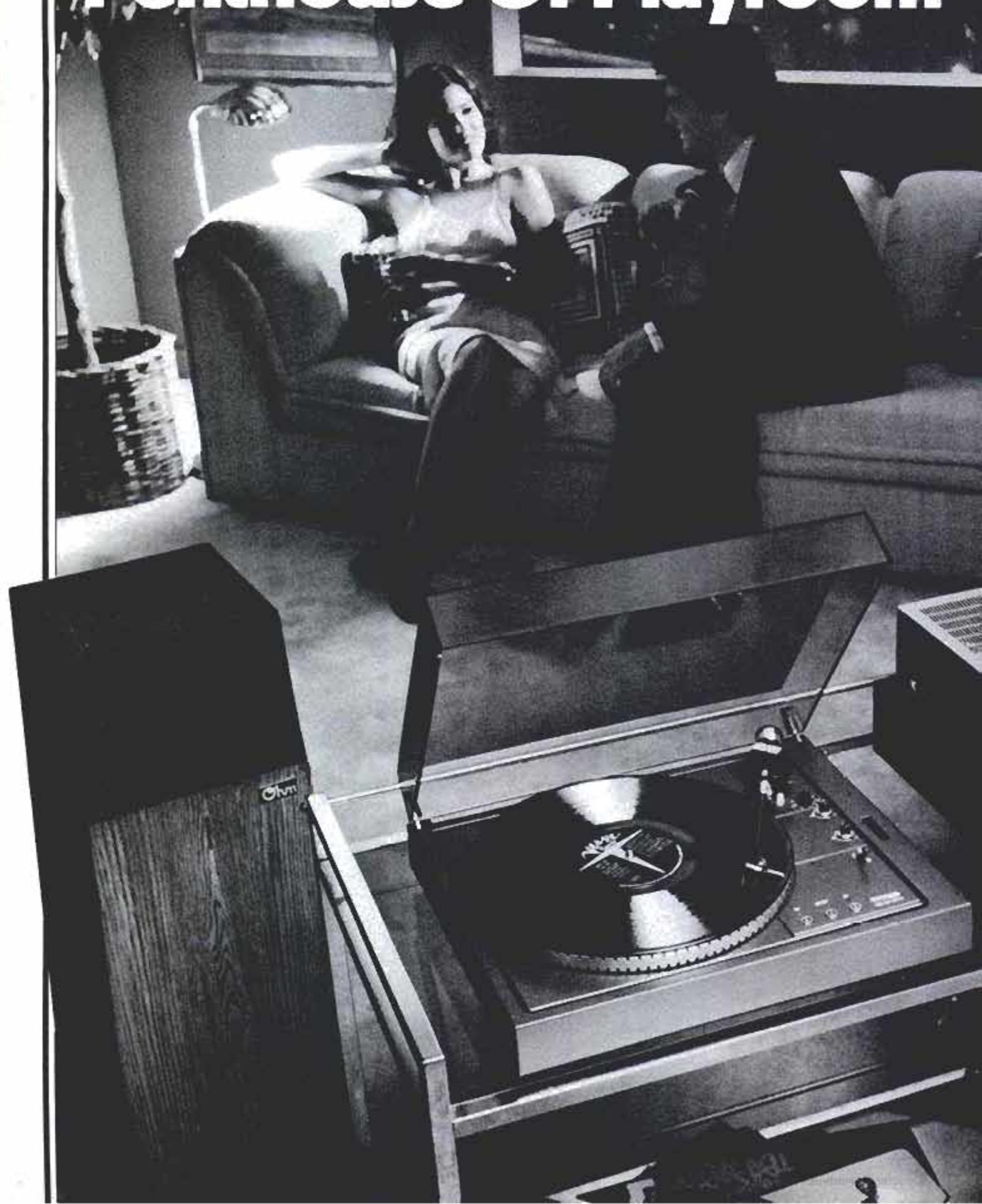
Small single engine panel still has room for radar (center), dual Instrument Landing System glideslopes (left side), autopilot (center) plus multiple radios and stereo tape deck (stacked at right).



Earmarks of the hot singles include the following: 1 Radar antenna—shown here built into Mooney's wing. 2 Air scoop for turbocharger—Piper Saratoga's makes a landing light housing as well. 3 Pressurized cabin is unique to Turbo Centurion II; others are planned. 4 State-of-the-art electronic instruments—Collins CRT navigational instrument is still in development; push-button changes overall compass display to an arc segment, incorporating supplemental nav data.

Interiors have grown up along with engines and instruments. Piper Saratoga's fore-and-aft rear seats (right) add a touch of luxury to the necessarily narrow cabin.

# Best Stereos For Penthouse Or Playroom



**'Penthouse' system (left):** Sony STR-VX6 receiver is an advanced design that pumps out 70 watts of pure sound per channel. The TD-105 Mk II Thorens turntable stars true Swiss-precision mechanics. The TA-2070 cassette deck from Onkyo is a superb unit, featuring three-head design. Ohm Walsh 2 speakers have unique and sophisticated design. The middle-class system (right), pictured here in a playroom, is no sonic slouch. The Sansui R-606 receiver produces 30 watts per channel of clear power; Dual C-814 cassette deck features several splendid options and Acoustic Research's AR-38 speakers have full range of sound. Yamaha P-751 turntable rounds out system. The wall unit is courtesy of JCPenney.



PM photos: Harry Hartman

Regardless of your budget, you can get a stereo that sounds more expensive than it was. Here are three systems that fit the bill.

by Hans Fantel

**F**or most stereo fans, one specification outweighs all others: price. The kind of system you're likely to buy depends on how much money you have to spend. With the price of stereo ranging from a few hundred dollars to the five-figure stratosphere, you have to peg your budget somewhere between extremes.

A single, super-deluxe component may cost as much as an entire budget system. If this seems odd, consider that you can buy several Rabbits for the price of one Rolls, yet either car will get you there. Similar price/value relations hold true in the audio world.

The trusty old saying that you get what you pay for doesn't always hold true. Especially in stereo, some models give you more for your money than others. Expensive equipment naturally outperforms low-cost components. But within each price range, it's possible to pinpoint the exceptional. That's what we did here.

We set up three price classes: 1. "Dormito-





Our dormitory system is still at the top of its class. Onkyo's TX-11 receiver supplies 20 watts per channel; the cassette deck is Technics' RS-M205; the belt-driven turntable, which is also from Technics, is the SL-B202 and the speakers are the Boston Acoustics A40s. Total cost of system: approximately \$700.

ry," 2. "Playroom," and 3. "Penthouse." Then, we tried to pinpoint the exceptional components in each price group.

Our main concern was with musical merit rather than technical frills. We compared specs, but those weren't our primary consideration. In fact, we used the specs mostly to confirm what our ears told us. On the whole, our judgment was based on listening.

Our listening test covered four different kinds of music:

- Symphonic music, to check the system's ability to render heavy scoring and remain clear, even at an orchestral climax.
- Jazz, to test crispness of percussive transients and the ability to keep the brass shining with brilliance, without getting harsh at loudness peaks.
- Rock, to test for adequate bass thrust.
- Classical vocal and chamber music, to check truthfulness of tone color in voices and string instruments.

Here, then, is how the three systems stack up on those terms.

#### 'Dormitory'

With 20 watts per channel, the Onkyo TX-11 receiver won't shake the rafters, but it puts out sweet, clear sound at normal volume lev-

els—enough to get a fine sense of musical realism in a medium-sized room. Distortion (0.08 percent total harmonic distortion (THD) at

*(Please turn to page 204)*

### PM'S PICKS OF THE STEREO SYSTEMS

	Penthouse	Playroom	Dormitory
<b>Turntable</b>	Thorens TD 105 Mk II (\$335)	Yamaha P-751 (\$270)	Technics SL-B202 (\$135)
<b>Cartridge</b>	Shure V-15 Type V (\$200)	Shure M-75HE (\$92)	Audio Technica AT-11 (\$50)
<b>Receiver</b>	Sony STR-VX6 (\$670)	Sansui R-606 (\$300)	Onkyo TX-11 (\$200)
<b>Speakers</b>	Ohm Walsh 2 (\$700 per pair)	Acoustic Research AR-38 (\$300 per pair)	Boston Acoustics A40 (\$150 per pair)
<b>Cassette deck</b>	Onkyo TA-2070 (\$420)	Dual C-814 (\$300)	Technics RS-M205 (\$165)
<b>Total cost</b>	\$2,325	\$1,262	\$700

# New Cameras That Make Photography Easy

Cameras that autofocus, others that take 3-D pictures or some that use no conventional film at all make picture taking more fun than ever.

by Neil Shapiro ELECTRONICS EDITOR

**F**or shutterbugs or camera buffs, there are new systems that put the thrill back into taking pictures. It's easier than ever to click the shutter for a fine photo to show off later. We checked out six cameras, using these new systems, and were impressed by the fine results and startling designs.

The Polaroid sonar-imaging system for automatic focusing is an integral part of the SX-70 and new Sun Camera we used. Kodak's new disc system makes the Disc 8000 camera a treat. A new method of electronic autofocus turns the Canon AL-1 into a 35-mm friend. The three-dimensional effect of the Nimslo is astonishing. And Sony's plans for the Mavica system of no-film photography sound grand.

Times have never been



Polaroid Sun 660



Polaroid SX-70



Canon AL-1



Nimslo 3D



Sony Mavica

Handsome-looking cameras above help you take great shots. The Polaroids (Sun 660 and SX-70) have a sonar-ranging autofocus system. Canon AL-1 uses new, integrated-circuit technology for its autofocus. The Nimslo 3D takes three-dimensional photos on specially processed film. Kodak's disc system potentially puts easy-to-use cameras in everyone's grasp. In the meantime, Sony is trying to turn photography around with the Mavica all-electronic, filmless camera.



Kodak Disc 8000

better. Looking at the Polaroid SX-70 or the new Sun Camera, one feature that stands out is the round, golden-grilled object just above or next to the lens. This device, called a transducer, is the heart of Polaroid's sonar-based, autofocus system.

The transducer can be considered a very accurate, four-toned speaker. Inside it, very thin, plastic film vibrates as voltage is applied and sends out tones of 60, 57, 53 and 50 kHz.

The sound waves bounce back to the transducer from objects they strike between about an inch and 35 feet away. The detected echoes are processed digitally, then the lens of the camera is adjusted to focus through analog circuitry.

In use, the system was fail-safe. The SX-70 camera requires you to first depress the shutter partway in order to focus. The Sun Camera allows for focusing and shooting in one movement, though it sacrifices

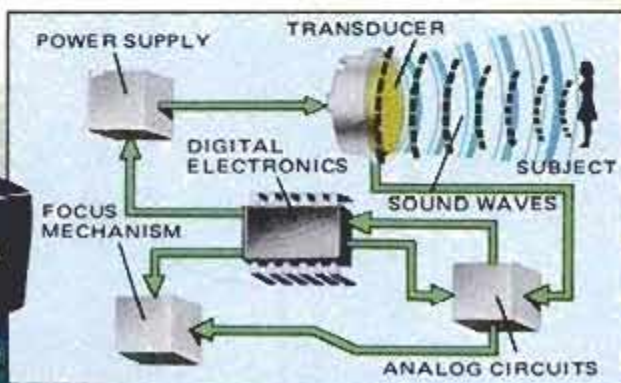
the SX-70's close-up abilities.

Every shot we took was in focus. Of course, there are certain shooting conditions to avoid. Obviously, you cannot focus automatically from behind a window, since the camera will focus on the window pane. Likewise, complex surfaces, such as leafy plants, could fool it.

But for everyday shooting, it couples the surety of autofocus with the quick gratification of develop-while-you-wait Polaroid film.

**POLAROID SX-70**

**POLAROID SUN 660**



Polaroid system of sonar-ranging (detailed above) uses a transducer next to lens. The transducer sends out sound waves, echoes of which are processed by computerized (digital) and normal (analog) circuits. The Canon AL-1 (left) uses charge-coupled devices to autofocus. Incoming light is split into three beams. Each hits a CCD and the camera's on-board microprocessor interprets results and suggests focus.

**CANON AL-1**

TRANSMITTIVE MIRROR

BEAM SPLITTER

CHARGE-COUPLED DEVICES (CCD)

## Split to focus

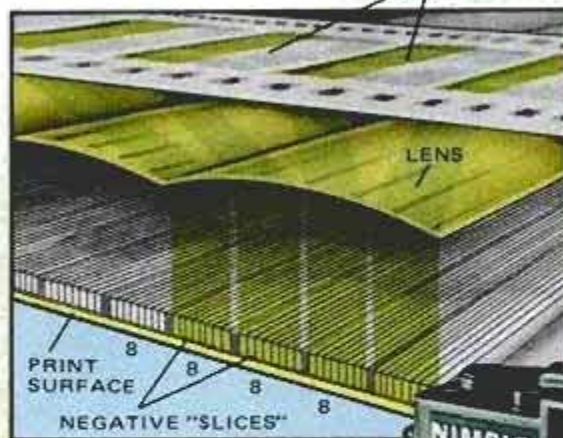
Canon's new system of autofocus departs dramatically from the sonar style. The Canon AL-1 is loaded with leading-edge, electronic technology in the form of three charge-coupled device (CCD) integrated circuits.

When you first pick up the camera and look into its ground-glass viewfinder, nothing seems unusual. But when you begin to focus on something and press the shutter lightly, the magic begins.

As an object comes into focus, three tiny indicators in the viewfinder guide you to focusing perfection. A left- or right-pointing, red

*(Please turn to page 185)*

HALF-SIZE NEGATIVES



Nimslo 3D's four lenses use half-size negatives. Each carries scene from different viewpoint. Negatives are sliced and arranged beneath lenses which cover print. Lenses blend image for 3-D. The Kodak Disc 8000 has new disc film, autoadvance, autoflash and great depth of field. Sony Mavica uses no film; it stores picture electronically in Mavipak.

**KODAK DISC 8000**



CARTRIDGE FRONT

SEPARATOR LAYER



HINGED COVER



LENSES

**NIMSLO 3D**

CARTRIDGE BACK

NEGATIVE DISC

MAVIPAK



SONY

VIDEO CIRCUIT

CHARGE-COUPLED DEVICE (CCD)

**SONY MAVICA**



HOME TV

MAVICA VIEWER

MAVICA PRINTER

MAVIPAK

Amidst the weeping and gnashing of teeth, Detroit is fighting hard to earn your car-buying dollar. With some interesting variations on established themes, it wants to make you an offer you can't refuse.

# Driving The '83 GM Cars

This year GM tries to right the wrongs of the past with more exciting cars.



Camaro (left) is available with a five-speed gearbox, something it should have had from the start. At right: Pontiac's 6000 gets an injection of muscle with the addition of the 135-hp, HO V6; Goodyear Eagle GTs, alloy wheels and suspension modifications round out the super STE package. Hurst Olds, with HO engine and chunky tires, looks like a NASCAR stocker. With new five-speed and 2.0-liter, fuel-injected engine, Cadillac Cimarron is now less anemic and somewhat more willing.

The only things ringing the General Motors cash registers these days are the recently introduced Camaro/Firebird twins. Dealers are clamoring for more of them and the public — unemployment, recession and all — has somehow found the money to buy these exciting new cars. And not only are they buying them, but the majority of these F-cars are going out the door in the full battle dress of Z-28s and Trans Ams, the versions with the highest ticket and the biggest built-in profit margin.

Shorn of all chrome and minus the screaming chicken hood decals, they have thrown GM's hidebound market surveys and buyer profiles totally out of calibration — hopefully for good.

For the '83 model year, GM seems to have readjusted its thinking to reflect this "new-found" soft spot in the psyche of the American car-buying public.

A prime example of this sort of new-think is the Pontiac 6000 STE. Last year's 6000 was decent enough. It more than matched the standards

of ride quality and handling that had previously been the domain of German/Japanese manufacturers. What it lacked was punch. This year the punch *is* there in the form of the potent, 135-hp, 2.8-liter, high-output V6 engine. This motor in the Citation elevated the X-11 to near supercar status (see *PM Road Test: An American Sport Coupe Takes On Four Imports*, page 88, Jan. '82). It should do the same for the STE.

Along with the motor is a suspension that will get the power to the

(Please turn to page 206)



1982 Chevy Blazer

1983 Chevy Blazer



Pontiac 6000 STE

Hurst Olds Cutlass



Cadillac Cimarron



# Driving The '83 Fords

*The fastest gets faster and the good get better.*

by Gary Witzenburg  
DETROIT EDITOR



**Mustang convertible**

PM photos: Buzz Freitag



**Lynx RS**



I was hanging on for dear life as Dan Rivard, one of Ford's top engineers, showed me the proper lines through each turn of the famed Dearborn Proving Ground handling course. He is the in-house master of the track, having learned its finer points from no less a talent than former World Driving Champion Jackie Stewart. Left, right, left, drift it sideways out to here, stand on it and rocket down the straight . . .

He was also demonstrating the finer points of the '83 Mustang GT: *more* horsepower, better handling, shorter (higher-performance) axle ratio, and a *five-speed* transmission! Last year's five-liter V8, four-speed Mustang GT (and Capri RS) were plenty fast (about 7.5

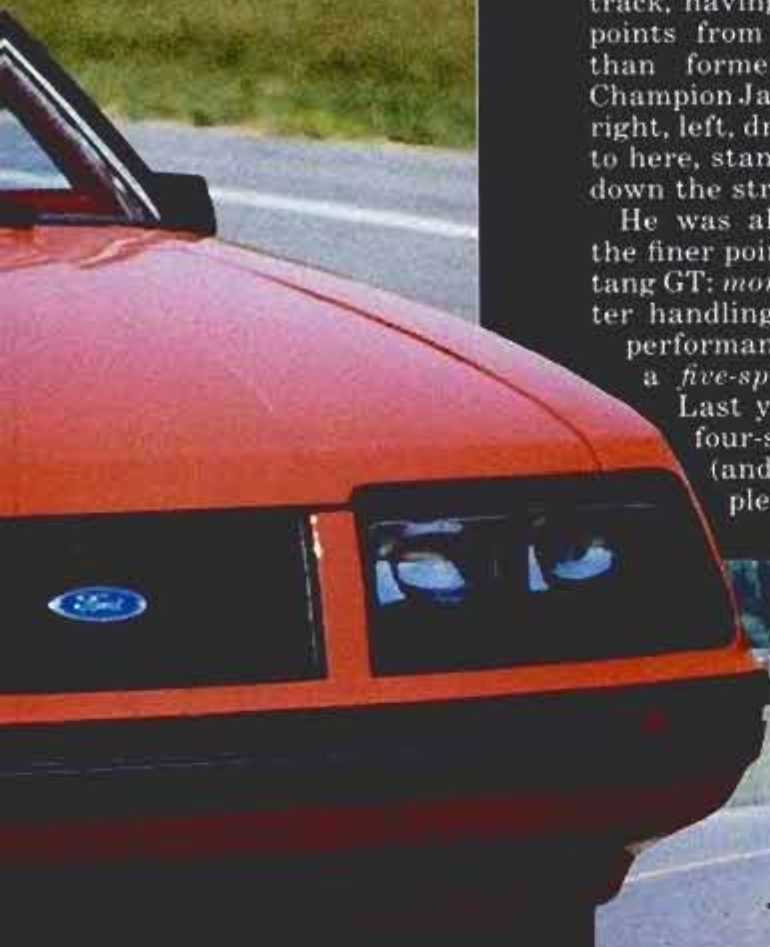
seconds 0 to 60) and cornered pretty well. But this year's make last year's look downright docile.

Wait a minute! Are we in some sort of time warp? Have we time-traveled back to the mid-1960s when cars used to be fun?

No. This is definitely the summer of '82, and the Ford folks are showing us their new stuff for '83. But in the last couple of years there's been a fundamental change in the company's entire attitude and in the way it's building cars.

Ford has realized that building boring, chrome-laden, slab-sided bricks on wheels just isn't going to cut it any more; and the Ford people have decided to stick their collective necks way

*(Please turn to page 181)*



**Mustang  
5.0-liter**

Convertible Mustang is available with the potent 5.0-liter V8 and a new five-speed gearbox. Up-rated suspension improves handling of last year's model. G-force fans will have a ball getting a stiff neck in similarly equipped Mercury Capri. Lynx RS benefits from the addition of fuel injection to its 1.6-liter Four. Suspension improvements will turn it (and the Escort GT) into economy road racers. Mercury Cougar and Ford Thunderbird are the first examples of the new-wave thinking at Ford. Rounded aerodynamic styling appears to be the look of the future for Ford.



**Ford Thunderbird**

# Driving The '83

Can Chrysler lovers learn to live without chrome?

by Gary Witzenburg DETROIT EDITOR



**T**his is a year of transition for Chrysler. Although they've recently become solvent, with \$800 million or so in the bank from selling off the defense works, they haven't quite had the time to translate those dollars into major new cars. Nonetheless, Chrysler has done a creditable job of refining and honing their existing hardware, while adding two new nameplates to the line, the Chrysler E Class and the Dodge 600, both based on last year's LeBaron/400 twins.

Compared to the LeBaron/400, the new E Class and 600 four-



Dodge 600 ES, with sports suspension and a new five-speed, is a real driver's car.

door sedans are stretched three inches in wheelbase and 4.4 inches in overall length, with the bulk of that added size going to a 1.5-inch increase in rear legroom and 2.1 cu.ft. more trunk capaci-

ty—17.1 vs. the LeBaron/400's 15.0. Front and rear styling are unchanged, but the new, slightly larger cars are distinguished visually by a fairly clean-looking, six-window roofline vs. the LeBaron/400's dated, padded-roof/ opera-window design.

Drive trains are essentially identical, with an improved 2.2-liter Chrysler Four standard and the Mitsubishi "Silent Shaft" 2.6-liter Four optional, both with standard three-speed automatic transaxle. Anticipated EPA economy ratings are 23 mpg city, 32 highway with the 2.2

*(Please turn to page 200)*

# Chryslers



**Dodge Charger**



**Aries Convertible**

Nonchromed and well suspended, the Dodge 600 ES is Chrysler's bid for Euro-sedan motoring. It's probably the handsomest car in the lineup. Charger gets a stronger 2.2-liter engine and a five-speed manual. Fresh-air fiends can get their K-car convertible with full leather interior, but rear seats are still for children or jockeys. Sapporo Challenger, one of the all-time sleepers, receives a sophisticated electronics dash package for '83.



**Plymouth Sapporo**

# Driving The '83 AMCs

*Alliance: Another contender for the economy car wars.*

by Michael Lamm  
WEST COAST EDITOR



PM photos by the author

Let's not kid ourselves. As the 1983 Alliance goes, so goes AMC's future. There's an awful lot riding on this car, more than on any automobile since Chrysler introduced the K-cars. It's extremely important to AMC that the Alliance succeed. Personally, I believe it will.

The Alliance arises from the recent partnership (or alliance) of American Motors and the French automaking giant, Renault. Manufacture becomes a joint venture in which AMC

builds 75 percent of the car in Kenosha, Wis., and Renault takes care of the other 25 percent—notably the power train—in France.

In addition, Renault has put up much of the money for the Alliance. AMC, for its part, has sunk \$100 million into new and modernized plant facilities. Renault designed the Alliance, which is known as the R9 on the continent. It was Europe's car of the year and a runaway best-seller; it has a good chance to re-

peat that success in America.

I drove a pilot version this past June and found that it offers everything you could want in an economy car: low base price, up to 50 mpg on the highway, ample performance, a good quiet ride, lots of room and comfort, decent workmanship and quality, some astute engineering touches, and just enough innovation to make the car interesting and fun.

On the face of it, there's really nothing to distinguish this front-

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Four-door Alliance (left and below) has nicely laid out instruments and controls (top). Vital fluids monitor (center above) keeps eye on oil, water, transaxle and power steering fluid levels. The 1.4-liter engine (above) is a reworked R5 motor with fuel injection added. Manual five-speed (below left) and electronically controlled automatic (bottom left) boost mileage to real-world 40+ mpg.



# Fine New Fibers Fight The Cold

Thinner synthetic filaments are holding more trapped air for insulation that claims to be better than the birds'.

by Bill McKeown OUTDOORS EDITOR



Mountaineers (above) have tested the Celanese Fortrel PolarGuard in gloves, mittens, jackets, vests, pants and sleeping bags. The continuous-filament polyester fiberfill is from Reliance Products, Oakland, Calif. Everest climber John Roskelley (right) was first to field-test Du Pont's new Quallofil polyester fiber.



Chicks and ducks and geese better scurry if they're going to keep up with the latest developments in man-made feather fuzz. The grow-their-own insulation that waterfowl, especially, sprout for foul weather warmth is being imitated and improved on again this year by textile fiber chemists.

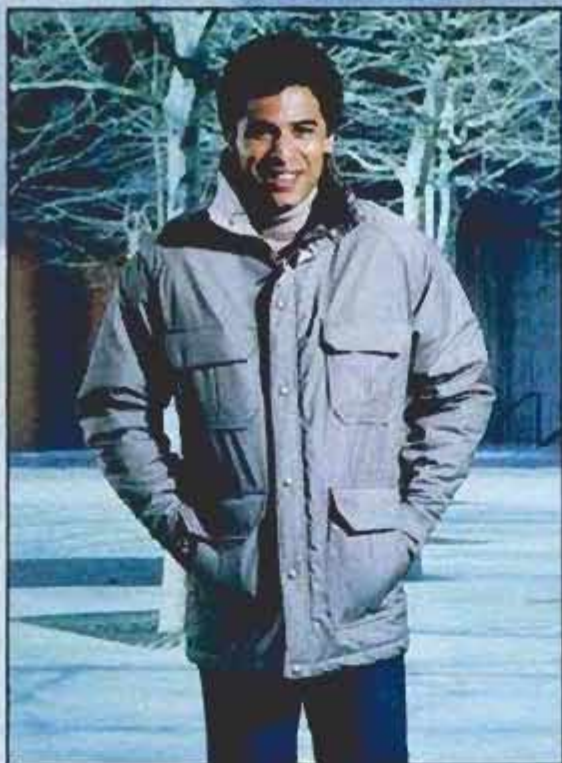
Down still fluffs up as the most efficient-for-its-weight insulator—if you're a goose. But once the feather

plumules are stuffed between layers of fabric, they lose "loft" (their fluffiness) when they get wet and they scatter into far corners unless they are trapped in place with quilted stitching. Research engineers now are producing extra-thin synthetic filaments that resemble down more closely. These can hold a boundary layer of dead air and keep body warmth from escaping, yet reduce somewhat the balloon look of cur-

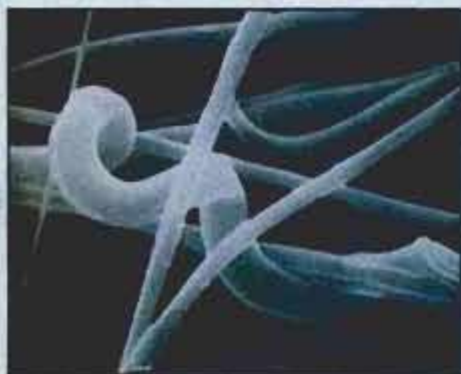
rent cold-weather clothes, and at much less cost.

Basic insulation fillers for clothing can be divided into down, which by law must have a high percentage of goose and duck down; "down-type" fillers, which often are adulterated with feathers and fibers; synthetic fiberfill, usually made of polyester and olefin compounds; and various foams and organic compounds. No product can match all





Sleeping bags filled with polyester fiber, such as the Slumberjack above that uses Eastman Kodak's Kodel-brand Kodofill, absorb minimum moisture. Woolrich Mountain Parka (left) has 3M's Thinsulate for warmth.



Under an electron microscope, Thinsulate shows a fiber mix that traps and holds air.



At the same magnification, part of a down plumule displays similar holding surfaces.



Enlarged even more, Du Pont's new Quallofil fibers reveal four air tubes per strand.

the features of down, but some of the newest synthetics surpass it in notable ways.

Man-made fibers, for example, at about \$1 a pound compare favorably with \$40-a-pound down, although roughly 15 percent more weight in synthetics is required to equal the warmth-retention properties of down. The weight difference starts to even out, however, when extensive stitching must be added to quilt

the down into pockets so that it does not settle out of place. Fabric to enclose the down must also be of a tight weave or treated to prevent "percolation," the name used to describe the way down can work out through cloth and escape. Some forms of chopped staple also require quilting, but others, with long continuous filaments, do not.

Down, unfortunately, loses its loft and insulating ability rapidly when

it gets wet, and then takes a long time to dry out. The new synthetics, in contrast, absorb only about one percent of their weight when wet, and dry many times faster than down. They can take machine washing with ease, and sometimes dry cleaning, lose little of their loft when wet, do not cause allergies, and resist moths and mildew.

In theory—and in dry regions and

*(Please turn to page 202)*

# WHERE ARE THE RUSSIANS HEADED NEXT?

Just 25 years after launching Sputnik I, the first man-made satellite, Russia is preparing for manned exploration of the planets.

by James Oberg



A Soyuz-type manned craft would release a tethered dirigible which would float toward Venus (above). And on Callisto, a moon of Jupiter, cosmonauts would scrape dirty ice, and spray it protectively over a makeshift shelter (right).

Unmanned landings on Venus have become a Soviet space program ritual, taking off like clockwork every three years since 1972. But last March's double landing on the nearby planet made the biggest splash yet, when one of two Venera landers sent photos and data back from the hostile Venusian surface for more than two hours. No previous craft—Russian or American—had survived even half that time in Venus's 900° F. heat.

Space watchers were just catching their breath from the Venus extravaganza when, in June, two Soviet cosmonauts pushed a communications satellite by hand off their orbiting Soyuz spacecraft and into Earth orbit. And, as America was conducting the final Space Shuttle tests in July, the Russians were reminding the rest of the world of

*James Oberg, author of four books on space exploration, is a flight activities director for the U.S. Space Shuttle's mission control. His latest book is Mission to Mars.*

PM art: Paul Alexander





## USSR IN SPACE

A rocket like this "Vertical 1" model, with engines larger than the U.S. Saturn V's, is expected to be on-line for launch soon. The time line shows the progress made by the Soviet program since 1957.

- 
- Mar. '82 Venera 14 broadcasts data and photos from Venus for over 2 hours
- July '80 Soyuz 35/37 crew stays in space for 185 days
- July '78 Progress 2 "freight craft" carries supplies to Salyut station
- July '75 Apollo-Soyuz program: First joint manned spaceflight with U.S.
- June '75 Venera 9 and 10 circle Venus to create photo maps
- Mar. '72 Venera 8 lands on Venus and transmits first data
- Oct. '69 Soyuz 6, 7 and 8 launch a record seven men in space
- Jan. '69 Soyuz 4 and 5 crews practice space rescue in orbit
- Venera 5 enters Venus atmosphere; impact is presumed
- Sept. '68 First unannounced Soviet launch detected when payload explodes
- Mar. '65 Voskhod 2: First "spacewalk"
- Oct. '64 Voskhod 1 returns first multiman crew after 16 orbits
- Apr. '61 Vostok 1 puts first man into space for one Earth orbit
- Aug. '60 Sputnik V is first orbiter to return to Earth with live dogs
- Nov. '57 Sputnik II carries live dog into Earth orbit
- Oct. '57 Sputnik I

their own prowess in long-term, manned space flight by sending a French astronaut aloft to join a Soviet crew already orbiting Earth for weeks.

As the 25th anniversary of Sputnik I approaches (launched Oct. 4, 1957), many of the world's leading space scientists are speculating on what the Russians are up to in outer space.

Of course, some of the more grandiose predictions made decades ago have not come true. No country has established a Moon base or an orbiting space platform from which rockets might be launched. But *most* of the predictions have come true: the Russian landings on Venus, America's landing on Mars and the extension of space endurance records to half-year flights. These elements give us ample reason to conjecture about what's next.

### Venus flyby

Space watchers expect some kind of fireworks this fall to mark the 25th anniversary of Sputnik. There have been signs that Soviets might go for a new space endurance record with a crew that would be entering its third month in space in October. By launching a freighter rocket loaded with supplies, the Soviets might keep the crew in the cosmos for a record four months or longer. Or they might launch a multinational flight of space workers to join the Russians in space as the Frenchman did earlier in the year. But no matter what the Russians do this year, the most spectacular possible project of the decade remains at least a few years off.

Within view is a manned flyby reconnaissance of Venus, Mars or both planets by the same expedition.

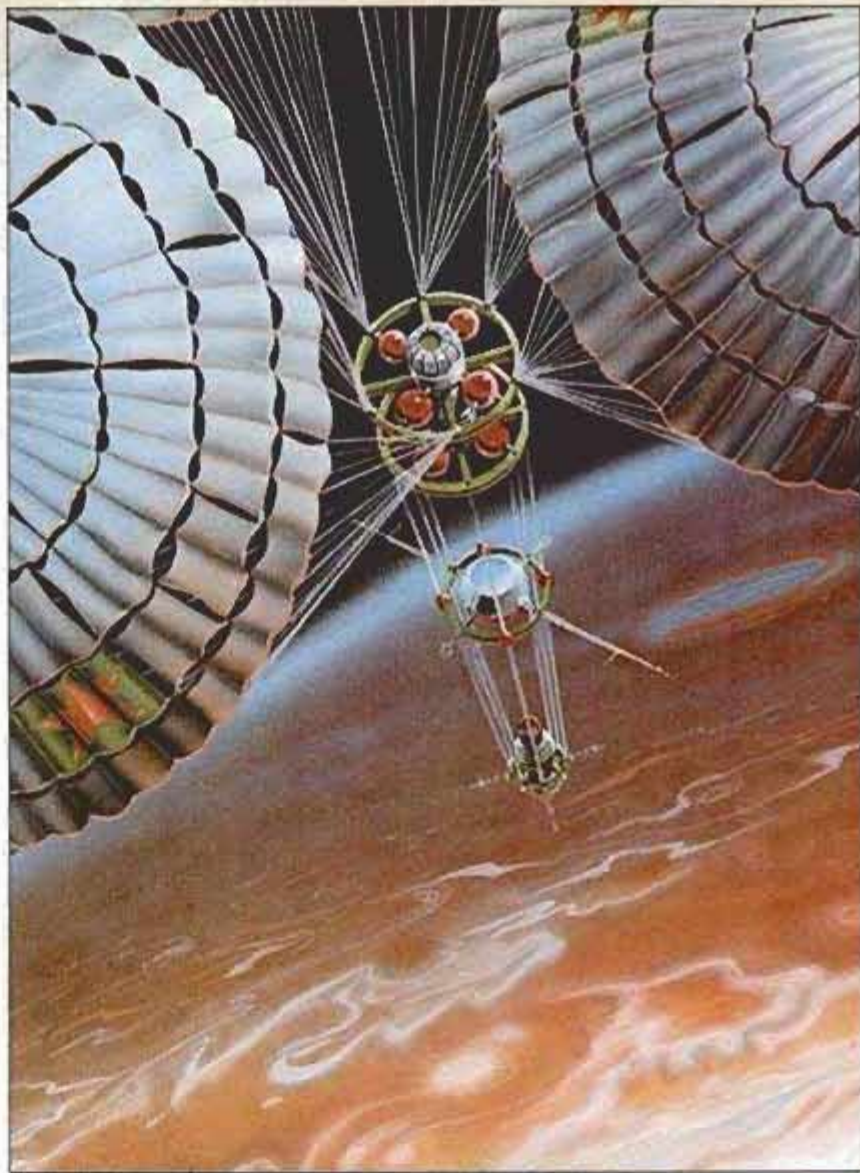
The Venusian flyby could be accomplished by current Russian spacecraft, slightly modified to carry along an unmanned, deflated dirigible. The lighter-than-air ship's tether could be dropped by the Soyuz mothership a few miles above Venus's upper atmosphere. Hot hydrogen or carbon dioxide from the Venusian atmosphere would fill the bag. And high temperatures and an atmosphere some 90 times more pressurized than that of Earth would keep the dirigible aloft for days or even weeks. Sensing equipment and cameras aboard the dirigible could send data and pictures back to the mother craft.

The trip would take more than a year, but in the past five years, Salyut 6 and 7 have demonstrated that the Soviets can keep cosmonauts in space for increasingly long periods—the record, held by the Russians, is 185 days. To prepare for that trip, the Soviets will undoubtedly conduct one test mission—probably in lunar or Earth stationary orbit—that puts men in space for about a year.

Soviet doctors have expressed confidence in the cosmonauts' ability to withstand the physical and mental stresses of prolonged "zero gravity" and space radiation exposure. One measure of their confidence was the launching of a cosmonaut—just back from six months in space—into another six-month orbit in 1980 as the last-minute replacement for an injured colleague. The man returned none the worse for his astounding 12 months in space.

Soviet life-support systems are already evolving into "closed-loop" affairs in which water, air and even food can be recycled and produced on

*(Please turn to page 183)*

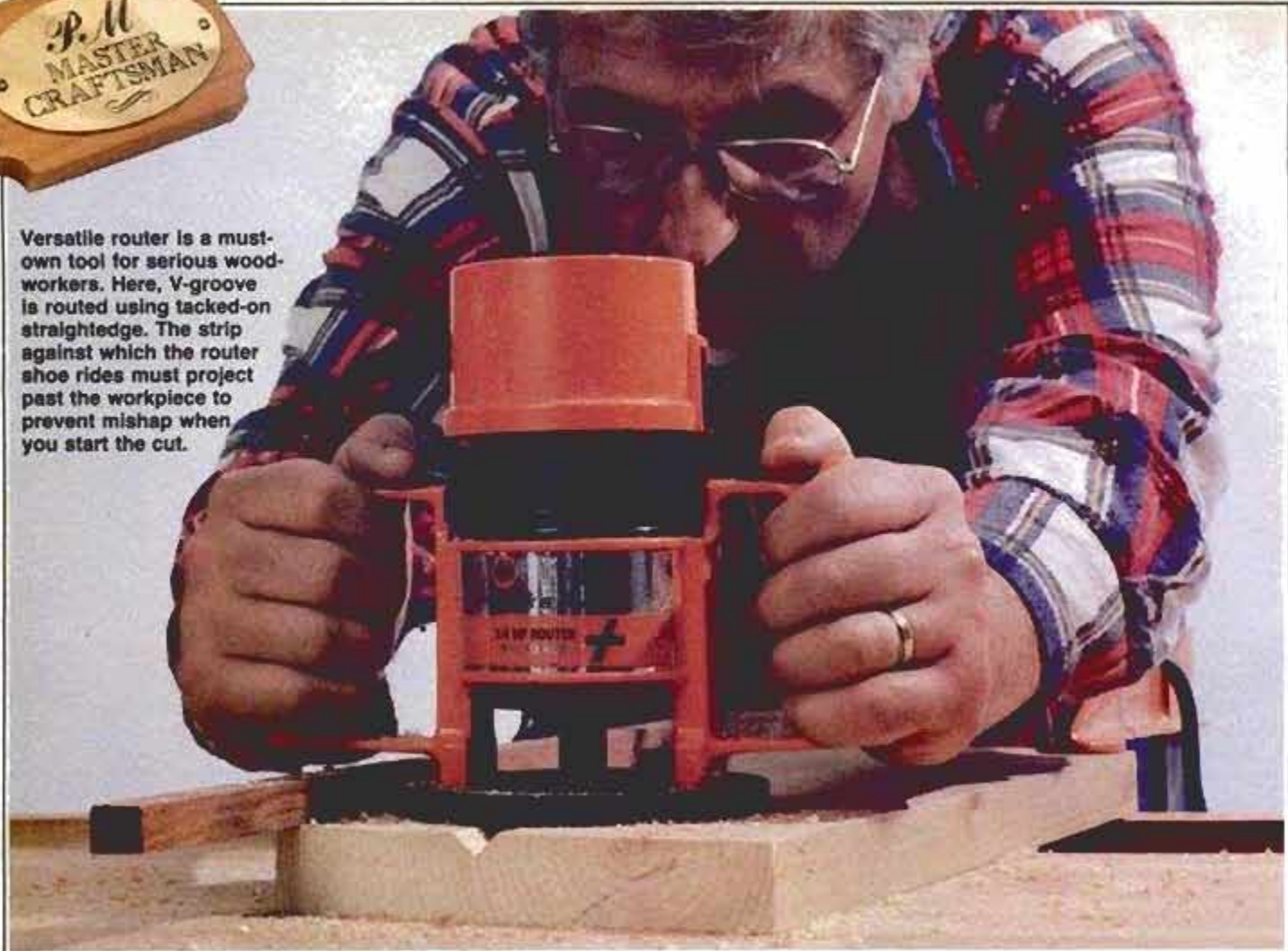


Parachutes would carry dropsondes to Jupiter itself (top right), which would send data back to the Callisto station.

On Io (right), Russia may use a "moon walker" to scoop up samples of soil and study the atmosphere, relaying video and other data to mother ship. The walker is made of a highly reflective material to tolerate high-energy rays of Jupiter. A backup tread system in the walker's belly would help it continue the mission if the legs got caught in one of Io's numerous crevices. Artist's concept of walker was based on existing Russian equipment.

P. H.  
MASTER  
CRAFTSMAN

Versatile router is a must-own tool for serious woodworkers. Here, V-groove is routed using tacked-on straightedge. The strip against which the router shoe rides must project past the workpiece to prevent mishap when you start the cut.



TM photos by the author

# A Craftsman's Secrets For Using A Router

Though it screeches like a banshee, it's the tool you're sure to turn to as your woodworking skills increase.

by Harry Wicks HOME AND SHOP EDITOR

For years, do-it-yourself writers have been saying that "the router is the tool that lets you add a professional touch to your projects." But that statement isn't exactly the truth. Actually, *you* put the professional-looking touch on any project you undertake. What is true is that if you use a router sloppily your project will be sloppy. The name of the game is craftsmanship—and *you supply that.*

As with every other tool in your woodworking shop the router will let you perform those tasks it's designed for almost effortlessly, and in far less time. For openers, recognize that you must spend some time

familiarizing yourself with your new router. Get a pile of scrap from the shop scrap box and start making test cuts.

You can begin simply by using the edge-guided bits with pilot bearings and work your way up to such sophisticated cutting as dovetail joints. But first master the tool.

## A high-speed tool

The router is a high-speed tool that performs similarly to the stationary shaper except that it is taken to the workpiece instead of the other way around. It can be used for certain other tasks such as trimming high-pressure plastic lami-

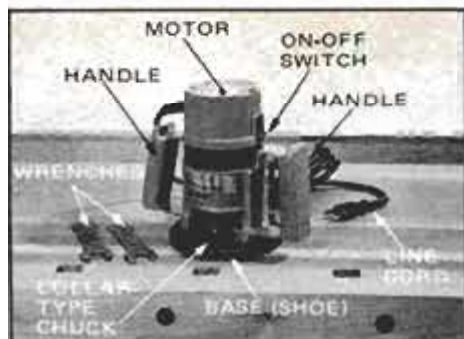
nates, mortising for door hinges and making dovetails.

Routers come with speeds from 20,000 to 28,000 rpm. The reason for the high speed is that many shaped edges will not allow hand sanding; they must be smooth enough to finish as soon as they are made. Thus, if you buy a router with a speed of 25,000 rpm you'll get 50,000 blade passes a minute when you use a two-flute bit. That's impressive.

Most routers sold in the United States have a universal motor that operates on a single-phase, 25- to 60-cycle, a.c. or d.c. circuit of the same voltage as shown on the tool's name-

*(Please turn to page 188)*

## GENERAL INFORMATION



The typical do-it-yourselfer router consists of two basic parts: the motor which holds the bit and the base section for holding and guiding the working half of the tool.



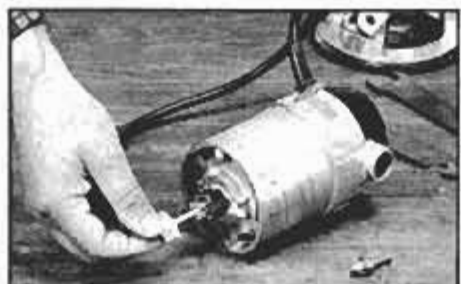
To change cutters, start by loosening the device holding motor in base. Here it's held by a thumbnut and slotted machine screw.



Quickest way to change bits is to then separate the motor and base, as here. Bit can be changed with unit intact, if preferred.



Manufacturer supplies wrenches needed for loosening the split (nut) collet. Pressure is exerted as indicated by the arrows.



Insert the router bit all the way, then withdraw it about  $\frac{1}{8}$  in. to allow for expansion (left). When shank is at the desired position, retighten the collet using wrenches (right).



To set cutter depth, you can use a scaled ring supplied on many routers or simply check the bit with a ruler (as many pros do). Here, rabbet cutter is set to  $\frac{3}{8}$  in. depth.



Another easy method is to hold installed cutter against a marked workpiece. Waste is marked with an X to prevent miscut.



Finished rabbeted edge is cut using the bit set as shown in preceding photos. The cut is right on the mark, as it should be.

Installing and removing a bit from a router varies slightly from one brand to another but, basically, the how-to procedure is quite similar. The router, in

fact, grips a bit by its shank, somewhat like a drill grips a drill bit. The difference is that instead of three jaws closing around the shank, most routers have a

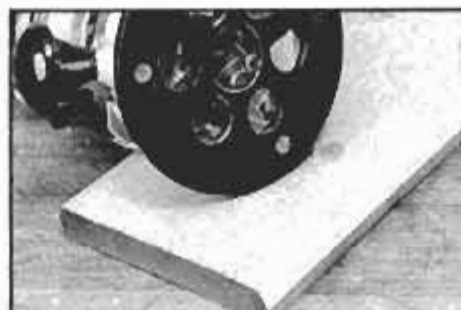
split-nut collet which closes tightly as a second nut is tightened.

Read the instruction book packed with your tool for the correct how-to.

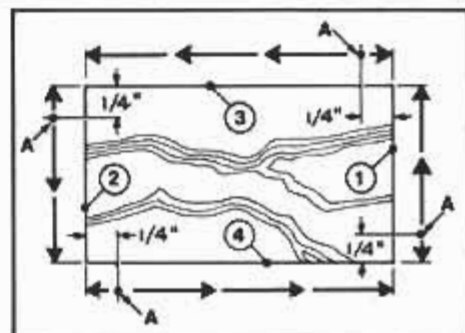
## MAKING AN EDGE CUT



Correct way to shape an edge using a cutter with pilot bearing: Start the cut about  $\frac{1}{4}$  in. from left end and push the router into the wood until bearing makes full contact with the board edge. Then move router right.



The correct sequence for edge shaping is shown at the right. When this work is handled in the proper manner, the router affords a neat edge, as shown above.



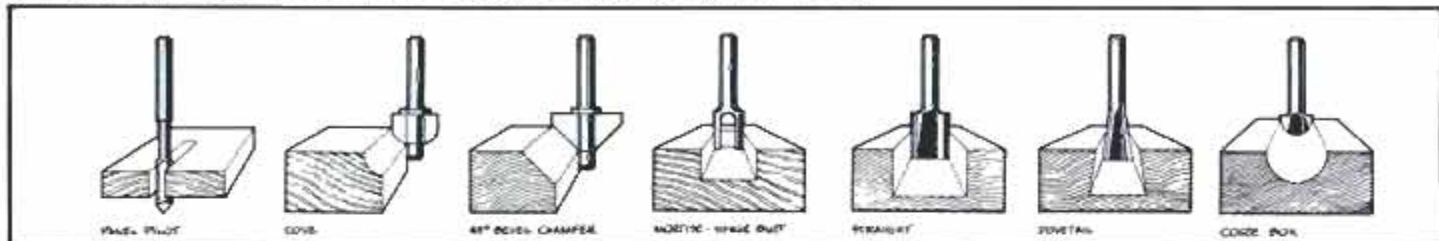
This is the sequence to use when routing all four edges. Always shape the end grains (1 and 2) first, then finish up by making the with-the-grain passes (3 and 4). Points A are the starting points for all four of the edges as shown in the diagram above.

Since a router bit revolves clockwise as you look down on it from above, feed the router in a counterclockwise direction when shaping an outside edge.

Conversely, if routing an inner edge—that is, a cutout—feed the router in a clockwise manner. The point is to feed the cutter to the work so the cutting

edges can do their job. When shaping all four edges use the sequence shown. If you rout just one edge, be sure the pilot doesn't turn the corner.

## CUTTERS TO HAVE IN YOUR ACCESSORY BOX



The V-groove and bead bits which are presented on the preceding pages as well as those that are pictured above and on the opposite

page are made available in a wide variety of sizes. The methods of using the various bits are spelled out in the text.

## GUIDING YOUR ROUTER



With the assistance of an edge guide, it's even possible for you to rout a circle.



All manufacturers produce edge guides for use with their routers. The guide shown is for the author's Model 150 Rockwell.

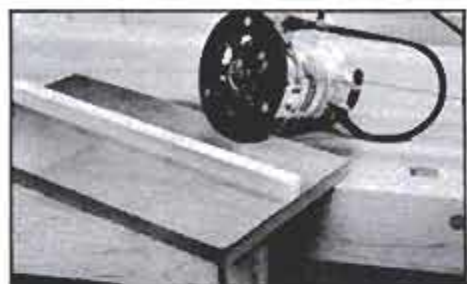


As also seen in the close-up photo on page 114, the projecting guide strip gets the cutter into the workpiece without mishap. The work, in turn, is clamped to the workbench (clamp not visible) to prevent movement.

## OTHER STUNTS YOU SHOULD KNOW



You can cut dovetails to join boards with the assistance of an edge guide and two pieces of scrap which are clamped on to support the router shoe. In this instance, it is particularly important for you to locate the edge guide accurately.



When face-routing a board it is often impossible to use clamps. Instead, nail-fasten a cleat along the bottom for gripping in the bench vise. Caution: Make certain that the nails are not in cutter's path.



Mortise shape in mating edge is cut using same technique, but cutter is now set to leave center portion (i.e., tenon) intact.





A rounding-over bit might well be the first one you will purchase. This shape is available in at least four radii.



A Roman ogee is also a good bit to own; the shape gives an attractive edge to plaques and the like. By using the lower portion only, you can create a small cove.

Router bits fall into two major classifications—one-piece bits and three-piece screw-type bits. All are of high-quality steel that has been heat-treated for hardness (so the cutting edges will be retained over fairly long periods of use). Steel bits are priced from about \$8 to \$20 with the three-piecers at the upper limit.

If you plan on doing a lot of woodworking you should consider purchasing carbide-tipped bits in those shapes you'll use most often. These start at about \$18.



The edge guide on this router is installed into two holes built into the router base.



Thumbscrews are finger-tightened so that the rods are secure, but movable. Next, the router is turned over and guide set the desired distance from bit using a ruler.



Thumbscrews are securely tightened; you might damage the workpiece if it should shift. To cut, set guide against board edge and lower spinning cutter into work.

If you buy your router in a kit form, which generally means it comes with a carrying case, the chances are the manufacturer will include a router-edge guide. If not, be sure to buy one.

The router (except when you do freehand routing) must be guided to create the professional-looking finishing touches you want. Thus, when you work with a straight (non-piloted) bit you'll often need an edge guide.

The guide used to control the router is also handy for cutting along the edge of a board. It is particularly useful for routing decorative grooves parallel to the edge of a board and for cutting grooves on long pieces

of lumber. It is frequently used in mortise and dovetail work (facing page).

The edge-guide installation may vary from that shown. But, all edge guides serve the same purpose and in the same manner.

Here, the two rods are installed in holes provided on the base. They are held by tightening the machine screws already in the base. The guide is then installed on the rods and slid in or out until the correct distance from bit to guide is obtained. Thumbscrews are then tightened.

Though some craftsmen measure from bit center to edge guide, I work with dimensions from bit edge to guide.

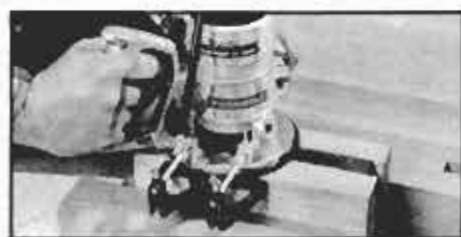
To start shaping, butt the guide against board edge, tilt-elevate the router to clear the cutter from wood and start the motor. Then lower the cutter into the workpiece.

The router will do far more than simply make decorative edges on boards. Once you have mastered the basics of using it you owe it to yourself to try new techniques. For example, using a dovetail bit and clamps, you can rig a setup for cutting dovetail-shaped "tongue and grooves" on boards to be edge-joined. The resulting joint is strong; viewers will marvel at your craftsmanship.

When doing such work, remember that the router shoe must be solidly supported.



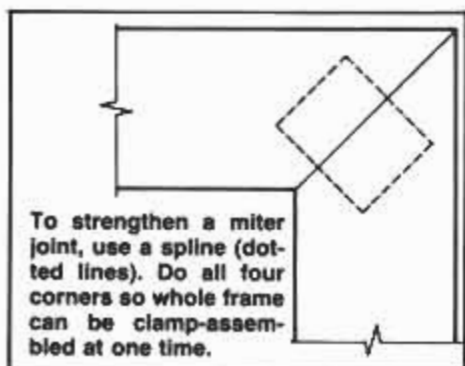
When routing freehand, work slowly and always push the router so that the cutter bites the wood as you go: Since the cutter spins clockwise—as you look down on it from above—push from left to right whenever possible. To make an S, for example, start at the bottom and work up.



You can strengthen the otherwise weak miter joint by using splines. To create hidden splines, use your router. Clamp scrap stock on both sides of the workpiece to keep router from wobbling, then grip the setup in the bench vise. It's best to use the edge guide to ensure accuracy.



Cut spline mortises in both workpieces, then fashion the splines to suit openings they will fill. Here, in 1/4-in. stock, 1/2-in. splines will be glued into mortise.



To strengthen a miter joint, use a spline (dotted lines). Do all four corners so whole frame can be clamp-assembled at one time.

The more you use a router, the greater your mastery of the tool will become. Once you are fully comfortable with it, you can try some of the more exotic router tasks such as cutting mortises for hidden splines and freehand routing.

Whenever you rout the narrow edge of a board you should increase the surface that the router shoe will ride on by clamping stock alongside as shown in the photos at far left. The idea is to make certain that the router will not

wobble as you make your cut. If it does, damage to the workpiece is almost guaranteed.

Freehand routing is done with a core box or other straight bit. It requires full control by the operator; otherwise the stock will be wasted. The big trick is to work slowly—that is, push the router at a very slow feed rate.

No matter what new technique you try with a router it makes sense to perfect your skills first by practicing with scrap stock.

# Double-Deck Porch Adds Two Party Rooms

The upper deck is great for sunbathing and entertaining guests. Lighting lets you enjoy it on warm evenings. You can use the porch night and day, any season.

**T**he PM double-deck porch extends the living space on both floors of this home. With sliding doors of the first-floor porch open, the adjoining living room doubles in size. The second-floor master bedroom has a panoramic view through the doors of its adjoining upper deck.

Several considerations were included in designing the two-level space: First, the structure had to blend with the American colonial house—the home of artist Ed Valigursky, whose cover illustrations are well known to PM readers. Second, we wanted to employ the newest construction materials and design ideas. Third, we wanted to join the deck and porch with a stairway fitting the design scheme. Fourth, the porch had to be as open as possible for summer enjoyment, yet enclosed for cold-weather use. Fifth, the porch/deck needed a lighting system.

To maintain the colonial feeling, we gave the deck an open look with railings made of simple 2x2 balusters between posts. Hinged French doors with grille inserts give a multipaned colonial "look." Several relatively new design features and materials include: a window greenhouse, decay-resistant, pressure-treated Wolmanized wood, metal construction connectors for strong joints; roof sheathing and finished ceiling panels of Waferwood particleboard. To join the two spaces,

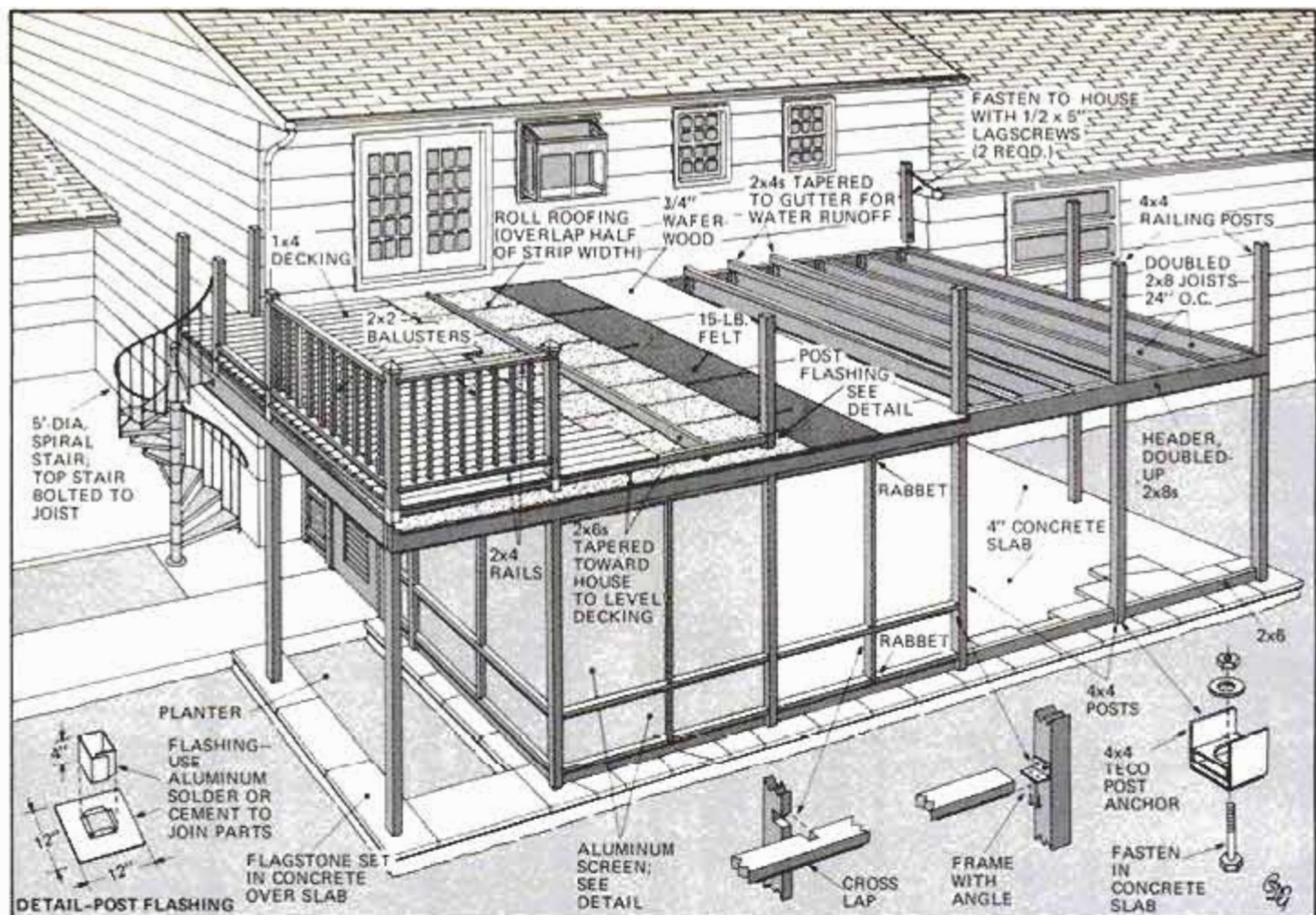


Upper-level sundeck (above) is a delightful vantage point for surveying the scenery while sunning, having lunch or entertaining guests. For evening entertaining, you might prefer moving downstairs to the screened-in room (left). It has an open, airy feeling, yet it's near the kitchen and living room. The room has window panels that seal it for use during cold weather. A galvanized-steel spiral stairway (right) joins the two levels for convenient back-and-forth traffic. Outdoor lights (far right) make this double-deck porch an ideal spot to invite your friends for nighttime parties.



one side of the deck overhangs the porch and neatly accommodates a spiral stairway.

For minimal obstruction to the view, the enclosed porch has a series of windows—the space between each pair of posts is framed into two larger windows on top and two smaller windows directly below; yet permanent screens ensure protection from insects. For cooler times, storm windows made in the shop using bronzed-finished aluminum sash are applied over the upper porch windows and fastened in place with screws. Screened openings at the floor are covered from the outside with particleboard panels. During the coldest weather, interior storm windows of PVC film in aluminum sash are applied to the upper windows; interior particleboard panels backed with polystyrene insula-



Support posts and joists have been installed in this view. Note the temporary diagonal bracing on the posts during framing.

tion cover the lower openings. A portable kerosene heater warms occupants.

Our night lighting system includes mushroom lights for the walkways and a spotlight on the deck.

**SHOPPING INFORMATION**  
All materials used in this porch/deck are available throughout the United States. For buying information or nearest dealer, write directly to these manufacturers: **barbecue grill** (model No. 9740), Structo Div., King-Seeley Thermos Co., Route 75, Freeport, Ill. 61032; **hinged deck door** (Concept with grilles), **porch storm and screen door**, Pease Industries, 7100 Dixie Hwy., Fairfield, Ohio 45023; **greenhouse window**, JCPenney Co., 1301 Avenue of the Americas, New York, N.Y. 10019; **construction fasteners**, Teco Product & Testing Corp., 5530 Wisconsin Ave., Washington, D.C. 20015; **heater** (Sun Omni 85), portable kerosene, Kero-Sun Inc., Kent, Conn. 06757; **lighting** (wall fixtures, mushroom lights, spotlight), Stoneco Lighting, Keene Corp., 2345 Vauxhall Rd., Union, N.J. 07083; **lumber** (Wolmanized) Koppers Co. Inc., 436 Seventh Ave., Pittsburgh, Pa. 15219; **sheathing, ceiling and panels for porch windows** (Walerwood), **slid-**



Framing of the lower porch is complete. The railing posts on the upper deck are in place and the roll roofing has been installed.

The concrete slab and flagstone floor on top were already in place. If you must begin by pouring footings and a concrete slab, an excellent reference book is *Concrete Floors On Ground*, No. EB-075, \$9.75 postpaid

**ing porch door and stationary glass panel**, Louisiana-Pacific Corp., 1300 Southwest Fifth Ave., Portland, Ore. 97201; **interior paneling** (Wind Ridge), Champion International Corp., Champion Building Products Div., 1 Champion Plaza, Stamford, Conn. 06921; **semitransparent stain and wood preservative** (Cuprinol nutmeg brown) and **caulking**, Danworth Co., Tower Lane, Box K, Avon, Conn. 06001; **spiral stairs**, 5-ft.-dia. galvanized, The Iron Shop, 400 Reed Rd., Box 128, Broomall, Pa. 19008; **aluminum window sash** (for interior plastic film and exterior glass panels), **plastic film and hardware**, Reynolds Aluminum, Reynolds Metals Co., Richmond, Va. 23261.

**Porch and deck furniture**: Scibetta Brothers Sunfun, Route 46, Little Ferry, N.J. 07643 (also located at Route 23, Pompton Plains, N.J. 07444; Route 17, Ramsey, N.J. 07446; and Route 10, Whippany, N.J. 07981).

through December from Order Processing, Portland Cement Assn., 5420 Old Orchard Rd., Skokie, Ill. 60077.

Lay out the header joist along the house wall. If you have access to the deck from the second level, position the header joist so the finished decking will be 2 to 3 in. below the sill of the doorway to the house. In this case, the center of the joist should be about 12 to 13 in. below the proposed sill to allow for decking, tapered boards and roofing materials. Make sure the header joist is level by snapping a level chalkline along the house where the top of the header joist will be.

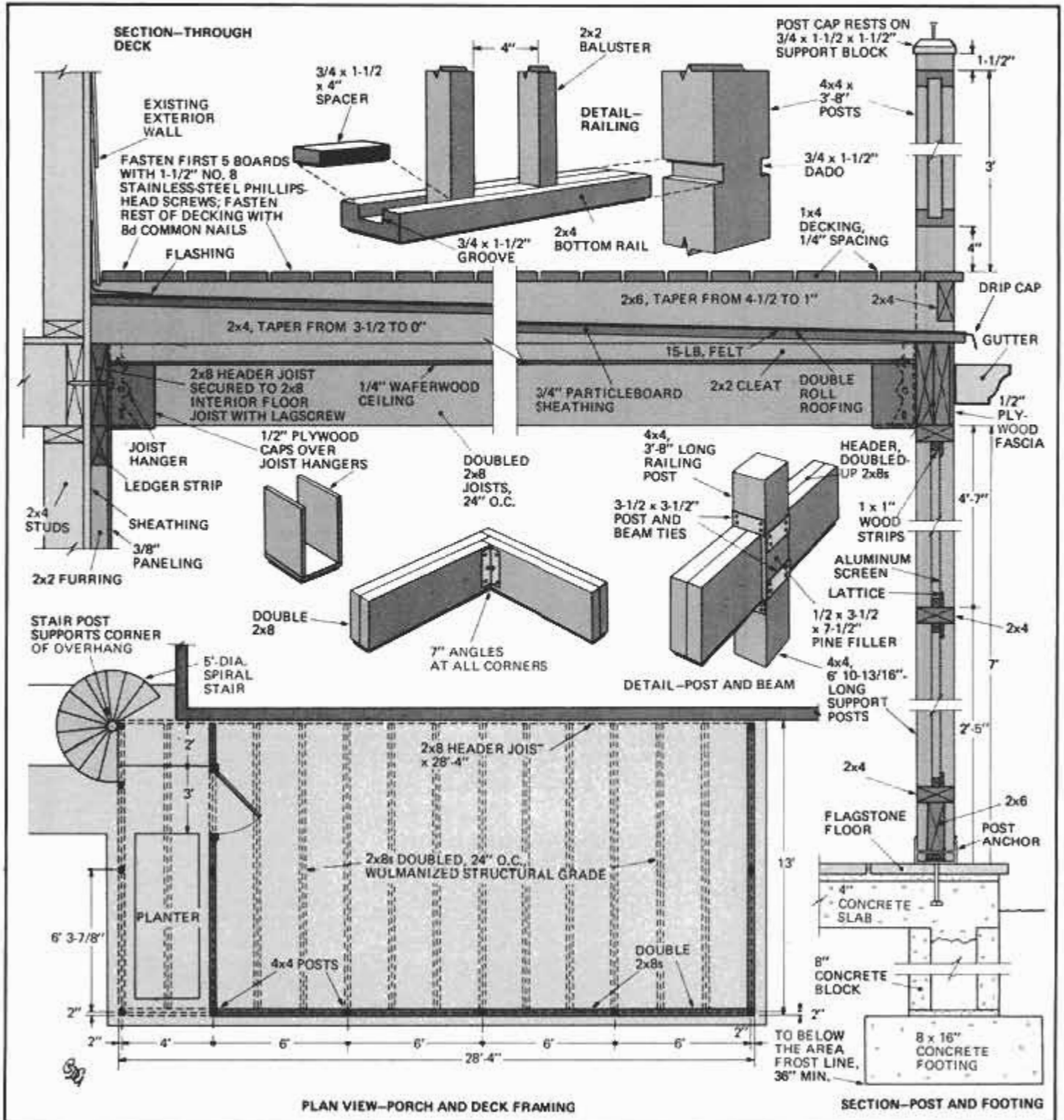
Strip away siding or shingles so the header can be installed flush against the sheathing and resnap the

PM photos: Keith Scott Morton  
Styling: Gabe Herrick  
Design: Lester Walker, AIA  
Technical art: Carl DeGroot

(Please turn to page 186)



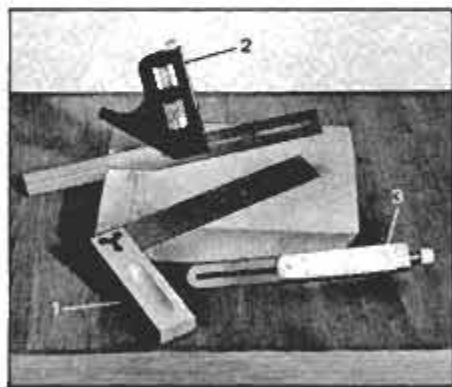
The detail (left) shows two upper rails joining a capped post. Detail (above) shows a metal post-and-beam tie. Note corner of the joist hanger (top left).



# WORKSHOP MINICOURSE



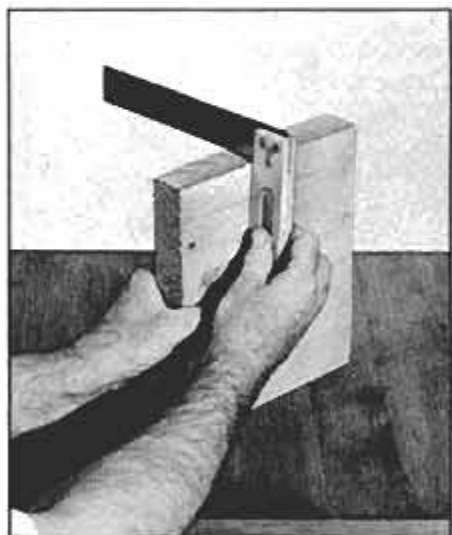
## Using squares in the shop



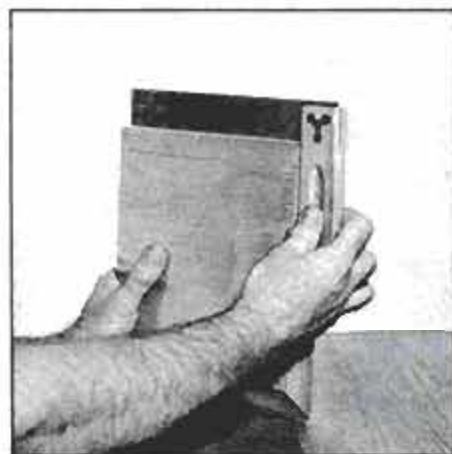
Three types of squares you should have on hand in your workshop: 1. Try square is used regularly for bench work. 2. The combination square performs several functions. 3. T-bevel square lets you transfer angles quickly.



When board flatness is important, use a square to check as shown. If you find a crown or valley, plane the board flat.



Edges must be absolutely square on all boards to be edge-joined. Use a try or combination square to check this.



After making a crosscut, check for squareness, using try or combination. If cut is out of square, use block plane.



The combination square comes with an accurate 45° angle built into its head. Use it as shown to lay out this angle.

blade is graduated into inches and fractions of an inch. Generally, the try square is used for these three tasks:

1. To test a surface or edge for identical thickness throughout its length.
2. To test an edge or surface for squareness with its adjoining surface or edge.
3. To serve as the guide for marking a line at a right angle to an edge or surface.

The combination square is the tool that combines the best features of the other squares. Besides the 90° angle, the head is shaped to produce an accurate 45° angle. Additionally, the head can be relocated along the blade, which lets you use the instrument as a marking gauge. Other built-in bonuses in a quality combination square include a spirit level bubble and a scribe for marking hardwood or metal. The combination square is the first one to buy.

Perhaps the second is the T-bevel square. This tool consists of a blade, 6 to 12 in. long, with a 45° bevel point at one end. The other end is fitted into a slotted wooden or metal handle equipped with a thumbscrew for securing the blade where desired. The bevel square is especially useful when you must cut a board to fit an existing angle.

More about the joys of being square next month.

One of the first things a neophyte woodworker learns is that *all* pieces of wood used in a project must be smoothed flat and square (unless, of course, some other shape is called for). If you start a project by first making certain boards are square and true, you will have fewer problems down the line (as you lay out the pieces). Professionals always start by checking the stock to be used—it's a habit you should acquire, as well.

The angle used most often in carpentry is the basic right angle—90°. To help you make perfect right an-

gles there are three types of squares—the try, miter combination and steel. The task at hand determines which you should turn to. For transferring unusual angles, there's the T-bevel square.

The steel square (not shown) is large and flat. Often referred to as a framing square, the steel square has many calculations on it and is shaped in a right angle. We'll talk more about this square in next month's column.

The try square has a hefty wooden or metal handle which is designed to serve as a right-angle fence. The

Popular Mechanics

# CAR CARE GUIDE

Build A Sturdy **Garage Workbench**

Make Our Mechanic's Roll-About **Tool Dolly**

**25 Car Care Tips** From The Pros

First Look Under The Hoods  
Of The '83 **Detroit Cars**



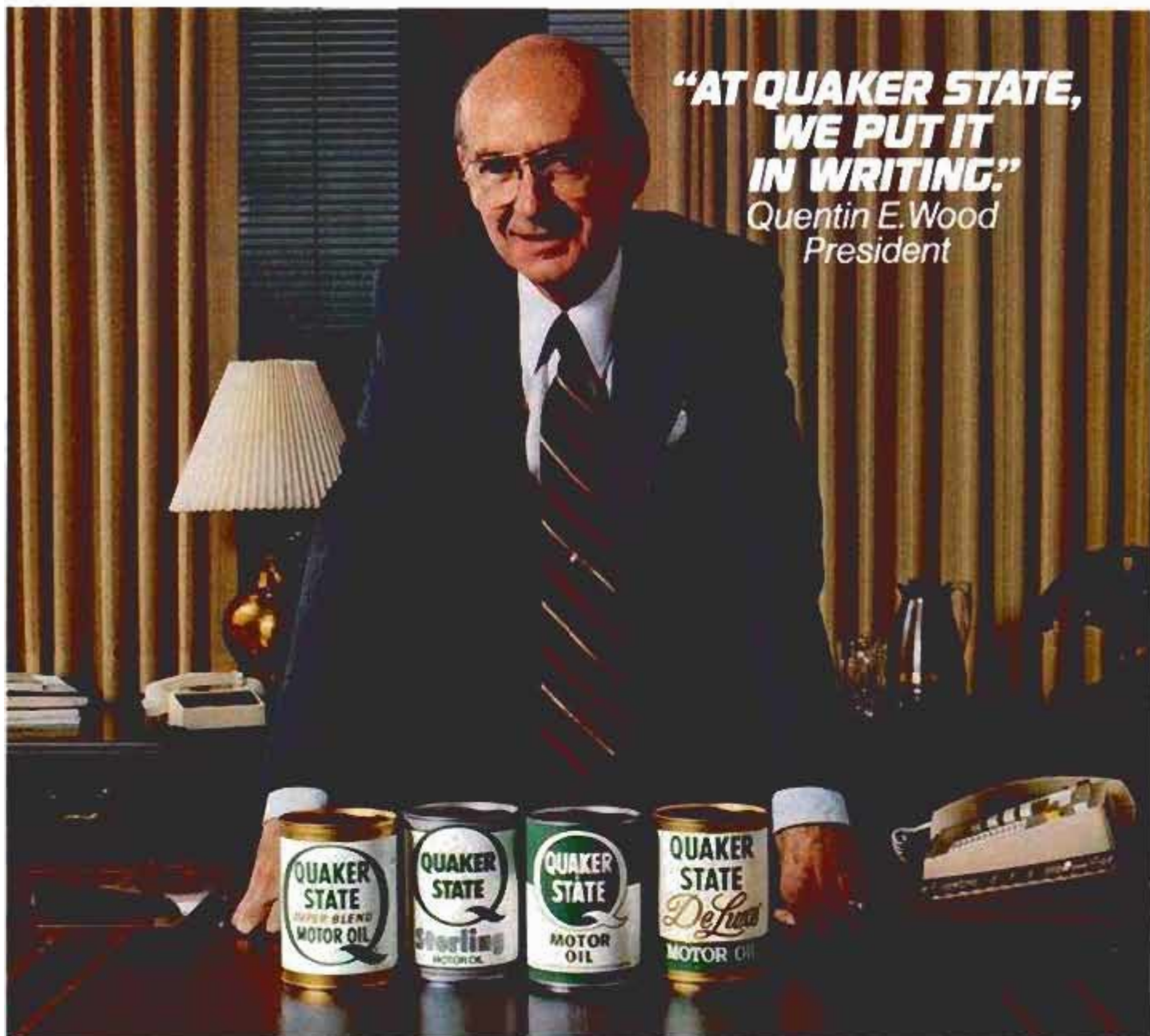
PM photo: George Ancona

Illustration: David W. Johnson

# HOW DO YOU KNOW HOW GOOD YOUR MOTOR OIL IS?

**"AT QUAKER STATE,  
WE PUT IT  
IN WRITING."**

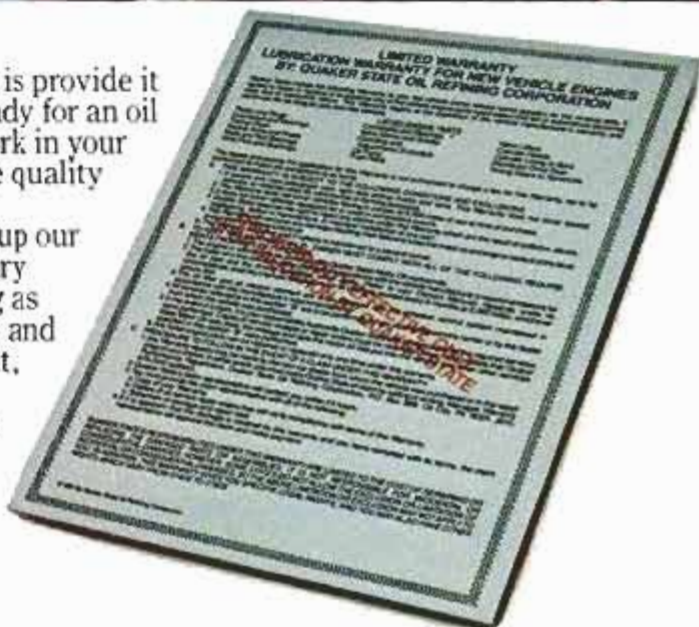
Quentin E. Wood  
President



Probably the biggest favor you can do your car is provide it with clean, fresh, *quality* motor oil each time it's ready for an oil change. But, since you can't watch a motor oil at work in your car's engine, how do you know you're getting all the quality you've paid for?

At Quaker State, we put it in writing. We back up our quality with a *lifetime* guarantee. We guarantee every new car engine against oil-related failure for as long as you own your car and use Quaker State. For details, and coverage, write Quaker State, Warranty Department, Oil City, PA 16301.

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**STAYIN' ON THE ROAD WITH QUAKER STATE**



# FALL 1982 CAR CARE GUIDE

## CONTENTS

### Build PM's garage workbench



Rugged and easy-to-build tool dolly (left) and workbench (right) will be indispensable additions to your home garage.



### Build PM's tool dolly

### What you should know before buying auto parts



### SPECIAL SECTION

### 25 service tips from the pros

### SATURDAY MECHANIC LOOKS AT:



#### The '83 GM cars

Getting serious about power, five-speeds and handling.



#### The '83 Fords

Would you believe a power dimming rear-view mirror?



#### The '83 Chryslers

More pep for the 2.2 Four and a turbodiesel pickup.



#### The '83 AMC cars

Now unlock your car doors with infrared light.

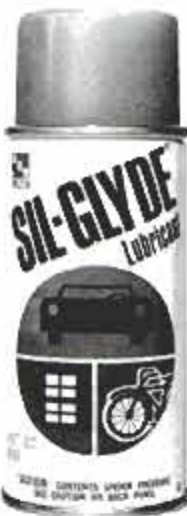
### How to find a good mechanic when you can't do it yourself

Prepared by the editors of PM. Contributors: Cliff Gromer, Mort Schultz, Paul Weissler. Car Care Guide designed by Don Mannes. PM art: Fred Wolff, Ed Lipinski and Hank Iken.

# MAKES THINGS WORK BETTER!

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THE "EVERYTHING LUBRICANT"  
THAT STAYS PUT—WON'T  
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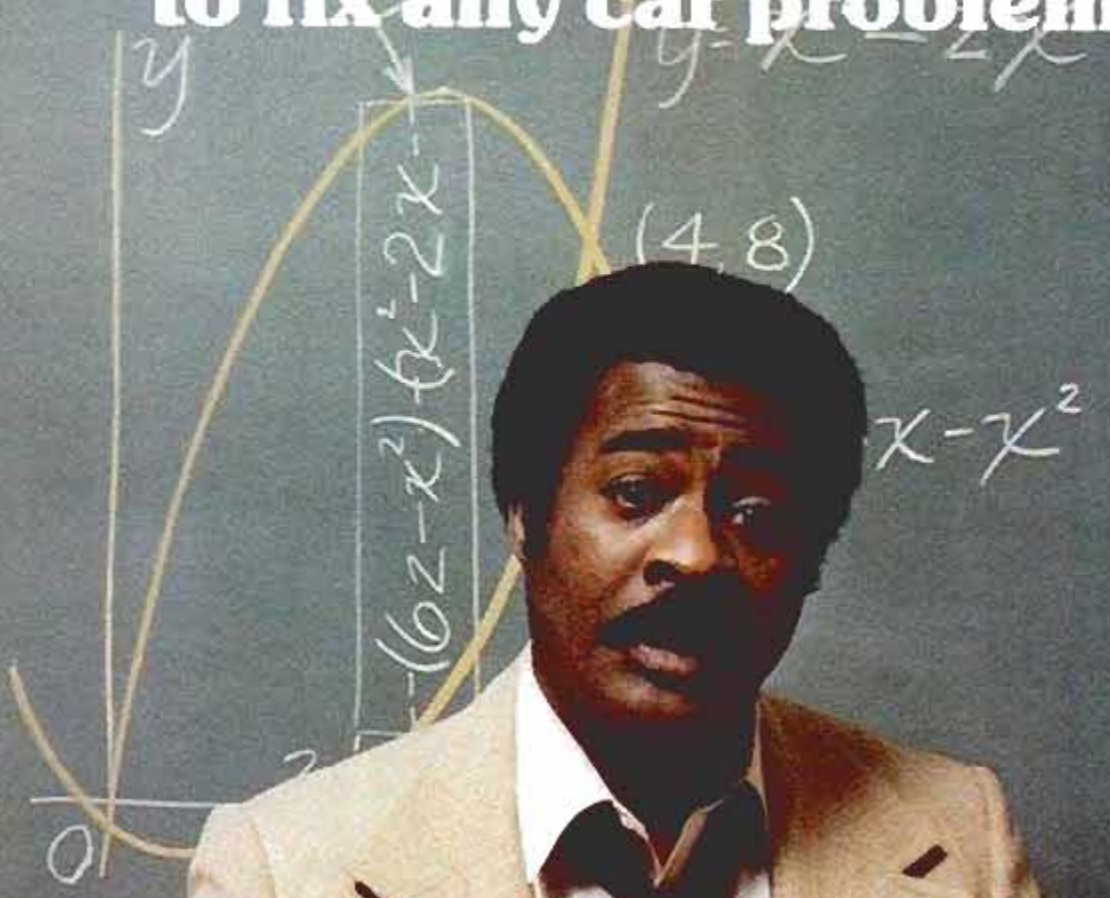
Penetrates, loosens rust, lubricates, dries wet surfaces, rust-proofs. It's the best for hinges, flexible cables, fittings, mowers, bicycles, fans, sewing machines, guns, reels, and many other Home-Car-Boat-Sports and Shop applications. 3.4-oz. oiler; 3.5-oz. aerosol.



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**Goodwrench**



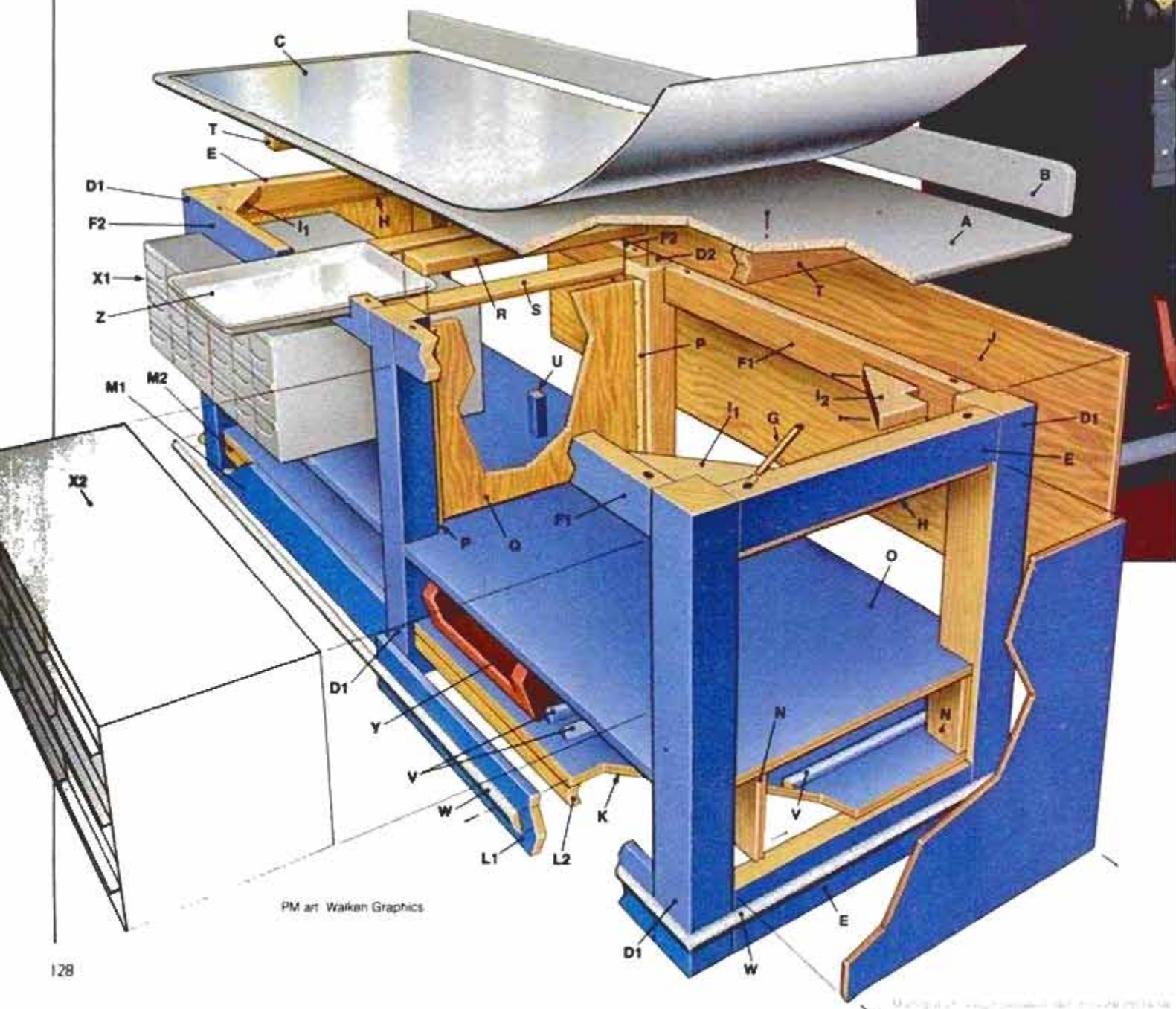
GENERAL MOTORS CORPORATION

# BUILD PM'S GARAGE WORKBENCH

It's designed specifically for auto work and can make car care a snap.

The professional garage usually has one great advantage over the do-it-yourself garage: adequate space. And because of this, the nonprofessional has to make some compromises when outfitting a shop. But a good sized workbench—like the one shown here—is one place where corners should not be cut. Its top has plenty of room for safe and efficient work, while the drawers and shelves below provide convenient storage where you need it most.

But size is only part of the story. Strength is the other. This bench was built of heavy-duty, construction-grade lumber and was designed



PM art Waiken Graphics



#### MATERIALS LIST—GARAGE WORKBENCH

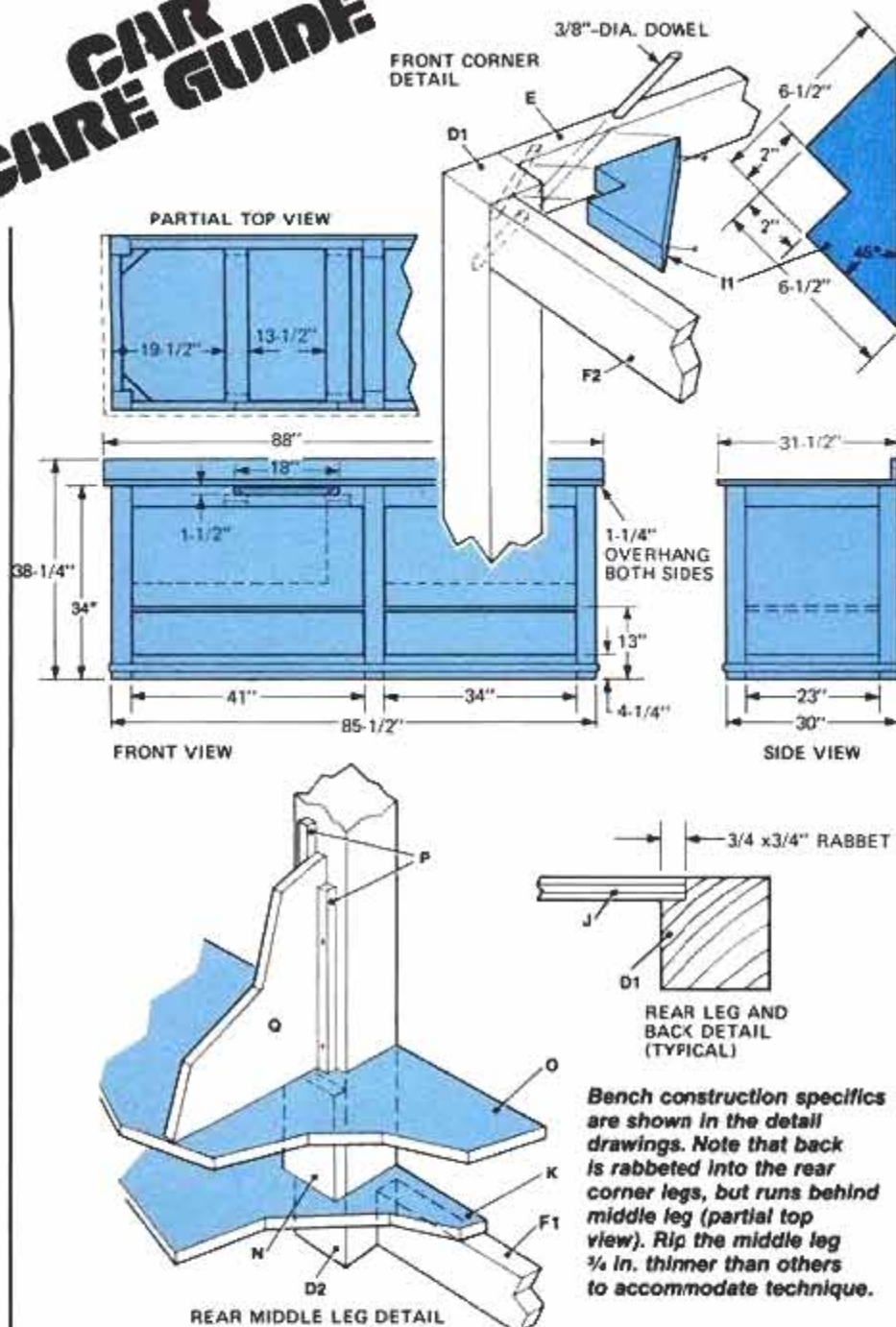
Key	No.	Size and description (use)			
A	1	3/4" x 31 1/2" x 88" particleboard (top)	P	4	3/4" x 3/4" x 19 1/2" plywood (cleat)
B	1	3/4" x 3 1/2" x 88" particleboard (back splash)	Q	1	3/4" x 19 1/2" x 23" plywood (partition)
C	1	1/2" x 30" x 86 1/2" sheet aluminum	R	1	1 1/2" x 3 1/2" x 23" fir (top support)
D1	6	3 1/2" x 3 1/2" x 34" fir (leg)	S	2	3/4" x 4 1/2" x 26 1/4" fir (tray support)
D2	1	2 3/4" x 3 1/2" x 34" fir (leg)	T	3	1 1/2" x 3" x 26 1/4" fir (stiffening cleat)
E	4	1 1/2" x 3 1/2" x 23" fir (rail)	U	1	1 1/2" x 1 1/2" x 4" fir (support leg)
F1	3	1 1/2" x 3 1/2" x 34" fir (rail)	V	†	Quarter-round pine molding (tray guide)
F2	3	1 1/2" x 3 1/2" x 41" fir (rail)	W	150"	Half-round pine molding (trim)
G	20	3/8" dia. x 6" dowel	X1*	1	18-drawer metal cabinet
H	2	3/4" x 3/4" x 23" fir (cleat)	X2*	1	9-drawer metal cabinet
I1	2	1 1/2" x 6 1/2" x 6 1/2" fir (front corner block)	Y**	†	Plastic tray
I2	2	1 1/2" x 6 1/2" x 6 1/2" fir (back corner block)	Z***	†	Metal tray
J	1	3/4" x 34" x 80" plywood (back)			
K	1	3/4" x 28 1/2" x 84" plywood (bottom)			
L1	1	3/4" x 4 1/4" x 34" plywood (toe kick)			
L2	1	3/4" x 1 1/2" x 34" plywood (cleat)			
M1	1	3/4" x 4 1/4" x 41" plywood (toe kick)			
M2	1	3/4" x 1 1/2" x 41" plywood (cleat)			
N	6	3/4" x 2 3/4" x 8" plywood (cleat)			
O	1	3/4" x 29 1/4" x 84" plywood (shelf)			

Misc.: 6d common nails, 1 1/2" and 2 1/2" No. 10 fh screws, glue sandpaper, primer, paint.  
 †As required.  
 \*Available from: Equipto, 225 South Highland St., Aurora, Ill. 60507.  
 \*\*Available from: Akro-Mis, Box 989, Akron, Ohio 44309.  
 \*\*\*Available from: Any restaurant supply outlet.  
 An hose reel available from C & H Distributors Inc., 400 South Fifth St., Milwaukee, Wis. 53204.

*This sturdy workbench was built to withstand the unique rigors of heavy-duty auto work. Full-width aluminum top makes oil spills easy to clean and prevents the wood from galling. The shallow, premade metal drawers optimize space for tool and parts storage. Space is provided for an air hose in the center. Other storage space is provided by easy-to-remove and inexpensive plastic trays. These hold larger, hard-to-store parts and groups of tools that are often used together.*

Design: Tony Assenza, Ralph deMassi.  
 Construction: Sal Fisanello.  
 PM photos: George Ancona.

# CAR CARE GUIDE



to hold a complete V8 engine without a word of complaint.

## Joining legs and rails

Begin construction by cutting all the legs the same length and ripping the rear middle leg 3/4 in. thinner than the other five. Then cut a 3/4 x 3/4-in. rabbet in each rear leg to accept the back.

Cut the upper and lower side rails to length and join them to the end legs, using glue and 3/8-in.-dia. dowels, as shown. We bored the dowel holes at 45° angles for added strength. But if you don't have a drill press with a tilting table to perform this task, use two dowels per joint instead of one and install them conventionally. Clamp the assemblies, check for square and allow them to dry overnight.

Next, cut the remaining rails to length

and cut the notch in the left front rail (F2) for the metal tray. Join these rails to the legs as explained above. Be especially careful to clamp these assemblies square. Otherwise the metal drawer cabinets will not fit properly later.

Install the four corner blocks with glue and 2 1/2-in., No. 10 flathead screws. Note that the notches in the front and rear blocks are not the same because the workbench back is rabbeted into the rear legs. The front blocks are shown in the detail drawing above. The rear block notch is 1 1/4 x 2 in.

## Installing bottom and shelf

Join the back to the legs using glue and 6d common nails, then cut the bottom to size and shape. Attach the front support cleats (L2, M2) to the underside of the bottom, and glue and nail the bot-

tom into place. Attach the quarter-round tray guides, allowing 1/8-in. clearance on both sides of each tray. Then attach the toe kicks with glue and 6d common nails. Install the shelf cleats (N), making sure to recess them 3/4 in. from the outside of the end legs.

Cut and install the shelf. Attach the rail cleats (H) and install the plywood side panels.

Cut the middle partition and cleats and install. Toenail the top support (R) into the front and rear legs and set the nailheads to prevent the top from rocking once it's in place.

Next, install the tray supports (S) by nailing them into the small cleats shown in the front view detail drawing at left. Or, because they carry little weight, these can be nailed directly in place, using 8d finishing nails driven through the front and rear bench rails.

## Top and drawers

Cut and join the top and back splash using glue and 2 1/2-in. No. 10 fh screws. Then position the stiffening cleats (T) on the underside of the top by measuring 18 in. in from both ends and 3 in. in from the front.

Next, attach the cleats with glue and countersink 1 1/2-in., No. 10 fh screws driven down through the top. Because the top is not fastened to the bench, these cleats keep it from moving during heavy use. If you prefer to attach the top, just screw it to the corner blocks from above.

Next, glue and nail the half-round trim pieces to the bench sides and front. Miter the corners. Then sand the entire bench with 100-grit sandpaper; prime and paint.

Now, remove the drawers from the metal cabinets and hang the shelves from the legs and upper front rails. Use wood screws driven from inside the metal shelf. Because the left cabinet is supported only by the upper rail and one leg, it is wise to cut and fit a small wood leg (U) underneath the back right corner. Toenail this block into the shelf, then screw down from the inside rear corner of the cabinet into the top of the block.

## Finishing touches

Insert the plastic storage trays, then cut the sheet aluminum to size and place it on the top. To add the multi-outlet fixture shown in the photo, just screw it to the front rail and wire a 12-2 cable with ground, extension-cord pigtail to the back of the fixture. Run the cable above the drawer cabinet and through a hole bored in the workbench back. Plug it into an existing outlet. The air hose reel shown is available from C & H Distributors of Milwaukee (see materials list) and merely hangs from the bottom of the front rail.



If you're not using Mobil 1<sup>®</sup> you could be shortchanging your engine.

Mobil 1's unique molecular structure is the reason it lubricates better and helps protect engine parts better against friction and wear than conventional oil. So engines stay cleaner and run smoother.

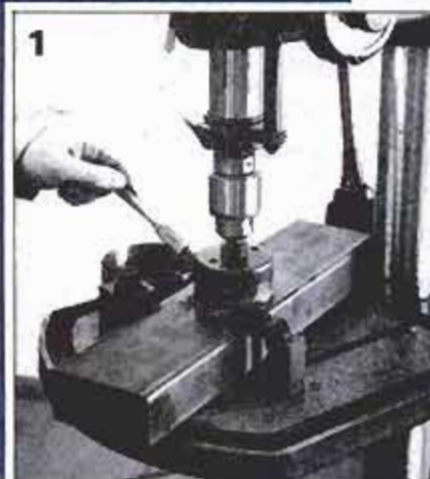
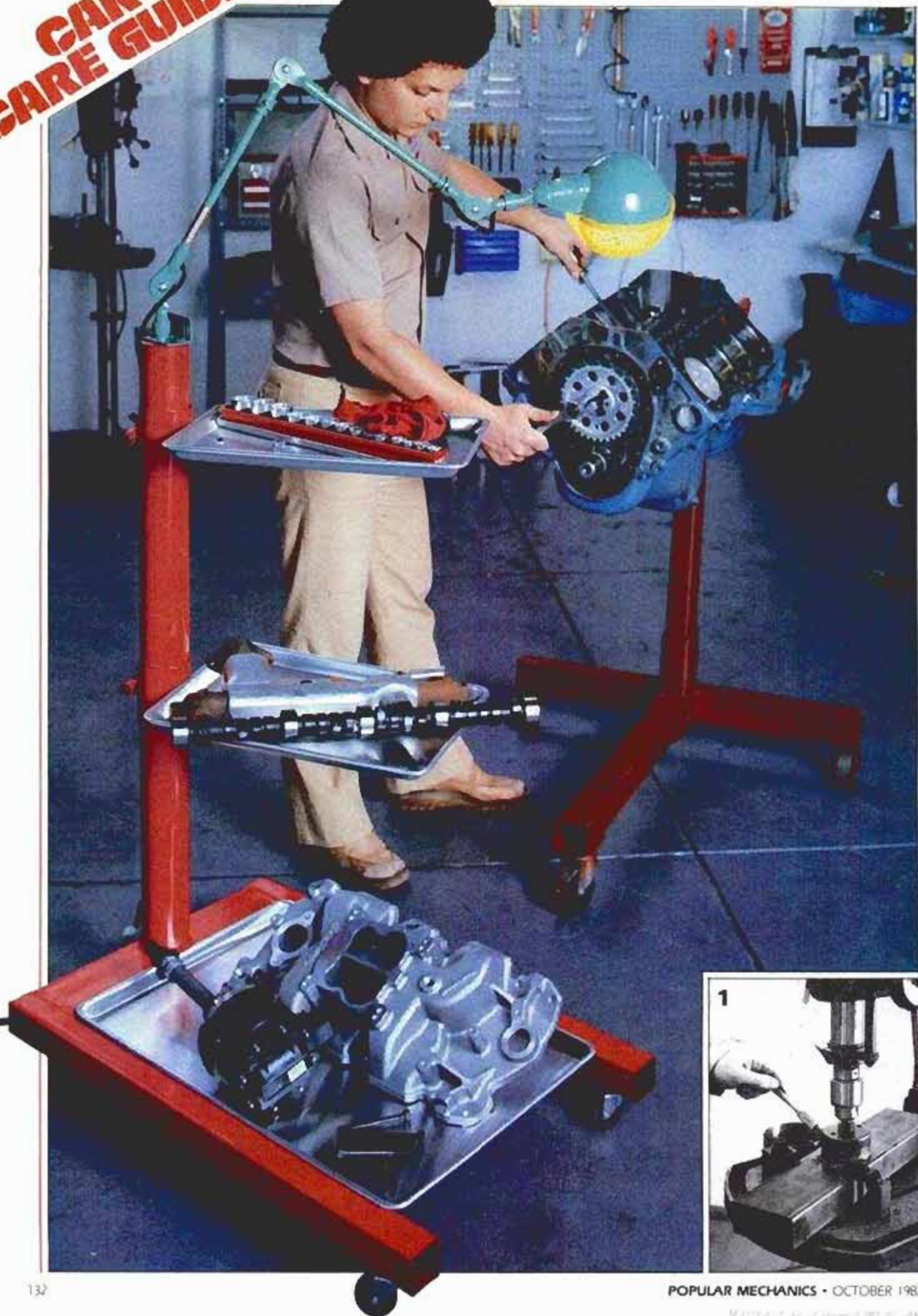
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**Treat the inside of your car as well as you treat the outside.**





# Build PM's Tool Dolly

Inspired by professional race crews, this easy-to-build dolly can make your pit stops a lot faster.

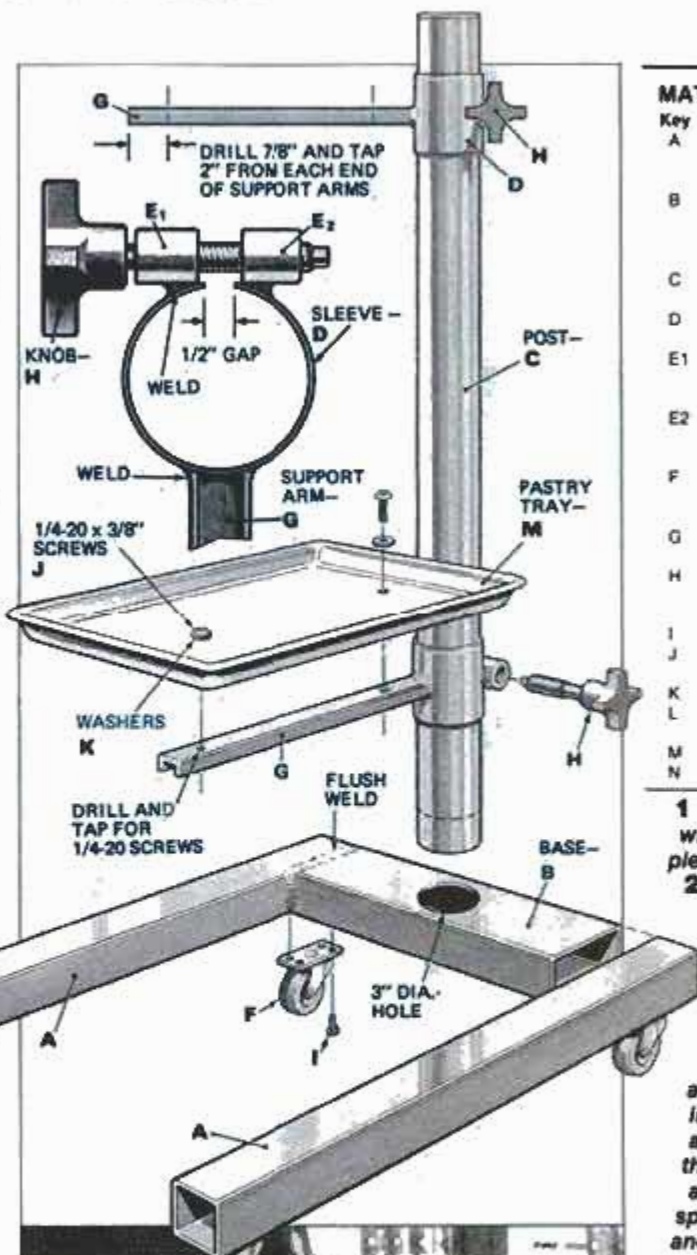
The tool dolly is one of the great, unsung heroes of any auto shop. We've seen them used by NASCAR and USAC pit crews and even in Maranello, Italy, where they build Ferrari street cars. Yet, we'd never seen one in anybody's home shop. The reason for this is simple. Nobody, as far as we can tell, sells them. Those lightning fast mechanics cobble up their own tool dollies for their unique needs. So we decided to design one for the home mechanic.

Our premise was easy enough. The unit had to be easy to build, easy to work with and rugged enough to handle heavy tools and auto parts. It turned out better than we expected. The base, in fact, can carry the weight of a fully dressed Chevy 305-cu.-in. V8, and the two top trays can handle water pumps, distributors and any tool you could possibly use on your car.

Construction is simple, utilizing steel tubing and U-channels normally found at local metal distributors. Unless you have a metal cutoff saw, have the distributor cut all pieces to size. Should any substitutions be necessary for post C or collar D, be sure that the sleeve slides over the post with no side play. We picked up the aluminum trays at a restaurant-supply company.

We used an arc welder, drill press, index table, bench grinder, belt sander and a .103-in.-thick rotary saw. We also needed a center punch, a 3-in. hole saw for metal, 10-32, 1/4-20

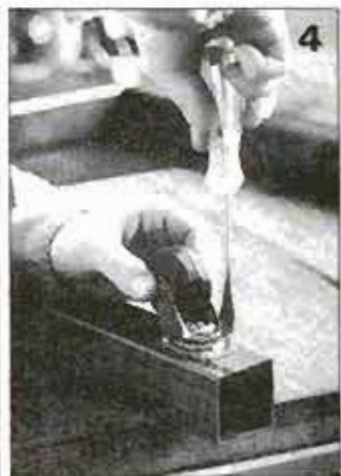
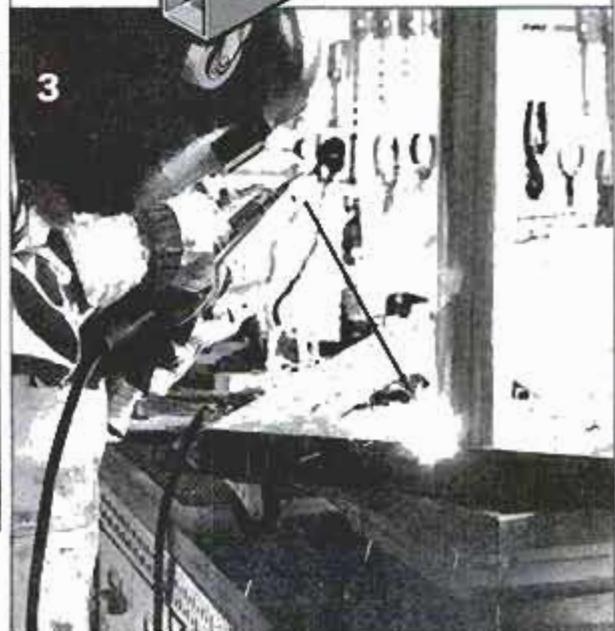
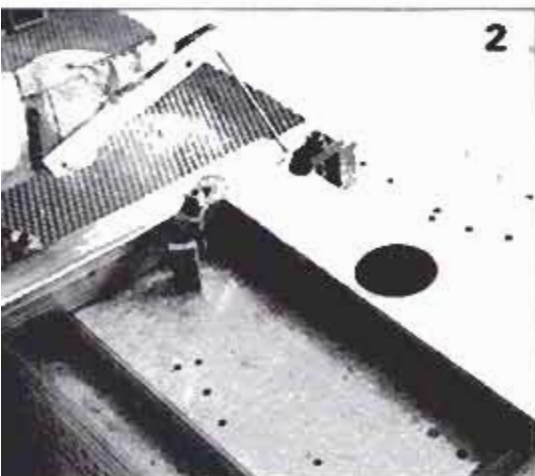
Design and construction: Tony Assenza, Ralph deMasi  
PM photos: George Arcona

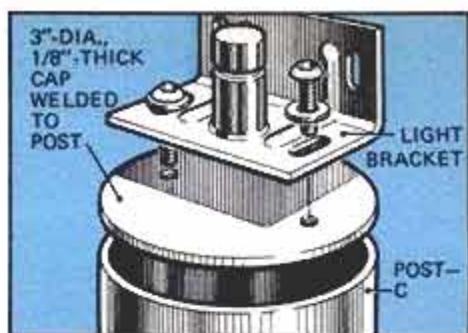
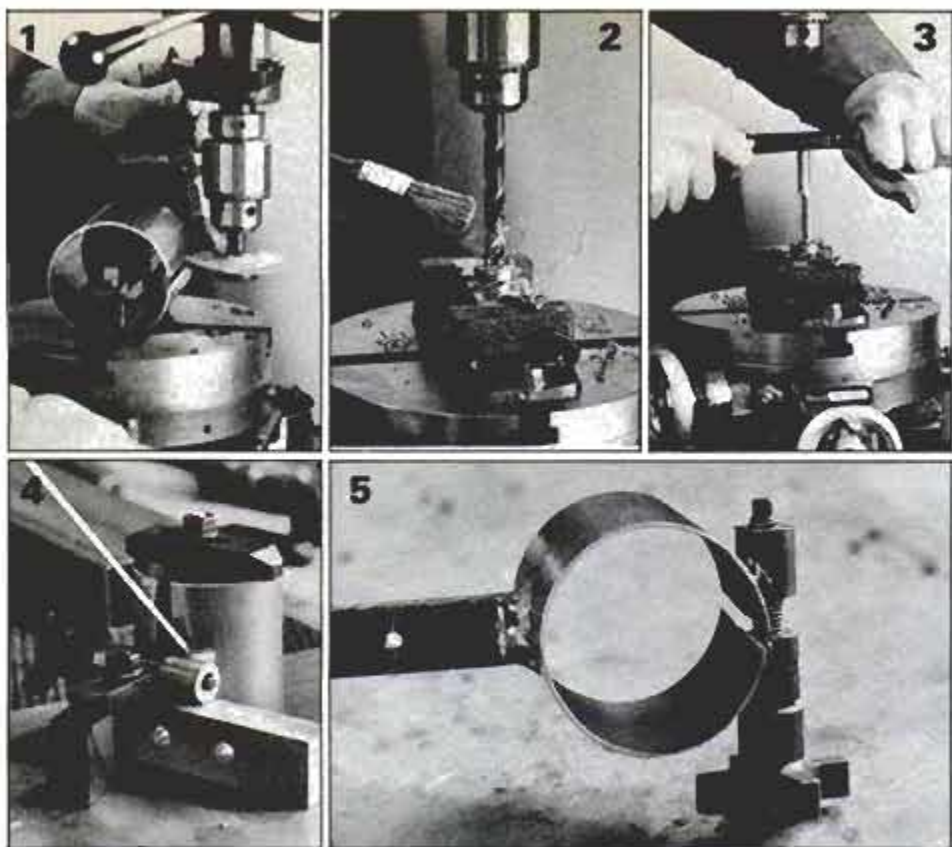


## MATERIALS LIST—DOLLY

Key	No.	Size, Description (use)
A	2	2 x 2 x 30" main frame legs with 1/8" wall, square tubing
B	1	2 x 4 x 17" main frame center section, rectangular tubing with 1/16" wall
C	1	3 x 3 x 41" post, round tube with 1/8" wall
D	2	3 1/8 x 4" round tube with 1/16" wall steel
E1	2	7/8 x 7/8 x 1" clamp sections, 3/8" l.d. steel, drilled only
E2	2	7/8 x 7/8 x 1" clamp sections, 3/8" l.d. steel, drilled and tapped
F	4	1 1/4 x 2" casters (mounting plate, dimensions)
G	2	1/2 x 1 x 15" U-channel steel support arms
H	2	1/2 x 3" knobs with threaded rod, 13 threads per inch
I	16	1992 x 1/2" screws
J	6	1/4-20 x 3/8" Allen button-head screws
K	6	washers for 1/4" screw
L	1	swivel lamp—not shown (optional)
M	2	aluminum trays 13 x 18"
N	1	aluminum tray 26 x 18"

- 1 Main base section is cut with a 3-in. hole saw. Hold piece securely with clamps.
- 2 Build the base frame in a jig; hold it tightly with clamps during the welding. Make sure edges are flush and tight.
- 3 Once the base frame is welded together, install post, and spot weld it to hold it in place. Then run a bead around the post.
- 4 Using the caster mounting plate, as shown in photo below, spot, drill and tap the base and install the four casters.





**1** Slot the sleeve on drill press. Secure sleeve on index table with T-nuts, clamps. **2, 3** Drill and tap the clamp sections. Two of the clamp sections should be drilled only, the other two drilled and tapped. **4** The sleeve assembly should be secured in a jig and held tightly while welding. **5** Sleeve assembly with support arm. The detail above is for optional work light.

and 1/2-13 taps and tap handle, No. 7, 21 and 2 1/4-in. drills, a flat and round file, primer spray paint and finish coat.

Hold down the sleeve on the index table by clamps. Fix the clamp securely so the sleeve won't shift when you begin to cut the slot. If the tube has a seam it should be opposite the slot. Feed the work slowly into the blade, using the index table's lateral movement handwheel. While you're cutting, keep the wheel cool with brushed-on water and a water-soluble cooling oil, available at machinists supply outlets. When both collars are done, deburr them.

Next take two of the four 1 x 7/8 x 7/8 in. clamp sections (E1 in diagram) and drill out the center to 1/2 in., using a table vise and drill press. Deburr using the belt sander. The other two (E2) are drilled out to 2 1/4 in. and tapped for a 1/2-13 thread. Don't clamp the clamp sections too tightly; this could distort the inside diameter and make it harder to tap. Use tapping fluid liberally. When finished, deburr them and set aside.

The knobs (H) were located at a machinist's supply house. We picked large knobs for a good grip. When adjusting the tray, grind down the threads on the rod which passes through clamp section E1, closest to the knob itself. This will keep the rod from binding and jamming the sleeve open.

After finishing the clamp sections, take the tray support arm and drill a hole using a No. 7 drill, then thread with a 1/4-20 tap. The end you weld onto the sleeve will need a concave shape when seen from above. This can be done on the bench grinder.

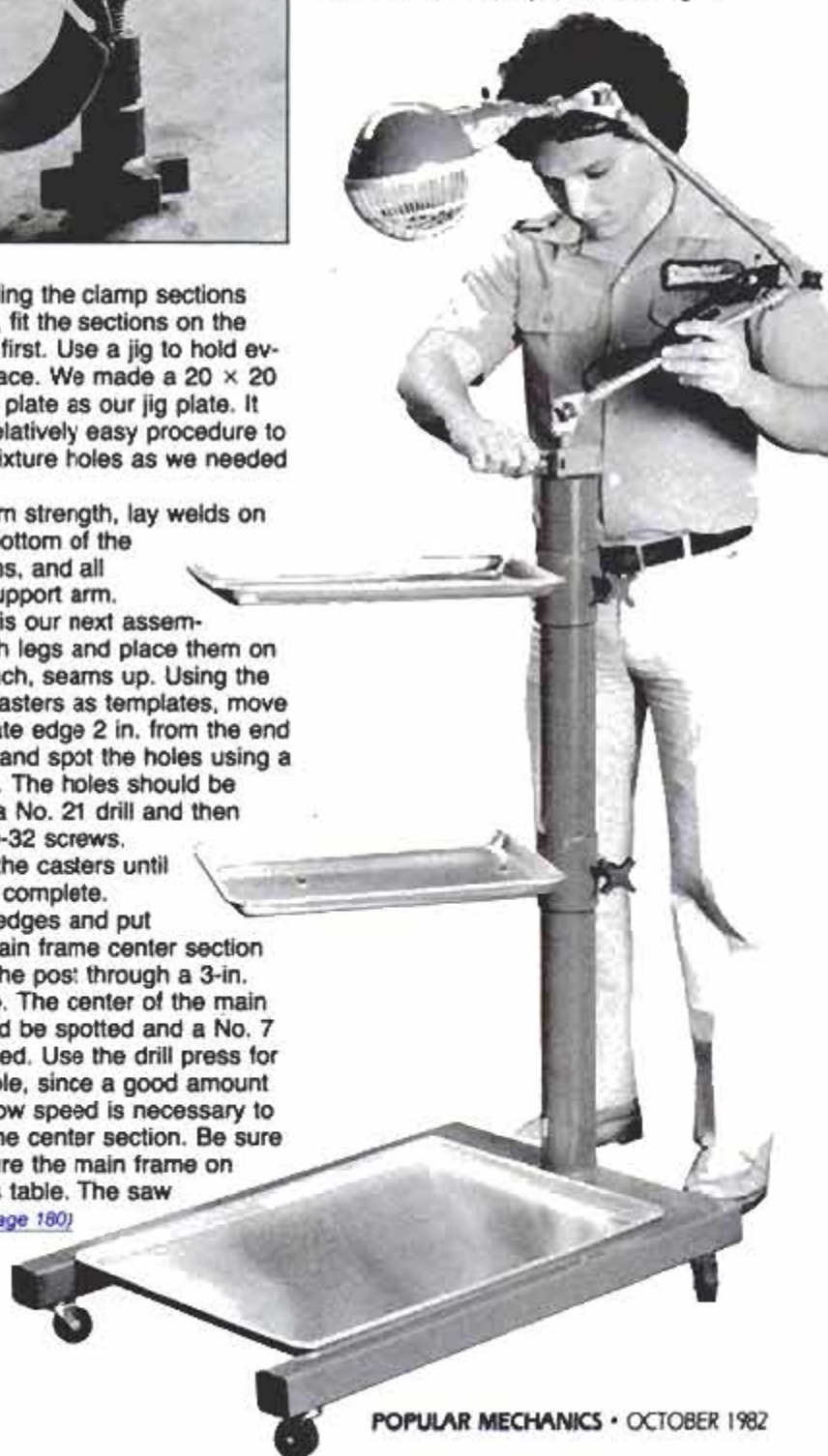
When welding the clamp sections to the sleeve, fit the sections on the threaded rod first. Use a jig to hold everything in place. We made a 20 x 20 x 1/4-in. steel plate as our jig plate. It was then a relatively easy procedure to drill and tap fixture holes as we needed them.

For optimum strength, lay welds on the top and bottom of the clamp sections, and all around the support arm.

The frame is our next assembly. Take both legs and place them on your workbench, seams up. Using the base of the casters as templates, move the caster plate edge 2 in. from the end of each tube and spot the holes using a center punch. The holes should be drilled using a No. 21 drill and then tapped for 10-32 screws. Don't mount the casters until all welding is complete.

Deburr all edges and put aside. The main frame center section (B) will hold the post through a 3-in. hole in its top. The center of the main section should be spotted and a No. 7 pilot hole drilled. Use the drill press for cutting the hole, since a good amount of torque at low speed is necessary to cut through the center section. Be sure that you secure the main frame on the drill press table. The saw

*(Please turn to page 180)*



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The TRX is the result of years of Michelin research. We took a fresh look at the tire and wheel and redesigned both until they were quite literally made for each other. And then after extensive testing on our proving grounds, the TRX proved itself on the Grand Prix circuit.

A completely new concept in radials for passenger cars, the TRX provides extraordinary cornering and braking, exceptional traction on wet and dry roads, and the ultimate in driving comfort.

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We put America on radials.

## What You Should Know Before BUYING AUTO PARTS

Not all parts are created equal. Amidst the used, rebuilt and even new ones, you just might find some counterfeits.

**T**he easy part of fixing your own car should be picking up the replacement parts you need to do the job. But is it?

Consider the choices you must make when buying replacement auto parts: Should you buy new, rebuilt or used components? If new, should you look for a factory-made part or one produced by an independent supplier? And that's just the beginning.

Where's the best place to buy the parts you need—a car dealer, auto parts store, discount or so-called "red front" store, or department store? Even your local drug store or supermarket may carry a limited line of auto parts.

Then there's another problem: All auto parts are not created equal. You'll find vast differences in parts designed for the same application—differences that can mean poor performance, premature failure, potential safety hazard, or maybe just a part that flat-out won't fit.

Parts that go into a new car at the factory are called original equipment (OE). These parts may be made by the car factory or by an independent supplier for the factory. Parts produced by quality independent firms will equal or better those made by the factory. If, for example, your

*Which is the real Chrysler part? Look closely: The box at right says it replaces Mopar. It's a cheap copy of the real thing.*

car has a Delco-Remy ignition system, you can use replacement components made by companies such as: Echlin, Sorensen, Niehoff and others. These brands offer factory quality at slightly lower prices.

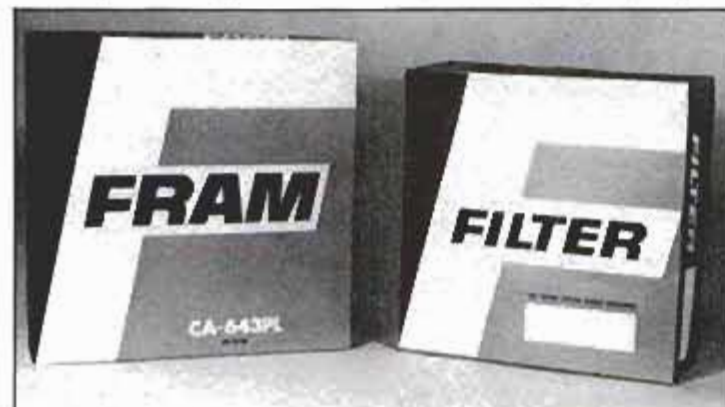
Some independently produced replacement parts may even be superior to the factory-made item. Replacing OE nongreaseable ball joints with a set that can be greased can increase ball-joint service life. Heavy-duty or upgraded replacement parts may cost more, but they'll give you greater reliability.

When you replace parts such as alternators, clutches, air-conditioner compressors, starter motors, water pumps and other components, consider a rebuilt unit. A rebuilt part uses the housing or "core" from a worn-out part that is fitted with new internal components where necessary. Rebuilts can perform as well as, or better than, new parts while costing up to 60 percent less. You usually have to turn in your old part as a core exchange or pay an extra charge.

The term "remanufactured" is often used interchangeably with the term "rebuilt." While today they have come to have the same meaning, there are two distinct rebuilding techniques. Smaller shops generally have one person overhauling an entire unit, testing and replacing bad components. Larger facilities are set up in assembly-line fashion. The parts move along through various work stations in a remanufacturing process that resembles production of a new part.

Some remanufactured or rebuilt parts may be better than new. In dealing with large numbers of worn-out units, the rebuilder can determine why they wore

*(Please turn to page 138)*



*Clever packaging ploy could fool even an experienced mechanic. In the box at left is the real Fram filter; the other box is a facsimile containing a filter that could ruin your engine.*

## BUYING AUTO PARTS

(Continued from page 137)

out in their original use. If the cause is a bad design or substandard components, the rebuilder can make design changes or use stronger components.

While major remanufacturers often have more extensive testing and quality-control procedures than smaller shops, size alone does not determine the quality of work. Both types of operations can turn out a good product. Aside from independent parts rebuilders, OE companies such as Delco also offer a rebuilt line.

Rebuilt parts are clearly labeled as such. Look for a strong warranty as a sign of quality. Companies such as Arrow Automotive Industries, Champion Parts Rebuilders, among others are established leaders in this field.

Used parts, sometimes called recycled parts, are taken off junked or wrecked vehicles, cleaned up or sold as is. This route offers substantial savings on big items such as body parts, radiators, rear-end assemblies and even complete engines. Warranties in this area are practically nonexistent, and unless you are looking at parts that don't wear out, such as an intake manifold, buying used is something like playing a crap game. Even if you have to freshen up a used part, such as installing new rubber bushings on a suspension component, you may still come out far ahead on price. Careful inspection is the name of the game here. A part that may be okay on a wrecked car can be damaged by sloppy removal.

Auto parts are available at any number of outlets ranging from new-car dealers to junkyards. Car dealers offer genuine factory parts, but charge top dollar.

Auto parts stores (wholesale/retail) also carry some factory brands, such as Delco, Motorcraft, Mopar, along with parts made by aftermarket firms. They may stock the same application part in a quality and "budget" priced line. This type of outlet basically is where your independent mechanic gets the parts for his repair jobs. You can buy quality new parts here at modest discount savings along with top-grade rebuilt components. The staff in this type of outlet more likely will be able to give you technical advice on a particular repair problem and guide you in a choice of parts than sales clerks in discount stores.

Discount outlets and mass merchandiser operations are geared for self-service and offer limited tech assistance. Price is a big consideration here. Quality products may be stocked along with off-brand merchandise of dubious worth.

What parts you buy is more important than where you buy. Your best bet is to stick with established and familiar brands. A knowledgeable, reputable parts outlet can guide you in this area, but there's a little known pitfall that awaits even the brand-conscious parts buyer.



Rebuilt distributor from a reputable company—Arrow, for example—will perform as well as an original equipment unit but can save 60 percent of price.

Some unscrupulous parts manufacturers produce products that are outright junk. Shoddily made, and failing to meet the performance standards that carmakers set for their own parts, these "gypsy parts" operators, as they're known, have come up with a gimmick to sell their stuff to consumers who normally wouldn't touch their products with a 10-foot pole. What these shysters do is counterfeit packaging of their products so you think you're buying a genuine factory part or name-brand item.

Big name-brand companies have considerable research and development facilities to improve their products continually and bring out better ones.

We got a sample of this kind of R&D on a recent trip to Fram, the filter people, in Rhode Island. Their head research engineer, Tony Caronia, showed us how they take random samplings of oil filters off the assembly line and bring them into the lab for tests. The filters are subjected to a variety of tests including a hot, high-pressure test to 600 pounds per square inch (p.s.i.). The highest pressure an oil filter will ever see in its service life is around 60 p.s.i. For comparison, they tested an off-brand filter under the same conditions; not only did it blow its gasket at 100 p.s.i. but the casing also failed and began losing oil at 200 p.s.i.

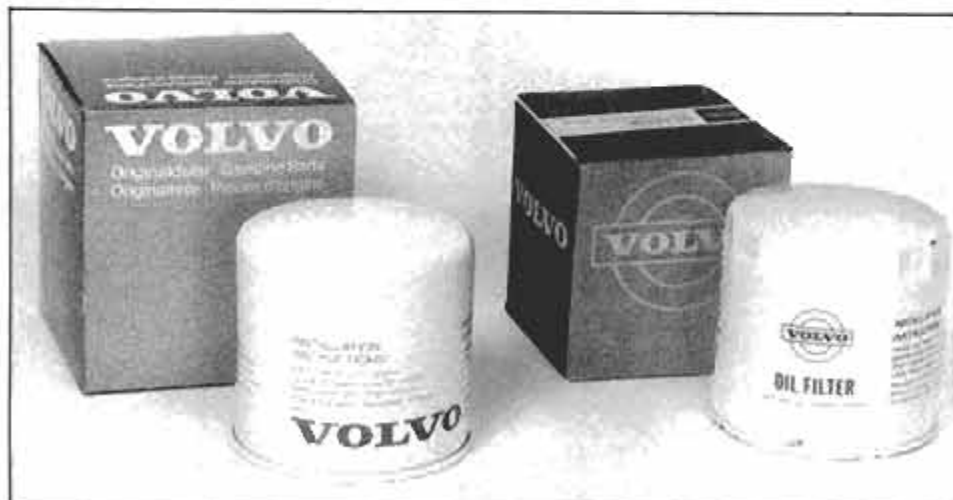
Reputable companies also carry product liability insurance. If your engine blows up because a name-brand oil filter proved defective, the oil filter company, through its insurance coverage, would pay for the damages.

If some retailer wants to sell you look-alike parts, just ask him if it makes any difference to him if you pay in look-alike money.

PM



The real Volvo filter is at far left. It has more drain holes and a pressure relief valve. The one at left is a counterfeit sold in a box made to resemble the Volvo box. Below, the real thing is at left, the fake is on the right.



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Whether you change your own oil or someone else does, there are some important things you should know about Havoline Supreme.

First of all, Havoline Supreme has a Texaco-developed, balanced additive system with a built-in, special friction fighter.

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Supreme, with its special friction-fighting additive, helps save gasoline.

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## **Listen to an expert.**

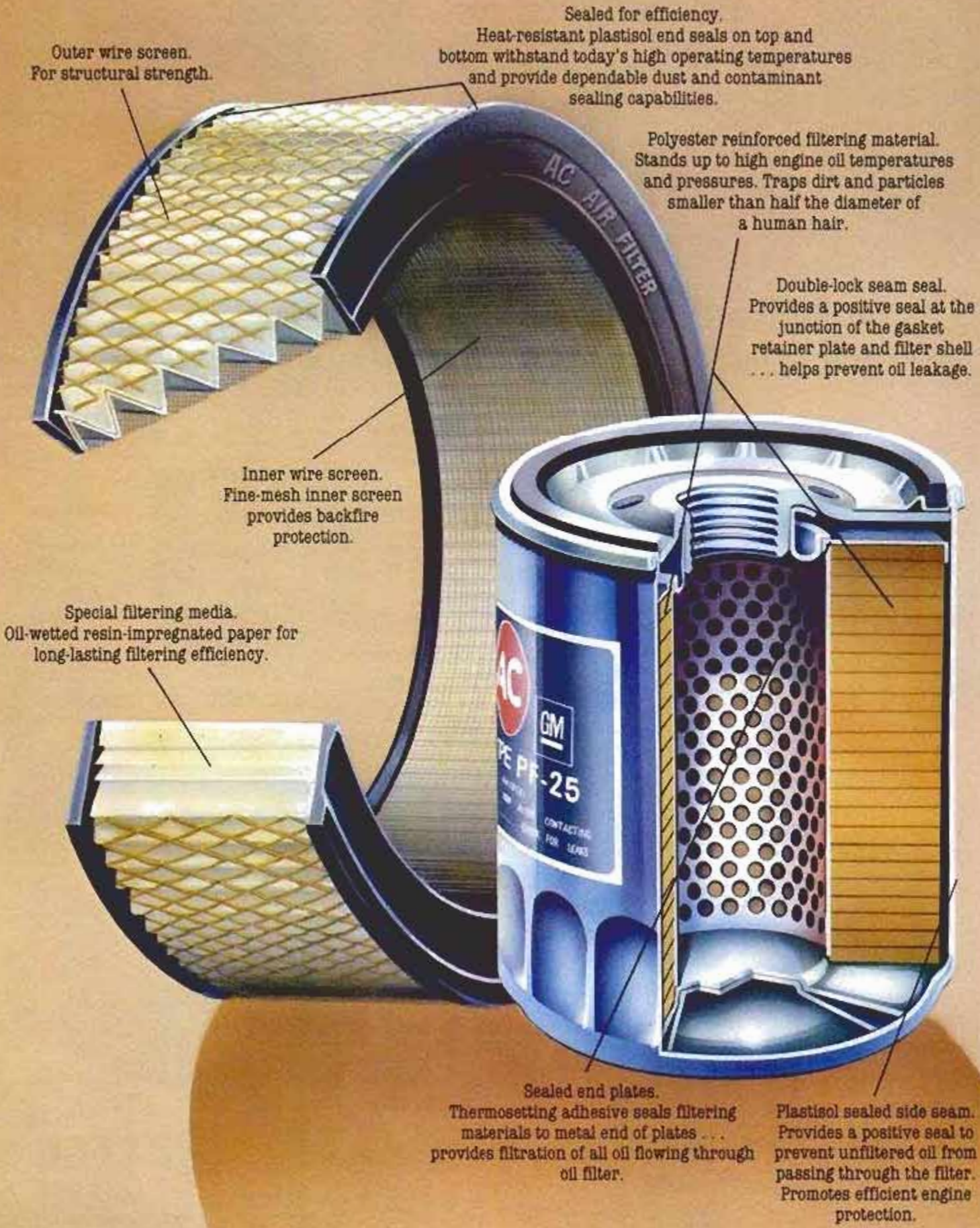
Top Indy 500 driver Tom Sneva calls

Havoline Supreme a "very sophisticated oil...one that a prudent car owner should use on a regular schedule." Shouldn't you?



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# Now you can get great engine





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You'll wear it with pride.

## And take your favorite cars inside.

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treatment to two of the hottest cars on the streets today. And two of the most popular performance cars of the past.



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Fuse kit — yours at no charge when you order any item at right.

Indicate type:  American-built, 1976 and before

American-built, 1977 and after

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Jacket Sizes	XXS	XS	S	M	L	XL	XXL
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Emblems: Firebird, Camaro, Corvette, Chevrolet, Oldsmobile, Pontiac, Buick, Cadillac, GMC, Chevrolet Truck, None

PM-10

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GENERAL MOTORS CORPORATION

# Service Secrets And Shortcuts

## 1 Ignition-wire check

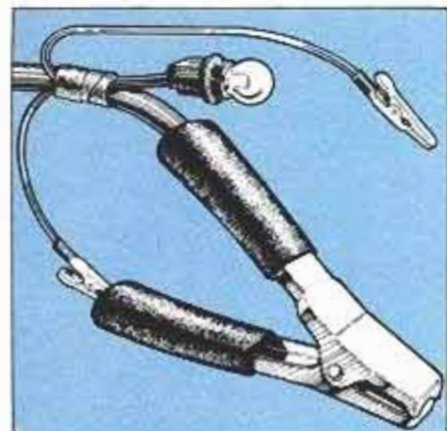
If your engine misses while idling, or runs poorly, and you suspect the problem is being caused by a bad ignition (sparkplug) wire, here's an easy way to check your wires. First you'll have to get an inexpensive timing light that uses just two leads. This type of light doesn't have leads that attach to the battery.

Remove one sparkplug wire at a time. Connect one timing light lead to the plug wire and the other lead to the sparkplug. Then start the engine. If the wire is in good shape, the timing light will flash brightly each time the plug fires. If the flash is dim, there is a problem in the wire.

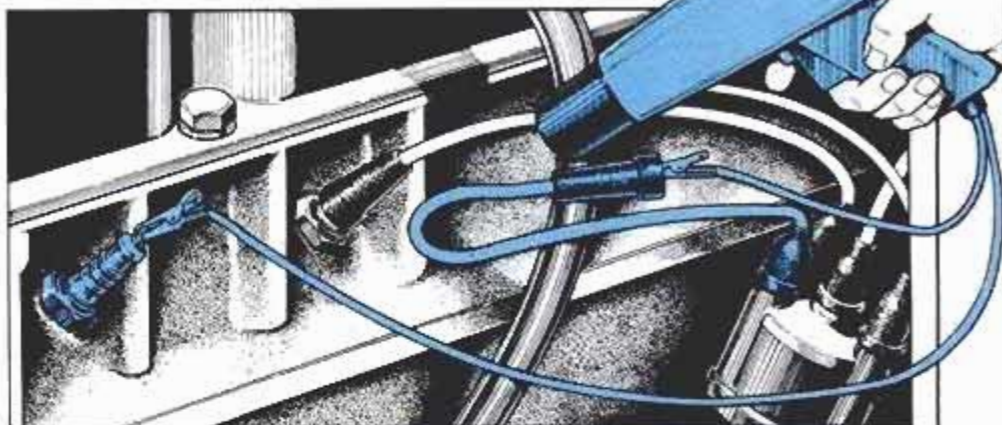
If there is a question as to whether the wire or the sparkplug is at fault, remove the plug and install one that you know to be good. Then you can repeat the test.

## 2 Booster safety light

Improper connecting of booster cables can be expensive and dangerous. You can seriously damage an alternator, and



Do-it-yourself safety light helps prevent improper connection of booster cables.



To check the condition of sparkplug wires, connect a two-lead timing light between the sparkplug and the wire. A bright flash when the plug fires means the wire is okay.

worse, you can cause a battery to explode, causing harm to yourself. Protection is simple and cheap with a safety light you can rig up yourself. Take any 12-volt, single-contact socket and connect the hot lead to the positive-cable metal clamp. You can either drill a hole in the clamp and attach the lead with a sheet-metal screw, or attach an alligator clip to the lead wire and connect it to the battery clamp. Pull down the plastic grip on the free side of the battery clamp, run the wire through the grip, clamp the metal handle and slide the grip back into position. Also attach an alligator clip to the other wire lead.

Tape part of your test-light wire to the booster cable to prevent the wire from getting fouled.

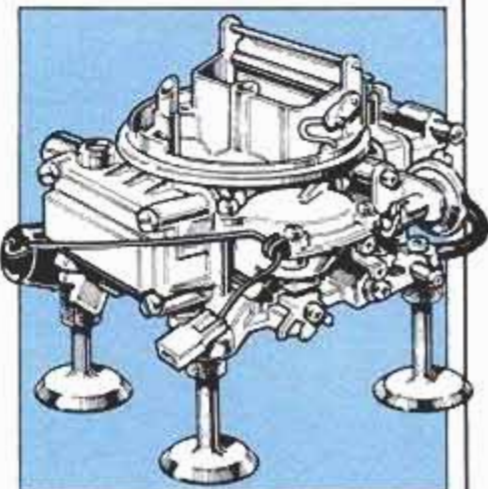
Before hooking up the booster cable, be sure to identify the positive battery terminal. Connect the alligator clip on the free end of the test light to any suitable ground. Now touch the positive booster cable to the battery terminals. The terminal that lights up your test light is the positive one.

We're making the assumption, of course, that your vehicle isn't a real oldie, as some early electrical systems used a positive ground.

## 3 Carburetor workstand

If you've ever placed a carburetor on a flat-surfaced workbench, you know how clumsy and awkward it is. The linkages and other attachments extending down from the carb body make it unstable and unwieldy to work on. This problem is

*(Please turn to page 144)*



Old engine valves and tape combine to make an inexpensive carburetor stand.

# SMOKERS

## U.S. GOV'T LATEST REPORT:

King, Menthol or Box 100's:

**A whole carton of Carlton has less tar than a single pack of...**



...KINGS			...100's		
	TAR mg./cg.	NICOTINE mg./cg.		TAR mg./cg.	NICOTINE mg./cg.
Kent	12	1.0	Kent 100's	14	1.2
Winston Lights	11	0.9	Winston Lights 100's	12	0.9
Marlboro	16	1.0	Benson & Hedges 100's	16	1.1
Salem	14	1.1	Parliament Lights 100's	12	0.9
Kool Milds	11	0.9	Salem 100's	15	1.1
Newport	16	1.2	Marlboro 100's	16	1.1

TAR & NICOTINE NUMBERS AS REPORTED IN LATEST FTC REPORT

Carlton Kings	Less than 0.5	0.1	Carlton Box 100's	Less than 0.5	0.1
Carlton Menthol	Less than 0.5	0.1			

Box—lowest of all brands—less than 0.01 mg. tar, 0.002 mg. nicotine.

# Carlton is lowest.

U.S. Government laboratory tests confirm no cigarette lower in tar than Carlton.

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

Box: Less than 0.5 mg. "tar", 0.05 mg. nicotine; Soft Pack, Menthol and 100's Box: Less than 0.5 mg. "tar", 0.1 mg. nicotine av. per cigarette, FTC Report Dec. '81.

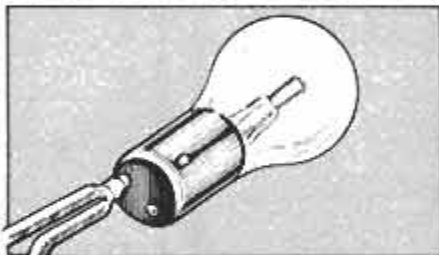
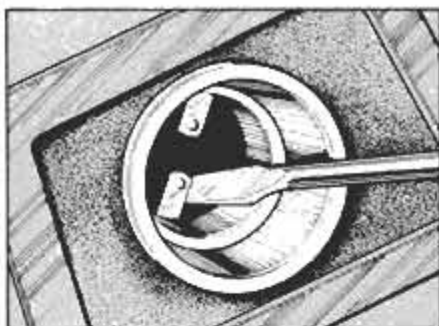
easily eliminated with a simple carburetor stand you can make yourself. Just take four old engine valves and wrap some tape around the stems about two inches down from the top of the valve stems.

Place the carburetor mounting holes over the valve stems and ease the carburetor down the stems until it rests against the tape. If the valve stems are too thick for the carb mounting holes, grind the stems down until they fit. The valves will give you a good stable workstand and elevate the carb a couple of inches off the bench.

## 4 Better bulb contact

Temperamental taillights and parking lights that flicker or go out because of poor connection between the bulb and socket contacts can be remedied without having to buy new bulbs or socket assemblies.

An excellent way to revive weakened

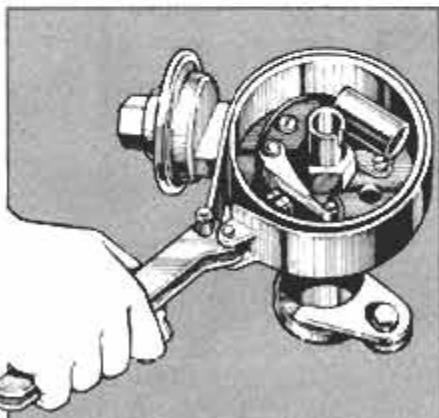


*Flickering parking lights and taillights may be caused by poor bulb contact. An inexpensive fix is to pry up weakened contact springs in the socket with a small screwdriver. Flattened bulb contacts can be built up with a small drop of solder.*

contact springs is to pry them up with a small screwdriver. Make sure the vehicle lights are off to avoid shorting out the circuit. Flattened bulb contacts can be restored by applying a bit of solder to them. If you add too much solder, file down the excess.

## 5 Distributor handle

When checking and adjusting your engine's ignition timing, you may find you're unable to budge the distributor after you've loosened the hold-down bolt to advance or retard the timing. In



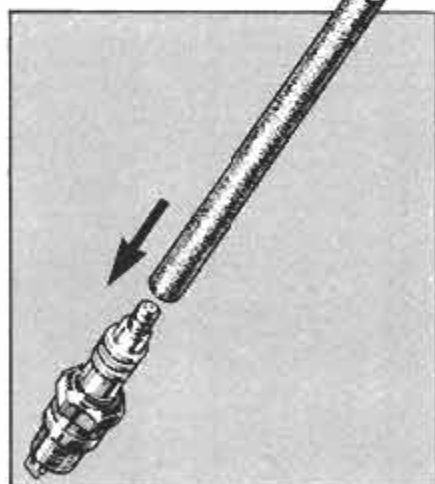
*Oil-filter wrench will give you extra leverage needed to free a stuck distributor.*

this case, you can get the extra leverage you'll need to free the distributor by removing the cap and gripping the distributor body with an oil-filter wrench.

## 6 Sparkplug tool

Tuning up a V8 engine is not significantly different from tuning up a Four or Six—except for one thing. Sometimes the sparkplugs are hidden so far out of the way that you need a hand with universal joints in your knuckles and extensions on your fingers just to install them.

One old trick entails attaching a short piece of 1/4-inch wiper



*Installing sparkplugs in some V8s is easier with this bolt-stiffened hose tool.*

hose over the end of the plug so you can get it started in the cylinder head.

This measure doesn't work all the time because, in some instances, the hose is too flexible and it won't turn the plug. What you need in those cases is a super trick. Take a two- or three-inch section of 1/4-inch wiper hose and insert a 1/4-inch bolt that's a little shorter than the hose. The bolt will give the hose the increased rigidity needed for easy sparkplug installation.

## 7 Timing marks

Timing your engine is much easier if you can see the timing marks and pointer clearly. Unfortunately, most engines are dirty and grimy, a condition which tends to obscure the timing marks. Painting a set of permanent timing marks will ease the timing process considerably.

First, clean the pulley or wherever the timing marks are located on your engine. An engine degreaser will work best here. Then use white enamel nail polish to paint over the timing pointer and the timing mark that your engine should be adjusted to at idle. The enamel nail polish will shrug off grease and



*Timing marks painted with white enamel nail polish will be much easier to see.*

water, and is especially visible for accurate timing.

Some timing scales don't extend far enough for you to check mechanical and vacuum advance accurately. Painting additional marks will help you to check engine advance at specified rpm.

*(Please turn to page 146)*

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# CAR CARE GUIDE

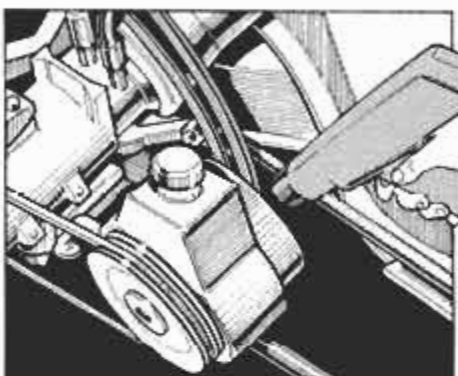
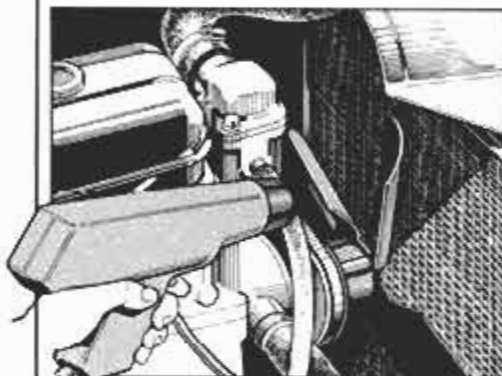
## 25 TIPS FROM THE PROS

### 8 Belt slippage check

Drive belts that slip are inefficient and wear out prematurely. Slipping belts don't always squeal to let you know they're slipping.

If you want to check the alternator fan belt for slippage, hook up a timing light as you would to check ignition timing. Turn on electrical accessories and lights to put a load on the alternator. Aim the timing light at the fan blades. If the blades don't appear to be standing still,

the alternator belt is slipping. Use the same basic procedure to check the other belts. To check the power steering belt, use a chalk or tape reference mark on the pump body and pulley. Aim the light at the pump while someone turns the steering wheel from lock to lock to put a load on the pump. If your reference marks don't stay in the same relative position, it's a safe bet that your belt is slipping.

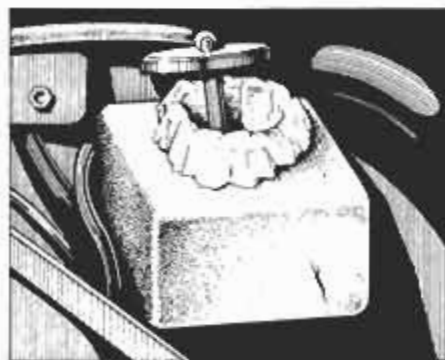


Slipping drive belts can be detected by means of a timing light aimed at the fan blades (left) or at reference marks made on accessory drive pulleys and housings (right).

### 9 Washer reservoir repair

Water in your windshield washer reservoir can cause problems in winter. It'll freeze and crack the reservoir, causing

trick could also save a good reservoir if you forget to add antifreeze fluid next winter: When the plain water freezes, the plastic bag will expand and prevent damage to the reservoir.



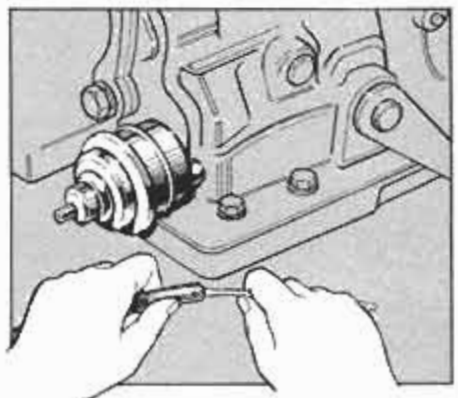
Fix leaking windshield-washer reservoir by inserting a plastic bag inside container.

it to leak. If yours is already cracked, an inexpensive fix is to take a strong plastic bag—the kind that's used for food storage—and stuff it into the washer reservoir.

Open the bag as much as possible inside the reservoir and fold the open end over the reservoir opening. Fill the bag with washer fluid and snap the lid onto the reservoir over the bag. This

### 10 Modulator check

You know that sinking feeling when your automatic transmission starts acting up by shifting roughly. While transmission work generally results in big repair bills, there's a relatively simple check and repair you can do yourself. Automatic transmissions use a vacuum modulator unit to maintain proper shifting opera-



Transmission fluid in the modulator vacuum hose is a sign of a bad modulator.

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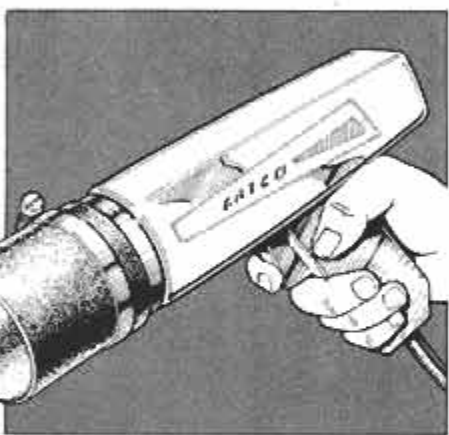
tion. Occasionally, the internal diaphragm in this unit fails and causes rough shifting. To check, locate the vacuum hose running from the carburetor to the modulator. A bad hose will cause vacuum leaks that can also be the source of transmission shifting problems.

If the hose checks out okay, disconnect it at the modulator and check for evidence of transmission fluid. You can do this by inserting a pipe cleaner or a Q-tip as far as possible into the vacuum hose. Also check for transmission fluid in the modulator vacuum hose connection pipe.

If you find telltale evidence of transmission fluid, it means the diaphragm is blown and the modulator is bad. You can replace the unit yourself at minimal cost and effort. Or you can have your local mechanic replace it.

## 11 Timing-light extension

Some engines have timing marks in such an out-of-the-way location that you practically have to stick your timing light into the fan in order to draw a bead on them. After having one expensive timing light grabbed out of our hands and chewed up by the fan, we came up with this safety tip. Take a section of old radiator hose, place it over the end of the



Timing-light extension made from a radiator hose or inner tube is a safety feature when working close to fan blades.

timing light and hold it in place with a hose clamp. If a piece of hose isn't handy, you can do the same thing by rolling a section of old inner tube into a tube shape and slipping it onto the timing light.

The flexible rubber extension will give you an additional measure of safety

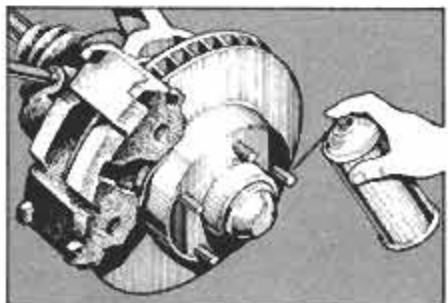
should the tip accidentally strike the fan blades.

The extended tip also narrows the light beam and concentrates it, providing greater visibility of the marks for better timing accuracy.

## 12 Lug-nut removal

Many cars today with sporty styled wheels do not use hubcaps to cover the lug nuts. Exposed to water, road salt and other corrosives, the lug nuts tend to stick to the wheel lugs after a period of time, making removal rather unpleasant.

A penetrating oil will sometimes help



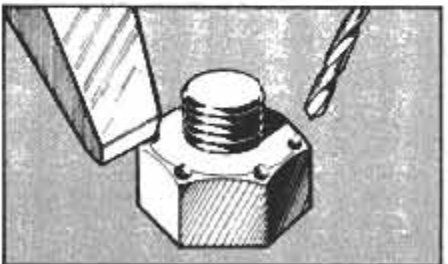
Spraying wheel lugs with antiseize compound will make lug-nut removal easier.

loosen stubborn lug nuts, but in this case some preventive maintenance will go a long way. Remove the lug nuts (while they're still easy to remove) and spray the wheel lugs with antiseize compound (available at parts outlets and hardware stores). Then replace the lug nuts. In the event you have to remove a wheel later on, you'll be able to keep your cool while everyone else is jumping up and down on their lug wrenches.

## 13 Nut cracker

Large nuts that are frozen to bolts present real problems in removal. When the nuts are too large for a nut-splitter, or if you don't have one of these tools avail-

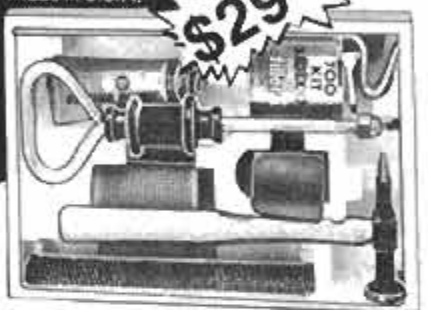
(Please turn to page 148)



To remove large frozen nuts, drill corners and then split, using a hammer and chisel.

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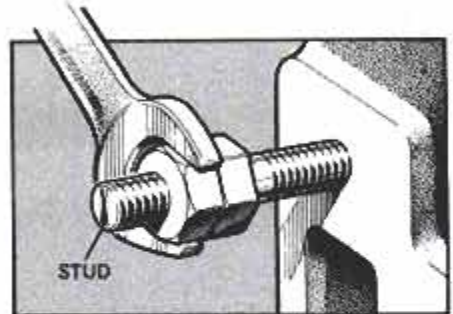
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able, you have to resort to the old chisel and hammer routine. This is a tedious operation at best.

A shortcut that usually works is to drill holes in the corners of the nut and then go at the nut with chisel and hammer. The nut will peel away much faster when the corners are drilled. Before you start drilling, make pilot marks with a punch so the drill won't slip. If the nut and bolt start moving around during the operation, have someone hold the nut with a pair of locking pliers. Remember to use safety glasses when you're doing this job.



Remove studs by screwing two nuts against each other, tightening them, and then turning the bottom unit.

The same method works equally well for installing studs. In that case, however, you turn the top nut in a clockwise direction.

## 14 Air-filter check

It's difficult to tell just how dirty an air filter really is by looking at its outside surface. You'll get a more accurate picture of the filter's state of health if you remove it from the air-cleaner housing and place it over your droplight. If you can see light through the filter element,



If the light from your droplight doesn't penetrate air filter, change the element.

you can reinstall the filter after tapping the element to shake loose some of the surface dust that has managed to accumulate. If light is not able to penetrate the filter, however, it's too clogged with collected dust, dirt and grime to be salvaged. In this case, you have no alternative but to replace it.

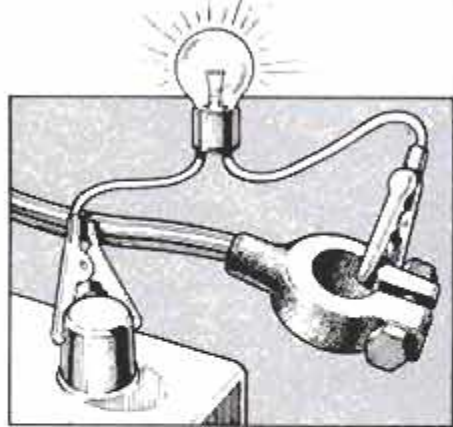
## 15 Stud removal

How do you go about removing a stud without damaging the threads? Very simple, really. Screw two nuts partway down the stud and then tighten them against each other. Now, turn the bottom nut counterclockwise to remove the stud.

## 16 Testing for current drain

If your battery has a nasty habit of running down or going dead, the problem may be in the battery itself or a short somewhere in your wiring system. To check for shorts, disconnect the positive battery cable. Then disconnect any accessories, such as the clock, that runs continuously. Also make sure your dome light is switched off.

Connect a 12-volt test light between the positive battery post and the cable end. If the test light glows, there's a

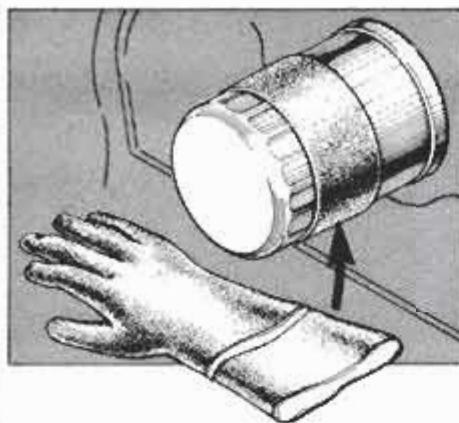


A test light hooked between positive terminal and cable detects battery drain.

short somewhere in your wiring system. A faint glow indicates minor current draw, while a strong glow means a more serious short.

No glow at all means you do not have a short, but you might have a totally dead battery. To be absolutely sure, you should charge the battery. If the light still doesn't shine, then you don't have a short and the battery is simply worn out and should be replaced.

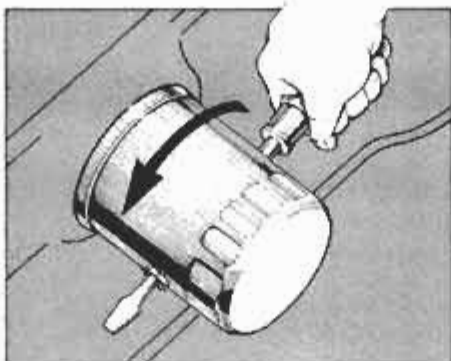




### 17 Oil-filter removal

If your oil-filter wrench slips on a stubborn oil filter, there's an easy way to improve its grip. Cut a 2-to-3-inch band from the end of an old rubber glove. The kind that's used for washing dishes or household chores works just fine. Slip the band over the oil filter and try your wrench again. This should work on all but the most difficult filters.

For filters that are attached to your

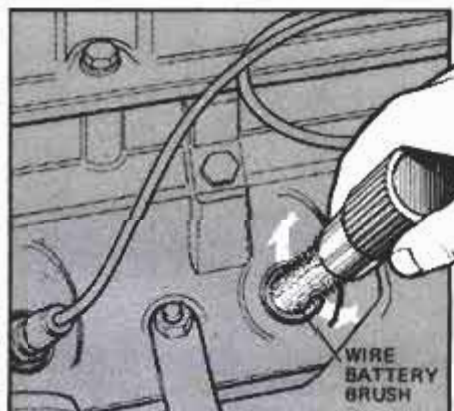


Strip of rubber glove (left) gives oil-filter wrench better grip. Spearing filter with screwdriver (right) is a last resort when the rubber-glove trick fails.

engine in a death grip, more drastic action is necessary. Punch a long screwdriver completely through the lower portion of the filter. Make sure you have a pan handy to catch the oil that squirts out of the filter. Use the leverage provided by the screwdriver to free the filter. You can finish the job by unscrewing the filter by hand or with a filter wrench.

### 18 Sparkplug-hole threads

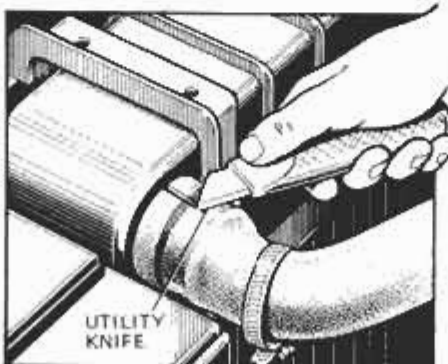
Sparkplug-hole threads can get gummed and caked up by combustion gases and blowby that can work their way past improperly tightened sparkplugs. Dirt and grit can also fall into the threads when sparkplugs are removed. This condition not only makes sparkplug replacement more difficult, it can cause cross-threading in the case of aluminum heads. You can buy a special tool, called a thread chaser, to clean up the threads, but a less expensive method is to use a battery cable end brush. Work



Battery cable end brush does a good job of cleaning threads in sparkplug holes.

the metal brush around thoroughly in the sparkplug holes to clean up the dirty threads.

### 19 Hose removal



Remove stubborn hose by slicing with a knife and peeling hose away from fitting.

Radiator and heater hoses have a way of eventually bonding themselves to their metal fittings, making replacement a chore. One thing to avoid, after loosening the hose clamp, is yanking and twisting the hose. Radiator fittings are soldered and can be broken off with rough treatment. Remove the hose by slicing it with a knife. Work the knife between hose and fitting to peel the hose off.

(Please turn to page 150)

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# CAR CARE GUIDE

# 25

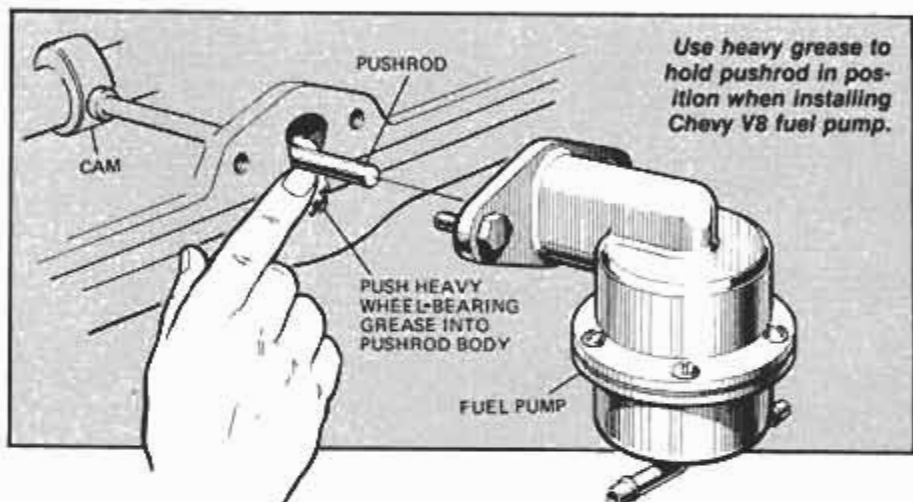
## TIPS FROM THE PROS

### 20 Fuel-pump installation

Some fuel pumps, such as those used on many Chevy V8s, use a pushrod to activate the pump's rocker arm. When you replace the pump, the pushrod has to be positioned up in its bore before the new pump can be installed. The problem is that the pushrod tends to slide out of position before you can get the pump on. If you push some heavy wheel bearing grease into the pushrod housing with

your finger it will hold the rod in position long enough for you to install the fuel pump.

To make sure that the pushrod is in the correct position, first press it into the housing. Have someone momentarily crank the engine with the ignition key until you feel the pushrod move to its innermost position. Then insert the grease.



### 21 Belt quieter

A shrill, high-pitched squeal from under the hood usually means a slipping drive belt—either fan, power steering, air pump, alternator or air conditioning. The proper fix for this is to tighten the adjustment on the belt or replace the belt if it is



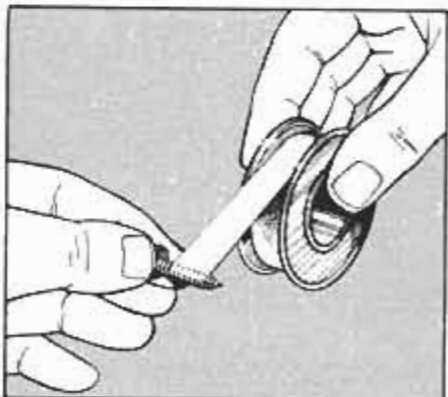
To lessen squealing sounds produced by a slipping drive belt, apply soap to the belt while the engine is idling.

worn or glazed. A temporary measure to quiet the squeal and sooth your nerves is to apply some bar soap to the offending belt while the engine is idling. Be very careful not to catch your fingers between the belts and pulleys, and keep them clear of the fan.

### 22 Thread helper

If a sheet-metal screw starts to lose its grip because the hole is slightly stripped, there are a variety of inserts to cure the problem. But there's a simpler fix you can use if the hole isn't excessively enlarged and if the screw doesn't require excessive torque in its application. Merely wrap the screw threads with Teflon tape (available at hardware stores). One or two layers of tape should give the screw a new grip.

(Please turn to page 154)



Teflon tape wrapped around threads of sheet-metal screw tightens screw's grip.



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# MOTORCRAFT

# More Comfort for Drivers



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introductory offer.

My name is Archibald Mason. I am a wool merchant from New Zealand.

New Zealand has more sheep than people. Our lambswool rugs are the finest in the world. Every year thousands of Americans travel to New Zealand and buy our lambswool rugs and car seat covers.

I began selling lambswool rugs by mail in the United States in 1978. Since then I have supplied many rugs to American homes and offices, and every week we receive further requests for rugs from people who cannot visit New Zealand just yet. I have often been asked by Americans if we can supply car seat covers. New Zealand was the first country to use lambswool car seat covers and we have been making and using them for over 20 years. About three out of five new cars in New Zealand have lambswool seat covers fitted when new, and this figure is even higher for luxury cars. I am the largest single supplier of custom made car seat covers to New Zealanders.

## STRONG FIBERS

If the wool in the photo seems too plush for your car seat, don't worry. We trim the wool to an even  $\frac{3}{4}$ " for car seat covers, so there is enough length for those springy resilient fibers to hold you off the seat and allow air to circulate behind and beneath you; and the  $\frac{3}{4}$ " wool is short enough for easy care and laundering. Yes, laundering! New Zealand tanners have perfected "chrome tanning," which means your car seat cover can be thrown in the washing machine and washed like a woolen sweater. It goes back on your car seat as soft and resilient as new.

When you buy your car seat covers, you need to know they will last for years. New Zealand wool is the world's strongest — and the secret is in the nourishment of the sheep. We have an equable climate with adequate rain falling evenly through the year, so those lush, green pastures you have seen in our tourist publicity supply plenty of food for the sheep all year. No summer droughts, no

harsh winters. The wool grows into even, strong fibers. When your friends run their fingers through the wool in your seat covers, they may find it incredible that the world's longest-lasting wool can be so soft. But you will know, as your seat covers give you comfort for year after year, that you have bought from the people who know how to make the best seat covers.

## THE BEST METHOD

But think about the fixing method. Some of the seat cover advertisements I have seen in the United States worry me — the fixing systems they are offering are clearly inadequate. As you slide in and out of your car seat, there is a tendency for the seat cover to move sideways on the seat, and it may move out of position. It took us many years of experience in New Zealand to develop the best fixing method, which holds the seat covers firmly in place without moving. On our Open Road model, we use color-matching straps in exactly the right places, and we even have light friction strips on the back of each seat cover to hold it in place. For our new Metropolitan seat cover, we have developed a special matching fabric which covers the entire back of the seat. So you will have the best of both worlds... genuine sheepskin to sit on and matching fabric for a firm fit and luxurious wrap-around look.

Wool is a great insulator. When you enter your car on a hot day, the wool seat covers never feel hot, unlike the synthetic materials often used in car seats.

On a cold day, vinyl or synthetic materials drag the heat rapidly out of your body. Wool doesn't do this — wool adjusts slowly to your temperature, at the same time cradling you in thousands of soft, springy fibers. A great way to start any drive.

## LUXURIOUS

But the greatest benefit is the air circulation. No matter how heavily you sit on a sheepskin seat cover, there is always air between the wool fibers, separating you from the car seat. As the air moves behind you, it carries away the moisture given off by your body. No more sticking to the seats, or damp clothing on a hot

day. You may even find you use your air-conditioning less and thus conserve fuel.

We have seat covers in stock for all American and imported cars. They are in matched pairs to suit the front seats of your car. U.S. Customs have been paid and we deliver to you by UPS from our nearest warehouse within a few days of dispatch.

## TWO CHOICES

You have the choice of two models.

If you like the luxurious wrap-around look, order *Metropolitans* in tan, honey or charcoal gray.

Matching pair, **\$174.50**. Single, **\$88.00**.

If you want to take advantage of an outstanding price (our New Zealand factories are overstocked at present), order *Open Roads* in tan, honey or charcoal gray.

Matching pair, **\$115.00**. Single, **\$60.00**.

(This price good only while stocks last.)

Please add **\$5.50** per pair or **\$3.50** per single to all orders for handling and delivery.

## MONEY BACK GUARANTEE

Either style seat cover installs easily. Enjoy them and decide. If you don't admire them and feel you are driving in greater comfort, send them back within 30 days for a full refund.

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Ext. PM-11. (24 Hour Service).

Tell us the make, model and year of your car. We will charge your credit card. Or, if you prefer to pay by check, please include your driver's license number for prompt processing of your order.

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# Fastest way yet to time an engine!



## Digital Mag Timing Tester makes timing lights obsolete

Remember the last time you had to time an auto's engine? Remember how you first had to clean off the timing mark on the pulley which, in itself, was difficult to find? Remember how you had to walk back and forth and take several readings, because you had difficulty seeing the timing light to get an exact readout? Would you like to be able to adjust an engine in one-third the time?

Now you can, with the 3801 Mag Timing Tester from ALL-TEST, INC. It's a digital tester that meets today's demands for precise timing for maximum motor performance and fuel economy. Just sit the 3801 atop the air filter, plug it in; and read the exact timing and RPM directly on the display.

The 3801 was designed to meet the precise timing demands of GM, Chrysler, Ford and AMC on today's complex autos.

### OPERATION

The 3801 has two pickups. An inductive pickup clamps on the #1 cylinder high tension wire. A magnetic pickup plugs into the bracket on the flywheel dampener, on most American cars manufactured after 1977. The magnetic pickup senses a notch on the flywheel that corresponds to the top dead center of the engine. The #1 inductive pickup senses the precise moment when the #1 cylinder fires. A powerful micro-processor calculates both ADVANCE (timing) and RPM and displays both simultaneously on two bright LED displays.

### CONSTRUCTION

The outer shell of the tester, made of ABS, is extremely tough. It is fabricated with superior components. It can be easily read, even in bright sunlight. The instructions on both sides of the tester will not rub off, because they are protected with clear Lexan.

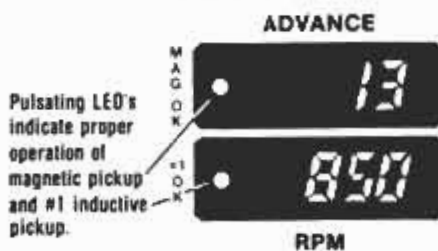
If you drop it from the hood of a car, onto a cement floor, it won't break or lose accuracy. Compare that to timing lights that you can't drop more than a few inches.

Finally, every unit is put through five rigorous quality control tests, including a 24-hour test, which is the equivalent of 6 months of actual operation before we let it out of the factory.

Sure all these things cost us more money. But our engineers wanted to have the best analyzer on the market. Just look at what the tester will do:

### FUNCTIONS

#### Initial Timing to Set Distributor



#### Checking Vacuum and Centrifugal

##### Advance of High RPM



**Inductive tach:** just clamp the inductive pickup on any spark plug wire and read RPM on the display.

**Diesel tach:** GM diesel cars - plug the magnetic pickup in the receptacle by the harmonic balancer and read RPM on GM diesels. Use it to set idle speed, check governor speed, accessories, etc.

### Unconditional Guarantee

ALL-TEST guarantees this timing tester unconditionally. Try it for 30 days. If for any reason you are not completely satisfied with it, return it for a complete refund or credit; and owe nothing.

**WHAT ABOUT SERVICE:** ALL-TEST will repair or replace any unit absolutely free of charge for the first year and will also repair or replace the unit on a flat fee basis for the first five years.

The 3801 Digital Mag Timing Tester, packaged in durable ABS carrying case, comes complete with leads, pickups, adaptors, operating manual, and warranty. Order yours today!



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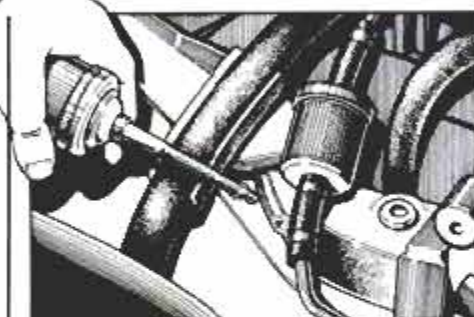
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# CAR CARE GUIDE

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## TIPS FROM THE PROS



Intake-manifold leaks can be detected by squirting oil around mating surface (left) or spraying carb cleaner (right) in same area and noting changes in engine idle speed.

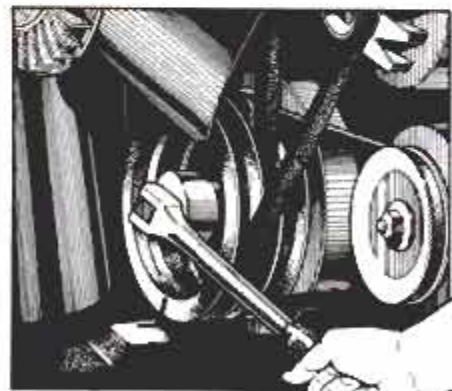
## 23 Manifold leaks

An intake-manifold leak will cause your engine to idle roughly. To check for leaks, take some carburetor and choke spray cleaner and blast it all around the manifold where it mates with the cylinder head. If there's a leak, the cleaner will be sucked into the manifold and the engine will idle noticeably rougher. An alternative is to squirt some light engine oil on the same area. The oil will momentarily seal the leak, causing the engine to idle smoother. Bubbles in the oil also indicate a leak. If a leak does exist, retorque the manifold to the manufacturer's specs. If that doesn't work, replace the intake-manifold gasket.

## 24 Timing-chain check

Timing chains sometimes stretch due to wear. When this happens the valve timing gets out of sync and the engine runs poorly and lacks pep. Checking the timing chain normally requires pulling the front cover on the engine. You can avoid this hassle by using a shortcut.

Remove the distributor cap. Place a large wrench on the crankshaft nut on the bottom pulley at the front of the engine. Rotate the engine against nor-



Check timing-chain by rotating crankshaft-pulley nut, noting distributor-rotor movement.

mal rotation until you see the distributor rotor start to move. Stop turning and mark reference points on the front vibration damper of the engine.

Now turn the engine in the direction of normal rotation. Check the distributor rotor and stop turning as soon as you notice movement. Mark a second reference line. Now check your reference marks for the amount of engine travel just before the rotor started to move. Measure the distance between your two marks. If the marks are more than two inches apart, your timing chain has excessive stretch, or your timing gears are worn, and need replacement.



Increase the light output from your droplight by wrapping aluminum foil around reflector.

## 25 Light brightener

For a more effective droplight, line the inside of the reflector with a 5 x 6-inch piece of aluminum foil, shiny side out. Fold the edges of the foil over the outside of reflector to keep it in place. When the foil becomes stained with grease or oil, just drop in a new piece. Make sure the bottom edge of the foil is clear of the base of the bulb to prevent any shock hazard.

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You can save from 10% to 50% of the cost of your new home by building it yourself. And NRI can show you how. NRI's new professional course in Building Construction teaches you what you need to know to be a building contractor. And you learn at home in your spare time. Whether you want to build your own home, get a better job, or start your own contracting business, NRI can get you started right.

## From Site Selection to Landscaping

By being your own contractor, you save at least 10% of the cost of the typical home right up front. Then, depending on how much of the job you do yourself, you can save up to 50%. NRI takes you through the job from start to finish in 70 lessons full of photos and diagrams to make learning easy. You begin by learning how to pick the best site, learn to read blueprints, estimate costs, follow the job through right to the planting of shrubbery and trees.

## Learn Professional Secrets

Nothing's left out. You learn the trade practices and secrets of the pros. Masonry, carpentry, roofing, painting, even plumbing, heating and electrical work. You learn what good work looks like, tip-offs to bad or sloppy work. How to supervise jobs...when to bring in specialists...trade and financial practices...how to keep your job moving on schedule.



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You learn better because NRI training is practical training. You get over 100 action projects from scale-model construction to building actual framing sections. Lessons and projects are coordinated with a contemporary energy-efficient home designed espe-

cially for NRI. You keep these plans to build your own home or select from more than 50 low-cost optional plans.

## Includes Seminar, \$1,000 in Discounts

At no extra charge, graduates may participate in optional owner/builder seminar, meet other builders, get expert advice on local building codes and conditions. Or, elect individual consultation. And you get NRI builder discounts worth over \$1,000 on materials and panelized house packages.

## Free Catalog, No Salesman Will Call

There's much, much more to the NRI Building Construction Course. Send the postage-paid card today for your free catalog describing all lessons, projects, and opportunities in the building business. See how you can save big money by building your own home or earn big money by building for others. If card has been removed, write to address below.

## Or check card for other career opportunities

### Small Engine Repair

Learn to service lawn mowers, garden tractors, chain saws, tillers, outboards, mopeds, motorcycles and more. Includes professional tools like inductive tachometer, volt-ohm meter, torque wrench, valve spring and ring compressors and more. You learn by doing, actually work with 5 HP engine as part of your training.

### Air Conditioning / Refrigeration / Heating with Solar Technology

Covers both residential and commercial fields, including lessons on solar heating, heat pumps, etc. Complete with professional tools, including top-grade vacuum pump, system analyzer, tubing and joint tools, leak detector, and more.

### Electrical Appliance Servicing

NRI trains you to be a professional appliance repairman, even shows how to start your own full- or part-time business. Fix everything from toasters

to refrigerators and microwave ovens. You even get professional tools and instruments like appliance multimeter and clamp-on ammeter.

### Auto Repair and Servicing

"Hands-on" training covers what you need to know from bumper to bumper. Includes professional tools like inductive timing light, ignition analysis and tune-up instrument, vacuum test pump, and precision oscilloscope for diagnostic work. Approved by Richard Petty, America's winningest stock car driver and NRI automotive consultant.



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We'll give you tomorrow.

# SATURDAY MECHANIC LOOKS AT... The '83 GM Cars

GM's got fuel-stingy transmissions for your wallet and hotter engines for your soul.

The four-wheel-drive Chevy Blazer is GM's only all-new vehicle for '83.

A dog clutch holds the two pieces together in 4wd. When you shift the transfer case into 2wd for better fuel economy, you also trigger a vacuum circuit that moves the dog clutch to separate the pieces.

When this happens, the front axle's ring and pinion gear and the propeller shaft stop moving, reducing drag for even better fuel economy. Although the left axle shaft is not disconnected, its wheel turns only the differential side and spider gears, an almost insignificant power loss.

One feature of the Blazer 4wd system that is new for its type allows it to be shifted from 2wd to 4wd in high gear without coming to a stop. This was accomplished by putting a synchronizer in the transfer case.

### Jumpin' J

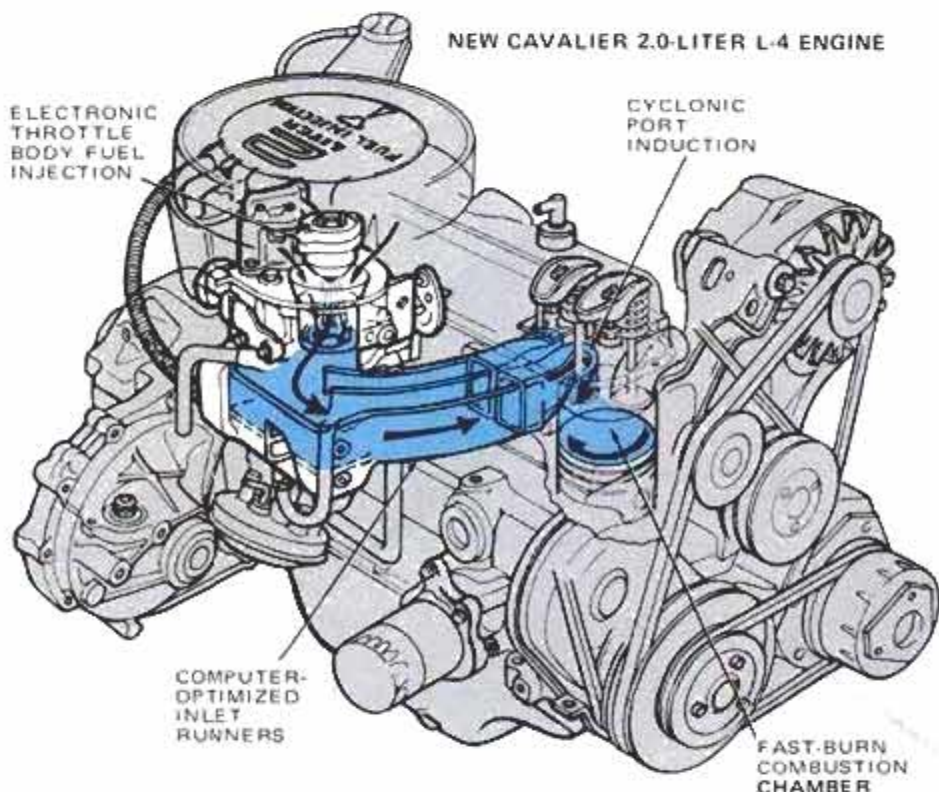
The J-car was GM's big disappointment in 1982. It had a host of startup problems, coupled with lackluster performance.

For '83, the J has no more horsepower (it's still 88), but torque is up 10 percent from 100 to 110 ft.-lb. and it peaks at 2,400 rpm, vs. 2,800 in 1982. These changes result from enlarging last year's 1.8-liter engine to a full 2.0 liters.

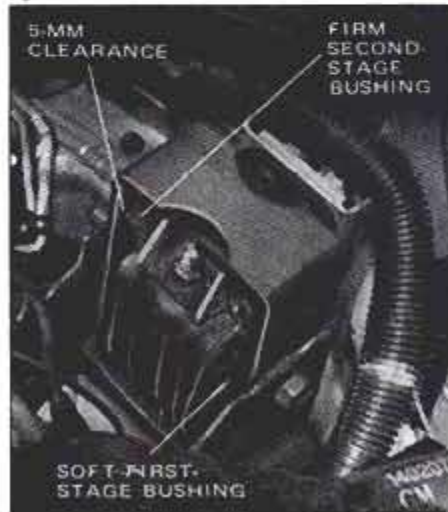
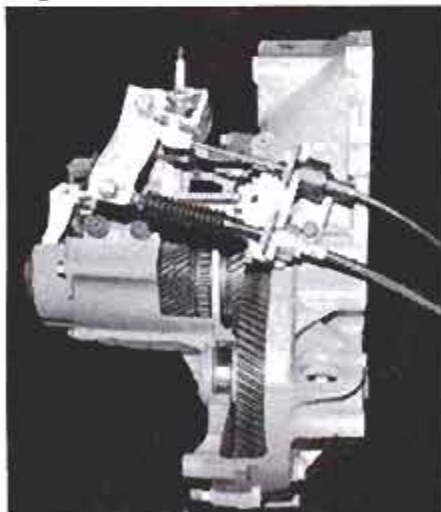
The '83 changes include throttle body fuel injection (TBI), a reworking of the engine, revised rear axle ratios and a five-speed transmission. There's also a new power-train mount that reduces idle speed engine shake.

TBI was the most important change

NEW CAVALIER 2.0-LITER L-4 ENGINE



*Bigger, higher torque engine (above) for Cavalier uses computer-controlled fuel injection and more efficient intake system. Five-speed transaxle (below left) can be ordered on Js, Chevettes and 1000 models. J-car idle shake is lessened by two-stage transaxle mount (below right). First stage lets engine move slightly to dissipate shake. Second stage restricts additional movement under higher torque loads.*







Computer-controlled pulsating solenoid valve (left) makes for tight EGR control. A new casting process eliminates porosity on the Pontiac 6000 STE wheel (right). Electronically controlled on-board air compressor on STE operates rear air shock to keep the car level. The compressor hose has a gauge (below) to inflate tires and toys.



Less vacuum equals less exhaust gas flow. The system debuts on the 3.0 V6 Century and most 3.8 V8s.

for performance. The unit, which is similar to that introduced on the 2.5-liter Iron Duke in 1982, just wasn't ready for the 1.8-liter Chevy J-car pushrod engine last year, so GM went with the carb.

In addition to TBI, Chevy increased engine displacement from 1.8 to 2.0 liters by lengthening the stroke 6 mm (1/4 in.). Rods are shortened 3 mm so the same engine block could be used.

The cylinder head is modified by incorporating swirl ports. These U-shaped ports, called cyclonic port induction, turn the air around, so it swirls into the combustion chamber. The swirl results in a more uniform fuel mixture that not only burns more completely, but much faster.

Because the fuel burns faster, the spark can arrive later without affecting performance. The fast-burn cylinder heads contradict the old thinking about improving performance by increasing the spark advance.

In fact, with less spark advance, the engine is less likely to knock. So the compression ratio can be raised—and it was (from 9.0 to 9.3). This improves engine efficiency.

The new five-speed transmission is made by Isuzu, GM's Japanese affiliate. It has a 3.92 to 1 first gear ratio compared with 3.53 to 1 for the four speed, which also helps off-the-line performance.

The idle shake problem was hardly unique to the J-car. Just about every transverse four-banger, including those from Japan, suffers from it.

Chevy's cure is a two-stage transaxle mount. The first stage is a soft rubber bushing that allows the engine to move fore-aft at idle, dissipating the shake energy.

The power train can't be allowed to



rock too much or it may grind against the body, stretch cables, and so on. So after 5 mm of movement (enough to take care of the idle problem), the mount comes up against a second stage. This is a much firmer rubber bushing that retards further movement. The second stage works when the car is going down the road and the engine reacts to the greater torque being developed.

The new design reduces idle shake, as measured at the steering column, by 75 to 90 percent.

### Don't bother to knock

Buick is now using a piezoelectric sensor to tame engine knock. The unit, which generates electricity by exerting pressure on a crystal, sends a signal to the electronic control unit to retard the spark and avoid knock. The system is more accurate than the previous accelerometer.

### Gas meter

Buick now has more accurate EGR control with a new pulse-width-modulated system. An on-board computer controls a solenoid vacuum valve that pulsates (opens and closes rapidly) to regulate vacuum flow to the EGR valve.

### Shift trick

Remember the vacuum modulator, that little diaphragm unit threaded into the transmission? Connected by vacuum hose to the carb, it responded to changes in the engine vacuum to signal the transmission to shift gears. In the mid-'70s, GM dropped it in favor of a cable to the throttle linkage.

Now the modulator comes back in 1983, on a new automatic four-speed overdrive transmission with lockup converter. The new transmission will be part of a transaxle on the A-car diesel V6, starting in the middle of the model year. The Cutlass Ciera probably will be the first A-car to get it, followed by Celebrity, 6000 and Century.

But the cable will be used also. The Hydra-Matic engineers found out that the cable still is the best way to get a shift signal. It doesn't vary with changes in altitude. As does engine vacuum. However, it doesn't provide the kind of information needed to tailor the transmission's hydraulic pressure. The idea is to transmit maximum pressure for maximum hold by the clutches and bands at maximum torque, so there's no slippage.

The diesel doesn't produce manifold vacuum, but it has a vacuum pump in the place normally occupied by an ignition distributor. The vacuum it produces flows through a little regulator mounted on the fuel injection pump. This regulator controls vacuum flow according to accelerator link position, so the modulator gets a signal that is proportional to throttle position.

### Three on the floor

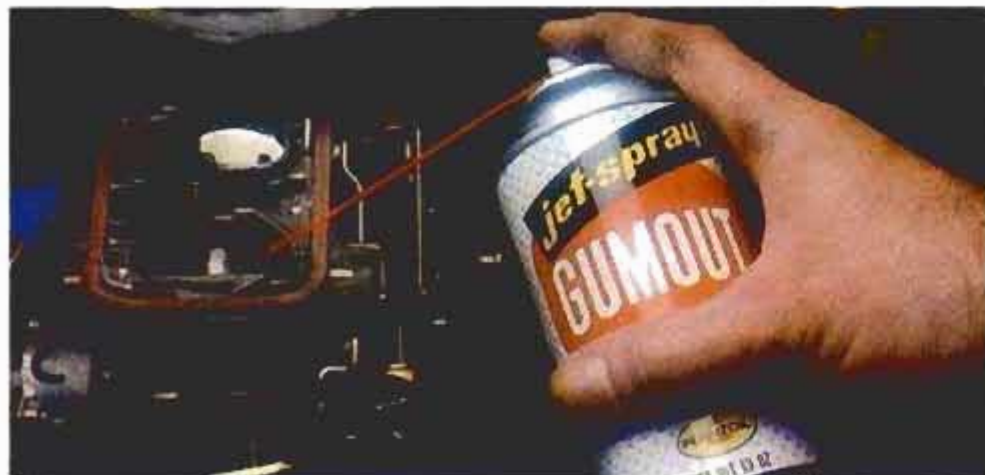
The new Hurst Olds automatic gets a three-lever shift system. The lever closest to the driver has the normal pattern from PARK down to DRIVE. Put it in DRIVE

(Please turn to page 160)

# POUR IN



# SPRAY ON



# A TUNEUP

When a car needs a tune-up, the symptoms are much like those of a dirty fuel system: Hard to start, rough running, stalling, loss of power.

So before you spend \$60 or so on a tune-up, try Gumout. Gumout Liquid in the gas tank cleans deep into carbs, down into manifolds, keeps valves clean, too. And Gumout Jet Spray cleans linkages, carb throat, throttle

plate and more.

Gumout Liquid and Jet Spray—together they help engines run smooth. Help save gas, too. So when your car starts acting like it needs a tune-up, try Gumout first. It might just save you a bundle.

## GUMOUT. THE BETWEEN TUNEUPS TUNEUP.

Gumout is a division of the  company.



(Continued from page 159)

and it goes from 1 to 2 to 3. Push it up a notch and it goes into overdrive.

The second lever picks up with the first one in drive. It permits the driver to do a 3-2 or 2-3 shift manually. The third lever can be used with the first in drive and the second in 2. It allows the driver to do the 2-1 or 1-2 shift manually.

The Lightning Rods setup, however, is primarily for show. There's only one cable from the three levers and only one operating lever at the transmission.

### Heavy performance

Like the GM J-cars, the big 1982 Cadillacs were panned for poor performance. So Caddy has upped the torque from 190 to 200 ft.-lb. and horsepower from 125 to 135 on the 4.1-liter V8.

The extra performance comes from an exhaust crossover restrictor in the intake manifold gasket, so less exhaust gas passes through. The manifold runs cooler and engine performance goes up. This should be a modification that can be retrofitted. There's been a general retuning, including a new spark-advance curve and fuel-flow calibration.

A free-breathing exhaust system for the Fleetwood Brougham and DeVille is similar to that used in the front-drive Eldorado and Seville. It includes larger diameter piping, a retuned muffler and addition of a resonator.

The Cadillac engine computer used with the 4.1-liter V8 has more on-board diagnostics than any other. And in 1983, it gets yet another code.

The new one, No. 53, is the first to cover the condition where the distributor signal suddenly drops to zero. This could occur if there's a poor connection in the distributor circuit.

When a problem is detected, the CHECK ENGINE light goes on. You can probe the computer's memory by simultaneously pressing the OFF and WARMER buttons on the a/c control panel, and following a shop-manual-prescribed procedure. The trouble code will be displayed on the a/c temperature digital readout.

### Cleans up its act

Oldsmobile has a new diesel injector that uses extra clearance between the needle and nozzle. A flute on the needle causes it to turn as it opens. The resulting "wobble" results in a self-cleaning action, even though Olds engineers can't explain why.

# WORTH WRITING FOR

LOOKING FOR IDEAS ON CAR CARE, AUTOMOTIVE AND HOME PRODUCTS? CHECK THESE LISTINGS. THEN USE THE COUPON BELOW.

## 609 Drive Cool/Save Fuel

Brochures available from Hayden explain how keeping oil temperature down can extend the life of your car's transmission and engine. Plus, how to take a load off your engine... recover 8 to 25 horsepower and save fuel. Free

## 610 Give Your Car Added Life

Four-color brochure from Cyclo Automotive Products describes a complete line of auto cleaners and treatment products. Designed "for the life of your car." Includes carburetor, engine and brake cleaners, fuel treatment, and lubricants. Free

## 611 Auto Body Shape-Up

Do-it-yourself auto body repair can be fun and easy with Sanin International. Their Auto Body Repair Kit contains tools and everything needed to repair dents, holes and rust spots. Includes complete easy-to-follow, step-by-step instructions. 4-color, illustrated brochure and tools catalog. Free

## 612 Car Care... At Your Fingertips

If you drive a car, you need POPULAR MECHANICS' MASTER KEYS TO CAR CARE. This information-packed series of illustrated brochures contains step-by-step instructions to help you maintain your car and keep it looking like new. Convenient size makes this valuable guide the handiest tool in your car care kit. Only \$4.95

## 613 Spoil Your Car

Front spoilers can save fuel and promote safety. 24-page, full-color catalog from Kamei describes its wind tunnel testing and aerodynamic automotive products. \$2.00

## 614 A Grease For All Seasons

Super Lube with Teflon is a clear non-staining lubricant that transforms a penetrating spray to a grease. Sample and literature. Free

## 615 Don't Be In A Fog

Fogged vision can be aggravating and dangerous. "Never Fog" from North American Oil is designed for interior auto glass, goggles, eyeglasses and bathroom mirrors. Cleans and protects in a single action. Free brochure.

## 616 Automotive Performance

Here's an invitation to discover dramatic horsepower and fuel economy gains from an Edelbrock Performer intake manifold and camshaft package. The Performer Test Series, featuring torque graphs, fuel economy and acceleration data, plus a Mini-Catalog illustrating the complete product line. Free

## 617 Steel Replacement Panels

60-page catalog from Mill Supply offers die-formed steel replacement panels to replace those damaged by rust and collision. Over 1,000 different panels available for many American cars, small pick-ups and vans. \$3.00

## 618 Rocket-Power Your Car

Rocket Automotive Products' new catalog has 80 pages of stock replacement, high performance and cosmetic accessories for almost everybody. Over 1,700 parts are described. Popular Chromatized Engine Parts and Hub Caps are illustrated in four-color. \$2.50

## 619 Specialized Automotive Hand Tools

With the right tools, you can do jobs right and do them easier. Lisle Corp. offers a catalog of more than 100 unique auto service tools... for almost every job. Specialized hand tools that can make the do-it-yourselfer into an efficient and capable mechanic. \$1.00

## 620 Keep Your Car in Peak Condition - Basically

Popular Mechanics' BASIC CAR CARE ILLUSTRATED shows you how to perform simple maintenance checks, prevent breakdowns, do tune-ups and handle basic repair jobs. Includes manufacturer's specifications for each make and model of domestic car by year. \$13.00

## 621 How To Radiate Warmth

Radiant King would like you to know that kerosene heaters are 92% efficient. Full-color catalog with complete specifications describe five new portable UL listed models. From 8,000 to 20,000 BTU's. Ideal for home and office. Free

## 622 Magnetic Inside Storm Window

Brochure demonstrates how to stop heat loss, air infiltration and condensation through windows with POLLYMAG, the magnetic inside storm window. Available in regular and heavy duty grade, and widths up to 83". From Kansas Diversified Products. Free

## 623 How to Talk Without Using Your Hands

Talkman is a new miniature, lightweight, voice-activated, hands-free two-way radio. Ideal for active motorcyclists, bicyclists, snow skiers, hunters and on the job. 4-color brochure from Standard Communications. Free

## 624 Compute Your Future

The future is now with the new personal computers. 48-page, full-color catalog describes hardware, software, accessories and books. From Radio Shack. Free

## 625 New View For Home Heating

A 12-page, four-color catalog from Russo Manufacturing includes complete information and specifications on the company's line of wood stoves, coal/wood combo stoves and fireplace inserts. All feature the famous Glass-view® window. Free

## 626 Stop Costly Energy Leaks

TOUCH 'N FOAM Instant Insulation can be used in summer and winter for spot insulation. Fills cracks in walls and around windows, doors, electrical outlets and pipes. Brochure from Convenience Products. Free

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Caring for your lawn is not a summer-only concern. Seasonal issues of *Lawn Care*, from Scotts contain when-to-apply checklists, how-to articles, and the latest information on lawn care. A 2-year subscription to this colorful publication is available... Free

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Total items requested \_\_\_\_\_

## SATURDAY MECHANIC LOOKS AT... The '83 Ford Cars

Can we interest you in an automatic, digital, power rear-view mirror? How about a glued-together car?

**W**e thought the Japanese had the corner on technological overkill when they began selling talking dashboards, air-bladder adjustable seats, whoop-de-doo digital gauges and navigational satellite receivers in their cars. Not to be outdone, Ford had offered an automatic, power-dimming, rear-view mirror.

Are you tired of flipping the day-night, rear-view mirror every time a car is on your tail? If you buy a 1983 Ford luxury car, you can get electronic circuitry and a little motor drive to do the job.

A new device uses two photocells: one aimed forward to tell the electronics if it's day or night (or on a brightly lit street), a second aimed to the rear. During the day, the system is off. At night it comes on automatically. If the rear-facing cell detects more light than the other one, it triggers a motor, which turns a gear train. The latter operates a cam to turn the mirror to nonglare position. A knurled knob on the mirror case adjusts sensitivity of the rear photocells circuit.

A tag of about \$100 is expected. The mirror will be available on all Lincolns, plus Cougar and Thunderbird.

### No room to spare

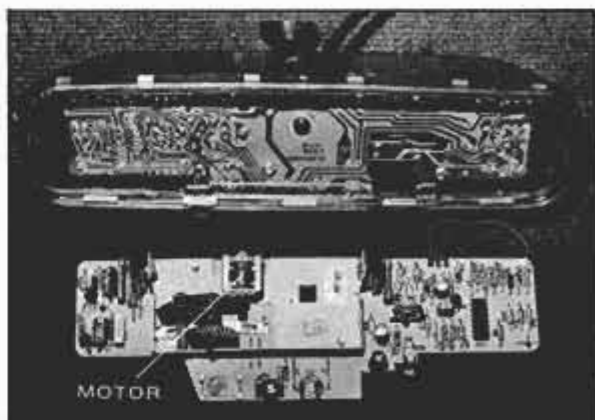
Problem: you have 14 inches for a manual transaxle and your four-speed takes 13¾. How do you fit in a five-speed?

Ford engineers realized they couldn't just lengthen the output shaft and add another gear. That would make the transaxle two inches longer and it wouldn't fit in the Escort/Lynx or the EXP/LN-7.

Their solution—slightly increase the gearbox diameter for an additional shaft at the top. This holds the fifth gear and



*Power-dimming rear-view mirror uses two photocells that sense light levels at front and rear of car. System is triggered when rear-facing sensor detects more light than front sensor. A tiny motor and drive train goes into action to flip the mirror to the nonglare position. The option is expected to cost \$100.*



its synchronizer at one end, and an output gear at the other. The output gear meshes with the differential ring gear, just as the output gear for the one-to-four-speed shaft does.

When the driver shifts into fifth, a fork arrangement simultaneously engages the fifth-speed synchronizer and disengages the fourth speed.

The new gearbox is 13.92 inches, 0.2-inch longer than the four-speed. The gear ratio in fifth is the same as in fourth (1.02 to 1). However, the output gear that meshes with the differential ring gear has a different ratio from that on the one-to-four speed shaft. Fifth gear actually gives an overdrive ratio of 0.75 to 1.

Ford might have been able to redesign the four-speed transaxle with smaller gears and put No. 5 in on the 1-4 shaft. This would have substantially

reduced torque capacity and reliability—the Escort-Lynx with the 1.6-liter Four might have been okay, but the same gearbox has to go into the Topaz-Tempo with the 2.3-liter engine this winter.

Like the four-speed, the new Ford transaxle has internal shifting rails and a floating-position shift lever. A design that eliminates cables and adjustments.

### Tight and rattle-free

If you hate to take your new car back to the dealer for dashboard squeaks and rattles, you should know the feeling is mutual. He knows that unless he's lucky, he isn't going to find the rattle, let alone fix it.

Recognizing that dashboard noise is *(Please turn to page 164)*

# SEARS HAS MORE SHOCKS THAN THE ROAD OF LIFE HAS BUMPS.

It really doesn't matter what kind of shock absorber your car needs. Sears probably has it in stock. Right now. Right in your neighborhood.

We start with Sears Best SteadyRider® Radial Tuned shocks. And there's our air adjustable and booster shocks for hauling loads and towing trailers.



*Amazingly, Sears lowest-priced shocks are just \$5.99, each. Prices apply only to the continental United States.*

Then there's our Super Duty shocks for light trucks, vans, and off-the-road vehicles. Finally, Sears has MacPherson cartridges and struts for many imported and front-wheel drive cars.

Almost anything you could need. And chances are, you need something right now. In fact, three out of every four cars on the road need new shocks right now.

The problem is, shocks wear out slowly. So slowly, you might not notice that they're going. But you can still

hit a pothole in a hurry. And that can mean big trouble holding your car on the road.



*From heavy-duty shocks to air adjustables to MacPherson struts, Sears has more shock absorbers in stock than almost anybody.*

The fact is, shocks do a lot more than give you a smooth ride. They hold your tires on the road. Compared to worn out shocks, new ones give you better braking, improved stability, and quicker maneuvering. That's where Sears shock absorbers ride to the rescue.

For instance, our conventional shocks have 40% more ride control area than original equipment on most new cars.

And Sears Best SteadyRider Radial Tuned shocks are temperature compensated. That means you get more control when it's hot, more comfort when it's cold. It also helps keep the SteadyRider steady.

Best of all, Sears shocks start at just \$5.99, each. We'll also install them for you. And we'll do a professional job at a reasonable price.

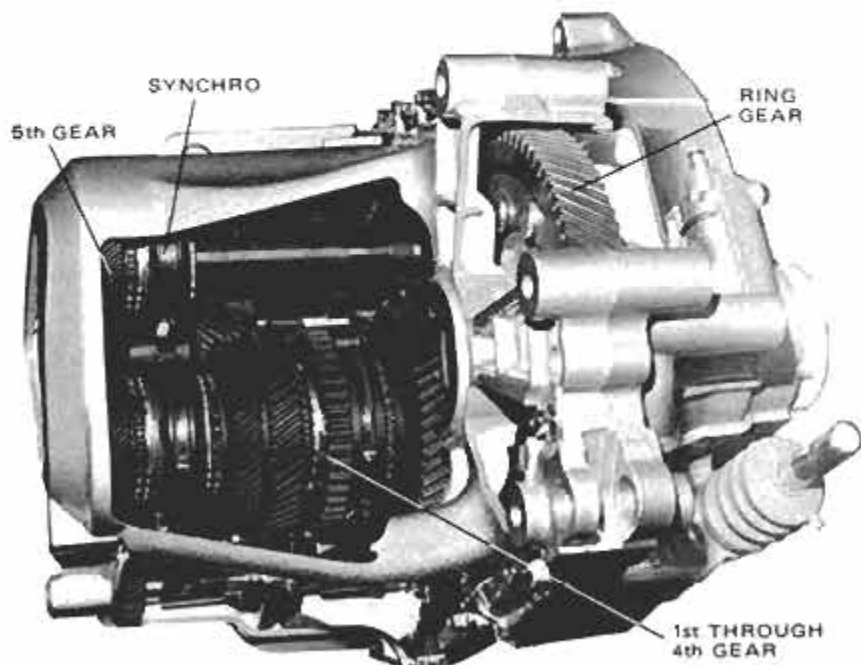
One more thing. There's no extra charge for confidence.



You can count on

# Sears

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*Five-speed transaxle fits into space of a four-speed by increasing gearbox diameter and adding a shaft for fifth gear and its synchronizer at the top of the gearbox.*

a no-win situation, Ford is executing a program designed to prevent it on the '83 cars. Engineers found that most noise is due to contact between plastic parts, primarily bezels to the instrument panel. They began by welding the instrument-panel frame to prevent movement of sections that had been held by screws. Then they:

- Molded locating pins into the dashboard bezels to fit holes in the instrument panel to improve alignment.
- Added antirattle clips to retaining tabs of the bezels to keep them from moving.
- Molded turbo-tipped standoff pins into the bezels to prevent plastic-to-plastic contact at problem areas.
- Molded rectangular raised sections around screw holes.
- Installed "prevailing torque," U-shaped, stamped-metal nuts for the retaining screws. The nuts have metal tabs that partly restrict tightening of the screw, so when the screw is tightened through the restriction, it won't loosen. If you must remove a screw through a prevailing-torque nut, you can reinstall it up to two times.
- Installed foam tape on the back of bezels to lessen plastic contact.

### EEC IV

Just when you thought it was safe to lift the hood of a Ford, the big computer

system is back. Ford had just about eliminated computers on all but a handful of cars last year. But for 1983 a new Electronic Engine Control is standard on all Escort-Lynx with electronic fuel injection and many forthcoming Tempo-Topaz models.

Fortunately, the new computer, EEC IV, should be less fearsome than previous systems. It will carry 80 trouble codes (not all in every car) and have a convenient underhood diagnostic connector into which you can plug a voltmeter. This is similar to what Ford did with its Microprocessor Control Unit, but the checkout will be simpler, Ford says.

EEC IV is significantly different from the previous model. It's much smaller

*Rattle-resistant dashboard design uses techniques (right and below) to prevent plastic-to-plastic contact. Screws in instrument panel are replaced by welds.*

but can work much faster (up to a million commands a second). Some changes provide meaningful benefits.

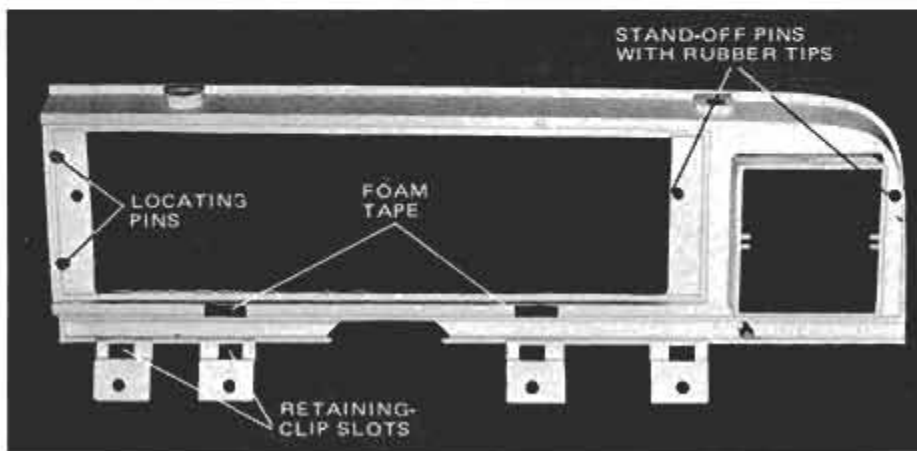
First, a knock sensor is wired to a listen-and-readjust circuit that retards timing a little at a time, until the knock is gone.

A flap-type airflow sensor to control fuel injection is a new addition. Other companies are looking for better sensing than the flap, on which air pushes to operate a variable resistor, but Ford says that the flap is the best combination of price and performance it has found. Response time with the flap is significantly better, Ford claims.

Unlike the throttle body fuel injection, the system on the 1.6-liter Escort engine uses a separate injector at each port. The computer triggers each one of them during every engine revolution, so the flow rate is scaled down.

Idle speed is controlled by the computer operating a valve in an air bypass around the throttle. The job is done with a new, infinitely variable position solenoid.

The forthcoming Tempo-Topaz front-drives will get a turbo to go with a 2.3-liter engine. EEC IV will control the turbo



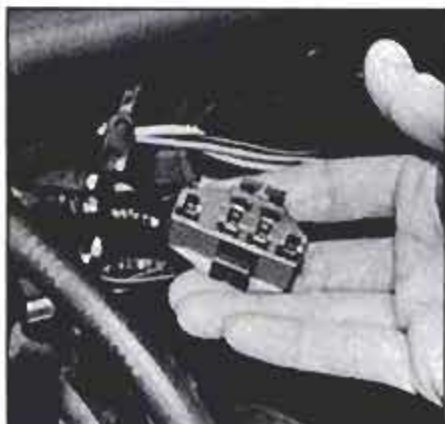
wastegate with a new solenoid valve.

If the engine knocks, the computer will know if the engine is in a turbo-boost condition from the airflow sensor. If it is, the computer first will reduce the boost pressure. If necessary, the computer will retard the ignition timing.

There's a glued-together Ford in your future. Production-car testing begins this fall with the 1983 Thunderbird.

If you've got a mental picture of a car coming unglued at the seams, forget it. This isn't library paste, but a polyvinylchloride sealer containing a superstrong adhesive made by the Uni-Seal Corp.

The glue has a shear strength of 800-



Voltmeter plugs into this diagnostic connector for Electronic Engine Control (EEC IV) computer to check out system.

900 p.s.i., well above the 600-700 p.s.i. of a conventional weld. All that has to be proven is if the glue will resist deterioration for the life of a car body.

For the '83 T-bird test, the glue will be applied to eight locations in addition to the welds. However, this will not affect the validity of the test. The decision to go ahead with this conservative check follows an '82 T-bird factory-test with 667 spot welds and 10 inches of arc weld actually removed in favor of the glue.

The '83 T-bird test is due to be repeated on the '84 Continental Mark VII. If both these tests prove successful, some welds will be removed in favor of the glue shortly thereafter.

Use of glue has many potential advantages. Applied as a continuous 3/16-inch-diameter bead, it joins the body better than spot welds. The result is less metal shake, a quieter interior and better ride.

Structural adhesive, as the glue is called, has proved itself in aircraft applications. Potholed roads are next. **PM**

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# SATURDAY MECHANIC LOOKS AT... The '83 Chrysler Cars

Crunch-free shifting and squeal-free brakes. It's the little things that count.

In transition year '83, Chrysler has made good use of its limited resources and done a worthy job of improving the existing hardware.

The bread-and-butter, 2.2-liter Four is reliable and versatile. It does double duty as a performer (in the Charger) and a fuel-stretcher (in the Ks and Super Ks).

This year sees the 2.2 with more power. There's a redesigned combustion chamber which ups compression from 8.5 to 9.0 and gives more swirl to the mixture for better burning.

Other mods include tuned intake and exhaust manifolds and smaller ports for higher gas velocities.

All this adds up to a boost in ponies from 84 to 94 at 5,200 rpm. Torque is up from 111 to 117 ft.-lb. at 3,200 rpm.

Fuel economy moves up about one mpg because of the higher compression and fuel-cutoff solenoid that works on deceleration.

In spite of the added power, the 2.2 doesn't kick up enough sand for use in the new E-body car. Standard powerplant here is the 2.6, which produces the same horsepower as the 2.2, but higher torque: 132 ft.-lb. at 2,500 rpm.

The 2.2 may yet be used in the B, as the mill is slated to get fuel injection by winter and a turbo by next fall.

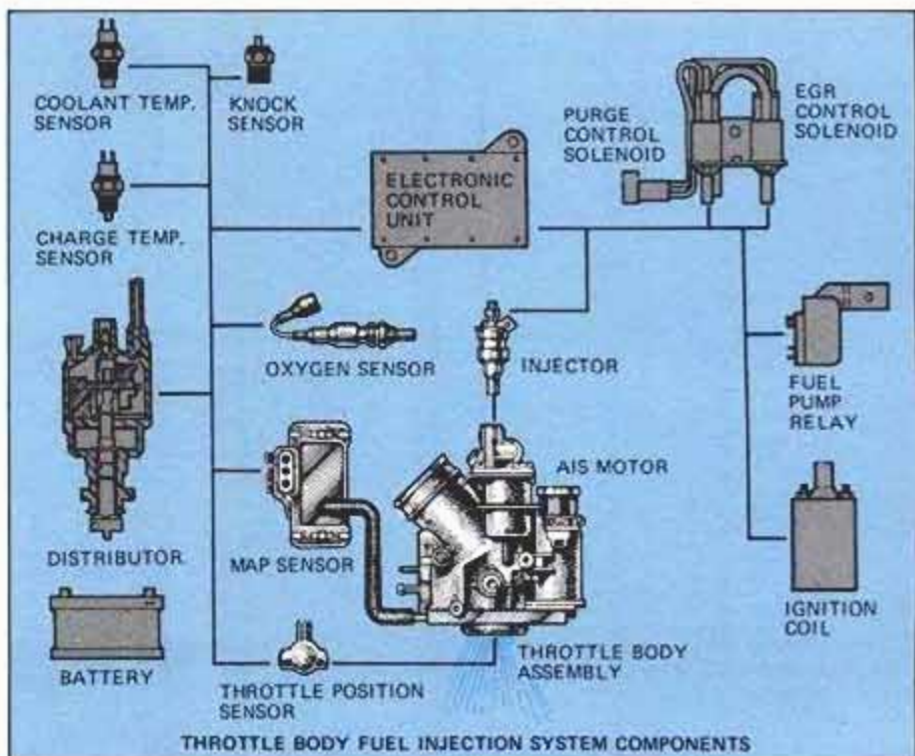
### Stretching the K-car

Chrysler's new E-body (Chrysler E Class and Dodge 600) is about seven inches longer than the Super Ks (LeBaron/400). The extra room is added in the rear legroom and trunk areas.

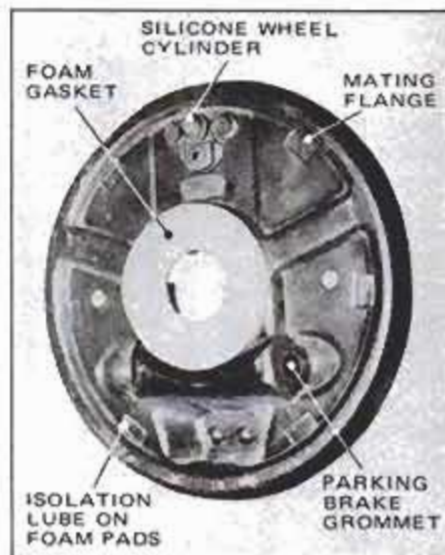
Weight of the E is over 2,500 pounds so Chrysler is taking no chances on marginal braking. Big discs up front and big rear drums are accommodated by standard 14-inch wheels.

The first of the Japanese turbodiesels

*(Please turn to page 168)*



Available by mid-year will be this new fuel-injection system for the 2.2-liter, four-cylinder engine. It won't improve horsepower much, but torque and fuel economy will increase. Considerable engineering effort went into quieting noisy rear brakes (below). The drum (left) and backing plate were modified as shown.





# NEW Digital Engine Analyzer!

New Digital Engine Analyzer will help you tune up your car, truck, motorcycle, boat engine, or lawn mower. You won't have to pay the \$28-35 per hour that service stations and garages charge. And you will know that the job was done right . . . because you did it yourself!

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It tests 2, 4, 5, 6, 8 cylinder and rotary engines. It has a high-intensity, four digit display. It measures only 6-7/8" x 3-3/4" x 1-7/8" and weighs only 16 ozs. It's small enough to fit in your tool box. It works off the car's 12V battery and requires no other power source. You can use it for bench work with the optional 110V AC adaptor (p.n. 4550, only \$25.00).

It tests what other testers won't. It measures tach on all ignition systems — including conventional, electronic, and CD (including GM C-3 and C-4). It measures volts — even on electronic modules in the newer cars. It measures ohms — even as low as .3 ohms for ballast resistors.

It checks the new computer controlled carburetors (such as GM Computer Command Control, Ford's EFI, etc.). It checks all the sensors for the Electronic Control Modules such as throttle position, barometric pressure, engine coolant temperature, etc.

The outer shell of the tester, made of ABS, is extremely tough. It is fabricated with superior components. It can be easily read, even in bright sunlight. The instructions on both sides of the tester will not rub off, because they are protected with clear Lexan.

If you drop it from the hood of a car, onto a cement floor, it won't break or lose accuracy. Compare that to the analog unit that you can't drop more than a few inches. And it won't be damaged by misconnection. It will withstand 50,000 volts on the test leads from a cracked coil.

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## Do it right and save money!



maintain the same high accuracy, even after years of use.

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ALL-TEST guarantees this engine analyzer unconditionally. Try it for 30 days; if for any reason you are not completely satisfied with it, return it for a complete refund or credit; and owe nothing.

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*Carroll Shelby*



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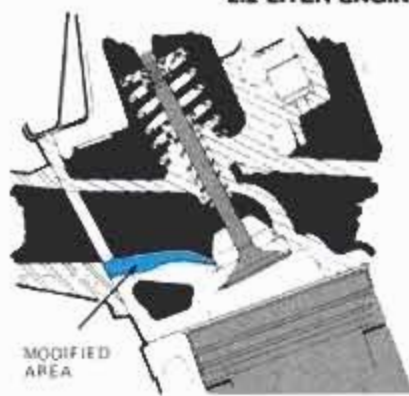
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MODIFIED AREA

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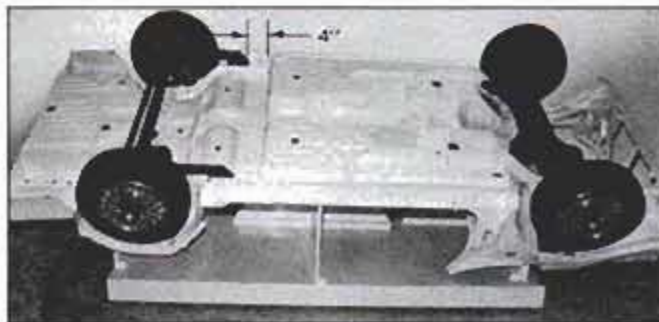
will make its debut this fall in the Dodge Ram 50 pickup, built by Mitsubishi. The 80-hp, 2.3-liter Four is built off the same 2.6-liter block and has the same "Silent Shaft" feature.

The turbo is made by Mitsubishi and has no waste gate. When boost pressure exceeds 12 p.s.i., a diaphragm device cuts fuel flow to the injection pump to slow down the engine. Chrysler expects the turbo, with a five-speed gearbox, to chalk up 35-mpg city, and about 50-mpg highway.

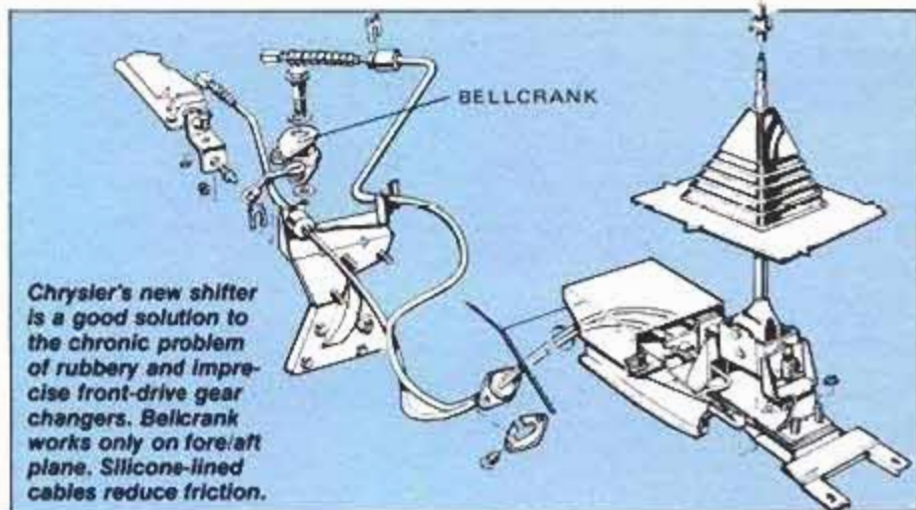
**Finally a five-speed**

Chrysler's front-wheel-drive cars get an optional, five-speed manual transmission this year, which is the first such unit to be designed and built in the United States.

The two top gears are overdrive ratios. Like the four-speeder, the end cover comes off with the gearbox in place, so the unit can be overhauled while still attached to the engine. The bellcrank, that swivel pivot used in cable (and rod) linkage systems, operates



Stretching a Super K involved addition of 4 inches to the floorpan just ahead of the rear wheelwells.



BELLCRANK

Chrysler's new shifter is a good solution to the chronic problem of rubbery and imprecise front-drive gear changers. Bellcrank works only on fore/aft plane. Silicone-lined cables reduce friction.

**CHRYSLER**

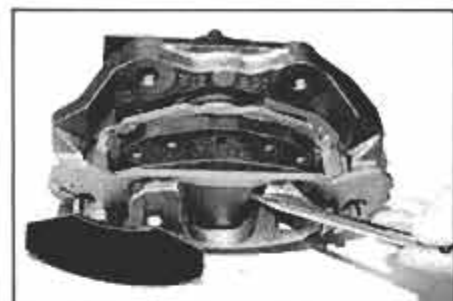
only when the shift lever is moved fore and aft (into or out of gear). So any friction in the bellcrank doesn't affect the position of the shift lever or linkage in the transmission. These are located by springs and detents, so the shift lever is always properly lined up to go into gear.

The shift-lever assembly is cable-operated, and the system is practically jamproof.

The five-speed comes with a choice of final-drive ratios: 2.20 for economy and 2.57 for performance. There's no choice in seating, however, as the five-



**New five-speed transmission accommodates the fifth gear and synchro at the end of the gear housing.**



**Front discs get quiet treatment with addition of a metal plate coated on both sides with rubber and an adhesive.**

speed comes only with buckets up front.

A lot of effort went into quieting the brakes without giving up performance. Linings are now riveted on instead of glued, and the linings themselves were reformulated by Bendix for quieter operation. Wider use of damped disc-brake rotors also cuts brake squeal.

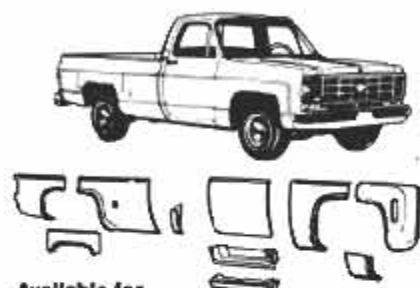
Other screech-killing features include a stiff drum backing plate which doesn't amplify sound, rubber-coated-metal components in the caliper and special noise isolating lubrication on the backing plates' brake-shoe platforms.

The brakes are also designed with new sealing features which keep out moisture to slow rust and corrosion. **PM**

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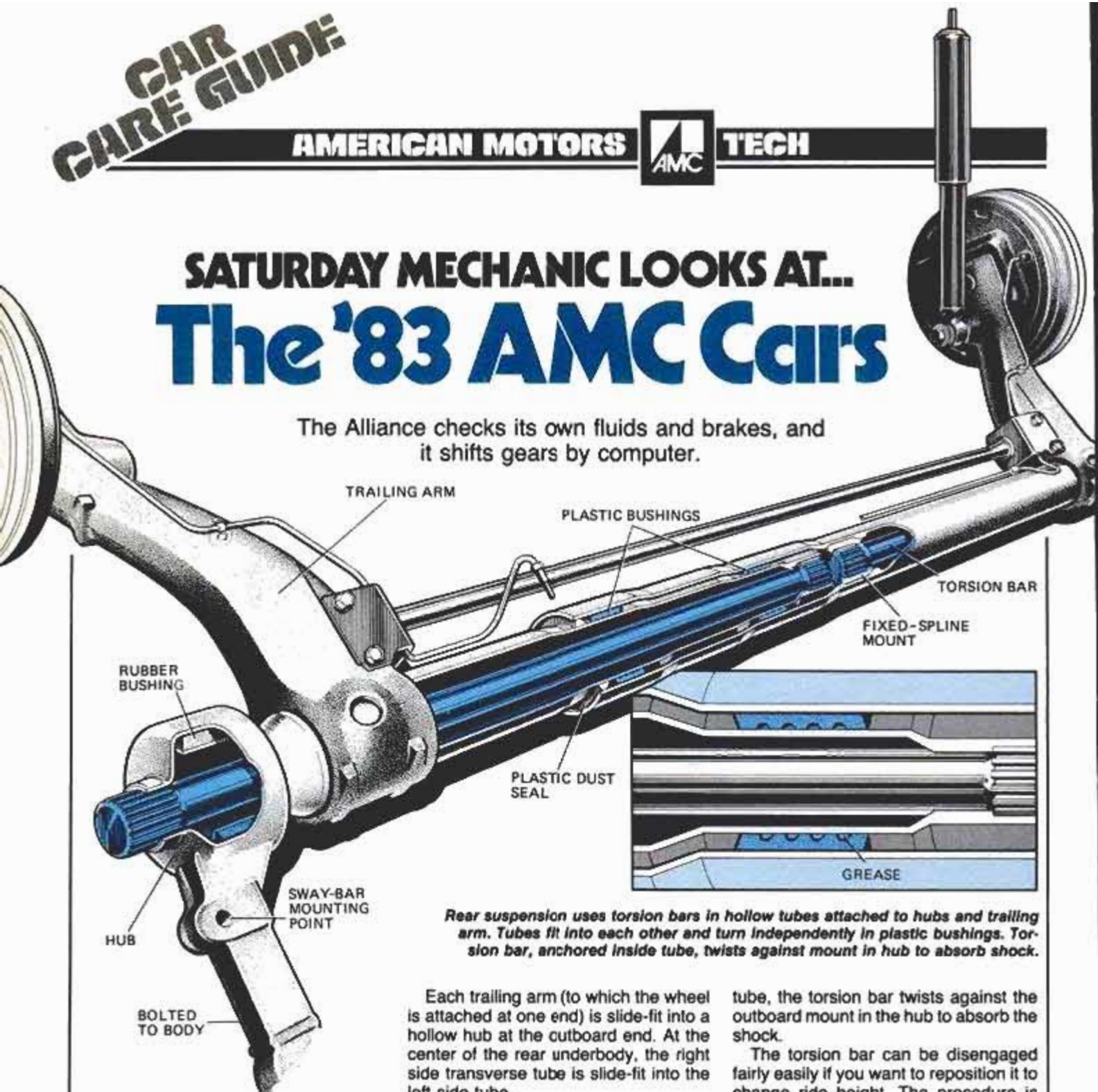
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# SATURDAY MECHANIC LOOKS AT... The '83 AMC Cars

The Alliance checks its own fluids and brakes, and it shifts gears by computer.



Rear suspension uses torsion bars in hollow tubes attached to hubs and trailing arm. Tubes fit into each other and turn independently in plastic bushings. Torsion bar, anchored inside tube, twists against mount in hub to absorb shock.

The technology news from AMC this year isn't really from AMC, but from its French partner, the Regie Nationale des Usines Renault. It's the new Alliance. Designed in France and built in Kenosha, Wis., this automobile simply abounds with technical sophistication.

### Rear axle

The rear suspension is fully independent and uses torsion bars that are cleverly installed inside hollow tubing that is part of the suspension system. The result is a supercompact layout that leaves all kinds of extra room in the rear for luggage and passengers.

Each trailing arm (to which the wheel is attached at one end) is slide-fit into a hollow hub at the outboard end. At the center of the rear underbody, the right side transverse tube is slide-fit into the left side tube.

Plastic bushings that have grooves to hold grease are installed to separate the tubes slightly and permit one to turn freely as well as independently whenever a wheel hits any kind of road irregularity.

There is a torsion bar for each trailing arm tube, of course, and it is splined at both ends. One end is anchored in the outboard side in the hub, which is bolted to the underbody. The other end is held in a mount in the inboard end of the trailing arm tube.

When a wheel bounces, the trailing arm goes up or down and the transverse tube turns. Because the inboard end of the torsion bar is anchored inside the

tube, the torsion bar twists against the outboard mount in the hub to absorb the shock.

The torsion bar can be disengaged fairly easily if you want to reposition it to change ride height. The procedure is similar to that used on Japanese cars with transverse torsion bars, such as Subaru.

### Sway bars

The Alliance rear suspension includes a sway bar. There's also a sway bar in front, so the Alliance has more roll resistance than you'd normally expect in a European car, and the suspension is a French design picked up from the Renault 9, the European version of the Alliance. Even the Renault 9 spring rates and suspension travel are retained in the Alliance. However, the shocks were recalibrated to tune the suspen-

(Please turn to page 172)



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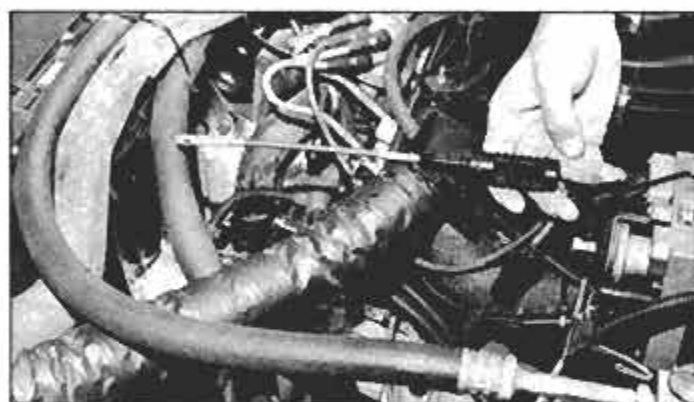
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# CAR CARE GUIDE

AMERICAN MOTORS



TECH



Automatic transaxle fluid sensor (left) uses modified dipstick that works by resistance change in electrified tip. Resistance of tip immersed in fluid differs from that when fluid level falls below tip. Other fluid-level sensors (below) are a float-type built into reservoir cap.

sion for the American market; they're more compliant.

### Computerized tranny

Like many other cars, the Alliance uses a computer to control the fuel injection system, engine idle speed and some emission controls.

However, it also will have a Renault exclusive: computer shifting of the three-speed automatic transmission, a function that was pioneered in the Renault 18.

The transmission's hydraulic valve body contains solenoids that operate ball valves in the oil passages. These solenoids are triggered by the computer to force upshifts and downshifts.

The computer makes the shifting decisions by relying on the same information that a conventional all-hydraulic valve body does—throttle position and road speed.

However, instead of a mechanical linkage or a vacuum hose to the throttle body, there's a throttle position sensor—in essence a variable resistor that provides an electrical signal the computer can interpret. A miniature alternator



generates current proportional to road speed.

### Monotrace seats

Like power seats but not the price? The Alliance has a less expensive alternative, a manual seat with six-way adjustment. It's called Monotrace seats. There's the usual fore-aft adjustment plus full seat-back rake that adjusts from vertical to recline. But, there's also something new—a fore-aft tilt along a curved seat track.

For many people, the power seat's combination of up-down and tilt is what makes one car fit a short wife and tall husband.

However, when you move the new Alliance seat through a tilt, the top of the back angles to the rear and the front of the seat moves up. This accommodates the taller driver.

This isn't as good as the power seat's infinite range of up-down plus tilt, but it's free—standard equipment on all but the base Alliance and it might even become standard on the base model by mid-year.

### Door-lock zapper

That's no ordinary key fob that comes with the Alliance. The special fob, part of a system called Infrawave Entry, actual-

(Please turn to page 176)

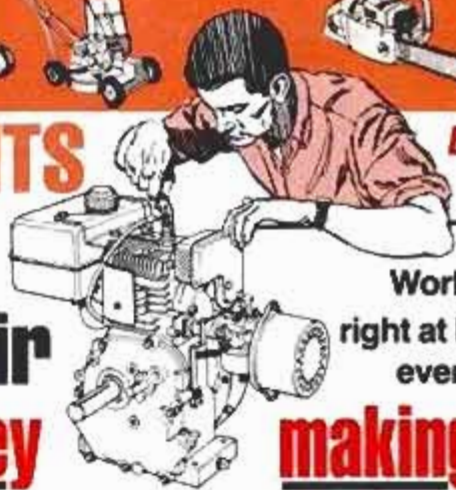


System Sentry takes three seconds to report on all vehicle fluids, except fuel; also condition of front brake linings.



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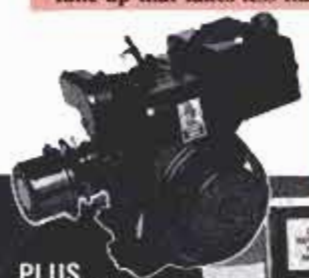
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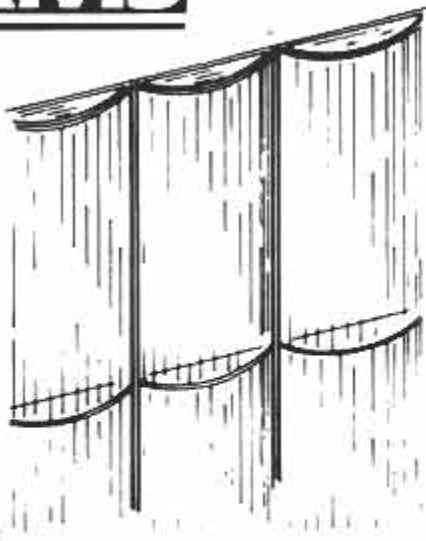
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TECH

ly is an optional battery-powered, infrared light transmitter that triggers a sensor on the car's dashboard. The sensor then signals a relay to operate the power door lock solenoids.

There are 50,000 possible infrared light signals that can be generated with this system, so there's no reason to wor-



infravave entry system opens door locks with an infrared light instead of a key.

ry about your fob popping open every Alliance on the block.

### Smart idiot lights

At a time when other carmakers are offering dashboard monitors that talk to you, the AMC Renault Alliance's System Sentry will be doing what the others cannot: measuring and reporting on fluid levels in the engine, transmission cooling-system, power steering and master-cylinder reservoirs. It also tells if



Monotrace seat mounts offer a six-way manual adjustment, including fore-aft tilt, to accommodate riders of all sizes.

the front brake linings are worn out, and checks the fluid level of your window washer.

When you shut off the engine, a "checking" light goes on in the panel to tell you the monitor is taking readings. After three seconds, the other display lights go on, green if a fluid level or brake lining is good, red if it's not. After nine seconds, the Sentry shuts down.

The Sentry has no microprocessor, but it does contain 15 integrated circuits and it has memory.

PM4





# When You Can't Do It Yourself...

Here's how to cope when you need the help of a professional who has time and tools to do the job.

**R**emember the last time you dropped a screw—or was it the screwdriver—down the carburetor throat? Or maybe it was some other dumb thing like tightening a bolt an extra quarter turn, only to have it strip, snap off or crack the part you were installing.

Don't feel bad. You're in good company. We don't know many Saturday mechanics who haven't blown at least one repair job and wished they'd let a professional mechanic handle it.

While some back-yard wrench benders consider the professional a deft-fingered mechanical healer who can unerringly troubleshoot and fix any car-related problem, others don't hold the pro in such high esteem. In fact, some believe there is nothing the pro can do that they can't do as well, except perhaps overcharge a customer.

There is good reason for misconceptions about the professional mechanic. Because there is no minimum requirement, you'll find a wide range of skills and abilities in the auto service trade. While some government agencies license repair shops, primarily to handle consumer complaints, the mechanics themselves are not licensed by any regulatory agency. Herein lies a problem.

How do you distinguish between a competent mechanic and one that picks up a wrench and creates a disaster?

Your best bet that a mechanic knows his stuff is NIASE certification. NIASE stands for National Institute for Automotive Service Excellence, set up "to organize and promote the highest standards of automotive service in the public interest." NIASE sponsors a voluntary mechanic-testing program that's handled by the American College Testing Program (ACT) in Iowa City, Iowa.



*A mechanic concerned about improving his skills earns gear-shaped patch by passing exams formulated by the National Institute for Automotive Service Excellence (NIASE).*

ACT provides test development expertise at NIASE question-writing workshops. Test questions are written by technical experts from all sectors of the auto service industry. ACT administers the tests under contract from NIASE.

To qualify for tests, a mechanic must have at least two years of work experience; hands-on activity is just as important in certification as theoretical and practical knowledge. Tests are given in eight categories: engine repair, automatic transmission, manual transmission and rear axle, front end, brakes,

electrical systems, heating and air conditioning, and engine tune-up.

Mechanics can take tests in as many categories as they wish. A mechanic who passes at least one test receives a gear-shaped shoulder patch for his workshirt. Underneath this patch are bar-shaped patches indicating the areas in which he's been certified. An alternate method to indicate certified areas is the display of a card that fits in a shirt pocket. A mechanic who passes all eight tests receives a double-gear patch indicating he's a certified general me-

chanic. NIASE has certified about 220,000 mechanics to date.

If you're wondering how hard these tests are, we're reprinting some actual questions used recently. We invite you to test your knowledge by circling an answer to each of the following 12 questions. The correct answers are given at the end of the story.

1. Which of these is **least likely** to cause a car to hesitate (stumble) when the gas pedal is opened quickly?

- A. Retarded ignition timing
- B. Low carburetor float level
- C. Leaking carburetor accelerator-pump check valve(s)
- D. Leaking carburetor power valve

2. All of these statements are true about operation of the EGR (exhaust gas recirculation) emission control system **except**:

- A. The EGR valve allows exhaust gases to enter the intake manifold
- B. The EGR valve is open at engine idle
- C. The EGR system reduces NOx (oxides of nitrogen) emissions
- D. The EGR system reduces combustion chamber temperatures

3. All of these statements are true about a factory installed a/c-heater system **except**:

- A. Air flows through the evaporator before going through the heater core
- B. Inlet air can come from outside or from inside the car
- C. Airflow through the evaporator is controlled by the position of the blend door
- D. Outlet air temperature is controlled by the position of the blend door

4. Which of these is a correct method for testing the instrument voltage regulator (limiter) used in some gauge circuits?

- A. Connect an ammeter in series with the voltage regulator; if the reading is above 5 amps., the voltage regulator is okay
- B. Connect a test light to the voltage regulator output terminal; if the light flashes, the voltage regulator is bad
- C. Connect a test light to the temperature sending unit; if the light flashes, the voltage regulator is okay
- D. Connect a voltmeter between the battery positive post and the temperature sending unit; if the reading is 12 volts, the voltage regulator is okay

5. While testing a starting circuit on a 350-cu.-in. V8 engine, the mechanic finds that the engine cranks slowly, the starter current draw is 90 amps., and the battery voltage while cranking is 11 volts. What should the mechanic do next?

- A. Check the voltage drop of the starter motor circuit
- B. Test the battery capacity
- C. Replace the starter motor as a short is indicated
- D. Determine the condition of the engine

6. After installing new brake shoes and turning the drums, high pedal pressure is needed to stop a car. Mechanic Al says that bleeding the brakes may correct this problem. Mechanic Bob says that arc grinding the brake shoes may correct this problem. Who is right?

- A. Al
- B. Bob
- C. Both
- D. Neither

7. On a car with single-piston, floating-caliper disc brakes, the disc brake pad between the caliper piston and the rotor is badly worn. The other brake pad is slightly worn. Mechanic Al says that too much rotor runoff could be the cause. Mechanic Bob says that a binding caliper piston could be the cause. Who could be right?

- A. Al
- B. Bob
- C. Either
- D. Neither

8. A driver says that the front end of his car vibrates up and down while traveling at most road speeds. Mechanic Al says that too much runoff of the front tires could be the cause. Mechanic Bob says that static out-of-balance of the front tires could be the cause. Who could be right?

- A. Al
- B. Bob
- C. Either
- D. Neither

9. In a four-speed, fully synchronized transmission, there is a clunking or knocking noise in only first and reverse. Mechanic Al says that a broken tooth on the main drive

(Please turn to page 180)

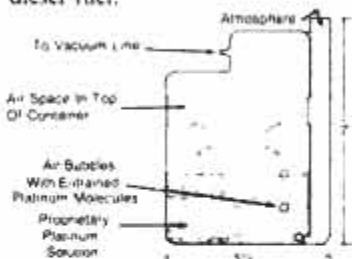
## Platinum Technology Detoxifies Gas Guzzlers Into Social Drinkers!

U.S. Patent Office Issues Patent 4,295,816 to National FuelSaver Corp. for Platinum Technology That Permits Much Higher Percentages of Gasoline to Burn in Car Engines.

The EPA's Federal Test Procedure shows that as much as 28% of the fuel entering a perfectly tuned engine will leave the engine without burning. Average engines suffer greater waste.

Research done by Mobil Oil, Corning Glass, Toyota, and Brookhaven Laboratories has shown that a much larger portion of the fuel will burn if the fuel is accompanied by a minute quantity of platinum, large enough to be effective yet small enough to be economical.

Until the development of this platinum dispensing technology, it was not possible to meter this effective yet economic quantity of platinum into the engine, since neither platinum nor any of its stable compounds can be dissolved in gasoline or diesel fuel.



National FuelSaver received the patent by designing the apparatus shown here that takes a water soluble platinum compound, "vaporizes" it, and meters the platinum "vapor" into the engine along with the air and fuel.

15,000 Platinum GaSavers are now in use around the country, achieving an average of 20 to 25% more miles per gallon.

12,000 miles of the platinum cost \$69. The equipment and the unconditional money back guarantee are included at no extra charge.

Platinum GaSavers may be ordered by calling: 1-800-343-4022. (MA: 617-731-4444).

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## PLATINUM GASAVER TEST RESULTS

Vehicle Number	Miles Per Gallon Without GASAVER	Miles Per Gallon With GASAVER	Per Cent Improvement With GASAVER
59	12.0	17.8	48.3%
63	11.3	16.6	46.9%
53	14.1	20.7	46.8%
51	13.0	18.8	44.6%
56	12.2	17.1	40.2%
64	9.6	13.3	38.5%
60	13.3	17.9	34.6%
55	9.8	13.1	33.7%
68	14.3	18.4	28.7%
50	10.8	13.9	28.7%
62	14.1	17.6	24.8%
66	15.8	17.5	10.8%
57	14.4	15.9	10.4%
54	13.1	14.0	6.9%
65	12.9	11.3	-12.4%
average	12.7	16.3	28.3%

Installation of the PLATINUM GASAVER, manufactured by NATIONAL FUELSAVER CORPORATION of Brookline, Massachusetts, was performed on 4/22/80 on the above numbered fifteen 1980 Chevrolet station wagons with 305 cubic inch V-8 engines (odometer readings between 15,070 and 38,784), owned and operated by TRANSPORTATION MANAGEMENT CORPORATION of Medford, Massachusetts.

We, the undersigned, officers of the two corporations (Transportation Management Corp. of Medford, Mass. and National FuelSaver Corp. of Brookline, Mass.) participating in the above study do hereby attest to the accuracy of the data contained herein and do agree that it may be made available for public dissemination, but only in its entirety.

*Richard Zimmerman*

Richard Zimmerman, President  
Transportation Management Corp.

*Ross G. Hong*

Ross G. Hong, C.P.A.  
V.P. & Controller  
Transportation Management Corp.

*Stephen A. Gordon*

Stephen A. Gordon, Fleet Manager  
National FuelSaver Corp.



## DRIVING THE '83 FORDS

(Continued from page 103)

out and try to take over industry leadership in sleek, aerodynamic design, in performance and in the traditional values of quality, durability and reliability.

They're not quite there yet, of course. But judging from what we've seen, both new products and important improvements to existing ones that are coming in the next few months, we think they just may pull it off.

### Fast gets faster

Mustangs and Capris are nicely face-lifted front and rear and have slightly better aerodynamics as a result. The Capri gets a rear "bubbleback" hatch (which looks better on the LN-7 two-seater), and the Mustang now comes in a lovely new convertible version. Best of all, the ragtop will be available with the hot V8 motor, and five-speed box.

The HO V8's horsepower gets a boost (about 15, they tell us, mostly due to a new four-barrel carburetor replacing the former two-barrel), and a Borg-Warner five-speed transmission is added this year, too.

The '82 Mustang was the fastest car on the road last year. Now, more power on hand should put it beyond the reach of everything else until at least the '84 model year.

In addition to the horsepower, a higher numerical axle ratio (3.27 vs. '82's 3.08) and handling improvements have been added to make the Mustang still more of a driver's car.

There are other improvements up and down the Mustang line. The base 2.3-liter Four, for instance, is recalibrated for better performance. The 3.8-liter V6 replaces the old boat-anchor 3.3-liter Six, which bumps 0-to-60 acceleration by about two seconds with the automatic transmission—at "equivalent or better" fuel economy.

All Mustangs and Capris get larger tires and suspension refinements for more neutral handling—less understeer at the cornering limit. We tried both the newly available Good-year Eagle HR tires and the Michelin TRXs (part of the optional TRX tire/wheel/suspension package) on the V8, five-speed Mustang GT and Capri RS, and the Goodyears seemed to be the hot tip for G-force buffs.

There's also a very nice new option—a multiadjustable bucket seat with a Recaro-like, net-insert, open-head restraint. And brace yourself for the spring introduction of a hot SVO Turbo Mustang featuring the five-speed transmission cou-

pled to the same multipoint electronic-fuel-injected, turbocharged Four that will power the Turbo T-Bird. SVO stands for Special Vehicle Operations—Ford's racing group—and this car promises to be just this side of a street-legal racer. The turbo-Four engine, incidentally, also will be available in the Capri.

Ford hasn't forgotten its front-wheel-drive economy and sporty models in doling out the goodies, either. With basic-transportation buyers pretty well handled by the solid but dull original Escort/Lynx, the stylists made a mild feint at the sporty-car market with two-seat EXP/LN-7 versions of a half-year later, and the power train engineers finally backed up their bluff with a close-ratio four-speed and a stronger "HO" variation of the 1.6-liter engine early this year.

Now, at last, Ford has equipped itself to play some serious hardball with its import competition, thanks to a new multipoint, fuel-injected version of the 1.6 engine with fourth-generation electronic controls (EEC-IV) driving through a five-speed manual transaxle.

Most exciting are new Escort GT and Lynx RS versions designed in the image of the famous European performance-model Escort XR-3. Intended for the driving enthusiast on a budget, these neat little sport sedans (three-door only) come with the injected engine, five-speed, TR suspension, functional front and rear spoilers and fender flares.

The injected engine is quick and responsive with 11-second 0-to-60 mph performance, no flat spots in its power curve and (they tell us) nearly as good fuel economy as the base 1.6. The five-speed (actually the basic Toyo Kogyo four-speed re-ratioed and coupled to a separate overdrive box) is crisp and sure. The TR suspension makes the car delightful to toss around. And, if you're not enthralled with the sporty GT or RS trim, you can order the good engine with five-speed or automatic on any Escort or Lynx and the TR suspension on any but the wagons.

### Aero-elegance

The new Thunderbird and Cougar are the first in-the-flesh examples of Ford's new North American design philosophy: lower front and higher rear, sharply sloped windshield, tapered front fenders and rear quarters, smooth, rounded edges and not a slab side or sharp corner.

On the T-Bird, notice the restrained use of chrome (though we'd prefer even less), the aircraft-style doors that wrap up into the roof and

(Please turn to page 182)

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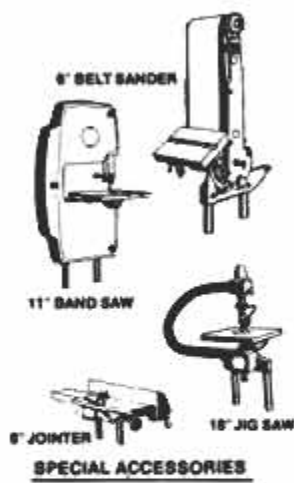
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## DRIVING THE '83 FORDS

(Continued from page 181)

forward around the windshield pillar and the blackwall tires on styled wheels. Gone are whitewalls and fake wire wheel covers and padded roofs. The new Thunderbird is very European, *very* tasteful. In fact, in profile and from above it looks a lot like Mercedes-Benz's slippery new \$50,000 380 SEC sport coupe.

Mercury's Cougar is intentionally more "traditional" than the new T-Bird, with a more vertical grille, more chrome, a very stiff (GM-style) rear roof and even optional (ugh!) "coach" lamps; for that reason, some may like it better. We're still trying to get used to the roofline, but otherwise find it very handsome and a *huge* improvement over the tasteless, brick-shaped XR-7 it replaces. Those more conservative lines take their toll in wind resistance, however: The Cougar parts the air with a mediocre .40 coefficient of drag vs. the T-Bird's outstanding .35.

### Wait until next year

Unfortunately, these exciting new cars won't be introduced until sometime in January. Ford didn't have any representative driveable prototypes for us to try, and so we can't tell you *yet* how they ride, handle and perform. We *can* tell you, though, that they have gas-pressurized front struts and rear shocks like the ones that make the Continental ride so smoothly, optional heavy-duty *and* handling suspensions and a standard, 3.8-liter V6 with automatic transmission.

New this fall are mid-size LTD and Marquis models, which are essentially restyled versions of last year's five-passenger Granada and Cougar sedans, bearing the traditional Ford and Mercury big-car names. These also get a slope-nose, high-deck aero treatment (Cd-.38) and the Continental's gas-pressurized suspension. Engine choices range from an improved (but still slow) 2.3-liter Four through a 3.3-liter straight six and a 3.8-liter V6, to a *propane-powered* version of the Four.

Finally, the Ford truck people would like you to know that their excellent compact Ranger pickup line is enhanced for '83 with addition of an optional, 2.2-liter, four-cylinder diesel and a five-speed manual overdrive transmission, the latter available with either the standard 2.0 or the optional 2.3-liter gas engine. Also, for all you urban—and country—cowboys, there are four-wheel-drive versions of both short- and long-wheelbase Rangers with the 2.3-liter Four.

FME

## WHERE ARE THE RUSSIANS HEADED

(Continued from page 113)

board a space ship from waste products. Already, half the water used by orbiting Russian space station crewmen comes from waste water. "Space gardens," grown in a special apparatus, aptly named "OASIS," have provided fresh greens for cosmonauts. Within the next five years, it's estimated that 10 to 30 percent of the bulk food consumed by space voyagers will be grown on board a ship or station.

### Algae banks arrive

Ground-based experimental algae "banks" have convinced both the Soviets and Americans that there will soon be in-flight air regeneration, expanding oxygen supplies for long trips.

Getting to other planets will require longer flights than 12 months, but not much longer. Trajectories have already been plotted in which a 50-ton module (perhaps similar to the Salyut space stations already in orbit) could carry two or three men out to Mars, swing past the planet, then plunge back across Earth's orbit all the way to Venus. There, an additional maneuver could send the vehicle directly back to Earth. The round trip might take about two years, but Salyut 6, launched late in 1977, was still going strong five years later, long enough for two double-planetary swing-by excursions.

Propulsion, however, is still a limiting factor. Soviet boosters are not sufficiently powerful to send big enough payloads on fast enough trajectories. But that, too, will change within a few years. Pentagon intelligence officials have publicly confirmed what observers have long suspected: The Soviets are well on their way to completing development of a giant new space booster twice the size of the Saturn V moon rockets of a decade ago. A single launch of such a booster would be able to carry a vehicle of sufficient size to support a first manned interplanetary venture.

Landings on the Moon and Mars could follow in the next decade, as new generations of space propulsion systems come on-line. Consecutive missions are expected, each deeper into space and each building upon previous accomplishments, while laying the groundwork for even more ambitious journeys.

A cautious, but steady, forward motion is the earmark of the Soviet space program. (See "USSR In Space," page 112.) This has led the Russians to an impressive series of firsts: first manned satellite to orbit

Earth; first man in space and first multiman crew in space.

### To Callisto and Io

Jupiter's moon, Callisto, is one example of a reasonable target for early manned exploration. Nuclear propulsion systems could push million-pound space vehicles to the Jupiter system in about a year, where the crew could land and survive comfortably on this outermost moon. There, just out of reach of the lethal Jovian radiation belts, crews would direct robot exploration of other more hostile environments, either deep in the atmosphere of Jupiter or on the radiation-blasted, volcanic surface of baffling, incredible Io, the moon closest to mighty Jupiter.

During their two or three year stay on Callisto, the cosmonauts (who might prepare a celebration for the 50th anniversary of Sputnik, in 2007) would live in insulated shelters. These dwellings would be made of converted propellant tanks and covered with deep layers of that moon's dirty ice to ward off meteorites and stray radiation from Jupiter's magnetic field.

Once established, the cosmonauts would drill deep into the skin of Callisto, seeking regions of underground water—suspected habitats for bizarre forms of life. Turning their attention to the surrounding objects of study, the cosmonauts would operate far-ranging robots by remote control. This could be accomplished far more efficiently from Callisto than from Earth, since the round-trip radio communication time would be only seconds, instead of hours. Remote-control rockets, would release dropsondes over Jupiter, and parachute "moon walkers" to the surface of Io.

### Outward bound

For the Soviet space program, the next quarter century will be filled with the fruits of a steadily paced, always advancing quest into the far reaches of the solar system. As with Sputnik, the Russians intend to lead this outward-bound wave. Indeed, their only potential competition for the foreseeable future is the U.S. space program. But we've backed off from manned planetary exploration since landing on the Moon in 1969.

The current low-budget, low-key American space program is geared to unmanned exploration or the Shuttle program. And unless the United States rededicates its resources to manned space exploration, it appears the Russians will have the rest of the universe all to themselves.

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LED arrow tells you how to turn the focusing ring. When you bring the center of the view into focus, a green, round LED lights.

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The middle CCD senses the light rays which come from the subject. The other two CCDs sense light which comes from behind and in front of the subject. The contrast and intensities of these three processed images are sent, in pulsed form, to the microprocessor.

The microprocessor compares the three outputs. When the output of the CCD which senses light from behind the subject is equal to that of the CCD sensing the light from in front, then the focus of what the middle CCD senses as the main image is correct.

We found it was great fun to focus the AL-1 on one object and then on another object very close to the original. The arrows guide you immediately to a proper focus that your unaided eyes might have missed.

### Disc-o-tech

My grandfather, who worked for Kodak in Rochester, N.Y., about 30 years ago, came home with one of the then-new, prototype Hawkeye cameras. It was the first, easy-to-use, more-than-a-box camera and it excited the whole neighborhood.

But today, Kodak's new disc system of photography has excited the whole world.

Kodak has taken easy photography and made it completely automatic. With the disc system, you're just about guaranteed good photos—as long as you can compose through the viewfinder.

The heart of the system is the disc cartridge. Because it's a disc, it was relatively simple to design an automatic film transport. When you take a picture, the disc spins so that the next negative along its perimeter can be exposed. The negatives themselves are made of a new high-resolution emulsion. They had to be, because in order to fit on the disc, the negatives were made very small. Normal emulsion-based negatives so tiny could not have been enlarged properly.

Because the negative area is so small, it's possible to place the lens very close to the film plane. This makes for a short focal length from the back of the lens to the film,

which gives the camera a very long depth of field. This means that objects from the foreground to infinity are all in focus.

Then, using new lithium battery technology, Kodak designed a compact power system. Although this system powers the flash and film transport and runs the camera's other systems, it will last five years before needing replacement.

It is by far the simplest camera on the market to use—and it gives results that all but professionals will be pleased with. We used it in just about every lighting condition—and we couldn't make it fail.

### Leapin' images

The four-eyed Nimslo camera is a combination of unique design and shooting simplicity. And it produces photos that really do have a three-dimensional effect.

A Nimslo photo (it uses regular 100 or 400 ASA film, only the processing is different) appears to be covered by a grooved, plastic overlay. As you move the photo, or your eyes, the background of the image seems to shift behind the foreground—just about the same parallax effect you see in a real-life scene.

The plastic overlay is composed of many long, thin lenses (200 per inch) which overlay the image area. The lenses blend the specially processed, multipart image areas.

As the illustration on page 99 shows, the Nimslo's four lenses each produce one negative that's half the size of a normal 35-mm image area. (A Nimslo picture gets 10 photos per 20 exposure roll because of this.)

Each of the four image areas carries a picture slightly different from its neighbor's. Together, the images comprise four separate shots of the same subject shot from four close, but separate, viewpoints.

Now, these four negatives must be blended into one three-dimensional picture.

Each of the images is divided optically into thin strips. Eight strips from one negative, eight from the next and so on to 32 strips, are placed side-by-side under each lens.

The lenses reflect light from the image slides in a way that almost recreates the manner in which light left the original scene.

The main "trick" to being a good photographer with this system is learning to think in 3-D. Taking photos of flat, more or less one-plane images results in dull finished work. You need a good foreground subject

with a distant and complex background to best show the 3-D effect. But there's nothing we've seen quite as eye-catching as a well-composed 3-D photo!

### Filmless photography

Sony, a giant in the world of video, is trying to turn the entire world of photography topsy-turvy with an all-electronic system that uses no film at all. The new Mavica system, which we first described last year (see *Tech Lines*, "New Filmless Camera," page 137, Dec. '81), displays its final pictures on the family television set (still-frame) or an optional, on-paper printer.

While Sony has been showing prototypes of this system for more than a year, they have yet to deliver an operating system for editorial review or sale to the public. Still, what is promised could be revolutionary.

The Mavica camera also uses the new CCD circuitry which converts light into electrical, digital impulses that computer-style devices can work with. On the Mavica, the CCD is right behind the lens.

Light from the lens is split. Part goes to the viewfinder and the rest hits the CCD. The CCD sends the light, in the form of digital pulses, to a video circuit in the camera.

The video circuit processes this pulsed information and stores it in encoded form on a Mavipak cartridge. This cartridge contains something quite similar—in many ways identical—to a computer's floppy disc storage.

The picture as information is written to the disc in a binary format. The disc, a wafer of recording medium, is then removed from the camera and plugged into a device similar to a videotape recorder. This is connected to a home TV, which is the main display device.

Sony also intends to market a printer. The printer reads the encoded data and converts it to a paper print via three primary-colored dye-impregnated papers.

And because the picture is digital, a Mavica photo could be sent over the telephone as audio tones, or on a tape recorder.

The Mavipak itself can be erased and reused. So there is also the prospect of very low "film" cost.

But the price of a complete Mavica system makes it far less competitive than the other systems mentioned. Sony estimates cost to be comparable to that of a full-fledged video system of video recorder and camera—well over a thousand dollars. But prices will likely fall.

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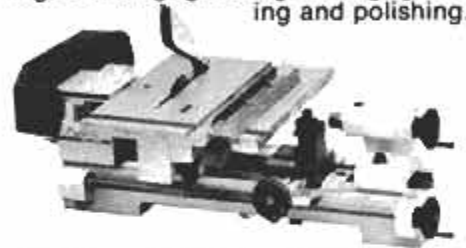
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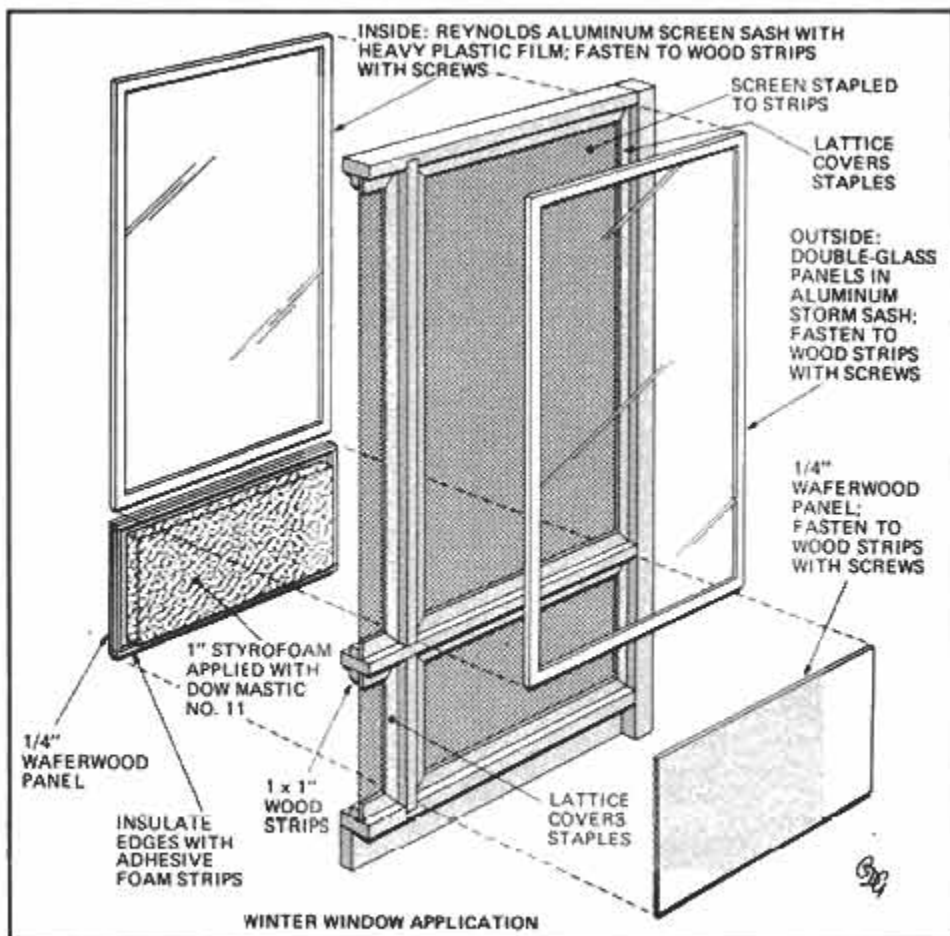
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Winterizing the porch includes fastening particleboard over lower windows. Here a panel is secured with screws through each edge of the panel into a wood strip.

### DOUBLE-DECK PORCH

(Continued from page 121)

level chalkline on the sheathing. Also remove siding to attach the two adjacent posts to the house studs with 6-in. lagscrews. Resnap the vertical chalklines; use a spirit level to ensure that the lines are plumb and level. Run a bead of caulk along the chalkline. Lagscrew header to second-floor joist header. Apply aluminum flashing over the sheathing and lap it on the header.

At each post location, bore an oversize hole through the flagstone into the concrete for a bolt to secure the post anchor bracket. Secure the bolt with patching cement. Slip the bracket over the bolt and secure it



Sliding patio door leads to living room. Stationary window (center) lets light in. "Winter windows" (drawing above) and space heater ready porch for cold weather.

with a washer and nut. Set the post in the anchor. Secure the post with nails through predrilled holes on the bracket. Brace posts with two diagonal 2x4s until framing is done.

Lay out locations of the rail-post fasteners on the header joists. Install the joist hanger hardware. Then measure, cut and fasten joists to posts with metal post-and-beam connections. You must use a 1/2-in. pine filler between posts with the connector (see detail on page 121).

The spiral stair post supports a corner of the deck overhang. Erect the stairway at this point and fasten it in place. We bolted the top step to the joist.

Next, we cut posts for the deck railing to size. Cut dadoes for top

and bottom rails; install posts in metal connectors already placed.

To finish the ceiling, we nailed 2x2 cleats near the top of the joists; then fastened 1/4-in. particleboard panels to the cleats.

After framing porch windows, we nailed 1x1-in. strips around each frame and used heavy-duty, galvanized staples to fasten screening permanently to the strips. Lattice strips cover the staples.

For proper drainage of the deck level, we attached 2x4s cut on a skew (to direct water to the rain gutter) to the joists. Over this we fastened 3/4-in. particleboard sheathing with panels staggered to avoid any long seams.

Then we applied 15-lb. roofing felt (tarpaper) parallel to the house wall. Each layer should overlap the preceding one 12 in., starting at the lower edge. Next, we installed 30-lb. mineral roll roofing, sealing it with asphalt cement. Each strip laps the upper half of the previous strip to get a double thickness over the deck.

The next step is to flash the railing posts (see post flashing detail, page 120). Solder the two-part aluminum flashing together or join it with plastic cement.

#### Leveling the surface

To level the deck surface, we positioned 2x6s tapering toward the house. Space the 2x6s 24 in. on centers; temporarily tack some 1x4 decking on top of them to hold position. When they are set, begin to nail decking at the railing; work toward the house, staggering the joints.

To avoid splitting, prebore 1x4 decking for fasteners, especially near edges. Trim board ends after nailing deck to ensure a straight line.

The deck railing has 2x4 top and bottom rails between posts with 2x2 balusters 4 in. apart. Using a circular saw, cut baluster grooves centered the length of each rail (see railing detail, page 121). Cut balusters to length, test-fit and assemble rails and balusters with resorcinol glue and 6d galvanized nails. Install 4-in. spacers between balusters on the bottom rail to fill the groove, then the railing sections between posts, and finally the post-cap support blocks and caps.

We wanted to stain the lumber a rich brown, but we have to wait six months to let salts leach out.

In the meantime, you can work on the window treatments (see winter window application drawing on facing page). An indoor-outdoor porch like ours is sure to increase your enjoyment of the outdoors and encourage you to entertain.

FM

187

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plate. Note: Operate your router only at the voltage shown on the nameplate or the motor will burn out.

Nowadays, almost all power tools are double-insulated so you don't need the old three-prong (grounding-type) plug. But if your router does come with a three-wire cord, be sure to use the proper adapter so that the tool is safely grounded.

When you get your new router home, check the box—make certain you have all the pieces that you paid for. Then take time to become familiar with the router and all those accessories you own. And don't forget to fill in and send back the warranty card.

### Getting ready

Since that work end of the tool—the bit—is always out there in space ready to do its job, even on your fingers, make it your habit from the start to disconnect the tool from power whenever changing bits. Insert the desired bit into the collet until it bottoms, then back it out  $\frac{1}{16}$  to  $\frac{1}{8}$  in. This procedure is to protect the collet from breaking due to heat expansion.

I generally finger-tighten the collet nuts until they're "snuggled" against bit shank, and then reach for wrenches to finish up the tightening.

Make absolutely certain that the collet is *fully tightened* before restoring power to your router. Failure to correctly install a bit and tighten the collet could result in a bit hurtling about the room like a piece of shrapnel.

Next, reassemble the motor into the base (on my model I just have to loosen a wingnut on the base). Slide the motor fully into the base and tighten the wingnut.

### Set bit depth

To use the micrometer ring on a router to set bit depth, follow these steps:

1. Place the router on a flat surface.
2. Loosen the wingnut and slide the motor down until the bit barely touches the surface.
3. Retighten the wingnut.
4. Rotate the depth adjustment ring until it hits the base. Now the bit is set for 0 in. depth of cut.
5. Note the position of the graduations on the depth-adjusting ring in relation to the index on the router base (usually a point, or arrow).
6. Rotate the ring in the appropriate direction to achieve the desired depth of cut. On my router the depth

is changed by  $\frac{1}{64}$  in. for every three graduation lines; thus the depth is changed for  $\frac{1}{32}$  in. for every six graduation lines.

7. Loosen the wingnut and slide the motor as far into the base as the depth-adjusting ring permits. Retighten the wingnut and you can put the router to work.

The above procedure applies specifically to the Rockwell model I own. Consult your router manual for any possible variations.

*Pro trick:* Certain cutters are used more often than others in the type of woodworking most of us do. This includes the rabbet and straight (mortise) cutters. Thus, I made up a board with both of these cuts plowed to exactly  $\frac{1}{4}$ - and  $\frac{3}{8}$ -in. depths—the usual depths for working with  $\frac{3}{4}$ -in.-thick boards. Each time I need to set a  $\frac{3}{8}$ -in. rabbet cutter  $\frac{3}{8}$  in. deep, I don't have to fiddle with rulers; I simply and quickly set the bit using the pre-cut board.

There are five ways to guide a router:

1. With a pilot on the bit.
2. With an edge guide.
3. Freehand.
4. Against an edge.
5. With a templet guide.

Methods are listed in the order that I think a beginner should tackle them—the easiest is first.

### Guiding with a bit

Almost all decorative edging done with a router is with a bit that has a self-contained pilot. The pilot rides the edge of the material during the cut, so it is important that the edge be in perfect shape. For example, when putting an edge on a piece of plywood the pilot will enter any voids in the plywood, causing the decorative edging to indent, too.

When using a piloted bit make the cuts sequentially as shown on page 115. Always start the router with the cutter standing away from the wood, then feed the spinning bit into the workpiece. Since the router bit spins in a clockwise direction, when viewed from above, an outside edge is always routed from left to right. Feed the tool in about  $\frac{1}{4}$  in. or so from the left end of the board, push right for a couple of inches then bring the tool all the way to the left and off the board. If you are routing just the one edge, don't allow the pilot to turn the board corner or you will edge-shape the end of the board as well. If necessary, you can tack a guide to the workpiece in order to prevent this.

Make no mistake—as simple as this routing task will eventually be

for you, in the beginning it takes practice to master.

### Several rules:

■ Always rout the edge grains first as shown in the drawing on page 115. You will learn that as the router bit exits an end grain on the far end it is not uncommon to have some splintering. If this is your last pass, it means that the finished adjacent edge may be splintered. But, done correctly, end grain first, the following pass—with the grain—will remove the splintered wood.

■ A constant rate of feed is important for achieving a smooth cut. The point is to work your tool so that the router is working at its highest possible rpm. This will vary, depending upon the material being worked, depth of cut, sharpness of cutter and so on.

■ As soon as the cut is completed, release the trigger to turn off the power to the router. Do not put the tool down until the cutter stops spinning.

### Using an edge guide

An edge guide should probably be the first accessory that you buy for your router. As can be seen in the photos it is particularly useful for cutting blind mortises and the like, such as for the hidden-spline miter joint. For more details see page 116. Take time to read the manufacturer's instructions for the edge guide to ensure installing and using it correctly.

### Freehand work

Freehand routing is plain fun, even when you're just showing off. More often than not when routing freehand you will probably be making a sign or plaque.

There are two basic freehand techniques:

The letters or pattern can be cut directly into the wood.

You can rout out the background, leaving the letters raised from the surface.

To do freehand routing you must first put the pattern directly on the workpiece, using either a pencil or felt tip marker. Next, select the appropriate bit. Bits generally used for freehand work include the core box, straight (mortise type) for large areas and the veining bit for more delicate work.

In general, you should not rout more than  $\frac{1}{4}$  in. deep. The deeper the cut, the more difficult it will be to follow a pattern. Ordinarily, you should make the first depth setting equal to about 25 percent of the

desired finish cut. The initial cut then acts as a guide for the final, full depth cutting.

Though safety glasses should be worn for all types of routing, it is absolutely imperative that they be in place when freehand routing. It is often necessary to get your face down close to the tool base to follow the pattern with your bit.

#### Guiding against an edge

The fourth method for guiding a router is to keep the base against an edge of material. The edge can be straight, such as for plowing long grooves or dados, or it might be curved or scalloped to suit a custom task.

Clamp the board (or templet) securely to the top surface of the material being routed and guide the router in a counterclockwise rotation (left to right, as in edge shaping). Be sure to *keep the shoe in contact with the guide at all times.*

A typical application of such cutting would be the plowing of dados to receive let-in shelves, (on opposite vertical panels in a bookcase). Once the panels are laid out, they can be clamped or tacked together (side by side) so the grooves (dados) can be made across both boards at the same time.

#### Templet guides

Templet guides are accessories available for the router. Since these elevate the user into the world of advanced wood craftsmanship, some of the simpler do-it-yourself router models are not designed to accept templet guides.

The guides are locked in the router subbase using various means, depending upon the maker: Some are held with screws, others with locking nuts. In place, the guide's collar projects down from the shoe. The collar, in turn, rides a pattern edge, such as a dovetail templet or a templet for butt routing (routing the mortises for door hinges).

If you are heavily into woodworking—or plan to be—you will at some point want to master the templet guides, if for no other reason than to be able to produce accurate dovetail joints quickly.

#### About bits

The basics are shown and discussed on pages 116 and 117. Over the long haul, you'll come out ahead if you purchase carbide-tipped bits to begin with. But this is true only for those who use a router fairly regularly. Here's my reasoning: Steel router bits, depending upon style,

are priced from \$8. The average person cannot sharpen his own bits; thus each time the bit is sharpened professionally you'll pay another \$3 to \$5. Cutting edges on a carbide bit will outlast those on a steel bit many times. Even with an initial outlay that may be three times as much (\$18 to \$25) you'll save money after only three or four projects.

A dull pilot bit will cause scorch marks on the edge that it rides. For this reason work only with sharp bits.

#### A final word

Take time to read the manufacturer's manual that comes packed with your tool. Quality toolmakers have the user's interest at heart; they want you to master the tool so you can get the most out of it.

If you're satisfied, the chances are your next power-tool purchase will be the same brand. In addition to operating instructions, the manual will also provide a maintenance run-down. It is in your best interest to maintain the tool as suggested. **PM**

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*Popular Mechanics  
Magazine,  
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# TECHNOLOGY UPDATE

## A guiding light, by day or night

### Aviation

Visual approach slope indication (VASI) devices have been in use at most civil airports with scheduled traffic for about 30 years. With the exception of intensity gains and better reliability, they haven't changed much. Now, what is being called the second generation of VASI is being developed and installed. One of the leading contenders is based on an idea from the McDonnell Douglas Corp. that was eventually developed by DeVore Aviation Corp. It is known as PLASI, for Pulsating Light Approach Slope Indicator.

In tests at airports in the United States and overseas, airline pilots have found it preferable to older systems (and, in some cases, to a competing British system).

Housed within a rectangular box that's less than three feet long (not shown to scale below), the PLASI shows the incoming aircraft an "on-glidepath" signal consisting of steady white light. If the plane (or helicopter, for which the system was originally designed), climbs above the glidepath, the pilot sees a pulsing white light; if below the slope, he'll get a pulsing red light. Migrations, either high or low, produce pulses that gain in rapidity according to the degree of deviation.

The unit can be easily adjusted to provide a steep glidepath for heli-

copter approaches or a normal one for fixed-wing aircraft. Obstructions on or near an airport can be considered in setting glidepath angles.

One of the advantages of the DeVore system seems to be its efficiency. The lights are visible from nearly 4 miles off the runway with bright sunlight directly behind the approaching aircraft—the worst visibility condition. This intensity is derived from 900-watt Sylvania tungsten-halogen projection lamps with an overall power drain roughly equivalent to that of a home hair dryer. Five lamps are mounted on a turntable which moves a new one into place automatically in the event of a burnout. When the last lamp is active, a warning light on top of the casing goes on.

PLASI system lights are visible for over 10 miles off a runway in most conditions, including night operations when a photocell reduces the voltage to the lamps for longer life and less power drain.

### New lightning scare

With composite materials being used increasingly in wing and empennage structures of newer civil and military airplanes, lightning strike could be a new threat. If the bolt's energy isn't bled off easily, as it is by all-metal wings and other parts, the resulting arc might ignite fuel in the tanks. Boeing Co. has a contract to study ways of dissipating lightning from composite materials.

### Medicine

#### Cold capsule

With most weekend athletes getting more familiar with sports medicine principles, the RICE (rest, ice, compression, elevation) method for treating sprains and strains is fairly well known.

Only the rest part is at all controversial, since many doctors now prescribe ethyl chloride spray followed

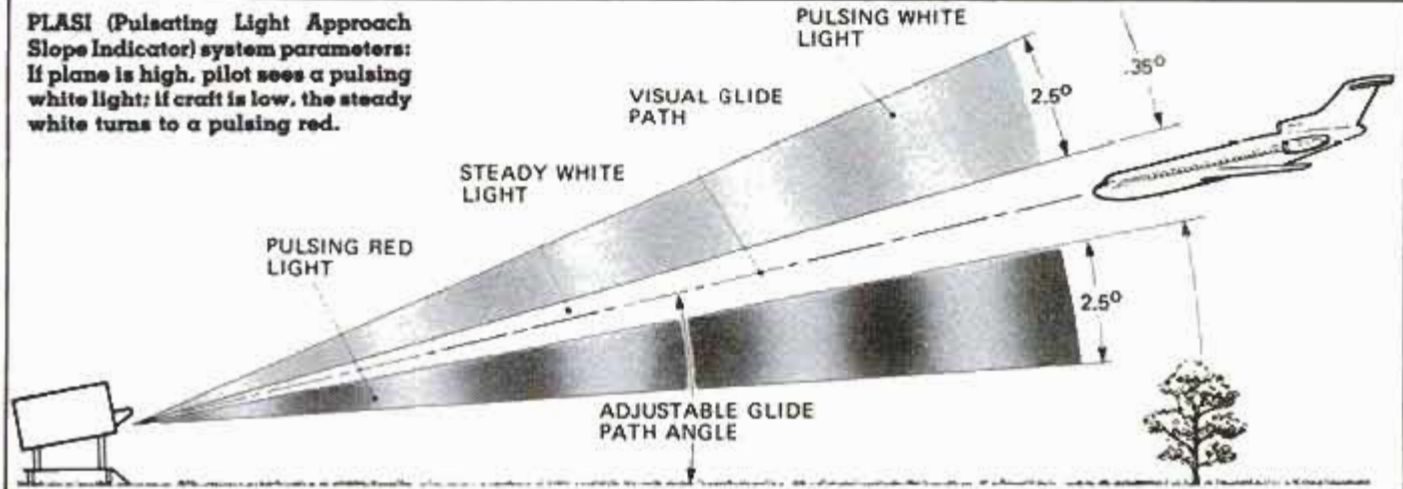


Sportlife's new cold pack is taped over muscle; pressure starts cooling chemical.

by immediate exercise of the injured part.

The new chemical cold packs might provide a good intermediate path for nonprescription treatment. The one in the photo is new from the West German firm of Manan and is being sold under the Sportlife brand. Pressure on the pad produces an immediate cold effect that lasts about half an hour.

PLASI (Pulsating Light Approach Slope Indicator) system parameters: If plane is high, pilot sees a pulsing white light; if craft is low, the steady white turns to a pulsing red.



## Energy

### Germany's 'cool' coal fire—no pollution, no acid rain, no chimneys

The buttons, bumper stickers and decals are omnipresent in West Germany these days. Bright red and yellow, they depict the sun with a smiling face and bear the slogan: *Atomkraft? Nein Danke!*—Atomic Energy? No, Thanks!

This antinuclear movement poses a seemingly insoluble problem for the Western world's second largest industrial nation. West Germany today meets half its total energy and 70 percent of its heating needs with oil, 97 percent of which it has to import.

But if not the atom, and if not oil or gas, how then to meet fuel requirements that have doubled during the past 20 years?

The popular answer is coal. After all, the famous Ruhr Basin is still one of the world's richest treasure chests of black diamonds. Economically extractable reserves are estimated at 25 billion tons of hard anthracite and 18 billion tons of soft brown lignite—more than enough to last well into the next millenium.

But coal has always meant pollution. Compared to nuclear energy, the sulfur and nitrous oxide emissions of coal-burning power and heating plants pose an infinitely greater immediate danger to the environment.

As it is, fossil-fuel combustion—both oil and coal—already emits more than 60 million tons of pollutants into the atmosphere over Western Europe each year. They come back down as toxic particles and the same corrosive acid rain that plagues the northeastern United States and Canada.

But how about a form of coal combustion that needs no filters because it desulfurizes the flue gases and also has virtually no emission of nitrous oxides?

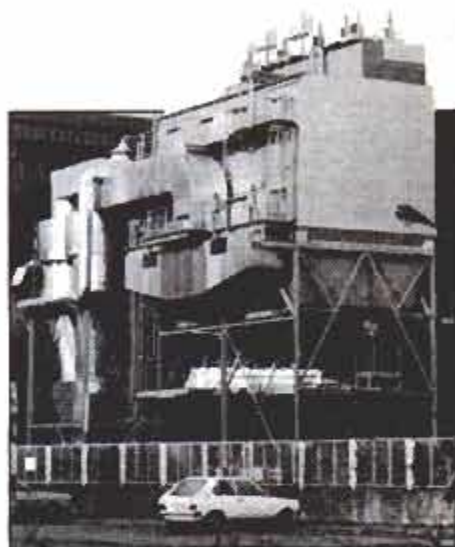
West Germany's coal industry has come up with such a technique, suitable for power generation, as well as production of steam for district heating. Not only is it so environmentally clean that sulfur emissions could be

reduced by more than 99 percent, but it is more efficient and cost effective than any conventional coal-burning system now in use.

Based on the principle of "fluidized bed combustion," it was developed by engineers at Ruhrkohle A.G., the country's largest coal mining conglomerate, in cooperation with two leading engineering and boilermaking firms—Deutsche Babcock A.G. and the Thyssen-Standard Boilers consortium.

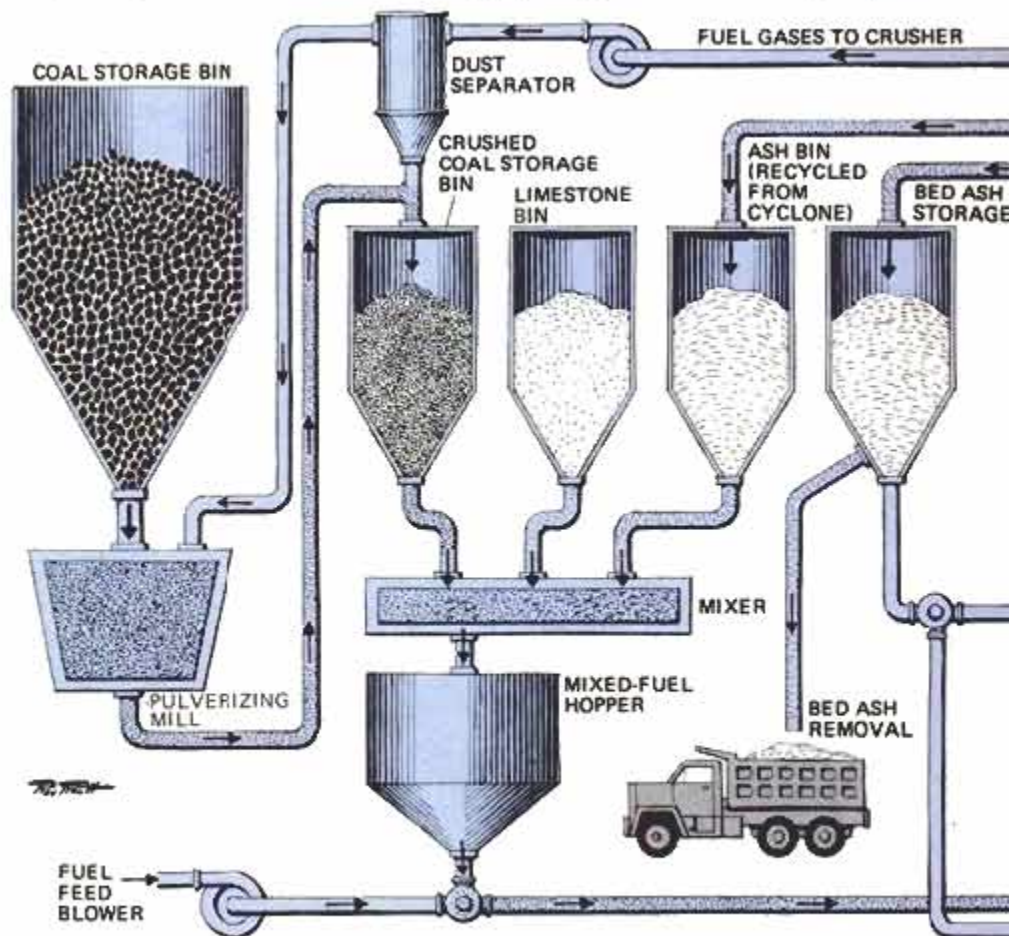
"Of course," concedes Hermann Krischke, project chief at Ruhrkohle A.G. in Bottrop, "the principle of the fluidized bed is hardly new. It's been known since the 1920s, when it was used for various catalytic processes and the calcination of pyrites. But it was rediscovered—as a means of coal combustion—after the first oil crisis in 1974."

At first glance, the principle seems relatively simple: Pulverized coal is mixed with a certain amount of forced air to lubricate it and make it flow like a fluid. In the process developed by Krischke's team, coal,



Germany's largest fluidized bed combustion power plant is 35-megawatt burner at Flingern, near Düsseldorf.

crushed to fine grains, measuring about 6 millimeters in diameter, is fed into the burner. Simultaneously, the combustion air is blown into the chamber through a perforated distributor plate. The air churns the coal into an eddy about 3 feet high. This is called the "bed" and it behaves, physically, like a boiling liquid





while it burns. That makes for more even temperature distribution and provides very high thermal efficiency. The heating surfaces—water pipes to produce steam—are immersed directly into this swirling eddy in order to provide optimum transfer of heat.

"Because of the high heat transfer coefficient," says Krischke, "combustion can be kept at 800° to 900° C., instead of the 1,600° you have in conventional systems. As a result of the lower temperatures, there is virtually no formation of nitrous oxides.

"Even more important than that, crushed or pulverized limestone can be mixed with the coal to act as a desulfurizing agent. At temperatures ranging from 800° to 900°, the limestone is converted into calcium oxide and combines with the sulfur dioxide that is released from the coal to form calcium sulfate—that is, gypsum. The gypsum becomes part of the residual ash which can be used as

an aggregate for building materials.

In theory, SO<sub>2</sub> emissions could be eliminated almost totally by the process, depending on how much limestone is added, and on several other factors. For all practical purposes, though, a ratio of 8 to 10 percent limestone suffices to reduce SO<sub>2</sub> emissions by 80 percent—enough to call the flue gas "environmentally clean" and meet even the strictest pollution-control standards now in effect.

There are other important benefits besides clean combustion, as well. The thermal efficiency is very high—95 percent and more. That means very small heat-transfer areas are needed, which makes for compact burner and power-plant designs. Capital investment costs can be cut substantially. And operating costs are judged to be as much as 30 percent lower than in conventional systems.

Moreover, even low-grade coal with a high ash or sulfur content and tailings of low calorific value can be converted into energy without the slightest pollution impact. That not

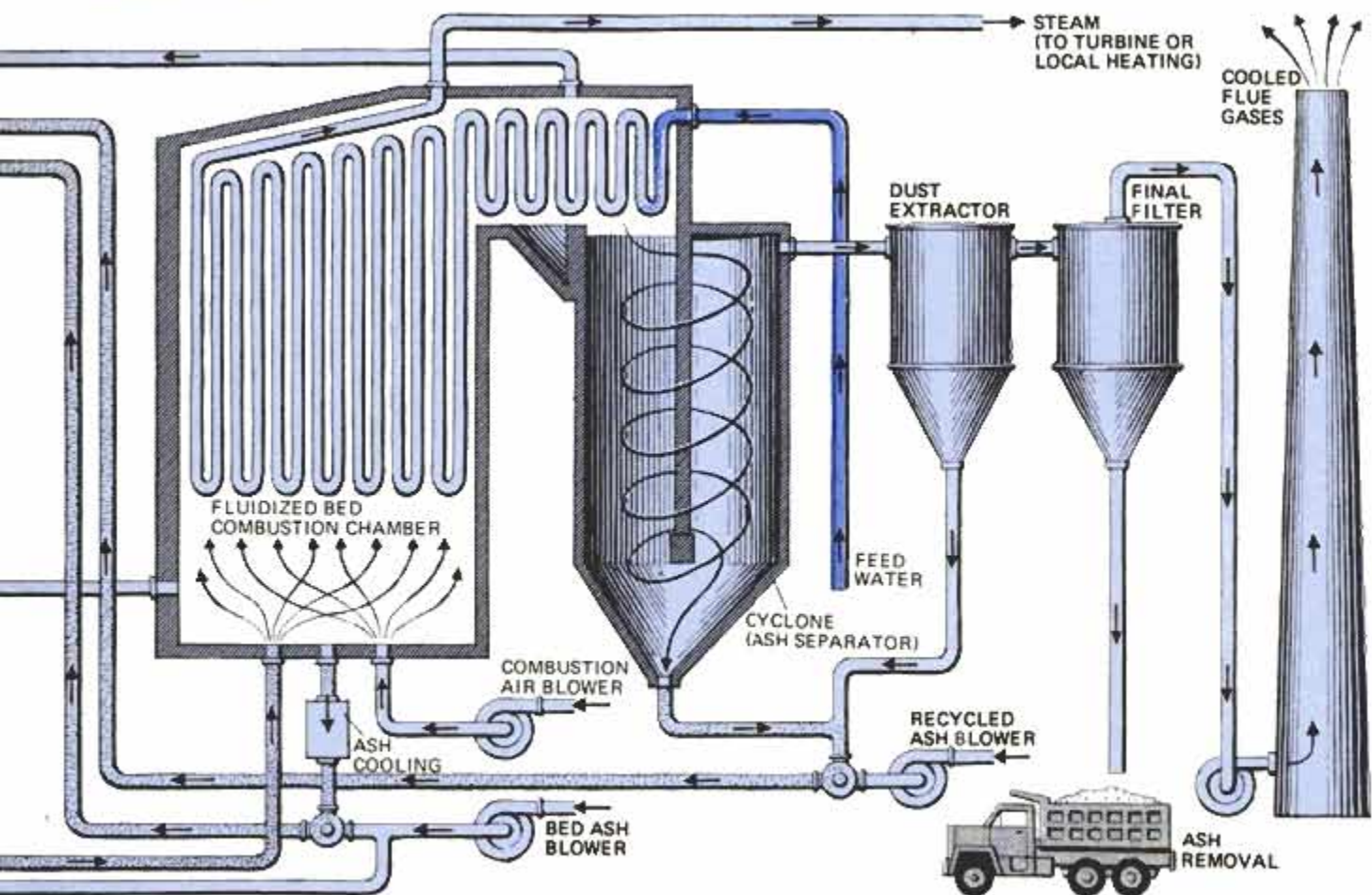
only reduces the fuel costs, but saves reserves of higher quality coal.

As part of the development project, two prototype plants were built and have proven highly successful. A 35-megawatt unit, used as a combination electrical power and district heating station (see diagram) was set up by Ruhrkohle and Babcock in Flingern, a suburban district of Düsseldorf. A smaller plant, with a 6-megawatt capacity, built by the Thyssen-Standard Boilers consortium, was installed at Ruhrkohle's "King Ludwig" mine in the city of Recklinghausen to produce steam for central heating and industrial boilers.

Many additional plants are now under construction or on order. A 230-megawatt station is planned in Volklingen in the Saarland.

"The plant in Volklingen," says Krischke, "will be the first coal-burning power station in the world without a chimney. The flue gases, totally desulfurized, electrically filtered and cooled down to under 200° C., will leave via the cooling tower."

Editor: Robin Nelson  
Contributor: John Dornberg



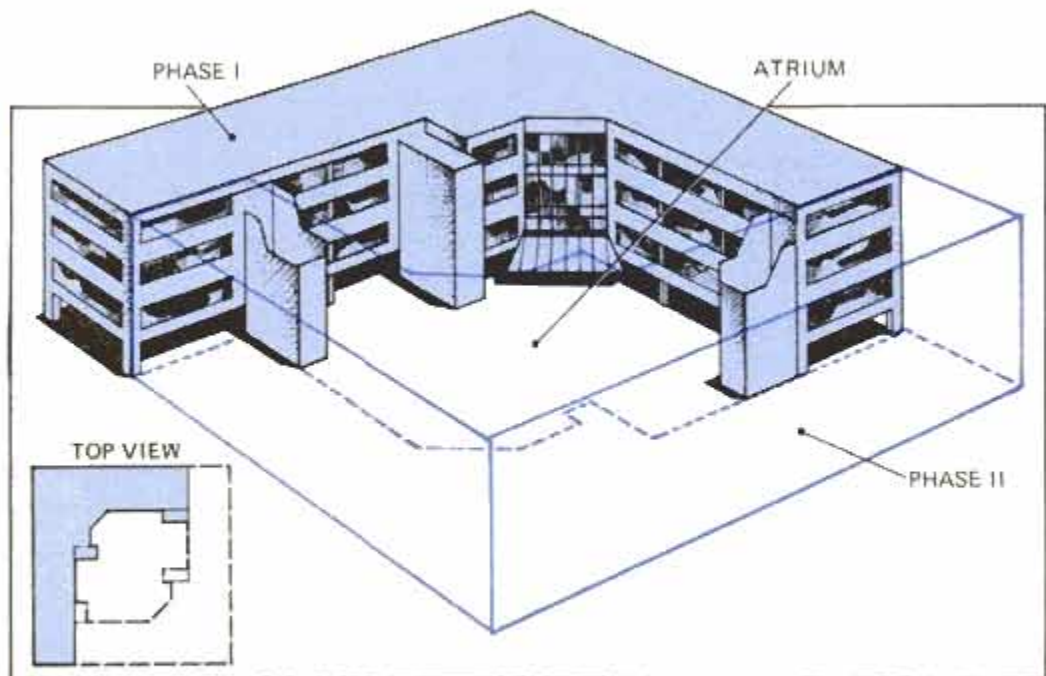
## Architecture

### The world is their atrium

A revived ancient Roman might feel right at home in the sunbelt South, where atrium style, rediscovered in Atlanta a decade or so ago, has become the architectural format for office buildings.

What's different about the atrium building going up at 405 North Reo St. in Tampa, however, is that for about a year, it is going to be "half" a building with its atrium open to the world.

Designed by Tampa architect Warren Smith for Zurn Industries, a builder of cooling towers, the building is actually two buildings. Phase I is nearly completed, with occupancy by the owner (approximately 50 percent) and tenants close at hand.



Tampa's Zurn building: Half will be occupied, while half is built; eventually, they will join.

Phase II turns out to be a mirror-image, L-shaped building that will be constructed over the next year. When completed, it will be linked to its twin by the removal of demountable walls.

Construction techniques

that include the demountable wall structures make it all feasible, says the architect. Although each side of the new building will require self-contained heating and air-conditioning systems, the economic advantage lies in being

able to lease out half the building and get revenue from it, while the other half is being completed.

A skylight will cover the atrium after both phases are linked. A 20-foot open square in the center will admit natural sunlight.

## Marine

### Man as accessory

The Mantis Duplus is a one-atmosphere submersible evolved from a series developed by IUC International, the Bermuda-based diving con-

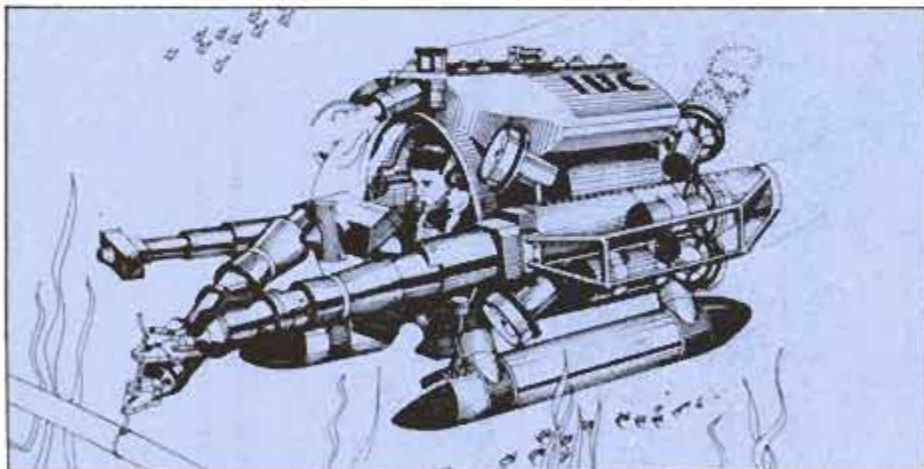
cern. An optional third manipulator arm and stronger thrusters offer more reliability and versatility than previous models, but it's the multimode control that sets the Duplus apart from other Mantises.

It can go below on its tether to 2,300 feet—and the Duplus doesn't care if there is a man aboard or not. In its

fully manned mode, a pilot steers the craft and operates all the equipment. In a semiremote mode, a surface operator with a television view can operate either the manipulators or the steering controls, leaving the other function to the diver aboard. This would prove helpful in areas of strong currents, for instance, where the pilot could concentrate on thruster control to hold position, while manipulator work was handled from above. In its fully remote format, all systems are controlled through a tether attached to a panel and video screen on the surface.

### Water-driven tools

After some six years in development, the Naval Civil Engineering Laboratory at Port Hueneme, Calif., has produced and tested hydraulic impact tools powered solely by seawater. The advantage over oil-driven tools now used by divers is that no return hose is required; seawater merely exits the tool. This cuts current drag on feed lines by half.



Mantis Duplus can be controlled from the surface, by its driver-pilot, or both ways.

# ME COLD? NEVER!



There are some people who love the cold and the wind—but I'm certainly not one of them. I used to try just about everything to stay warm—big coats, bulky sweaters, thermal underwear, the works. Somehow I still was cold or worse yet, sweating under layers of heavy clothing.

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to have all these performance capabilities without the optional avionics package that lets you take full advantage of them. Reading the options list on some models, you get the idea that without the \$40,000 in full radio/nav panel, plus autopilot and color radar, the stock airplane is little more than a powered hang glider with some added structural integrity. The funny thing is, the brochures are right. If a 300-hp, turbocharged airplane is to be fully and efficiently utilized at today's operating costs and in today's evolving electronic air-traffic control environment, it needs expensive navigation equipment.

To have paid up to \$100,000 for airframe and powerplant alone only to sit sipping machine-made coffee on a hard chair in some Sleepy Hollow airport, while the fronts of summer thunder across the nation, would be an extremely bad situation. In addition, the FAA is bent on expanding the number of metropolitan terminal areas where any aircraft entering must be equipped with a transponder (radar identification) and must fly precise routes under positive control.

to have all these performance capabilities without the optional avionics package that lets you take full advantage of them. Reading the options list on some models, you get the idea that without the \$40,000 in full radio/nav panel, plus autopilot and color radar, the stock airplane is little more than a powered hang glider with some added structural integrity. The funny thing is, the brochures are right. If a 300-hp, turbocharged airplane is to be fully and efficiently utilized at today's operating costs and in today's evolving electronic air-traffic control environment, it needs expensive navigation equipment.

An underequipped airplane won't get the flight time it needs to pay off; fixed costs such as hangar rental, insurance, maintenance and overhauls gobble up money. At 300 hours per year flight time, a typical single-engine plane will cost about \$10 more per hour of operation than the same model flown 600 hours in a year.

So while cramming a King RNAV system, a Century autopilot and a Sperry color weather radar into a small-plane panel might cost an extra \$40,000, look what it gets you: Point-to-point flight (area navigation) by computer-generated waypoints—rather than having to fly from one VOR (radio homing) station to the next, along with the airlines. Weather avoidance—if you know where they are, those thunderstorms can be sidestepped. And the autopilot? In its most rudimentary mode, holding the wings level or maintaining a preselected altitude,



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Airborne commuter taxis back to personal hangar at California's Cameron Airpark.

## A plane in every garage

Companies struggling to sell the public on small planes wish that there were more communities like Cameron Airpark Estates in California. A small development nestled in oak-covered hills near Sacramento, it is peopled by diehard plane owners. Every home (\$150,000 and up) has a hangar, a windsock on the roof and is connected by taxiway to the main runways of the community airport.

Street signs are only three feet high to prevent wing damage; all streets are 100 feet wide, allowing two cars and two aircraft to pass simultaneously (the middle lanes are reserved for cars).



Robert Arnold uses his plane more than his car, finds it cheaper going direct.

"I do more flying than driving," says Cameron resident Robert Arnold. With his wife, Irene, Arnold often packs weekend camping gear and folding bikes in his plane. "Flying direct," according to Arnold, "can be cheaper than driving."

it gives the lone pilot the time he needs to establish and cross-check complex navigational data. In its most sophisticated form, the autopilot can take over just after takeoff and, linked to the plane's navigation system, fly you to within 200 feet of your destination runway.

### Bombs away

It is truly noteworthy, then, that these highly evolved, instrument-jammed, luxury single-engine airplanes are among the biggest bombs in a quiet disaster that is the general aviation industry in 1982. Singles account for an estimated 170,000-plus of the total general aviation fleet of 220,000. By June of this year, their sales were off more than 50 percent. By midyear, some of the biggest names in the small plane business had, discreetly, all but suspended production.

Why? The recession is an easy out, with interest rates one reason why fewer people might care to contemplate the giddy price tags being hung on small aircraft. Yet some industry executives admit that nobody has done a selling job worthy of the product. "Businesses are afraid of stockholders, afraid of the IRS," says one airplane marketer. "While the big boss can fly around in his conspicuously unmarked Learjet, if middle managers take off in a smaller plane, everybody reads it as 'having fun.'"

Another factor could be the unwillingness of some potential buyers to accept the fact that single-engine planes are as safe as twins. In their favor, singles must, by FAA edict, have a stalling speed—when the wings lose lift—of no more than 61 mph. If you want to walk away from a survivable aircraft accident, stall speed is one number that counts. Furthermore, while the situation has largely been rectified in later models, many twin-engine aircraft have a minimum speed at which control can be maintained with one engine out (Vmc) that's higher than the nominal stall speed. (In many light twins, this runs up to 10 mph higher than singles.)

The growing dependability of all types of general aviation engines, of course, works somewhat in the favor of singles in regards to the foregoing. Perhaps the awareness of the new versatility and range of small planes will grow as well, and a relative golden age can be hammered out after recovery. Some of us, in any case, will know what to do when we hit the state lottery for a big one. The yacht will have to wait. **PM**

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## DRIVING THE '83 CHRYSLERS

(Continued from page 104)

and about two mpg less with the more powerful 2.6 engine.

Standard in the very plush interiors are a "message center" instrument cluster, a new three-mode heater system with "ram air" outlets and a center armrest front bench seat. Optional is a 50/50 split bench with individual armrests and built-in console. Each console contains a seat recliner lever and a small-item storage compartment.

The E Class and 600 also come with a much improved (over previous K-based cars) power front disc/rear drum brake system, power steering, halogen headlamps, a locking fuel filler door, an electronic deck release and a new "easy-close" counterweighted decklid design.

In driving the E Class and the 600, we found them thoroughly pleasant, comfortable and competent luxury/family sedans with no major vices or, for that matter, outstanding virtues. Performance from the much improved 2.2-liter engine is more than adequate even with the standard automatic gearbox, and ride and handling are what you'd expect from domestic fwd cars in this class—soft and not very sporty.

### Exciting newcomer

But hold on. There is one exciting car in this new line. It's called the Dodge 600 ES (for Euro-Sport?) and comes with a new five-speed manual transmission, a special sport handling suspension, Goodyear Eagle GT tires on styled aluminum wheels, blackout trim, high-back reclining bucket seats, console, sport steering wheel and "talking dashboard."

Except for the incongruous (very un-European) fake fender vents and the stand-up hood ornament, the 600 ES looks the part of a European performance sedan—and it even drives like one. The five-speed makes the willing little engine come alive and the big tires and very competent suspension make it feel and handle like, say, an Audi 5000. The whole effect is to magically transform the nice but mundane 600 into a whole different car for a whole different kind of driver—one who really enjoys driving.

The five-speed also boosts the ES's rated fuel economy to a very respectable (for this size car) estimated 24 mpg city, 38 highway. If you're not into manual shifting, though, you can get the rest of the ES package wrapped around an optional automatic transaxle. You can also get it bolted to the 2.6-liter engine—but not with the five-speed.

Also new is Plymouth's Scamp version of the delightful Rampage sport minitruck. Available in basic Scamp and racy GT variations, this little hauler comes with the higher output 2.2 engine and four-speed transaxle (or optional automatic).

Like its Dodge Rampage twin, the Scamp is a ball to drive and even semi-useful as a load carrier. It offers amazingly gutsy performance along with excellent fuel economy and superb cornering capability. And for '83 the little pickup's braking ability is much improved with a new load-sensing rear brake proportioning valve that adjusts front-to-rear balance according to weight distribution.

The excellent Mitsubishi-built Plymouth Sapporo and Dodge Challenger coupes are far from new, but both offer a new "Technica" option package that's a real electronics buff's dream. On the instrument panel are a digital speedometer, a graphic LED tachometer shaped like a torque curve (similar to that in the Toyota's luxury Celica Supra) and heater/ac flow indicators that change color with air temperature.

### Stylish base cars

The small fwd Omni and Horizon lines have been simplified and generally upgraded for '83 with the strippo Miser models dropped and very nicely trimmed and equipped base cars—you'll never believe they're "base"—taking their places. Top-line versions are simply called Custom. Similarly, the TC3 and 024 designations are discontinued and the aerodynamic sporty coupes are now just Plymouth Turismo and Dodge Charger—or "2.2s" with the zippy performance package.

A 1.6-liter Four, purchased from Chrysler's French partner Peugeot, will be phased in as base engine for these cars as the 1.7-liter VW Four is phased out. Offering comparable performance and economy with lighter weight and better accessibility in the engine compartment, it generates 62 hp at 4,800 rpm and in the five-door hatchback sedan should deliver 34 mpg EPA city and 50 highway.

In addition, as we mentioned, Chrysler's own 2.2-liter Four is substantially upgraded for '83. Mostly due to improved electronic spark and fuel controls and better intake and exhaust flow, it offers 10 more horsepower (94@5,200 rpm) than last year's 2.2, and two to three more mpg besides. As optional powerplant in the Omni/Horizon sedans, for example, it gets 29 mpg city and 45 highway EPA ratings when teamed with the new five-speed. **PM**

## DRIVING THE '83 AMC CARS

(Continued from page 106)

wheel economy car from the hordes of similar transportation modules that issue from every corner of the globe at prodigious rates. From the back it looks like a Corolla. From the front it looks like a Jetta. And from the side it looks like a toolbox.

### Vive la différence

What does set the Alliance apart are its bolt-on front subframe, its transverse torsion-bar rear suspension, its relatively long wheelbase for so short a car, the rocking-chair pedestal front seats, and a couple of its options, like the infrared, keyless entry system and the dashboard vital fluids monitor.

The bolt-on front subframe borrows technology pioneered by Mercedes and Opel. You usually don't find subframes on inexpensive econocars, but the Renault benefits—as do other cars that use it—from better road and engine isolation.

As for the rear suspension, it's the trailing-arm type, but with one important difference: Instead of the usual coil springs, the Alliance uses a single transverse tube that houses torsion-bar halfshafts—one half bar per side. It's one of the most space-efficient rear suspension setups devised to date.

And, by the way, the Alliance uses suspension stabilizer bars front and rear, which improves cornering.

The car's relatively long wheelbase (as related to overall length: 97.2/163.8 inches vs. 94.5/167.3 for the Nissan Sentra), plus its rather small wheelhouses make for more room in the interior.

Pedestal front buckets, introduced last year on the Renault Fuego, increase rear legroom by letting rear riders stretch their feet forward alongside the two seat pillars. Meanwhile, the buckets themselves have six-way adjustments.

Finally, we come to those two gee-whiz gadgets that Alliance offers optionally. These are only two among many more conventional options that include power steering, five-speed manual and three-speed automatic transmissions, power door locks, air, cruise control and tach.

The two innovations are what AMC calls its Infracave Locking System and its Systems Sentry.

The Infracave Locking System gives you a key fob with a tiny battery inside it. When you point the fob at the car and push a button on the unit, an infrared light beam zaps a sensor on the instrument panel, and solenoids lock or unlock the doors.

The Systems Sentry mounts just

to the right of the driver's windshield pillar and has a battery of warning lights. The device monitors all the engine's vital fluids, from oil level to coolant to power steering, transaxle, washer, and so forth.

Under the hood, the Alliance reads like a textbook economy car. It uses the same 1.4-liter, square (same bore and stroke dimensions) push-rod Four as LeCar, but with either throttle-body fuel injection on 49-state models, or Bosch multipoint injection for California. The engine seems more refined and less buzzy than the LeCar motor, especially at high rpm. And, of course, the engine lies crosswise, unlike LeCar's.

Early EPA estimates put fuel mileage at 36 mpg city, 50 highway.

Looking at the rest of the AMC/Renault lineup, you'll find all the familiar nameplates: Concord, Eagle, Spirit, Jeep, Fuego, 18i and LeCar back on the scene for '83.

The Concord series is squeezed down to two models—a four-door and wagon. Also chopped from the line are the Spirit sedan and Eagle two-door. This leaves just the Spirit Liftback model and the Eagle SX/4, four-door and wagon models to carry the AMC pennant into '83.

Concord and Spirit models now have the 4.2-liter, 258-cu.-in., six-cylinder engine as standard.

Eagle vehicles still use the Pontiac Iron Duke 2.5-liter, 151-cu.-in. Four as the base powerplant. The Six can be checked off on the factory option chart. Eagles motivated by the four-banger will have more spirited performance due to higher rear axle gearing. The '83s use a 2.73 gearing compared to '82's 2.35.

### Jeep

Changes in the Jeep brigade are relatively minor. Engine mods for the six-cylinder passenger cars also carry over to like-powered Jeeps.

### Renault

Remember how confusing those three stalks were on the steering column of the 18i and Fuego models? Well, both models have been destalked by one.

In other changes, the 18i comes only as a deluxe model equipped with a standard five-speed transmission. The final drive ratio has been toned down from 3.78 to 3.44.

The Fuego gets the Infracave keyless entry system and a locking fuel filler door is thrown in when you order power door locks.

Those thrifty LeCars are now even stingier on a gallon of gas. A final drive gear ratio change from 3.63 to 3.10 is the benefactor. Driving fun is reduced proportionately. **PM**

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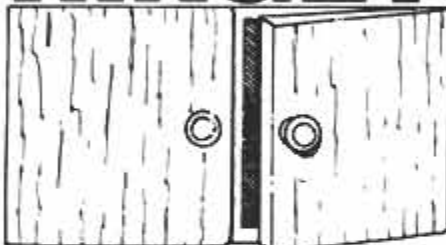
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## FINE NEW FIBERS

(Continued from page 109)

high mountains where it's too cold to rain and snow just dusts off your clothing—wetness should not be a problem.

However, Everest climber John Roskelley tells about a week of zero temperatures at high altitude when clothing was soaked with sweat from climbing. While testing sleeping bags using Quallofil, Du Pont's lat-



Warmth without bulk is from 3M Thinsulate in leather Robert Comstock parka, pants.

est polyester fiberfill, Roskelley found clothing could be dried with body heat inside the sleeping bags every night without the Quallofil insulation absorbing the moisture or losing its loft or warmth.

First, to produce fibers only one or two microns (millionths of an inch) thick compared to regular 25-micron polyester fiberfills, 3M found the ultrathins had special insulating properties and introduced Thinsulate several years ago. Because surface friction seems to hold air layers around the tiny filaments, less loft is needed and body warmth can be retained without the usual puffy look of down insulation. (Geese and ducks apparently keep up a comfortable core temperature and streamlined look without excessive fluffing up.) Thinsulate has made possible less bulky ski clothes and, because the material maintains warmth retention while under compression, it is now being used in gloves and boots, as well. The 3M product, unlike most synthetic insulators made from polyester, uses the olefin compounds of polypropylene for a compression-resistant Thinsulate and the addition of polyethylene where the insulation is less likely to be compacted.



Trim and light insulation in Wilderness Experience vest is with Eastman Kodolite.

Du Pont's new developments to keep us warm have been approached in a different way. To get more insulating air into the batting layer, they turned the solid polyester filaments into tubes that lighten the weight of the fiber while increasing its air-holding ability. Hollofil is the name of the product. Du Pont's micro-thin fiber is called Sontique and is designed for insulation in thin-silhouette clothing such as ski wear.

Latest of the Dacron fiberfills from Du Pont is just appearing on the market: Quallofil. It is similar to Hollofil, but Quallofil has four tubes inside every fiber to increase the amount of insulating air even more. The material is also reported to regain its full loft quickly after compression. Hollofil is used, in addition, for weaving the new warm and quick-drying pile materials such as Everel and Borglite.

Developed by Celanese and produced by Reliance Products in Oakland, Calif., Fortrel PolarGuard has earned a loyal following as the polyester fiberfill that has continuous filaments. This means that PolarGuard clothes, sleeping bags, and even insulating curtains can be made without any need for quilting, and the new, siliconized PolarGuard has an even softer feel.

And from the Eastman Chemical Products Div. of Kodak come three types of Kodolite polyester fibers. They are Kodofill, tubular filaments crimped for extra loft; new Kodosoff that has additional softness, loft and resilience; and Kodolite, with micro-fine fibers for light and trim insulation.

Forecast: Cold is on the way, but the new fibers should make for a warmer winter.

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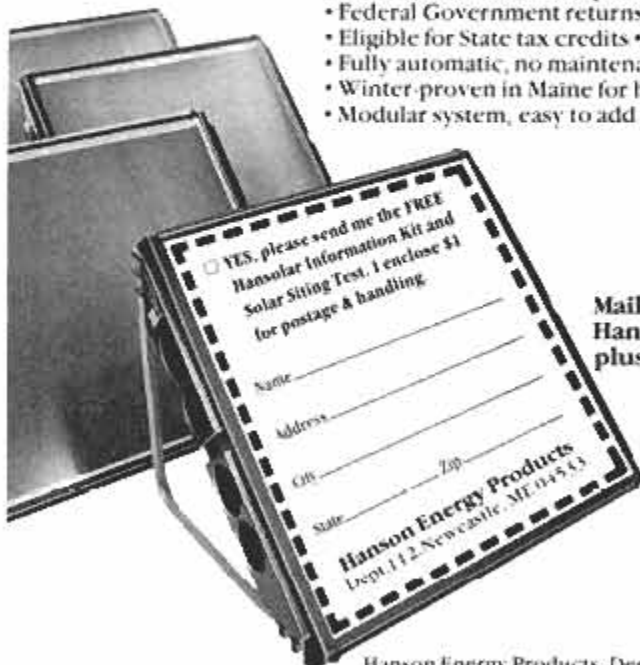
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## BEST STEREOS

(Continued from page 96)

full output) remains imperceptible.

The tuner section of the receiver is nondigital; however, it holds FM stations firmly in tune. Sensitivity suffices for most urban and suburban locations, especially with an outdoor antenna.

The little Boston Acoustics A40 speakers (small size is an important cost factor in loudspeakers) are a bit skimpy at the bottom. But within the available range, response is flat within 3 dB from 70 to 20,000 Hz. This exceptional smoothness of response—seldom achieved even in far more expensive speakers—nearly makes you forget that the lowest notes are weak. Besides, the bass of the A40s is so tight and well controlled that you can crank up the bass boost on the receiver without making the sound boomy. That way,



The Ohm Welsh 2 speakers feature a unique, inverted cone radiator that contributes to their excellent response and sound.

you get a very pleasing tonal balance, even for a full orchestra.

High-frequency response of the whole system is outstanding, with every tonal detail projected clearly and naturally. The tweeters scatter the highs over a broad angle (roughly 90° without perceptible off-axis loss), giving the system the kind of spacious sound usually associated with far costlier speakers.

The platter of the Technics SL-B202 belt-driven turntable spins without audible rumble, even with volume and bass boost way up. The tone arm tracks at minimal stylus pressure and the automatic return puts the arm to rest at the end of a record.

The Technics RS-M205 cassette deck is rather basic, but the sound is good. Flutter and wow are just 0.05 percent; signal-to-noise ratio with Dolby B is 66 dB; and frequency response (with Type II tape) extends to a very respectable 16,000 Hz.

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Here, in sum, is a budget system to rival the performance of many systems costing twice as much.

### 'Playroom'

There's nothing middling about this middle-class rig. With 30 watts per channel, Sansui's R-606 receiver puts out convincing orchestral sound or gut-throbbing rock bass. And the sturdy and remarkably efficient AR-38 speakers can take anything the receiver dishes out and project it with full force. Here's a system capable of doing justice to any kind of music.

There's enough power to fill a large room with concert-level sound, yet the softest whisper comes through with startling clarity against a virtually silent background. To sum it up, this system is a bargain at the price.

Even so, we won't pretend that our "Playroom" rig is without compromise. The point is that the designers of these components have chosen their compromises wisely. With evident intelligence, and maybe a bit of luck, they've managed to shave costs precisely at those points that least detract from the experience of the music.

The particular components we picked offer not only excellent performance, but also an array of advanced operating features and conveniences. For example, the Yamaha P-751 direct-drive turntable has automatic start and cuing, as well as automatic tone-arm return and stop.

Sansui's R-606 is fully digital, assuring the ultimate in tuning precision. Up to 12 station frequencies can be stored in memory and summoned up at a single touch. What's more, there's a scan mode which searches out available stations, and the THD of this unit is a commendable (and inaudible) 0.07 percent.

As for the Dual C-814 cassette deck, it's the product of a company noted for its outstanding turntables; it has the feel of being built to tight mechanical tolerances. A particularly useful feature is the automatic tape selector, which senses the type of cassette placed into the loading slot and automatically adjusts bias and equalization.

A lot of experienced listeners feel that components in the mid-price bracket give the highest return of pleasure for each dollar spent. The components listed here give added evidence for this opinion.

### 'Penthouse'

If the "Playroom" system is so good, why move up to the "Penthouse"? For starters, our top-of-the-

line system can burst forth into great cascades of symphonic sound without any audible trace of effort, lay a deep foundation of solid bass under the musical structure and remain unfazed even by the earthquake notes of a great pipe organ. Also, it's turntable is so quiet that no rumble obtrudes, even with extended bass response and a sound spread so spacious that your living room will sound like a concert hall. Add to this an FM tuner that does more tricks than a trained monkey and a cassette deck with elaborate refinements, and you've got a good picture of our top-rank choices.

The Thorens TD-105 Mk II belt-driven turntable is an outstanding example of Swiss-precision mechanics. It's exceptionally quiet and the automatic return of its ultralight tonearm is activated by a velocity sensor that puts no mechanical drag on the motion of the arm.

### All-time tracking champ

I haven't said anything about the phono cartridges in the other systems, because there wasn't much to say. They do their jobs and do them well. Here, however, we picked the Shure V-15 Type V, which may well be the world's finest cartridge. Its response is as flat as a mirror, and a dynamic stabilizer helps the cartridge ride out the ups and downs of warped records without any audible thumps. We played some grueling test records with it and we're convinced it's the all-time tracking champ.

As for the receiver, Sony's STR-VX6 is one of the most advanced and sophisticated audio items ever designed. At 70 watts per channel, it packs as much power as anyone is likely to need in a home, even if he likes his music to register on the Richter scale. Distortion is a spectacular 0.006 percent THD—almost too small to be measured. This is the result of Sony's exclusive "legato linear" circuit, which cuts down so-called switching distortion between each half-cycle of the waveforms to be amplified.

The tuner section incorporates the "direct-comparator" circuit, a new development which yields extremely quiet background, even with relatively weak signals. This makes the STR-VX6 ideal for fringe areas.

The digital front end allows for 16 memory presets. In addition, there are three separate scanning modes: The unit scans up or down the dial for the next station and holds it. Or it can hold the scanned station for 4 seconds, then move on to the next. The third scanning mode scans only

those stations which you have preset in memory. As an added option, you can restrict the scanning in any mode to only those stations strong enough to come in clearly.

Onkyo's TA-2070 cassette deck, aside from being a superb performer is equally feature-laden. Offering the new Dolby C noise reduction (in addition to the standard Dolby B), it banishes every audible trace of tape hiss, letting the music emerge against nearly total silence. Its three-head design lets you monitor your tapes while you're recording them, so you can correct any maladjustment instantly. The dual-capstan transport keeps tape tension constant as the supply reel unwinds inside the cassette, limiting wow and flutter to a minimal 0.021 percent.

Most importantly, the *Accubias* feature test-runs each tape to determine the optimum bias setting and then applies the correct bias automatically. This assures the best possible recording from whichever tape type you have chosen. The recording head itself is made of Sendust, an alloy that concentrates magnetic flux, thereby extending frequency response on high-bias tapes to 19,000 Hz. As an added convenience, a computer-controlled, real-time tape counter lets you know exactly how much recording time remains on your cassette.

### Super speakers

But the real clinchers in our top system are the Ohm Walsh 2 speakers. Named after the late Lincoln Walsh, the physicist who first formulated this patented speaker concept, they are unique both in their outer shape and their sophisticated innards. Their inverted cone radiator maintains proper phase relationships throughout the audible range, while spreading sound in a full circle. In this model, rearward radiation is attenuated through a sound shield to prevent wall reflections from the immediate vicinity and resultant placement problems.

A conventional tweeter augments sound output in the uppermost range so as to restore whatever stereo directionality might otherwise be lost in the overall sound scatter. The net effect is a wonderful sense of total immersion in sound. Add to this the exquisite clarity of the treble and ample bass, free from false boominess, and you have a speaker that speaks the musical truth.

All in all, our "Penthouse" rig pretty much meets the ultimate audio test: It makes you unaware of its presence. You feel there's nothing between you and the music. **PM**

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## DRIVING THE '83 GM CARS

(Continued from page 100)

ground via Goodyear Eagle GTs, alloy wheels and as much roadholding hardware as the engineers can cram between the fenders. The interior receives the full treatment, with Recaro seats, a gauge package and unique trim touches. With all this muscle, the STE designation should probably stand for steroids, a badly needed original equipment additive which the A-car has finally gotten.

But while Pontiac is working hard to position itself as GM's "driving excitement" division, there's good news for enthusiasts at the other divisions, too. Buick's elegant Riviera convertible will be joined early next year by a pair of more youthful and much less expensive flip-lid front-wheel-drive J-cars: Chevrolet's Cavalier convertible and Pontiac's 2000 Sunbird.

Chevy's gutsy 135-hp HO (high-output), 2.8-liter V6 becomes available in any compact Citation as well as in many other GM cars. Olds offers a European-style ES sedan and ESC coupe versions of its compact Omega, plus a hot new Hurst/Olds Cutlass. Buick boasts no less than five different T-type performance models, and even stodgy old Cadillac touts a tastefully turned-out and fine-handling Eldorado Touring Coupe.

The nice, but formerly sluggish import-fighter J-cars (Cavalier, 2000, Firenza, Skyhawk and Cimarron), have livelier performance across the board thanks to new 2.0-liter pushrod, and 1.8-liter overhead-cam engines—both electronically fuel-injected—plus five-speed manuals and quicker responding automatic transaxles.

Beyond that are expanded availability of fun-driving, fuel-saving, five-speed manual transmissions in Chevy Chevettes and Camaros and Pontiac 1000s and Firebirds, as well as four-speed automatics in various other car lines.

And there are loads of other improvements and refinements throughout the extensive General Motors lineup, ranging from upgraded seats and interior trims to significant power train developments to new super stereo sound system options.

### Chevrolet

Gearing up for economy is the game being played over at Chevy. Cavalier gets a five-speed transaxle with a 2.83 final drive and overdrive ratios in fourth and fifth. The Cavalier ME version's supertall 2.36 final drive hits the EPA charts at 30 mpg

city and nearly 50 mpg highway. But the lazy gearing lessens the driving fun.

The hot-selling Camaro isn't much quicker with its new fifth-gear overdrive, but the new four-speed overdrive automatic on dual TBI V8 Z28s does bump 0-to-60 time to about 8.5 seconds.

The Celebrity A-car can now be ordered with the peppy, Olds-built 4.3-liter diesel, while over in Chevrolet land, five-speed and new styling is the big news.

Finally, the 4.4-liter V8 is replaced by the more powerful 5.0-liter V8 as optional in Monte Carlo and standard in the Caprice wagon.

### Pontiac

Pontiac's answer to the European performance sedans is the 6000-based STE. The six-light front end, full-width blackout taillamps, subtle two-tone paint combinations and aerodynamic cast-aluminum wheels set it apart visually. The 135-hp HO V6, coupled to the standard three-speed automatic transaxle, gives it 11-second, 0-to-60 muscle, and fat Goodyear Eagle GT tires glue it to the pavement on twisty roads.

Inside is an electronic Driver Information Center that displays door/hood/deck ajar, exterior lamp and fluid level, including fuel status, plus oil pressure, voltage and even driver-programmable service intervals.

Firebird shares the Camaro's four- and five-speed gearboxes, with the dual TBI Trans Am getting the optional four-speed automatic. The S/E model now has the HO V6 as standard.

The fwd 2000 (formerly J2000) comes across with better motivation and economy with the new 1.8-liter OHC injected Four and standard five-speed box.

Face- and taillifts are the order for Phoenix and 1000. The former gets the HO V6 and handling goodies in the sporty SJ model, while the latter is available with a five-speed and also the Isuzu diesel Four.

Grand Prix and Bonneville get a new optional 5.0-liter V8 to replace the 4.1-liter V6.

### Buick

Buick's T-Type series, ranging from the small fwd Skyhawk to the personal luxury fwd Riviera, all offer unique appearance, special features and improved performance and handling compared to ordinary models in the same car lines.

The fwd compact Skylark (X-car) gets an aerodynamic rear decklid with a built-in spoiler plus new optional electric remote control out-

side mirrors. The T-Type Skylark coupe comes with the HO V6 engine, and Gran Touring suspension. It's the fastest and best handling of the bunch.

Both rwd Regal coupe and fwd Riviera T-Types feature Buick's famous 3.8-liter turbocharged V6, which boasts 180 hp, improved electronic knock-sensing and other refinements for 1983. Both come with automatic transmission only.

#### Oldsmobile

Hurst/Olds 1983 features a 180-hp, 5.0-liter V8 engine, special heavy-duty handling suspension, tires and wheels, full instrumentation, graphics, front airdam, hood scoop and a rear deck spoiler. There's a weird three-stick Hurst Lightning Rod shifter controlling the four-speed automatic transmission.

The fwd compact Omega X-car comes in Euro-look ES (sedan) and ESC (coupe) versions. Both have handling suspensions and are available with the HO V6 engine. The ESC features exclusive damage-resistant, soft plastic front fenders.

#### Cadillac

GM's luxury-car division is first to can the carburetor with across-the-board fuel injection for '83. This starts with J-car Cimarron's new EFI 2.0-liter engine and extends through the other models.

Cimarron also gets the much needed five-speed transaxle as standard (the automatic remains optional), plus an appearance upgrade to pull it away from the other J-car sedans. Cadillac offers its special Touring Suspension as an option on any fwd Eldorado or Seville and all the big Cadillacs need is more power than the standard 4.1-liter V8 can possibly provide. A new feature is the Delco/Bose optional sound system (available in Eldorado and Seville, plus Olds Toronado, Buick Riviera and the coming all-new '83 Corvette). Each speaker enclosure—two in the lower front doors and two on the rear package shelf—includes its own amplifier, a dynamic noise reduction (DNR) control, a tape equalization switch and Dolby noise reduction. It'll be a \$700 to \$800 option, and you have to hear it to believe it!

There it is: a carryover year allowing extensive power train and feature refinements while the world's largest automaker takes a welcome breather from its long series of major new-model introductions. But it all starts again soon—maybe too soon—when the super-exciting new Corvette makes its bow next spring. **PM**

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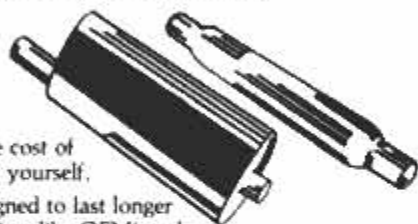
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Precision 32" radial unit has standard features and many extras. Depth of throat up to 16". Head tilts and table stays level. Drills to center of a 32" circle. Cast iron and steel. Less motor, belt and pulley. 30 lbs. f.o.b. factory. **\$89.90**

**7** **WOOD SHAPER KIT**



Makes beads, coves, moldings, tongue-and-groove joints. Accurate at high speeds. Sealed and greased for life ball bearings. Less wood. Takes 1/3 h.p. motor or larger standard cutters. Opt. hold down assem., \$4.50 add'l. 6 lbs. f.o.b. factory. **\$39.90**

These power tools have no chrome, embossed nameplates or any other useless extras... but they do the same job as tools costing 2 to 3 times the price! And their performance has been proven in the shops of literally millions of professionals and serious amateurs.

Don't be misled by AMT's low prices; these are quality tools. They are full scale, full speed and offer top performance and precision. There are good reasons why we are able to offer such values. Here is how we do it!

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**BRAND NEW ELECTRIC MOTOR**  
Develops a full 1 h.p., 17 lbs. f.o.b. factory (purchased separately \$54.05) \$49.00

**AMT OFFERS TWO GUARANTEES:**

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Try any of these power tools and compare it with any similar machine at any price. If not satisfied return it for prompt no questions asked refund! We pay the return shipping charges.

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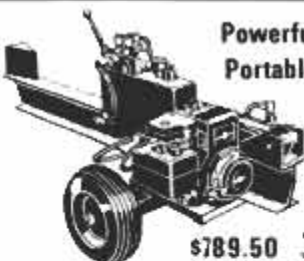
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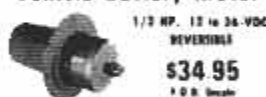


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#9-1062 or #9-075

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55-GAL bottom kit factory pick-up

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\* PATENTED INTERNAL DRAFT CHANNEL. Air entering top draft control is pre-heated as it is drawn down inside of door, and is sucked into bottom of heater with a turbulent action, mixing with the wood gases. This makes the Sotz stove most efficient. Also, it's impossible for hot sparks to jump out of heater as in others with draft straight open to fire.

\* Top drum kit squeezes 60% more BTU'S from heat normally lost up the chimney.

\* Engineered to limit metal temp. of barrel to prevent burn up.

\* Heavy all steel kit won't crack as poorly made cast iron imports with undersized door openings.

\* 55 Gal kit has a king-size 15½" diagonal opening for easy loading, less splitting of wood.

\* 30 Gal. Sotz has bigger opening (9¼" Rnd.) than other brands' 55 gal. kits.

FREE info. about heating water, drying wood, fireplace-to-woodstove.

Sotz Corporation, 13643 Station Rd., Columbia Station, OH 44028

## LEAKY, UNCONTROLLABLE

Send me one of your barrel stove kits. I've seen your ads for years in the Mother Earth News, but was under the impression your kit was like one my father has used for years: leaky, uncontrollable, etc. In my work as a chimney sweep, I met Peter King of Gonsvoort, N.Y. He was very impressed with your stove kit, and after cleaning his chimney this past season, I'm impressed too! I know how long his stove holds a fire - because after being unattended for 2 days, it's been too hot to handle and the creosote deposits were consistent with most well managed airtights. Congratulations!

Jeff Payne, Fort Edward, N.Y.

## ON THE LEVEL! Called B.B.B.

Several months ago my husband asked me to order him the Maul. ...I still didn't trust sending my money to Ohio and receiving an inferior product in return. I called your B.B. office to check you out before I ordered. You are on the level. My husband and son appreciate the good workmanship of the maul and it really works as you say. Very very well. We also ordered the top drum kit. Keep up the good work we are telling our friends about your products.

C. Simon, Birmingham, Al.

## NO OVERSEAS JUNK

I would like to commend you on your heater kit. With Illinois winters being what they are I expected to cut at least seven or eight cords of wood. But your fifty-five gal. unit gives so much heat for so

little wood used and keeps hot coals longer than I expected. It is going to take a lot less wood than I figured. . . This bottom heating unit does a fine job heating up our four rooms. I am glad there is a company that's making a heater kit that is affordable. What this country needs is more quality items at decent prices, instead of expensive junk from overseas. Thanks for a great product.

Vernon Dace, Rushville, Il.

## A HOT DESIGN

I purchased a stove kit last year and installed it on a Rudd 50 gal. commercial copper-lined gas water heater. The stove required only a small amount of fuel to hold a good charcoal fire. I wish also to congratulate your engineers on the excellent door design. The door is actually air tight and does not warp with high heat. Please enter my order for a standard stove kit for a 55 gal. drum. P.S. I am a retired design engineer.

Paul Fontaine, East Moline, Ill.

## DOUBTING THOMAS

Two winters ago, I purchased your drum kit. . . We are heating a 24' x 31' basement, and 26' x 31' ranch home with cathedral ceiling. Last winter, we burned about 3 cords of wood which kept our home at 75-80°. We would not part with this set up for any other stove or furnace in the world. Wherever we have anyone come into our home they are amazed at how warm our house is especially when they see how we heat it. We have gone away for 3 days after filling stove and

found hot ashes when we returned and house is still warm. I also like the idea that I can cut wood 24" to 30" long. So pleased with this barrel stove we got our son-in-law who was a doubting Thomas to put one in his home. He was soon so convinced and sold on it that I helped him put another barrel in, so he has the 2 barrel set up for his 7 room house.

L. Sierpinski, Alstead, N.H.

## NO BARREL OF PICKLES

I have a three year old double barrel stove and couldn't be more pleased. It's just as good as the day I built it. There was an Earth Stove in our house when we moved here and my barrels out perform it 100%. As far as I'm concerned there isn't a more practical, useful, or easier-to-operate stove in the world. If more American manufacturers delivered on their claims for their products the way Sotz does, our country wouldn't be in the pickle it's in now.

L.E. Peterson, Connersville, Ind.

## HEATS 2,220 SQ. FT.

Received lower barrel stove kit 55-H...and was very pleased with the results of this heater's operation. It was placed in service...and it heated two floors 2,220 sq. ft. to about 75° with outside temp. of 20°. I am now ordering the top kit DD, Lift-n-Saw TL, and the Monster Maul. For once I ordered something by mail that was better than advertised.

Edward F. Dostert, Augres, Mi.

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I started in Mail Order a few years ago, part time in my garage. I had less than \$100. I discovered how to make Mail Order pay big. Today my business empire spans the globe... 1,253 acres of land, office buildings, warehouses. My Plan lets you use my experience to make a fast start in your own big profit home business.

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Just a few hours a week part-time at the start! Then branch out into full time! Keep present income while adding welcome "second income." Use Mail Order profits for travel, savings, education, retirement. It's up to you.

I learned long ago the success secret in Mail Order is picking the right product. I reveal in my Free Course 3 tests your product must pass to be a Mail Order winner! I'll show how to make up simple little ads that bring in orders and cash. Everything I tell you is based on my own success. I know it works.

**BUY BELOW WHOLESALE FOR BIGGEST PROFITS**

Imports are great for Mail Order. I travel the world searching out new imports you can turn into quick profits. Start with 24,221 best selling imports. Deal in one or many. Buy Below Wholesale direct from overseas supplier. You keep all the profit. I will also

reveal my Drop Ship Plan that starts you with little or no product investment. Buy one at a time or in quantity.

**1000's NEW PRODUCTS EVERY YEAR**

With my Plan you get free Membership in International Traders. Vast world wide organization keeps you supplied with new products every month to sell by mail or other ways. Members also attend my personal seminars held in cities near you. Mail coupon for Course and home business report. No charge or obligation. No salesman will call! Find out what Mail Order holds for you!

**FREE MAIL ORDER COURSE COUPON**

The MELLINGER Co., Dept. R225A  
6100 Variel Avenue, Woodland Hills, CA 91367

Send Free Mail Order Course... Show me how I can start a Mail Order/World Trade Business of my own. There is no obligation; no salesman will call.

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City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

\*Save 3 days, give ZIP for fast reply\*

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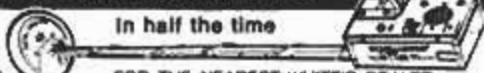


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PA-2

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# FINEST QUALITY

## Master Assortment

How many ads have you seen over the years for hardware assortments? Each of them with a zillion little pieces that claim to meet every conceivable need known to man? For a price so low it's unbelievable?

Well, this isn't one of those ads.

### WE SELL QUALITY

I'm Paul Reid, President of Reid Tool Supply Company. Our family-owned company has been in the mail-order business since 1948, supplying industry all over North America with specialized, high-quality tools. Recently we decided to use our knowledge of industry-standard tools to come out with a line of items for the home handyman or hobbyist.

Our Master Assortment pictured above is one of those items.

It's not intended to be the largest assortment on the market, although it is larger than some we've seen. Nor is it the least expensive, although it does cost less than some. Our Master Assortment does include, however, a very substantial 1,120 pieces of industrial-quality hardware that are all plated to resist corrosion.

### POPULAR SIZES

At Reid Tool, we have spent a lot of time researching the most popular sizes of all these fasteners. Included are seven sizes of hex head cap screws, two sizes of hex nuts, six sizes of machine screws, two sizes of machine screw nuts, two sizes of lock washers, two sizes of flat washers, nine sizes of sheet metal screws, five sizes of wood screws, six sizes of cotter pins, two sizes of plastic anchors, and three sizes of wire nuts.

In short, I think we have the finest assortment available anywhere. Items that won't rust right before your eyes. Pieces that won't strip when you put some muscle on them. Sizes that make some sense!

### CARRY IT WITH YOU

But maybe the thing that fascinated you most about the picture at the top of this ad is the box we pack our Master Assortment in. It's the neatest heavy-duty steel box I've ever seen. It can be latched and carried with you to the job. And that means no more fumbling around with glass jars filled with odds and ends. No more searching through rusty coffee cans only to discover you have to go back down the basement to get the right one.

Our 24-compartment box is manufactured of prime cold rolled steel, with a good strong latch and full-length cover hinge. When latched, the cover fits snugly, so items won't spill from one compartment to the other. Even the compartment bottoms are rounded to allow for easy removal of parts.

The box is finished in rust- and acid-resistant baked enamel in your choice of four colors: Medium Blue, Metallic Gray, Desert Tan, or Satin Black. It measures 13 1/2" W x 9 3/4" D x 2 1/2" H and weighs a hefty eleven pounds including the fasteners.

### BEST HARDWARE VALUE

If you purchased all of the items in our Master Assortment in small quantities at the hardware store, we estimate you would spend nearly \$100.00. Our price, including the box, is only \$25.95. A terrific buy when you consider what you get.

But I want you to see, up close, our quality. So order your own Master Assortment and carry-box and look it over piece by piece. Then decide if you want to keep it. If for any reason you're not satisfied, return it in original condition within 15 days and we'll refund your money. No questions asked.

To order, just fill in the order form below and send it to us with a check or money order. Visa or MasterCard holders call toll-free 1-800-253-0405 (in Michigan call 1-800-632-0165). When ordering by phone, it's helpful to have the order form filled in and our item number handy so our operator can give you faster service. Order yours today. It's a hardware value you'll appreciate for years to come.

### ORDER FORM

Please ship \_\_\_\_\_ Master Assortments Item No. 10024 @ \$25.95 plus \$4.50 shipping and handling each (total \$30.45). Michigan residents add \$1.00 sales tax.

Ship to:

Name \_\_\_\_\_

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City \_\_\_\_\_

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Blue  Gray  Tan  Black

Enclose check or money order

Dept. PM02  
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**Reid** Tool Supply Company

# LOGHOG

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CUTAWAY VIEW



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Is it here a modern working version of the legendary Pogue high-mileage carb? Inventor Ray Covey says YES, reveals secret! Sealed carburetor (laborer is heated by hot coolant in coil manifold gases in base. Fuel sprayed-in is vaporized, drawn into existing carb by engine vacuum on demand. System is NOT pressurized.

Covey's Vaporizer runs on "regular," high as 100 to 1 air/fuel ratio. Dual system, instant change-over. Compact (about 8" high) under-hood device it reportedly safe, easy to build. Cost? Low as \$75 with stock/used parts. Many units in use, but Covey seeks more performance data, many vehicles before manufacturing Parts Kit.

Join our Road Test Team! Build a vaporizer for your car/truck. We'll send complete working plans, specs, instructions and parts list that can cost you NOTHING!

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1982

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**More than 10 times as effective than popular air filter units in removing smoke, pollen and dust!**

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IG-700

Our research shows that the **ZESTRON IONAIR** is the most cost effective air cleaner currently on the market. The IG-700 operates for pennies a month and has nothing to wear out or replace, like expensive filters.

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**A free remote ion detector comes with each ZESTRON to verify and compare output. When you place the detector next to a ZESTRON and then a competitive unit, you will see greatly reduced or no ions from the competitive unit!**

Don't buy any ionizer without comparing output

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Executive Air	640,000	\$189.95
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Ion Fountain	540,000	\$129.95
Energair	438,000	\$79.95
Ion Cloud	350,000	\$79.95
Ionosphere	350,000	\$99.95
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**OUR 26TH YEAR**

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**24" OAK**

## WORKS WHEN OTHERS WON'T

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Bob Fitzpatrick, Souder, Mo.

## MONSTER BEATS MACHINES

Last summer I ordered a Monster Maul. It does such a terrific job. I would like one for my nephew. I have a screw splitter and also a hydraulic splitter, this Monster Maul beats both of them. Only this week I was visiting my sister. . . She had a big pile of stringy oak, that had been cut about 4 weeks. I put my cone splitter on, thinking it would do the job. I found out the only good job was done by my M-12. . . maul.

A. Chandler, Lancaster, Ca.

## MONSTER MAKES HIM A BELIEVER!

Quite frankly, I ordered the "Monster Maul" because of your no risk money back guarantee. I figured I would try it and if it didn't work out I would return it and the real loss would be yours, not mine. Well, you won't be getting it back. You made a believer out of me. . . the Monster Maul does get the job done and for the money, it's the best bargain around. Thanks for a darn good product at a price that is "easy" to live with.

John Geras, Bolingbrook, Ill.

## A SURPRISED BELIEVER

I have really been impressed with your 12M Maul. Prior to purchasing it I had used a 8# Go-Devil which had the problem of getting stuck. This was a time consuming problem. I saw your ad on the Monster Maul in one of my farm magazines, and decided to try you out. I must admit I was doubtful that it would work as well as your ad showed. I had several large pieces of oak that had been giving me fits trying to split. I unpacked my new Monster Maul and took it out to the old wood pile. Was I surprised, even though it was 4 lbs. heavier than my old go-devil it was much easier to swing. (Seem to be much better balanced.) It never stuck once, and did I ever split that oak up. A believer I became. My biggest problem now is keeping my neighbors away from it so I can use it myself. Please find enclosed my order for a Lift-N-Saw. I really appreciate your products.

J. Allen, Greenville, Tenn.

## LANGLEY'S PLEASURE

Ker Paw!!! means one good swing with my Monster Maul and my block of wood is cut in two. What a wood splitter it is and the metal handle is no draw back at all. I've always liked to cut and split wood, but my...Chain Saw; my Sotz Lift-N-Saw, and my Sotz Monster Maul has taken the chore out of it, and replaced it with pleasure.

Tom Langley, Canon City, Co

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I first saw your Monster Maul advertised

in Mechanix Illustrated. . . I was truly amazed when I discovered that it actually performed EXACTLY the way you said it would. Not one single testimonial that accompanied the maul was overstated in even the smallest detail. . . I quartered 3 1/2 ft. long green fir log sections, 18" to 30" dia., with four swings. . . I only weigh 160 lbs. . . and it was in no way exhausting. When I see others weighted down with two mauls and two wedges to do the same job I do but take twice as long, I count it as Providence that I responded to your ad before I threw my money away.

Dave MacGregor, Washougal, Wa.

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I'm very pleased with my single 55 gal. barrel kit and am adding the top unit. I must say I was skeptical at first but am very impressed with the performance. I'm just glad I didn't sink 4 or 5 hundred in a fancy but less functional stove. Thank you for a quality functional product at a fair price and with good service.

Jon Jackman, Cartersville, Il.

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Brenda Conine, Ketchum, Ok.

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(Continued from preceding page)

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# 1 Million Famous LCD Quartz Calendar Watches To Be Sold For Only \$5 Apiece In Mammoth Publicity Drive

*All who wish to apply for a watch  
should write to the company before  
Midnight, December 25, 1982*

NEW YORK—One million famous LCD Quartz calendar watches will be sold as part of a publicity campaign for only \$5 apiece to the first one million persons who apply in writing to the company before Midnight, December 25, 1982.

These are the same nationally publicized LCD Quartz watches advertised in The New York Times, TV Guide, Parade and other leading publications, with a built-in computer so powerful it never needs winding and which is accurate to within seconds per month. Time and date are displayed in full Quartz digital mode; and a unique "backlight" allows viewing even at night or in total darkness.

These famous LCD Quartz calendar watches will not be sold at this price by the company in any store. The only way to obtain one at this price is to apply in writing to the company address (below) not later than Midnight, December 25, 1982.

Each watch carries a full one-year money back guarantee and will be replaced by the company, free of charge, if it ever fails to function.

There is a limit of two (2) watches per address at this price, but requests which are mailed early enough (before December 17) are permitted to order up to 5 watches.

To apply for an LCD Quartz calendar watch, mail your name and address *and this original printed notice* together with \$5 for each watch desired. Add only \$2 shipping and handling no matter how many watches you are requesting. NOTE: Specify model and color choice for each watch as follows: Men's Gold (Item #20710A), Men's Silver (Item #20720B), Ladies' Gold (Item #20730C), Ladies' Silver (Item #20740D). Mail to: **Delucca, Goldrich & Lord, Ltd., Calendar Watch, Dept. 114-2, Box 1020, Westbury, N.Y. 11595. (D20700)**



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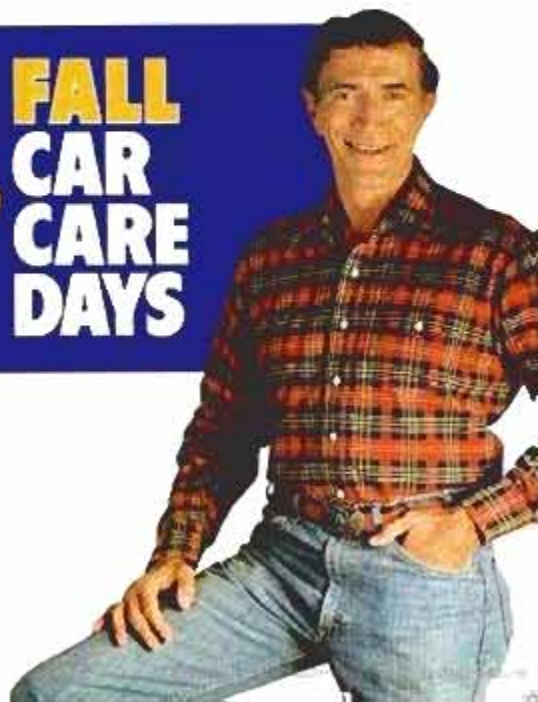
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A black and white photograph of a man with a beard and mustache, wearing a plaid shirt, playing a trumpet. The trumpet is the central focus, with its large bell on the right side of the frame. The man's face is in profile, looking down as he plays. The background is dark, making the man and the trumpet stand out.

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