

MARCH 1987 \$1.50



BUILD IT YOURSELF
A Classic Gentleman's Wardrobe

Popular Mechanics

SUPERCAR TEST!

FLAT OUT IN AMERICA'S FASTEST CARS

HOW TO GET AMERICA BACK IN THE SPACE RACE
by Wally Schirra



Chevrolet Corvette B2K Callaway and Buick Regal GNX



And for 1987, Tempo is the only car made in America that's offered with an optional driver's side airbag restraint system.

► **DECISIONS, DECISIONS, DECISIONS.**

Also new for 1987 is the sure-footed Tempo All-Wheel-Drive. With its "on-command" system you can move between front-wheel-drive and all-wheel-drive with a touch of the dash-mounted selector switch.

As you can see, the only disadvantage may be deciding which Tempo is right for you: the well-equipped GL series, the luxurious Tempo LX or spirited Sport GL—available for sale or lease at your local Ford Dealer. (When you order Tempo Sport GL or LX models with standard 5-speed manual transmission, we'll equip it with air-conditioning at no extra charge.)

Ford Tempo for 1987. Its outward form reflects its inner beauty. And that's what being true to form is all about.

► **ONLY FROM FORD: 3-YEAR UNLIMITED MILEAGE POWERTRAIN WARRANTY.**

Ford's powertrain warranty covers you for three years with unlimited mileage. It's a combination unmatched by any other American manufacturer. Ford's warranty covers major powertrain components on all 1987 Ford cars. Limited warranty and certain

deductibles apply. Also, participating Ford Dealers stand behind their customer paid work with a free Lifetime Service Guarantee. It's good for as long as you own your Ford car. Ask to see the Powertrain Warranty and the Service Guarantee when you visit your Ford Dealer.

AND HOW WE STAYED TRUE TO IT. FORD TEMPO.

► **FORD. BEST-BUILT AMERICAN CARS... SIX YEARS RUNNING.** "Quality is Job 1!" In fact, for the past six consecutive years, Ford quality has led all other American car companies. This is based on an average of owner-reported problems in the first three months of service on '86 models, and in a six month period on '81-'85 models designed and built in North America.

Have you driven a Ford...lately?



FORD TEMPO



Powertrain: 2.3 liter HSC (High Swirl Combustion) 4-cylinder; electronic fuel injection; front-wheel-drive; 5-speed manual or optional FLC automatic transaxle.

Facts and Figures: Seating: 5 passengers
Luggage Capacity: 12.9 cu. ft.*

Notable Standard Equipment: Tempo GL includes power rack-and-pinion steering, power front disc brakes, fully independent suspension, interval wipers, electronic digital clock and many other standard features.

Tempo LX (pictured) includes all of the above, plus power door locks, electronic AM/FM stereo, tilt steering, sport instrument cluster, touring suspension and much more.

Safety Features: Optional driver's side airbag restraint system; split diagonal hydraulic brake system; high-mount stop lamp; rear door child-proof locks, and many other vehicle and occupant protection features.

FORD TEMPO ALL-WHEEL-DRIVE



Powertrain: 2.3L 4-cylinder HSO (High Specific Output); electronic fuel injection; automatic transaxle.

Drive System: A dash-mounted system which—via a selector switch—allows the driver to switch between front-wheel-drive and AWD on-the-fly or standing still.

FORD TEMPO SPORT GL



Powertrain: 2.3L 4-cylinder HSO (High Specific Output); electronic fuel injection; 5-speed manual transaxle.

Notable Standard Equipment: 14" spoked aluminum wheels; performance suspension package; sport instrument cluster; leather-wrapped steering wheel; electronic AM/FM stereo radio with cassette tape player.

*Based on SAE Cargo Volume Index.

The 5-passenger Ford Tempo has an advantage few other cars can offer: an outward form which actually improves the way it drives.

▶ **HARNESS THE WIND: HARNESS THE ROAD.** You'll feel it in a tight turn: an uncommon sense of directional stability and cornering agility. It's handling you might not expect in a "family" car—the result of Tempo's aerodynamic outward form, which reduces front and rear lift.

▶ **FORMED WITH AN INNER STRENGTH.** Tempo's smooth form is extremely strong, too: its unitized body construction requires over 1,600 robot-directed or automated weld points. The result is a tightly-built, lightweight body that's a perfect platform for the rugged 2.3 liter High Swirl Combustion engine. And a fully independent suspension—with each wheel reacting individually to the road—gives Tempo a supple, balanced ride.

▶ **GOOD DRIVERS: A PRODUCT OF THEIR DRIVING ENVIRONMENT.** Tempo's design lets the *driver* perform better, as well. With features like expansive glass areas for a high degree of visibility. Controls which are easy to use. Quick-read instruments. Seats which keep you comfortable, yet alert.



Buckle up—Together we can save lives.



FORM.

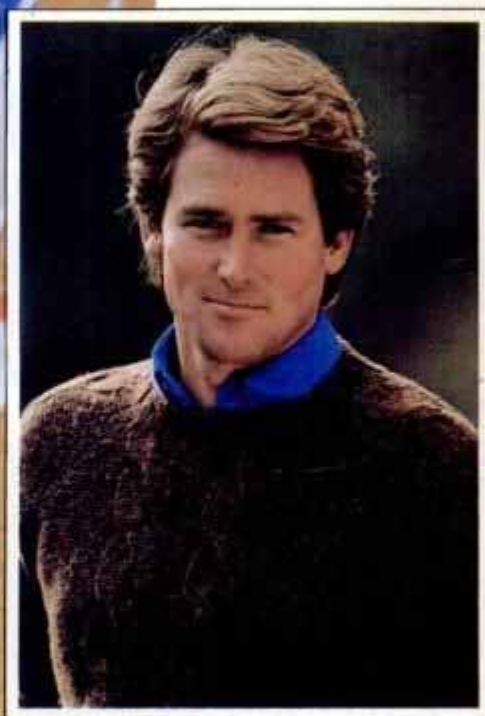


110% PROTECTION



Speed Stick[®] Deodorant. The Wide Stick.[™]

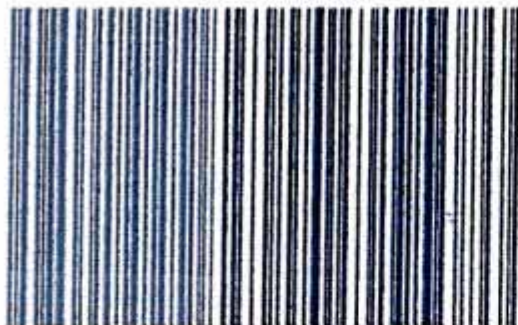
*It has no alcohol
to evaporate.
Its protection
lasts 24 hours.
That's 110%
protection.
That's your edge.*



1. Follow instructions on the other side

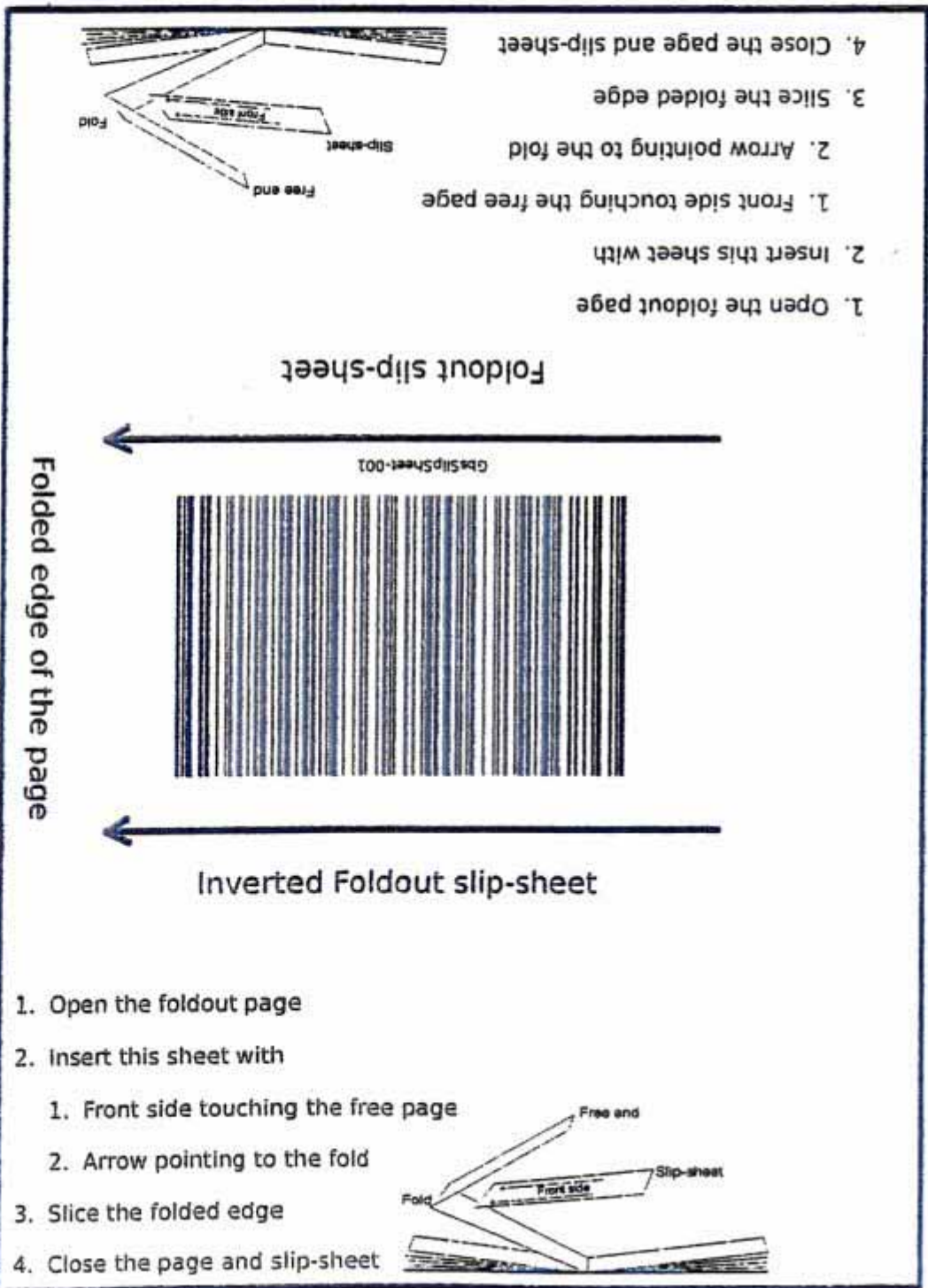
Back

Gbasipack-0018

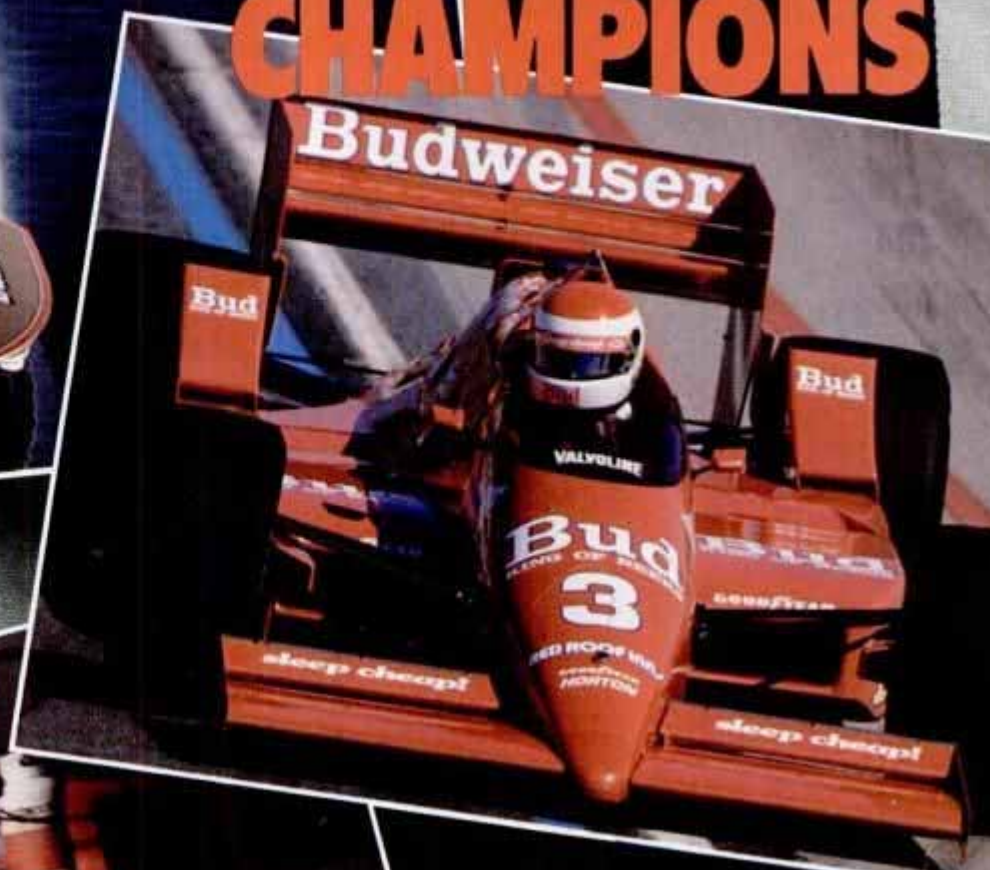
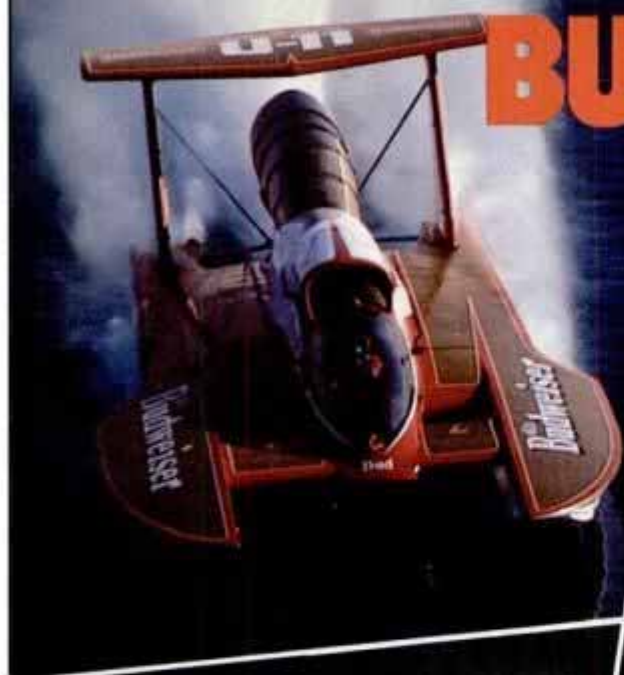


Inverted Back

1. Follow instructions on the other side



BUDWEISER NAT'L CHAMPIONS



This year, Budweiser Racing Teams swept the National Championships in Indy car racing, Hydroplane boat racing and Funny Car Drag racing.

The Budweiser Indy car, driven by Bobby Rahal, won the 1986 Indy 500 and the 1986 CART PPG Championship.

Miss Budweiser, piloted by Jim Kropfeld, is the winningest entrant in the Unlimited Hydroplane circuit winning her eighth National Championship and her second World Championship in '86.

The Budweiser King, with Kenny Bernstein at the wheel, captured the 1986 Funny Car Championship for the second year in a row.

We salute our championship teams for carrying on Budweiser's winning tradition and the racing fans who cheered them on...

THIS BUD'S FOR YOU.™

Budweiser

NOW YOU CAN CONQUER RUST!



New NEUTRA RUST Gets Rid of Rust For Good!

NOT A PAINT, NOT A COVER-UP, but an entirely new and revolutionary process for eliminating rust. Neutra Rust was originally developed to control the incredible rust on oil rigs in the North Sea and on ships of the Royal Navy. Think of the rust problems they have! Naturally they use vast quantities of Neutra Rust and buy it in huge 50 gallon drums. For a long time that was the only way you could buy it. But at last Neutra Rust is available in smaller sizes for home and shop.

Now you can get rid of rust for good just the way they do at industrial and military installations all over the world!

WHAT NEUTRA RUST DOES

Neutra Rust is like nothing you've ever used

before. It's amazing! No tiresome scraping, wire brushing and sanding to get down to bare metal. Neutra Rust works best applied right over rust! It penetrates the rust. Gets right down there and chemically changes the rust into an entirely new substance—a hard, black, paintable compound called ferroferric. The rust is gone—not just covered up—GONE! For good. It no longer even exists.

NEUTRA RUST IS EASY TO USE

First knock off the loose or scaly rust, but leave the rest of the rust there. (Remember Neutra Rust works with rust.) Then just brush Neutra Rust on. Within minutes that rust will be gone and the new surface will be there. That's all there is to it. Clean up is easy, too. Just soap and water.

YOU CAN ACTUALLY SEE NEUTRA RUST WORK!



When you first brush on Neutra Rust it is white. Then, as you watch, it turns pale green, then darker green, then finally a deep, wrought-iron

black. What you have seen is the rust being chemically converted. The hard new surface can be painted any color you want, or left as is.

USE NEUTRA RUST ON: Automobiles • Boats
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Railings • *Anywhere There's Rust!*

For Mail Orders Call:
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about Neutra Rust
write to:

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777 Dowd Avenue, Elizabeth, New Jersey 07201



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Letters



A Shop Of One's Own



At last I have a shop that's away from all the hubbub. It's in the Multipurpose Utility Shed built from the plans offered in your April '85 issue (page 60).

I finished it last summer, adjusting the dimensions to 16 x 16 ft. for my requirements. I included the loft for storage and installed the pull-down stairs.

I've built many projects and a lot of furniture from PM plans. Keep up the great design work.

MERRITT BROWN
DOVER, DE

What an enviable spot for a shop! Or studio out on the south forty! PM's outbuilding is versatile, indeed. The shed will even accommodate a compact car with optional extension.

For our building plans package, which includes an 8-page instruction manual and materials list, send \$17.50 to Utility Shed, Popular Mechanics, Box 1014, Radio City Station, New York, NY 10101. A second set of plans, if needed for a contractor or filing a building permit, is \$15.



Workshop is housed in Brown's structure, made from PM plans.

Out of uniform

That was a powerful cover in December showing "New Fighting Gear For Combat Survival." But surely the U.S. Army would not send a soldier into combat wearing camouflaged clothes and helmet, carrying a black automatic rifle, and wearing the bright yellow gloves!

TOM VENABLES
DENTON, TX

You weren't the only one to notice that Ranger Jack Braden would be easy pickings with those yellow gloves. Black is standard issue, but Jack had just demonstrated some skin-burning helicopter rappelling techniques for us and was still in his civilian gloves.

The right stuff

The fan-jet engine for model airplanes is featured in your *Speed In Scale* story (page 74, Nov. '86), but *real* jet engines for flying models go back 33 years. That's when Curtis Dyna Products started production of the world's first model jet. The Dyna-jet is a pulse jet with the highest pulse frequency—220 to 240 cycles per second—and it currently holds the world speed record of 189.2 mph for model jet planes.

JIM GORDON
NOBLESVILLE, IN

Sound thinking

Just a brief note to say how much I enjoyed Steve Booth's thoughtful "Changing Channels" story in your *Home Electronic Entertainment* section (page 75, Dec. '86). I know that PM readers like to think a bit beyond just nuts and bolts, and Steve's story brings out the broader context of home electronics.

HANS FANTEL
NEW YORK, NY

Hans Fantel, whose byline has appeared in PM, is the syndicated audio/video columnist of The New York Times and co-author, with Ivan Berger, of The New Sound of Stereo, published by New American Library.

Intrepid sailor

I'm proud to have been one of the original members of VB-18 Divebombing Squadron, so your recent article about the U.S.S. Intrepid (*Editor's Notes*, page 4, Sept. '86) brought back many WWII memories. Our squadron

boarded the carrier on Aug. 7, 1944, and could write a book about our many missions. But two dates are most vivid in my memory. Oct. 24 is when we located the third portion of the Japanese fleet which included the battleship *Yamato*. I am grateful to have returned alive from the 3-day Battle of Leyte Gulf.

The second date is the one you mention in *Editor's Notes*: Nov. 25, 1944—the day the *Intrepid* took two kamakaze hits within 5 minutes of each other. I was not in the air that day, and was on the flight deck at the time of the second hit. The dead pilot's body was on the forward part of the deck and I "liberated" a large piece of his silk parachute. I still have it.

ARTHUR "GUNNER" DASCHKE

A squadron reunion will be held in St. Louis, Missouri, this October. Contact "Gunner" at 35418 Phillip Judson, Fraser, MI 48026.

All hands on deck!

Thanks for your excellent deck story, *Stacked Deck*, in the April '86 issue (page 114). You combined many great ideas for decks into one functional and attractive project. I particularly liked the privacy screen and railing designs, and was able to adapt them to my own deck. It's well-liked by everyone who "comes on board." Your construction details were especially helpful. Keep up the good work.

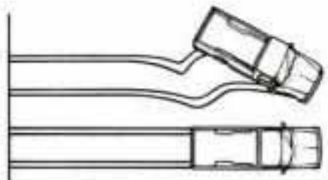
BRIAN D. JENSEN
PEORIA, IL



Jensen's deck, with built-in privacy, is customized to his house.

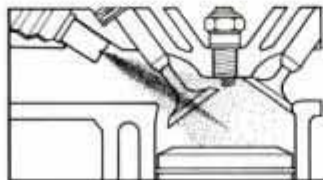
The new shape of tough: Announcing the new 1987 Ford pickup.

America's best-seller* gets even better!
New aerodynamic design. New multiport fuel injection
for 20% more power standard. New luxury interiors.
New rear antilock brakes, first in any pickup.



Rear antilock brakes standard.

Now, a major advance in braking control! All big '87 Ford pickups feature new rear antilock brakes — designed to help you make straight, smooth stops. Only Ford has them. And they're standard equipment! These aerodynamic Fords not only *look* new. They change the way pickups stop, go, ride and drive.



Multiport fuel injection.

New electronic injectors beef up Ford's 4.9L Six with 20% more horsepower — standard! V-8's range from the most powerful small V-8, the fuel injected 5.0L... to the biggest gas and diesel engines in any pickup. You get up to 245 horsepower to move payloads big as 5450 lbs. Or to tow over twice that much.**



Fully adjustable Twin-I-Beam.

Ford front suspensions have been redesigned for truer tracking, longer tire life. They're also now fully adjustable. And for '87, new gas-pressurized shocks contribute to a ride that's smooth on the road yet firm in rough going. Try the ride of a full-size Ford — America's best-selling pickup for nine straight years.*



Luxurious cab interiors.

Inside, you enjoy a new level of comfort and luxury. Behind the sporty A-frame wheel is full instrumentation backed by a dozen labeled indicator lights — all standard. Only Ford offers Regular, SuperCab and Crew Cab.

Lifetime Service Guarantee.

Participating Ford Dealers stand behind their customer paid work, in

writing, with a free Lifetime Service Guarantee for as long as you own your Ford car or light truck. Ask to see this guarantee when you visit your participating Ford Dealer.

Buckle up — together we can save lives.

To receive a free video tape on '87 Ford pickup, send name & address to: Ford Video Offer, PO. Box 10021, Toledo, Ohio 43699. Indicate VHS or Beta.

Best-Built American Trucks six years running.

Based on an average of owner-reported problems in the first three months of service on '86 models, and in a six-month period on '81-'85 models designed and built in North America. At Ford, Quality is Job 1.



FORD PICKUP

BEST-BUILT AMERICAN TRUCKS



*Based on latest available 1986 calendar year R. L. Polk registrations.

**When properly equipped and with a fifth wheel.

†Based on '86 model year manufacturers' reported retail deliveries.



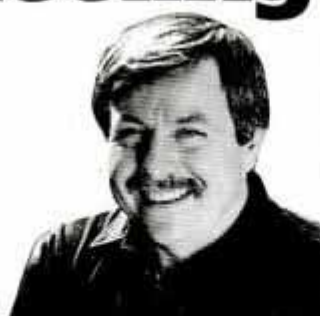
This One

TXN6-5YW-3UK2



Freewheeling

BY WADE HOYT



Wishful Thinking?



Pontiac brass is seriously considering a Bertone LeMans ragtop.

When Pontiac introduced its new Opel-Daewoo "LeMans" model last month, it already had a pair of custom show cars up its sleeve. Lurking in the bushes was a handsome convertible with built-in roll bar that looked very much like a VW Cabriolet. And for good reason; it was built by the Italian coachbuilder Bertone, who also did the VW. Pontiac's sharp design studio simply ordered an Opel Kadett Cabriolet from Bertone and grafted on LeMans nose and tail pieces.

Right now it's just another "design exercise to gauge public reaction." But if enough of the public reacts positively, it

would be relatively easy to get it into Pontiac showrooms. The Bertone/Kadett is already on sale in Europe. To get it here, LeMans body parts plus safety and emissions equipment would have to be added, either in Korea or the U.S. Feasibility studies are underway with the 165-hp 2-liter Sunbird Turbo engine, which is a quantum leap over the stock LeMans' 74 hp.

Shown below is a racy LeMans show car that's based on the 130-hp, 2-liter, 16-valve Kadett GSE. Aftermarket show-and-go parts from the German hot-rod firm Irscher include wheels, fender flares, rocker spats, air dams, 4-



German hot-rod parts transform LeMans into a pocket rocket.



wheel disc brakes, suspension pieces and the steering wheel, plus an interior dress-up kit. In Germany, you can order Irscher parts for D-I-Y installation on existing cars, or have your Opel dealer install them on a new car with a full factory warranty.

Mazda discovers 4wd

The big news about Mazda's new 4x4 pickup is that they finally have one. Although Mazda's built tough little trucks for some time, this is the first one to offer all-wheel drive. An enlarged 2555-cc, 102-hp Four accounts for the B2600 model name. A 3-speed automatic or 5-speed manual transmission are available.

West Coast Editor Steve Parker got to bash through the boonies in the new trucks and reports that the B2600 is: "Tight, taut and solid, with excellent steering feel. It's nice to have the responsiveness of that larger engine. Unfortunately, all models feature manually locking front hubs." A turbo is likely next year, but automatic hubs are probably two seasons away. The company may move cautiously, but as Steve reports: "Fit and finish is typically Mazda, which is to say, excellent."

Cab Plus short and longbed models have cargo beds 6, 7 and 7½ ft. long. Payloads are 1400 pounds without trailer brakes, 1500 pounds with brakes.

Last Rolls

Rolls-Royce has phased out its Camargue model with a run of 12 special "collector" models, all shipped to the U.S. In its 11-year model run, only 534 Camargues were built. Designed by the Italian stylist Pininfarina and named after a region in southern France, the limited-edition cars featured silver inlay wood veneers, monogrammed silver flasks, vanity sets, and a \$175,000 price.



Mazda B2600 4x4 has bigger 2.6-liter Four.

Instant shades

Researchers are working on a way to adjust the tint of car windshields in a way similar to photochromatic sunglasses. An electrical charge run through a thin film of tungsten oxide sandwiched between layers of glass will change the color of the windshield from pale yellow to dark blue in less than 10 seconds. The transformation in color can be adjusted by a rheostat in less time than it takes to fumble with your own pair of shades.

Plastic surgery

If you can't afford an exotic mid-engined BMW M-1, leave it to the clever Japanese to market conversion kits of add-on spoilers and decals that will make a Toyota MR2 look much like the *Autobahn* burner.

BMW and other European



Mid-engined BMW M-1? No, it's a customized Toyota MR2 kit car.

image cars are tremendously popular with status-conscious Japanese, but they're also hideously expensive because of high import duties. With the \$1975 "M1-2" kit, a day's labor and a paint job, you can transform an MR2 into a reasonable facsimile of the Bimmer.

Other kits are available to clone a Porsche 935 racer from an old-style RX-7 (\$1840). You can disguise a Toyota Starlet as a Peugeot 205 Turbo, or a Honda City as a Renault 5 Turbo. **FM**



KOOL

Milds



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

© 1988 B&W T Co.
12 mg. "tar", 1.0 mg. nicotine av. per cigarette by FTC method.

Science



BY DENNIS ESKOW

High-tech Cattle Call

America's strangest weight watchers wear cowboy hats and have doctoral degrees. They're members of a United States Agricultural Department research team working at Miles City, Montana and vicinity, to monitor the weight of cattle. The system includes a stall whose floor is an electronic scale that takes 30,000 weight measurements each second. Since the animal is constantly moving, the repeated weight readings provide for redundant accuracy checks. Averaging out 700,000 or so measurements gives USDA scientists a highly accurate general weight. The bovine wears a microprocessor on its collar. The microprocessor records the animal's weight, and also takes measurements of air temperature, barometric pressure, precipitation and humidity wherever the cow goes. The mi-



Cattle weigh in 30,000 times per second.

croprocessor also records the animal's traveling habits. "We're learning about ranching practices that produce the most beef on the least feed in the shortest time," says USDA researcher Pat Currie.

The system now being used by researchers could one day be used by ranchers who want to cull large herds. But since it is a prototype, the cost is prohibitive to cattlemen. Several companies are reported working on commercial versions of the computers. Electronic tagging of animals has been used mostly in the wild, where the technology has



Bovine microprocessor is carried on collar and keeps record of cattle weight.

mushroomed in recent years. Until last year, it involved transmitters placed on an animal's collar to track its movements.

Cards 'n' letters

We offered a free swatch of orange phosphor material to readers interested in doing experiments. Normally, I'd say keep the cards and letters coming. But we were avalanched! More than 700 readers requested the experimental swatch within the first week after the January PM went on sale. So, don't keep those cards and letters coming. We're out of orange phosphor.

Safety from nukes

Author Walton W. McCarthy took me to task in a letter recently for putting down nuclear shelters on various occasions. I think shelters are a waste of space and money. McCarthy disagrees. He offers forceful arguments for nuclear shelters in his book "The Nuclear Shelterist" (\$22.50, Todd & Honeywell). Essentially, he says we have taken a defeatist attitude about survival after a nuclear war. He points out through well-prepared tables and statistics, that it would be possible to survive, provided the survivors were willing to construct shelters before a war. Read this book, and you may agree with Walton McCarthy that survival is possible.

Antibodies for the gipper

A small biotechnology firm working in a lab at the University of Notre Dame has developed a "monoclonal antibody" that may eventually be used to break up blood clots. The antibody attaches to a blood cell at a specific point. Researchers for American Biogenetic Sciences Inc. say it could be used as a "magic bullet" to fight strokes. By placing anti-clotting chemicals on the antibody, then injecting it into the human patient, it might be possible to attach the antibody to a specific blood cell that is in the process of clotting. The breakthrough has been tried in laboratory mice only. Human experiments are several years away.

Science you do

The National Science Foundation has given a \$302,000 grant to the California Museum of Science and Industry to create basic chemistry experimental devices the ordinary museum visitor can use. One of the devices already under development is a clear glass tube filled with Freon gas. As you push on a cylinder in the tube, pressure condenses the gas into a liquid, demonstrating a basic chemical principle—that density and pressure are directly related. More innovation is expected before the project is completed by the end of next year. **FM**



Glass-tube lets a museum visitor turn Freon gas into liquid.



**Motorcraft
spark plugs.**
**THE LIGHTNING
BEHIND ITS
THUNDER.**



It stormed onto the American performance scene. The Thunderbird Turbo Coupe, moved by a sophisticated four-cylinder turbocharged engine that's as powerful as a V-8. And the lightning behind its high-revving thunder: Motorcraft extended-tip spark plugs. Their nickel-chromium-alloy electrodes are designed to cope with the intense heat of today's high-performance engines. There's a Motorcraft spark plug, as well as a full line of quality-made Motorcraft parts, available for all makes of cars and trucks.



Motorcraft from Ford
EXCEEDS THE NEED

Old House Restoration



BY BOB VILA

Refinishing Wood Floors

For most homeowners, refinishing a scratched and scuffed wood floor is a messy, arduous and time-consuming job. But it's not without rewards. With average wood-working skills, the right equipment and a fair amount of patience, you can often obtain professional results for a fraction of the cost professionals would charge.

Simple observation may be all that's needed for you to decide if your floor needs refinishing. If the finish is peeling, cracked or bleached then it's time to refinish.

Likewise, if deep scuffs, scratches, burns or stains have penetrated the finish, you probably need to sand and refinish the floor. The equipment you need to do this is available from your local equipment rental store.

Even with the best equipment, though, this is a job that must be done carefully, otherwise you can damage the floor. So pay close attention to the operating instructions when you rent the equipment, and take your time doing the job.

Preparatory work

The first step in restoring a hardwood floor is to remove all the furnishings from the room. The fine dust created from sanding the floor will coat everything. Remove draperies and seal off cabinet doors and

cupboards with masking tape, newspaper or hung sheets. Close the door to the room before beginning sanding and open all windows.

Next, perform all needed repairs to the floor. Now that all the furnishings have been removed, you can see the badly split or warped boards that have to be replaced.

Also, pull or redrive any protruding nails, pull out old carpet staples, nail down loose or squeaky boards and, finally, fill all nail holes or remaining cracks with wood filler and let dry.

Remove as much base molding from around the floor as possible. This will give you better access to the floor edges and will keep the moldings from being damaged by the sanders.

Sanding

You need to rent two different sanders: a drum sander and a disc sander, sometimes called an edger. You'll also need a hand-held scraper, a portable electric finishing sander and three grades of sandpaper—coarse, medium and fine.

Start off with the drum sander loaded with coarse sandpaper. Before starting the machine, tip it back so the drum is not in contact with the floor. After it starts, move forward while lowering the drum gradually until it touches the floor. Keep moving while the machine is sanding—even a short pause can leave a gouge in the floor.

Start sanding at one end of the room and work toward the

other. You don't have to push the machine forward, because when the drum hits the floor it will move forward on its own. Keeping a firm grip on the handle, sand the floor slowly, easing the drum up at the end of each run. Overlap runs a few inches to make certain you didn't miss any boards.

For strip flooring, always sand with the grain. With parquet flooring, the first pass should be at a 45° angle to the length of the room. The second pass is at a 45° angle from the opposite corner of the room (essentially, you're sanding in an X pattern). The final pass should be along the long dimension of the room.

After you have sanded the entire floor, switch to the disc sander. Load the disc sander with coarse paper and sand those areas that you couldn't reach with the drum sander. However, even the disc sander won't be able to reach into corners. Leave those areas until all the sanding is done and then scrape them smooth and even with the rest of the floor using a hand scraper.

After the floor has been sanded with coarse paper, re-

peat the procedure using medium and fine paper.

Use a portable electric sander to remove any cross-grain sanding marks left from the disc sander. Use the scraper and the sanders to touch up any remaining areas. Finally, vacuum the floor to remove dust and then wipe it down with a tack cloth.

Floor finishes

Once the floor is sanded, it's time to decide about staining. If you want a change of color, you can use either water-based or petroleum-based stains. Just pick a color you like, then try it on an inconspicuous part of the floor to see if the finished color meets with your approval.

The floor finishes that cover the stain fall into two broad categories: penetrating finishes and surface coatings.

Penetrating finishes, such as tung oil types or penetrating floor sealers, soak into the pores of the wood and bond with the fibers to seal, harden and protect the surface.

Penetrating sealer can be applied with a rag, brush,

(Please turn to page 16)



Use a rented drum sander and coarse sandpaper to begin resurfacing a wood floor. Make repeated passes in the grain's direction. Then sand with medium- and fine-grit abrasives.



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OLD HOUSE RESTORATION

(Continued from page 14)

squeegee or lamb's wool applicator. Though the particulars of applying the finish will vary from one brand to another, generally, it's applied to the surface generously and then the excess is wiped up. Once it's allowed to dry, the sealer is buffed with an electric floor polisher (available from your equipment rental store) and a No. 2 steel wool pad. Apply a second coat of sealer and repeat the process, then wax or apply two coats of polyurethane over it. Some finish manufacturers make an integrated system of floor finishes comprising a penetrating sealer, a top coat and even a finish renovator that will brighten the floor once its finish becomes worn or soiled.

Polyurethane is the most popular of the surface finishes. It can be applied with a lamb's wool applicator or with a brush. Polyurethane can be applied in two or three coats. Either way, the final coat does not need to be buffed out, providing that the coats that preceded it have been buffed with No. 2 steel wool.

Regardless of the type of finish you use, keep compatibility in mind. Some finishes are not compatible with other finishes, stains or even waxes. Carefully read the instructions for the finish you are applying and make sure that all steps in the finishing process are compatible.

Aside from that, don't ignore the safety issues concerning refinishing floors. Finishes are flammable and finish-soaked rags should not be left in a pile where they can self-ignite; dispose of them properly. Also, floor finishes should be used with proper ventilation.

Avoid using some of the more exotic and difficult-to-use finishes that are designed to be used by professionals. Among these are the so-called Swedish finishes that are urea-formaldehyde based, fast-drying floor sealers and moisture-cured urethanes.

Though not as exotic, but still difficult and risky to apply, shellac and lacquer are generally not appropriate floor finishes.

Varnish is suitable as a floor finish and was once widely used, but since has been surpassed by polyurethane in popularity.

Maintenance

The maintenance procedure you use to keep your floor looking good will depend on the type of finish you use. Once again, consult the manufacturer's directions.

For instance, some manufacturers recommend using wax on their finishes while others advise against it. Some floor finishes can be damp mopped, while others can't.

Some basics apply, however, regardless of the type of finish you use. Wipe up spills immediately. Vacuum frequently to prevent scuff-causing grit to build up and if you do use wax, apply it in thin coats and buff it out thoroughly. **PM**

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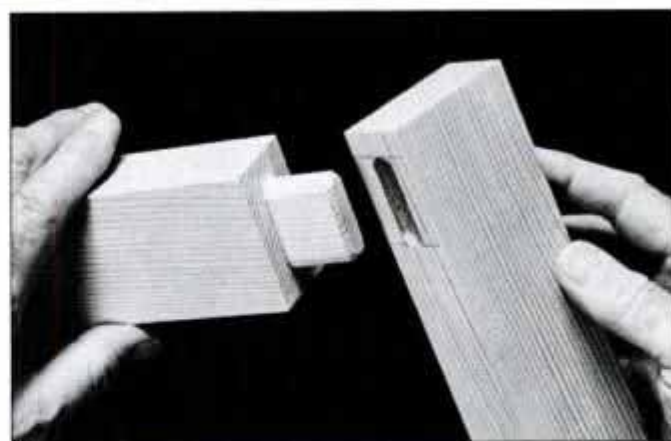


Visit the SNAPPER dealer nearest you. Or look in the Yellow Pages under lawn mowers.

Workshop Minicourse



BY ROSARIO
CAPOTOSTO



The mortise-and-tenon joint is versatile and strong. It can be used to join such assemblies as table aprons and legs or stiles and rails. You can cut the joint with basic woodworking hand tools.

Mortise-and-tenon joints

The mortise-and-tenon joint is strong and can be cut with basic hand tools. The joint is well suited for frame construction, post-and-panel and leg-to-rail assemblies because it resists wracking and twisting stresses.

There are many varieties of the joint. The one shown here is called a blind mortise and tenon.

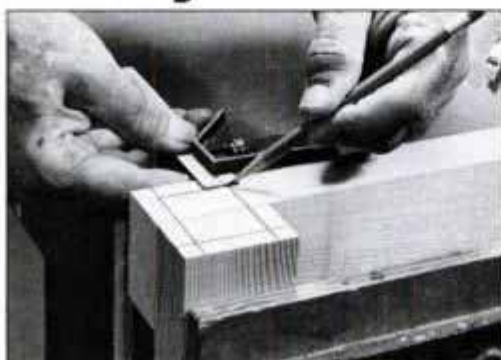
For a strong joint, the tenon (the projecting member) must slip-fit the mortise (the hole that receives it). If done properly, after the pieces are glued and clamped together, the joint lines should be nearly invisible. Therefore, careful layout and sharp tools are essential. While a marking gauge would be helpful, you can use a combination square and a sharp pencil. You'll also need a ruler, backsaw, chisel and a portable drill, preferably with a guide.

There are no hard-and-fast rules about tenon size, but generally its thickness is one-third to one-half that of the workpiece. Its length should be about $\frac{1}{16}$ in. shorter than the mortise depth.

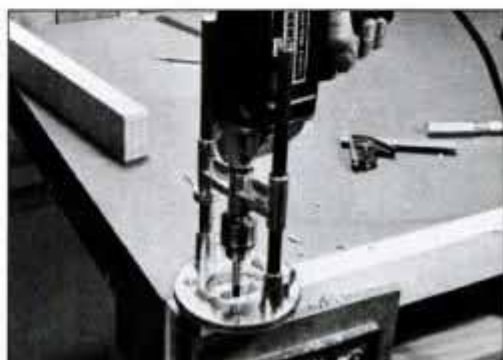
The depth of the mortise, however, depends on the application. In our example, the mortise should be about one-half to two-thirds the joint length.

Begin by marking the cutting lines as shown. Then, shape the mortise with a drill and chisel.

Finish up the joint by cutting the tenon as shown. Use a backsaw and do final fitting with a chisel. **PM**



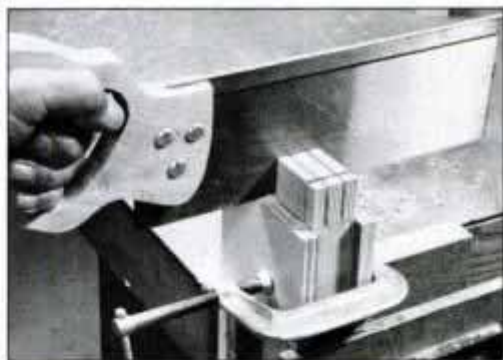
Clamp both pieces of the joint together and carefully lay out the joint using a combination square and a sharp pencil or a marking knife.



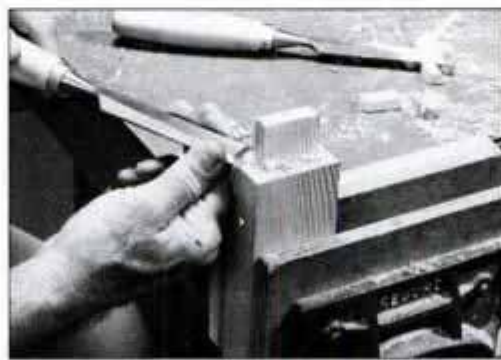
Cut the mortise first by boring it out with a portable electric drill and guide. Forstner and brad point bits work best for this procedure.



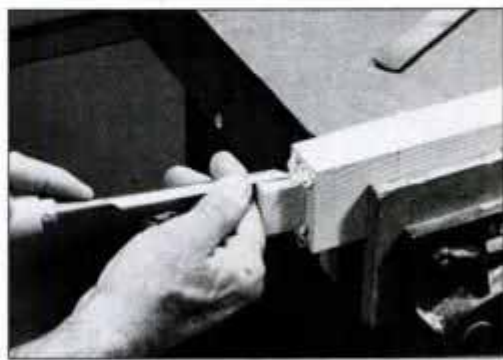
Square-up the mortise by removing the waste with a sharp chisel. Make the final cuts with the chisel tip held just on the pencil line. Don't overcut.



Using a backsaw, first cut the tenon's cheeks. The clamped stop blocks prevent the saw from overcutting. Then make the shoulder cuts, as shown.



Finish cutting the tenon by paring down to the lines with a chisel. The workpiece can be held upright in a vise or clamped to the workbench.



Round off the tenon's edges with a chisel and then chamfer its end. It should slip snugly, not too tightly, into the mortise with hand pressure alone.

Imports

BY BILL HARTFORD



Bread-And-Butter Bentley



Bentley Eight: It's the next step up for luxury-car drivers.

Niche warfare has broken out on battlefields mapped by automakers' marketing generals: Make the right car for the right price for the right person. One British carmaker has you targeted as the perfect customer for its latest "Silent Sports Car" if you were born between 1942 and 1952, and have lots of high-caliber ammunition in your wallet. The 1987 Bentley Eight is \$89,000 worth of transportation aimed at the enthusiastic driver, 35 to 45 years old, who knows liters from litters—who's outgrown Jaguar, BMW and Mercedes, but isn't ready to

be borne about in a chauffeured Rolls-Royce. If that's you, you can expect all the



Trademark grille will mesh with your lifestyle for \$89,000.

fine attention to detail that the owner of a Rolls receives for his dollar: Rolls-Royce



No chauffeur, please; we're Yanks and we want at that wheel.

has been crafting Bentleys since 1934, but has never formally launched any models of the sporting, winged-badge motor car here before. That Bentley badge and the bright mesh grille are trademarks that hark back to the early racing Bentleys when the mesh protected the radiator from flying stones. The mesh grille will still do that job, if you're unlucky enough to take a hit. But it also caps the bonnet, under which you'll find 6.75 liters of fuel-injected powerplant. By the time you get the V8, it's been micrometered, metallurgically tested, run 150 miles in an over-the-road test, stethoscoped and has had its exhaust acoustically tuned. The chassis' hydraulic leveling system maintains the car's posture even as gas is consumed from the fuel tank. Acceleration to 100 mph-plus is through a 3-speed automatic transmis-



Legendary marque: initial of W.O. Bentley in winged badge.

sion, and hauling down is the job of 11-in.-dia. disc brakes on all four wheels. The discs on the front are ventilated for quicker heat dissipation. Inside, tradition reigns, despite the sporty, leather-covered steering wheel. Walnut trims instrument panel and doors, Connolly hides cover more than 500 sq. ft. of interior, and Wilton wool carpets the floor. If you spring for a Bentley Eight, don't bank any left-over change in the ashtray as toll money: The ashtray will dump it automatically into a concealed bin.

BMW for the station

It'll be a schlepper, but no slouch. You can be sure that when BMW builds a station wagon (later this year) it'll be one a clutch-popper can love. There are just a few proud wagons—Volvo, Audi, Mercedes, Taurus/Sable—so an addition to the genre from BMW motor ma-



First look: New BMW station wagon will be in 3-Series.

vens is a cause for celebration. Maybe we'll even get the motorsports, or M, version—what we call the many-horses model. Mmmm.

Four-wheel drive in a can

Honda's not only got a way with wagons, but with words. Its Real Time 4wd system on the Civic wagon automatically engages when needed. It keeps the traction in your life on the road when the wagon's front-wheel drive isn't good enough. The instant your front wheels lose traction, power is applied to the rear wheels to get them working for you, too.

In the driveshaft to the rear wheels is a viscous coupling that makes the power connection. Any speed difference between the front wheels and rear wheels en-



INTER-LOCKING PLATES

Heart of Honda's 4wd is the viscous coupling that delivers power to rear wheels.

gages it: Interlocking plates in silicone oil transfer power to the rears to bring them up to the speed of the fronts. It's a slick way to go when the going gets slippery. **PM**

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Homeowners' Clinic



BY NORMAN BECKER, P.E.

Peeling Bricks

My house is completely faced with brick and is about 28 years old. Each spring for the past four or five years, six to eight bricks on the upper portion of the chimney shed their outer surface, usually in one piece. I have also discovered some bricks around my closed-in patio with missing surfaces. Could this problem stem from freezing rain, snow, frost or moisture? Can the faces of the bricks be glued back on? Can I prevent further peeling or shedding by applying Thomson's Water Seal or a similar product?

PETER MARTUCCI
WARREN, MI

The problem is indeed caused by the freezing of trapped water. Apparently, water is entering these structural elements through cracks or open joints.

You can't prevent the

brick face from disintegrating by coating the area with water sealant.

In fact, the Brick Institute of America recommends against using silicones or other clear penetrating solutions on brick masonry structures because they often cause more harm than do good. Such sealants will generally not bridge cracks and open joints and can trap moisture.

The only way to control the problem is to stop the water from penetrating by sealing cracks and open joints with mortar.

Gluing the faces back on the bricks won't last, eventually they will come loose again because they won't be able to withstand weather changes. Your only option is to replace the deteriorated bricks.

To do this, chisel out the

mortar that surrounds the affected bricks. It may be easier to break the bricks in order to remove them. Next, carefully chisel out the old mortar. Sweep dust and debris from the cavity and dampen the wall before the new bricks are installed to ensure a good bond. Mortar the appropriate surfaces of surrounding brickwork and the replacement brick.

Center the replacement brick in the opening and push it in place.

Remove excess mortar with a trowel. When the mortar becomes "thumbprint" hard, tool the joints to match the original profile.

Treated-lumber leaching

I am building a pole garage with pressure-treated wood poles treated with Chromated Copper Arsenate (CCA). Is there any danger of leachants from the wood contaminating my well, which is 122 ft. deep and about 90 ft. from the proposed building.

JAMES FOWLS
EATON, NY

Based on current available information, there is no danger of CCA leachate contaminating the well. When pressure-treating the wood, the CCA, which is relatively stable, reacts with the wood sugars and becomes fixed in the wood substrate. In researching this question, I spoke with Victor Lindenheim, vice president of the American Wood Preservers Institute in Vienna, Virginia. He cited two studies relevant to the subject. A 1976 study for the Environmental Protection Agency found that "there is no apparent health hazard to the consumer from the vaporization, leaching or other mechanisms as relates to arsenic and its compounds (which includes CCA)." Another study, for the U.S. Department of Agriculture, drew a similar conclusion.

Although there are no apparent problems when using treated wood for structural support, it is not

recommended for use where it comes in direct contact with drinking water; for instance, when it is used in a cistern.

Cracking up

Last year we had a beautiful cultured marble countertop and sink installed in our new bathroom. Just lately, we noticed tiny cracks that have spiraled out from the sink strainer. The cracks are thin, but getting longer. They do not go through and are limited to the surface. Have you ever heard of this? What can we do?

TED C. BRONSON
MONTICELLO, UT

The surface cracks near the drain can be caused by very hot water. However, more often than not it is the result of overtightening the drain fitting with a wrench rather than making it hand tight. Unfortunately, the condition cannot be repaired.

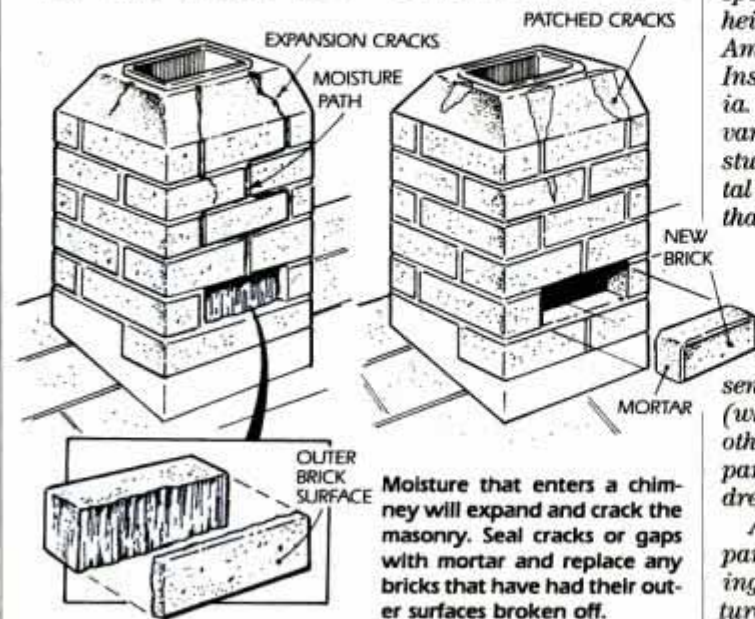
Info source

Homeowners who need information can find a ready source in the federal Consumer Information Catalog. Approximately 200 booklet titles are offered in the latest catalog, nearly half are free.

Among those topics of interest to do-it-yourselfers are: Buying Lots from Developers, No. 129P (\$2.50); Construction Guides for Exposed Wood Decks, No. 189P (\$50); Simple Home Repairs, Inside, No. 139R (\$1.50); Finishing Wood Exteriors, No. 137R (\$3.25); the Mortgage Money Guide, No. 129R (\$1); A Citizen's Guide to Radon, No. 136R (\$1).

*To send for the free catalog or order a pamphlet, write the Consumer Information Center, Dept. 80, Pueblo, CO 81009. **PM***

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





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SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, And May Complicate Pregnancy.

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

Car Clinic



BY MORT SCHULTZ

Ford To The List

On a recent TV report, Ford owners were warned of unexpected acceleration with cars having 3.8- and 5-liter engines. According to the commentator, this has happened when shifting into REVERSE and from PARK into DRIVE. The reporter showed several ghastly photos of wrecked Ford cars and reported that at least one fatality has occurred, plus a number of serious injuries.

I am, to say the least, frightened for my family since we have two Fords, one a 1984 Thunderbird with the 3.8-liter engine, the other a 1985 LTD with the 3.8-liter engine. The T-Bird engine idles awfully high when started cold—so much so that when shifting from PARK to REVERSE, the tires screech although my foot is firmly on the brake pedal. Do you have any information on this? If you do, please tell us.

MYRON GROSSMAN
NANUET, NY

In all the years I've been doing Car Clinic, I can't recall a more serious situation than what's been going on with this sudden acceleration business. As I indicated in the December 1986 column (page 24), this is an across-the-board problem involving domestic- and foreign-built models. I gave a rundown of the models in that column. It didn't include Ford. Now it does.

Unfortunately, no car company has yet uncovered a common denominator for the incidents that have been

reported. If, for example, the cars involved were equipped with a cruise-control system, this might increase the possibility of a solution, especially if Audi, Ford, GM, AMC, Honda, Nissan, Toyota, Volvo and the National Highway Traffic Safety Administration pool their efforts.

As for the Ford situation, owners of cars with high-idling 3.8- and 5-liter engines should have their dealers look at three technical service bulletins (TSBs): 85-12-14 and 85-13-8, which address the possibility of the idle-speed control motor used with 3.8-liter engines causing high idling

speed, and TSB 86-6-15, which covers correcting idling problems with 5-liter CFI engines. I want to stress, however, that although you have a repair made, don't get complacent. It doesn't eliminate the possibility that the car may unexpectedly accelerate.

The advice I gave in the December column for what to do in order to try and stop a vehicle holds for Ford owners as well as others. If your car suddenly shoots ahead, pull your right foot away from the control pedals and press down hard on the brake pedal with your left foot as you turn off the ignition key. You're urged to use your left foot for braking to eliminate the chance of accidentally hitting the accelerator pedal with the right foot when aiming for the brake.

A fifth of joy

I am pleased with my 1986 Plymouth Voyager LE (2.2-liter engine with 5-speed manual transmission), with one exception. Since I bought the vehicle in November 1985, the gearshift has been sticking in FIFTH gear, requiring much more than normal effort to downshift. This occurs once or twice a day, with

all other shifts being normal. Is there a painkiller for this headache? I've had the car to the dealer six times. He's greased and adjusted cables and connections, and now he says he's done all he can.

ELIZABETH STUMPF
ROME, NY

No, he hasn't. There are two possible reasons for the condition he hasn't touched on. The first is a FIFTH-gear synchronizer-strut retainer plate which, because of its design, may be causing hit-or-miss lockup of the synchronizer spring and gear. It's not as terrible as it sounds. All the dealer has to do, at no cost to you, is replace that FIFTH-gear synchronizer-strut retainer plate with a newly designed plate that carries part No. 4431894. Details are given in TSB 21-07-86, Rev. A.

The other possible reason for the problem is a selector shift cable that's hanging up, especially where this cable crosses the speedometer cable and damper strut.

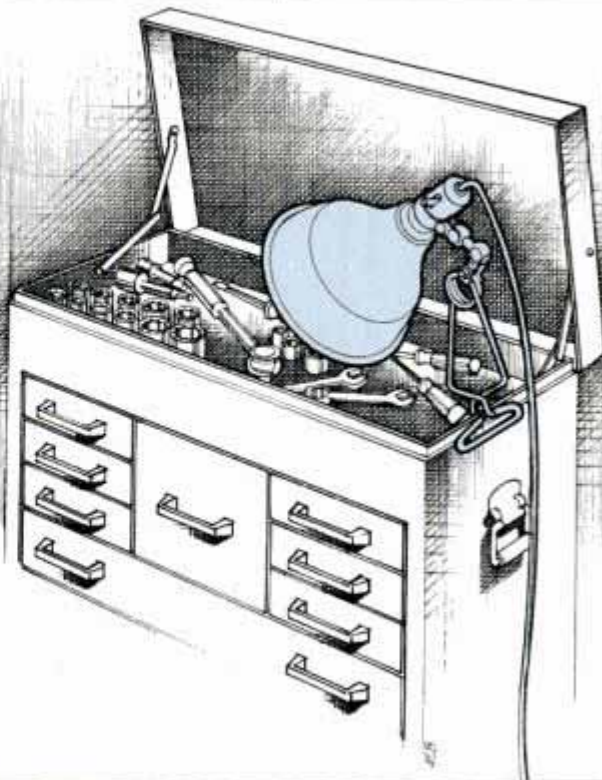
The dealer should see to it that the selector cable is routed behind them. Otherwise, the shift cable can snag and make shifting more difficult.

(Please turn to page 28)



No more sticky fingers

Even pro mechanics hate working with tools so cold they stick to your fingers like an ice cube tray. A definite 5-point jump on the I-hate-to-do-it scale. Leon Faulkner of Smyrna, Georgia, has a way of warming up even the nastiest day. He spreads the tools out on the top of his toolbox and warms them with a clamp-on socket and infrared lamp. This sure makes for a lot fewer parts dropped from numb fingers. It also won Leon a prize from *Motor*, the magazine for professional mechanics.





PICTURE YOURSELF

with a little less gray, a lot less, or none at all.



All over the country, there's a group of men—actually millions of them—who have a secret they don't share with anyone. Not even with each other.

You can do it too. Not necessarily the way this Grecian user did. You may have more or less gray to start with. And you may want to end up with more—or less. You're in control. A lot of Grecian users leave a little gray on the sides.



Their secret? That nobody knows they're using Grecian® Formula 16® to gradually take away as much gray—or as little as they want to lose, without anybody knowing. That's their secret.

The important thing is that you look perfectly natural all the time. The return of your own natural looking color each day over a period of weeks is so imperceptible, not even your friends can tell you're using Grecian. Unless, of course, you tell them yourself.



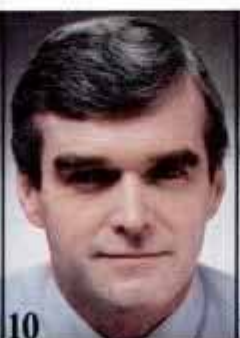
They do it with a clear liquid, as easy to use as a hair tonic. Here on this page you can see the undoctored photographs of the hair taken day-by-day as one of these Grecian users gradually took care of that older look.

You'll be glad to know you won't have trouble finding Grecian. It's available wherever men's toiletries are sold. That's because millions of men quietly demand it.

Note in the photos around the page how the change each day seems like no change at all. But compare #1 (when he began) with #18. The nearly invisible day-to-day changes have eliminated the gray and created a younger looking man.

Free trial offer. For a trial package send \$1.00 for postage & handling to Grecian, Suite 0155Q, Del Rio, TX 78847-0155. Specify liquid or cream. Limit one per family. Offer ends 5/31/87.

GRECIAN® FORMULA 16®



CAR CLINIC

(Continued from page 26)

Wishing upon a star

If you can answer this one, you're a miracle man. Why is it that when the windshield wipers sweep, the arm linkage strikes the cruise control servo electrical harness, causing a short that prevents the cruise control from engaging. You can find out easily enough by examining the cruise control servo harness. If it's routed over the windshield wiper motor, it's too close to the wiper arm linkage. Just reroute it over the top of the brake booster. To keep the harness in place, attach a clip to the firewall and snap the harness to it. I suggest you get the clip from a GM dealer, using part No. 1255157.

DON McEACHERN
BIRMINGHAM, MI

Piece of cake. I'll bet that as the windshield wipers sweep, the arm linkage strikes the cruise control servo electrical harness, causing a short that prevents the cruise control from engaging. You can find out easily enough by examining the cruise control servo harness. If it's routed over the windshield wiper motor, it's too close to the wiper arm linkage. Just reroute it over the top of the brake booster. To keep the harness in place, attach a clip to the firewall and snap the harness to it. I suggest you get the clip from a GM dealer, using part No. 1255157.

At the helm

I heard from George Altieri. He runs the show at Helm Inc.—the company that publishes service literature for



Put a finger on it

Given how many vacuum diaphragms there are on a typical car (vacuum advance and choke pulloff, to name just two), the test used by *Motor* magazine prize-winner David L. Finkelstein of Olivette, Missouri, to see if the diaphragm is in good shape can be a real timesaver.

Simply press on the actuating arm of the diaphragm to expel air and collapse the spring. Place your finger over the vacuum port and release the diaphragm. As long as your finger is over the port, the diaphragm



should remain collapsed. If it doesn't, the diaphragm is bad—or there's a hole in your finger. One warning: This test doesn't work on diaphragms with metering orifices.

Cadillac, Chevrolet, Ford and Pontiac. In addition to present-day material, "ancient history" publications are available, including Chevy shop manuals that go back to 1934.

George asked me to tell you that if you want to see what Helm has to offer, drop him a line at Helm Inc., Publications Div., 14310 Hamilton Ave., Highland Park, MI 48203.



Dumped a digit

I went to my Chrysler dealer with the May 1986 POPULAR MECHANICS in hand to ask for a damper weight that you said would eliminate a whine at 40 to 50 mph from my Chrysler fwd car (*Service Tips*, page 35). He told me there is no part No. 431107.

J. ROBERT COTTO
GREENWICH, CT

The correct number is 4431107. I apologize for the inconvenience the dropped digit caused you, but I also stated in the Service Tip that a dealer can check TSB 21-20-85 for confirmation. If he had done this, he would have found the correct number.

Person to person

I purchased an Oldsmobile Cutlass straight-drive in 1983. It had steel-belted all-season Uniroyal Steelers, which started cupping after 5000 miles. Despite rotation, wheel balancing and front-end alignment, this gave a rough ride for the 48,000-mile life of the tires. I bought a new set of all-season Goodyear Vectors. Sure enough, the same thing happened—cupping after 5000 miles. The Olds dealer blames the tires. Uniroyal and Goodyear blame the car. I'm stuck in the middle. What gives?

BILL PERSON
ADDRESS NOT GIVEN

It's a big flap that's affecting other car and tire manufacturers besides Olds, Goodyear and Uniroyal. Oldsmobile claims, "The single, most contributing cause of this type of wear, except for abusive driving, is excessive toe-in. Lack of tire rotation and low inflation pressure also exaggerate it."

The first thing to do is to have toe-in reset to zero. Disregard what the manual says—to set toe-in to +0.15+/-0.05 deg. Secondly, insure correct tire inflation. This information is given on a placard pasted on the driver-side door. The third thing to do is to rotate the tires every 7500 miles in what GM calls the modified "X" pattern. For cars with rear-drive axles this means to place the left-front tire on the right rear, right-front tire on the left rear, left-rear tire on the left front, and right-rear on the right front. This leaves the spare out of the picture, but many cars have Space-Saver temporary spares anyway.

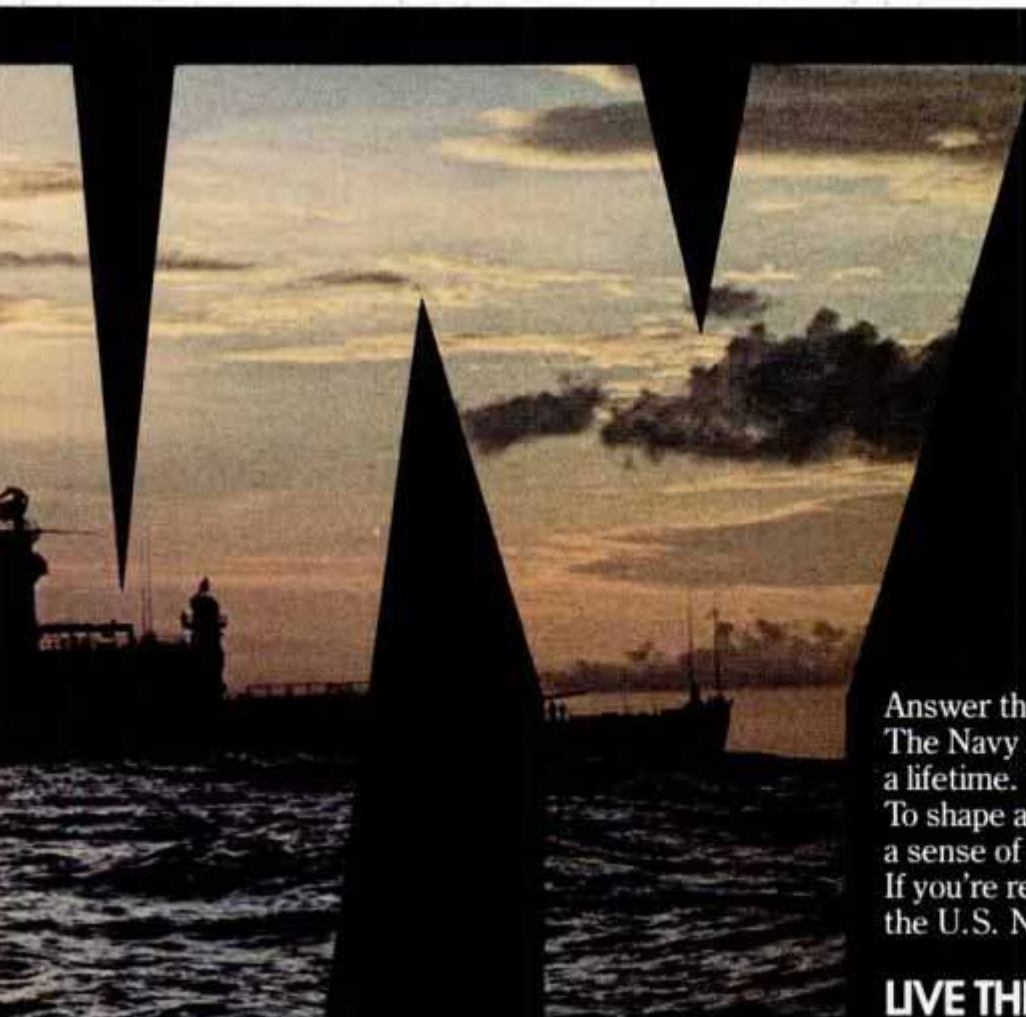
If this doesn't work for you, next time get the conventional tread design rather than all-season. **PM**

DO YOU HAVE A CAR PROBLEM?

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

SERVICE TIPS

- Your '87 Firebird or Grand Prix 5-liter engine with 4-barrel carb (VIN code H) that's having hot engine hesitation problems may benefit by having the air conditioner idle-speed setting "upped." TSB 87-6-9 says to raise that speed to 700 rpm for Firebird—to 725 rpm for Grand Prix.
- If the manual transaxle in an '84, '85 or '86 Dodge Colt or Colt Vista is noisy and difficult to shift, refer your dealer to TSB 21-15-86. The car probably needs some newly designed transaxle parts specified in this bulletin.
- Are you disturbed because the fuel gauge needle in your '87 Honda Accord doesn't fall to zero when you turn off the ignition? Don't be. The fuel gauge is designed to keep recording the fuel level when the ignition is off as well as on.
- If your '86 Aerostar keeps experiencing a discharged battery after you put a heavy load on the electrical system, replace the 60-amp alternator with a 75-amp unit (part No. E7PZ-10346-C). TSB 86-22-16 says your vehicle is electrically underfed.
- Are you losing coolant from an '85 or '86 Chevy Sprint? There might be a slight crack in the cylinder head gasket. If you find white deposits on the block, it may signify coolant loss, so replace the head gasket with one bearing part No. 96055143. Your dealer can find this info in TSB 86-26.



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LIVE THE ADVENTURE

Inside Detroit



BY JIM DUNNE

'89 T-Bird Trapped



The '89 T-Bird will have BMW styling, V8 power and rwd.

Big changes are in store for the 1989 Thunderbird, and that's a surprise considering the radical facelift given to Ford's personal coupe this year. The future Bird will get even more sleek, with a lower hoodline, softer roofline and enlarged side windows. Still, there will be lots of the old in the new car, including a V8 engine, rear-wheel drive and room for five passengers. Ford president Don Petersen says, sure the 1989 looks good, but the 1987 Turbo Coupe is a sensation, considering that its changes come in a facelift year, not one when radical changes are expected.

"Four-wheel disc brakes, antilock braking, a better turbocharger with intercooler, and an adjustable suspension system are major improvements on the Turbo," Petersen points out. "Those are things you can't see. The styling, especially the front end, is a radical improvement too." Petersen gets no argument from me on those claims. That's why Ford is expected to stay out in front of GM in sales of midsize personal coupes, even with GM bringing out radically revised Grand Prix, Cutlass Su-

preme and Buick Regal coupes later this year.

Get me a spotlight

Ross Perot, the outspoken Texan whose criticism of GM forced the automaker to buy him out of the company, says that one problem at the world's largest carmaker is that "top management was more concerned about who was in the spotlight" than about making changes. I can vouch for that. In interviews with GM officials, I've been asked to also interview the official's boss, so his nose would not be out of joint. This was, and probably still is, a big deal at GM. So, instead of focusing on company improvements, much time is taken up to see who could get his name in the press more often.



Merkur XR4TI goes conservative with conventional grille, wing.

You win

No fewer than 47 employees at GM's Moraine assembly plant in Dayton wrote to tell me I was all wet in saying that Corvette and Fiero are the top quality products made by General Motors.

"The S-10 and S-15 pickup assembled at Moraine have been the quality leaders among passenger cars and trucks for the past four years," they explained.

Okay, Moraine, I believe you. And congratulations for making quality a top goal. U.S. manufacturers need more of that.

Clipped wings

It looks like Ford is pulling back on the styling of the Merkur if this spy shot of an '88 prototype is any evidence. The car looks cleaner, has more conventional lines. The biggest difference apparent is the single rear wing in place of the double wing on today's cars. Also, note the radiator opening at the front and the NACA air scoop in the hood.

Lights out

The 1986 Sable will have a more common appearance in front than the current model has. Gone is the light strip that stretched between the headlamps. In its place is an egg-crate texture grille. The obvious question to ask is: Does Sable need this opening to aid radiator cooling? Apparently not, since the car has been in production more than a year now, without any widespread complaints about engine cooling. Like the Merkur redo, it represents a vic-

tory for the conservative element within the Lincoln-Mercury Division.

Good for the last drop

A new fuel pump that sucks the gas tank practically dry could show up on new cars as early as 1988. Walbro Corp. has such a pump and is ready to go into production for one of the auto companies within a year.

The new design is more like a fuel tank within the regular tank. Shaped like a small cylinder, the new system fits just about at the bottom of the fuel tank. It holds the pump, plus a tiny reservoir, filter and fuel-level sensor. The pump keeps a steady supply of fuel feeding the engine when the car is on a hill or turning, and the fuel level in the main tank is low. Park on a hill, and the new pump system will hold some fuel—just a few minutes worth—so that you can get your car started when the tank is low and the fuel has settled to one side away from the pickup tube.

Unlike current fuel-feed



Sable will ditch nose light in '88.

systems, the Walbro unit is small enough so it can be fitted inside the fuel tank through the filler neck after the tank has been built and welded shut.

Wide open

That's China today when you think of a potential market for new cars. The vast country lives on public transportation—you see buses more often than sedans—and trucks of all types. Most cars are Japanese brands like Toyota, Mazda or Nissan, but occasionally you will spot an older Beijing sedan. VW has a plant near Shanghai that builds the

(Please turn to page 32)



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

Buckle up — for life!

ISUZU

INSIDE DETROIT

(Continued from page 30)

Quantum—a style that looks out of place, far too advanced—when mixed in with the older vehicles on the road.

Private cars, if they exist at all, are rarely seen in even the big cities. The ones you see on the road are owned by public institutions like governments, factories or schools.

Roadways are wide, but could be congested quickly if the number of cars start to approach the number of trucks and buses. One hazard you won't find in most American streets: crowds of pe-

destrians overflow the sidewalks, and spill out onto the streets. They move the mass of bicyclers toward the middle of the streets. Drivers honk their horns constantly to clear a pathway ahead. Another oddity: Virtually all buses and trucks run on gasoline, not diesel fuel.

Will GM listen?

Slow-selling Toronados, Rivieras, Eldorados and Seviles are built at GM's state-of-the-art Poletown assembly plant in Detroit where workers are facing layoffs because of production cutbacks. Buyers are not enthused with GM's luxury lines, and sales are down.

"I think it's a styling problem, mostly," says one long-time Poletown employee. Another suggests that "luxury cars should be bigger." This is just the kind of worker feedback that GM claims it is looking for and listening to. But GM's response shows the company may not be listening that hard—"changing a taillight may take more than a year," says one GM spokesman. "A whole new body can take five or six years."

Here to stay

Big cars are a cinch for future GM and Ford models. GM plans to continue the full-size Chevy Caprice well into the 1990s, which is about as far as auto companies make plans. The big Chevy is set for a major body redesign in 1991. Then, in the mid-'90s, it will be completely redone, with chassis and drivetrain changes as well as a new body style. But rear-drive and V8 engines will remain benchmarks.

The 1991 Caprice is expected to be slightly larger than the current model, but styling will be radically different. Emphasis will be on an aero shape.

Ford will follow a similar path with its Crown Victoria/ Grand Marquis and Lincoln Town Car. Those designs, considered throwbacks to a bygone automotive era, but still top sellers, will have V8 engines and rear-drive chassis through the 1990s, according to Ford.

Another rotary

Mazda is expected to use a rotary engine in the top-of-the-line 929 passenger car it will introduce in the U.S. market. Mazda has sold the rotary in its Cosmos line in Japan for a number of years, some with and some without turbocharging. In addition to the rotary, the 929 may be offered in V6 and 4-cylinder versions.

Olds for show

Oldsmobile is said to be working on a major project to develop a 4-door special sedan that will compete with Audi 5000, Volvo, Acura and small Mercedes. As one part of the project, Olds commissioned the Italian designer Giugiaro to do a concept car that would serve as an inspiration for the project. Giugiaro came up with an unusual design that combines two clamshell-type doors. The front doors are attached to the windshield, and when opened, the whole construction swings up and forward on hinges mounted in the top of the cowl. That makes entrance to and exit from the front seat wide open (wide open to the sky as well, but that may not be a problem in sunny Italy).

For rear-seat passengers, there is a more conventional roof-hinged gull-wing door that also leaves plenty of room for passengers, but protects the interior from the elements. **PM**

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*See your owner's manual for recommended change intervals.



GENERAL MOTORS CORPORATION

Audio



BY FRANK VIZARD

Heard But Not Seen



Architectural Series speaker from ADS mounts flush with the wall.

Lots of people are frustrated by loudspeakers, not because of the sound they reproduce, but for the space they require. Living rooms, dens and even bedrooms become designed around proper speaker placement, much to the chagrin of spouses and interior decorators. The current boom in surround-sound systems, which creates the need for an additional pair of speakers, generates further annoyance.

One way to lick the sound-versus-space problem is to install speakers in the wall or even in the ceiling. Inboard-mounted speakers, once installed, are flush with the wall or ceiling. Then you paint the metallic grille to match the color of the room. For acoustical reasons, mount your main stereo speakers in a wall—one that faces your listening area. Use a ceiling mount only for surround-sound speakers, whose placement isn't critical for stereo imaging.

Speakers designed for wall-mounting are available from ADS, Boston Acoustics, Bang & Olufsen, Studer Revox and Sonance. Prices vary depending on the brand and size of the speakers, and manufacturers are reluctant to quote a list price because these speakers are usually installed by the store that sells them. Typically, the price of the speakers is concealed in one overall bill that includes both the price of the speaker and the installation charge. You can expect to pay anywhere from \$150 to \$600 for wall-mounted speakers, plus up to \$500 for installation. The installation price will vary according to the number of speakers and the complexity of the installation.

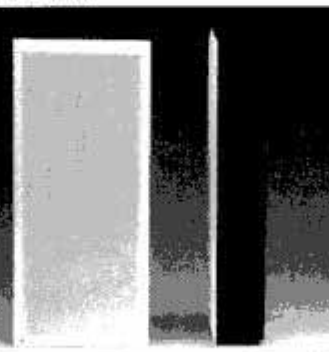
Wall-mounted speakers come in two different fashions. The Bang & Olufsen speakers, for example, are baffled in their own enclosure. The Studer Revox speakers are also fully en-

closed. The back of the enclosure features hooks which allow you to simply hang the speakers on the wall if you decide against sinking them into the wall. Depth is only 3 $\frac{3}{4}$ in.

Most other models do not have the speakers enclosed. Instead, they have the appearance of car stereo speakers, and use the wall or the attic as a baffle much the same way a car trunk is used to baffle speakers installed on a car's rear deck. These "infinite-baffle" speakers offer a little more flexibility in installation than enclosed speakers. If the spacing between studs is narrow, enclosed speakers would be difficult to install horizontally, if that's what the situation requires.

On the other hand, infinite-baffle speakers can be subject to sound leakage. Let's say you've mounted the speakers facing into the living room but inside a wall that separates the living room from the bedroom. Depending on the wall's thickness and the size of the speaker, muffled sound might inadvertently intrude in the bedroom. So pick an outside wall if you can.

Sonance, a loudspeaker maker based in San Juan Capistrano, California, is the only company that offers a subwoofer for wall-mounting. The company recommends mounting the subwoofer into a wall with a closet behind it. The purpose is twofold: The closet serves as a baffle and also prevents sound from leaking into living quarters where it isn't desired.



Bang & Olufsen in-wall speaker comes with baffled enclosure to prevent sound leakage.

If you're thinking of installing wall-mounted speakers in a single room, you can save a few hundred dollars by doing the job yourself.

Installing wall-mounted speakers into a house during the construction stage is relatively easy. The studs are readily visible and the installation instructions that accompany the product are easy to follow.

It's more difficult to retrofit the installation into an existing home. If you decide to put the speakers in the wall, you may want to invest in an electronic stud finder. This will prevent you from making unnecessary holes in the wall if the the location of the studs does not match your proposed placement.

All mounted speakers rely on being supported by the interior wall studs. Be sure to check for the location of any air ducts or plumbing before you excavate.

A knife should be enough to cut a hole in drywall material, while a coping saw or similar tool will be necessary for lath and plaster. Templates are provided with the speaker so you'll know exactly what size hole to make. A surprisingly small number of screws are then used to attach the mounting bracket, install the speaker and put on the grille.

The hardest part of the job may be the wiring. Here you'll have to get creative.

If you have an attic, run the wires through it. If there is no attic, you'll have to go down through the wall. You might then encounter fire-blocks in the bottom of the wall, which you'll have to drill through. Every installation is potentially unique when it comes to the wiring.

Pro installers, by the way, use PVC-covered 2-conductor wire instead of the usual zip cord. The harder jacket of the PVC-covered wire makes it less likely to tear or become stuck on sharp objects (such as nails) inside the wall. The stiffer wire is also easier to snake than conventional spaghetti-like speaker wire.

(Please turn to page 36)

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314443. Neil Diamond's 12 Greatest Hits, Vol. 2. (Columbia)
346809. Dvorak: Symphony No. 9 "New World"/Carnival Overture. The London Philharmonic Orchestra. (Verese Sarabande)
346767. Johnny Mathis—Most Requested Songs. (Digitally remastered—Columbia)
349324. Rodgers & Hammerstein—South Pacific. London Symphony Orchestra. (Digital—CBS)
348649. The Pachelbel Canon And Other Digital Delights. The Toronto Chamber Orchestra. (Fantare)

342667. Beethoven: Piano Concertos Nos. 3 & 4. Concertgebouw Orchestra. (Digital—CBS Masterworks)
328302. Tina Turner—Private Dancer. (Capitol)
321570. Beethoven: Symphony No. 5, Op. 67/Schubert: Symphony No. 8 (Unfinished). Vienna Phil. (Digital—CBS Masterworks)
343251. Bach: Goldberg Variations—Glenn Gould (Digital—CBS Masterworks)
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347054. David Lee Roth—Eat 'Em and Smile. (Warner Bros.)
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316604. Tchaikovsky: 1812 Overture; Marche Slave; Beethoven: Wellington's Victory. Larin Maazel, Vienna Phil. (Digital—CBS Masterworks)
343251. Bach: Goldberg Variations—Glenn Gould (Digital—CBS Masterworks)
287003. Eagles—Their Greatest Hits 1971-1975. (Asylum)
328740. Mozart: Piano Concerto No. 26 (Coronation); Rondos—Murray Perahia and English Chamber Orchestra. (Digital—CBS Masterworks)



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Please accept my membership application under the terms outlined in this advertisement. Send me the 3 Compact Discs listed here and bill me only \$1.00 for all three. I agree to buy two more selections at regular Club prices in the coming year—and may cancel my membership at any time after doing so.

SEND ME THESE 3 CDs:

--	--	--

My main musical interest is (check one): (But I may always choose from any category)

ROCK/POP CLASSICAL

Mr. _____
Mrs. _____
Miss _____
First/Last Name Initial Last Name

Address _____ Apt. _____

City _____

State _____ Zip _____

Do you have a VCR? (Check one.) Yes No 185/587

Do you have a credit card? (Check one.) Yes No

ADVANCE BONUS OFFER: Also send me a fourth CD right now at the super low price of just \$6.95, which will be billed to me.

This offer is not available in APQ, FQ, Alaska, Hawaii, Puerto Rico; Please write for details of alternative offer.

Note: We reserve the right to request additional information or reject any application. AP7/C2 AP8/C3

AUDIO

(Continued from page 34)

Ford goes digital

In our article on compact disc players for the car (*Road Vibes*, page 79, Sept. '86), all the manufacturers listed in that article are aftermarket suppliers—meaning that the CD player has to be purchased and installed after you buy the car.

Now it appears that CD enthusiasts can buy CD players with the car. Ford

has introduced a CD player as part of its Ford/JBL Audio System, available in the Lincoln Town Car. The CD unit uses an analog filter and a single digital-to-analog converter. The Ford player does not use oversampling. The sampling rate is the conventional 88.1 KHz. Like the Delco/Bose system available in GM cars, the Ford/JBL system is equalized to the contours of the Town Car. The system is powered by a 140-watt amplifier divided among four channels.

The Ford/JBL system, minus the CD player, is also being added to the Lincoln Mark VII. The system is already available in the Lincoln Continental.

Ford's luxury cars will also have a new cassette receiver that automatically determines whether a cassette should be

Ford is the first of Detroit's automakers to offer a CD player as an option. It's available with the 140-watt, 12-speaker Ford/JBL system in the Lincoln Town Car.

played in the normal or "metal" tape equalization mode. That makes for one less button on the radio. Bravo!

Early warning

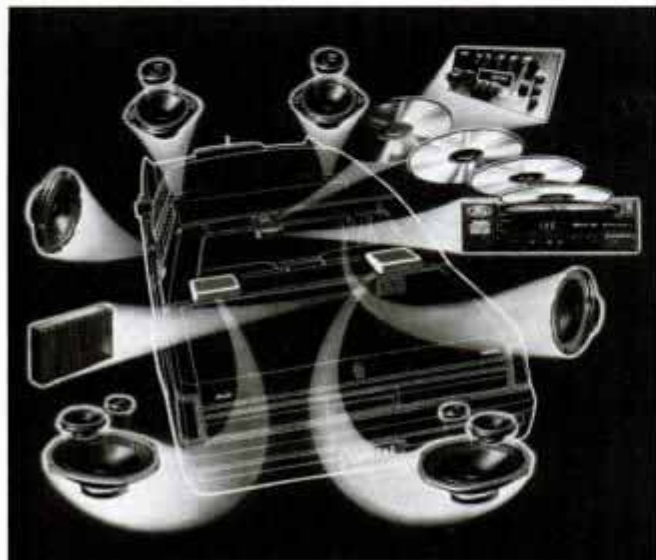
In a move that could foreshadow a similar development in the U.S., CBS/Sony Records in Japan is withdrawing 3600 LP, single and cassette titles from the Japanese market in order to allow record dealers more room to stock compact discs.

The withdrawn titles account for about 20 percent of the company's analog recordings.

Some recordings will be released on the digital compact disc, but many titles are destined for oblivion.

The titles being withdrawn were not big sellers, says CBS/Sony. Still, these titles probably had their appeal—if only to a limited audience. If your tastes in music go beyond the mainstream, or tend toward the obscure, then perhaps it's time to buy some of those albums you skipped over on your last trip to the record store. It might be your last chance to get them. If you own offbeat material, better make a cassette copy in order to preserve the original. If the title is discontinued, you might have a collector's item—even if it's valuable only to you.

PM



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At last! A wood filler for the big jobs.

Now there's a wood filler that can rescue damaged and even rotted wood—High Performance Wood Filler by Minwax.

It won't shrink, crack, or fall out. It hardens in only 15 minutes and can be sanded, planed, drilled, carved, painted, or stained in less than half an hour. And it's weather, water, and rot resistant.

It repairs almost anything made of wood, indoors or out. From windowsills and decks to woodwork and furniture... it's the wood filler for the big jobs. Look for it at your favorite store. For more information, send in the coupon.

High Performance Wood Filler to the rescue!

Minwax Company, Inc., Dept. PM-037
P.O. Box 426, Little Falls, NJ 07424

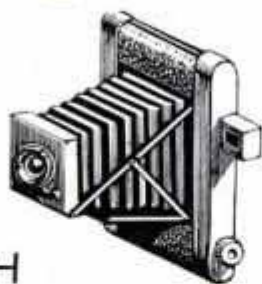
Please send free information package.

Name _____
Address _____
City _____ State _____ Zip _____



Minwax makes wood beautiful

Photography



BY STEPHEN A. BOOTH

Painless Focusing



Olympus OM-77AF has pop-up flash built into 1½ frames-per-second motor-drive handgrip (left). LCD panel (above) displays operating functions.

were first introduced.

Like the other AF cameras we've reported on, the OM-77AF gives you true point-and-shoot convenience. You simply sight your subject in the viewfinder, depress the shutter release button halfway, and the lens whirrs into perfect focus. In addition, the OM-77AF has a continuous-

focus function like that found in the Nikon 2020 and super-expensive Maxxum 9000. This means the autofocus lens system will track a moving subject as you click away from a stationary position—or as you run away (and out of focus) from an uncooperative subject that decides to hold its ground—if not its pose.

As you might expect, Olympus offers an entire family of lenses that are dedicated to perfect operation with the OM-77AF. What's more, the camera will work with older Olympus lenses, though not in the AF mode.

Other noteworthy features of the OM-77AF include its AF Illuminator. This helps the camera achieve automatic focus in low-light conditions by bouncing low-power infrared beams off the subject. Other AF cameras put this feature into an add-on flash, but Olympus builds it right into the camera body. Also noteworthy is the camera's multiple computer-program modes: When you don't want to worry about shutter speed or aperture, or the focal length of the lens you're using, the on-board microprocessor in the OM-77AF will do it for you. You can, of course, also operate its exposure and focusing functions manually. **PM**

Every other year, the photography industry convenes in the German cathedral town of Cologne for a look-see at the latest technology in image-making. After the huge success and sales tallied by Minolta's nearly 2-year-old Maxxum autofocus SLR camera, most industry observers expected to find a Klondike lode of autofocus 35mm SLRs at this September's Photokina Fair.

Those observers, including PM's man in Germany, were disappointed, at least in this regard. There were plenty of exciting developments in Cologne, which I'll report on in future issues. But in autofocus SLRs, only Olympus brought something to the party.

The company's OM-77AF now joins Canon's T80AF, Nikon's 2020 and the Minolta Maxxum series in the small and exclusive Autofocus Club. In a future issue, I'll report more thoroughly on how well it works once I've had a chance to put the OM-77AF through a

workout. For the time being, here's a summary on what it is and what it does.

The first thing you'll notice

PM Photo Album—Tips For Better Pictures

Long focal-length lenses, also known as telephotos, are mostly used to bring distant subjects within the camera's reach.

Pictures taken with these lenses, compared to those shot with "normal" lenses, reveal dramatic differences in foreground and background relationships, and even subject emphasis.

The telephoto's narrower angle of view yields a compressed look between objects in the foreground, center or background. Size relationships between objects also decrease. This is why a sailboat seems

so close to an oversized setting-sun in pictures taken with a telephoto lens.

Longer focal-length lenses also produce a shallower depth-of-field, causing subjects to stand out. This gives greater impact to your shots of sports action or wildlife.

As seen here, the photo on the left was taken with a normal lens. Notice how the background remains in focus. The model on the ATV appears more prominent in the picture (right) taken with a telephoto lens as the background is blurred.—Armand Ensanian



Appliance Clinic



BY STEVE TOTH

Rumbling Broiler

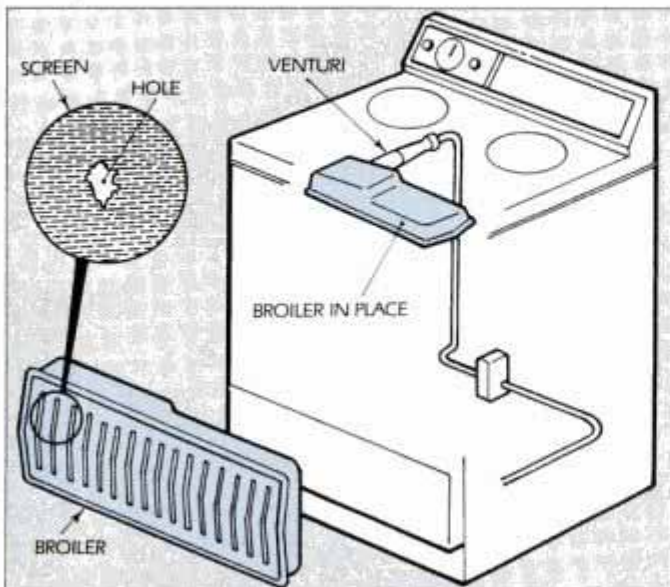
We have a Caloric pilotless ignition, self-cleaning range, model No. RSP 359UN, serial No. 350650D. The problem concerns the broiler. Whenever we put it on broil, it emits an on-and-off rumbling noise. Needless to say, we don't broil anything because we are afraid of this noise. I have replaced a couple of igniters in the oven section, but I would appreciate any help you could give me in solving this problem.

JAMES E. FRAIER
LYNDHURST, NJ

Sounds as if the noise may be coming from the broiler burner. This part is covered by a screen and is held to a venturi with four pop rivets. If one or more of these rivets have come loose or failed, this can create an improper air-to-gas mixture within the broiler, creating the rumbling noise. A hole or frayed area in the screen would have the same effect.

To check the broiler, unplug the range, turn off the gas to it, and remove the unit. Look for loose or missing rivets, a hole in the screen, or cracks in the metal. If any defects are found, replace it.

If the broiler checks out okay, then I suggest you contact your local Caloric service agency and have them inspect the range. A replacement unit would be sold by an authorized Caloric parts or service agency in your area. Order part No. 72218; it costs about \$105.



A Caloric range's broiler may rumble if a hole develops in its screen or if there is a bad connection at the venturi.

Bad element

I have a Sunbeam frying pan, model No. S31MB-7, 1250 watts, 120 volts. My heating element wire is bad. How can I replace it or where can I have it repaired?

LEO GERTSCHER
ST. CLAIRSVILLE, OH

Your 1965 vintage frying pan has a heating element which is part of the fry pan itself. That is, the element is sealed into the pan. Unfortunately, the pan for your model is no longer available from the manufacturer. So, if the element is bad, you're looking at replacing the entire appliance.

However, if the heat control that's plugged into the pan is causing the problem, it can be replaced for about \$15 to \$20.

I suggest you send the fry pan and control to a company-owned Sunbeam service center to have them verify that your element is bad and not the control. There is no charge for the inspection. Send it to Sunbeam Service, 7427 N. Harlem Ave., Niles, IL 60648.

Oven pops

We have a Montgomery Ward electric range, model No. KSD-4316, serial No. 347761. The oven pops loudly after it heats up and continues to pop at intervals until cooled down. What can be done to correct it?

KENTON BREWER
HERNDON, KY

Normally when you get a popping noise out of the oven, it is usually a matter of something in the oven that's expanding and contracting from temperature change. This can come from the broiler pan, the broiler pan grid, the oven racks, the oven door panel, or even the side, top or bottom of the oven itself.

A process of elimination will help you track down the source of the noise. Put the broiler pan, broiler grid, and both oven racks in the oven and turn it on until it makes the popping noise. Then turn off the oven and take out the broiler pan grid.

Let the oven cool and turn it back on. If it still pops, take out the broiler pan.

Continue this process until you have removed everything that would be a removable item. If the oven continues popping, then the source of the noise is the oven or door liners and you'll probably need to have a service technician check these parts.

If you need to replace any of the removable items, you can buy them at any Montgomery Ward store or service center.

Readers write

In response to the service tip in a recent column, several readers wrote in with another method of removing ink stains. Their suggestion: give a squirt or two of hair spray on the stain, rub together and launder as usual. I tried it, and it really works!

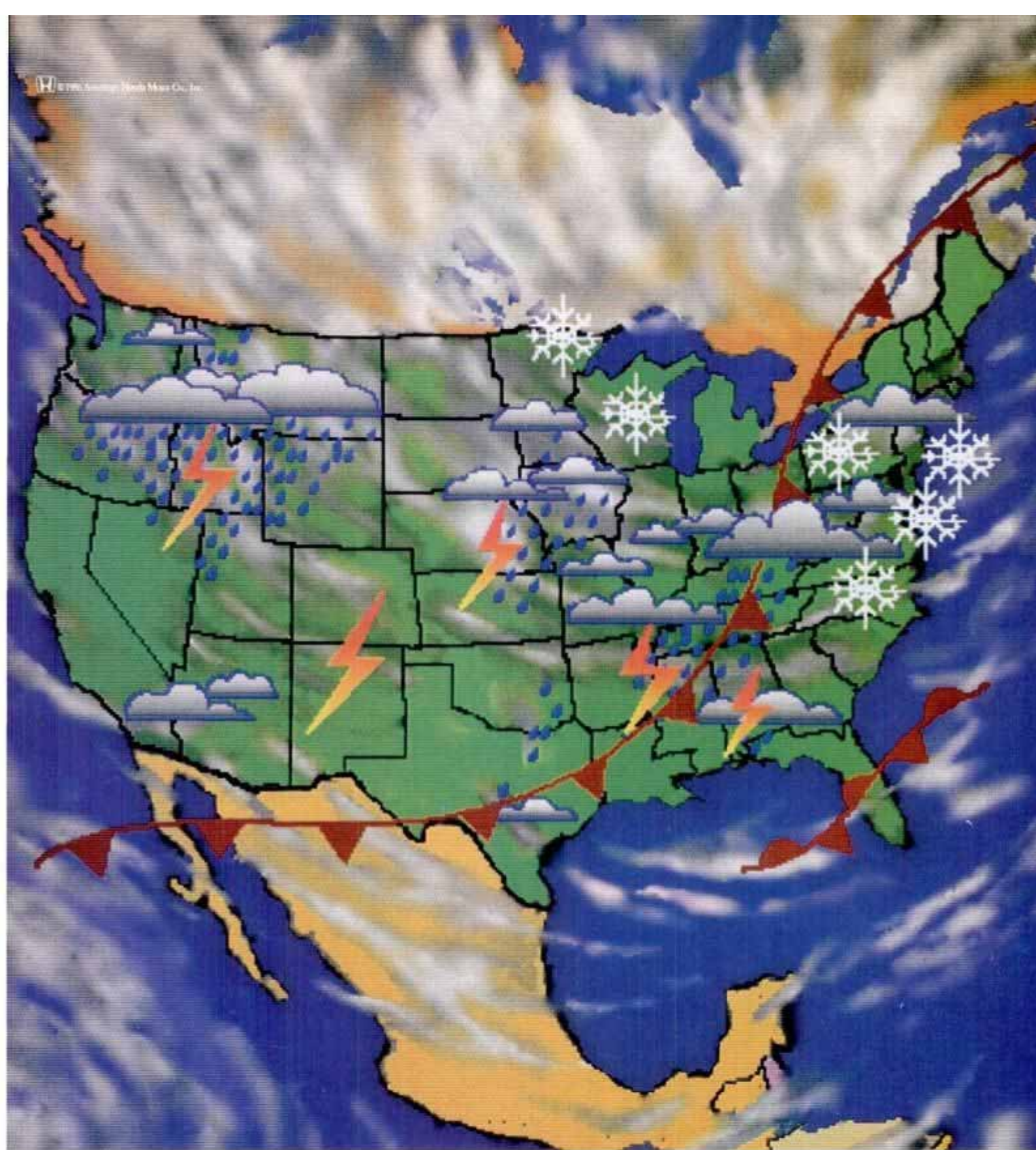
Switch failed

I have a Norelco coffeemaker, model No. HB5155. This week, the switch that turns it on and off had a mechanical failure and we cannot turn it on. We called the Norelco Los Angeles service store and they said the switch is no longer available. Since the coffeemaker makes very good coffee, I'd like to repair it. Can you help me locate a new switch?

BUD OHRENSTEIN
BURBANK, CA

*I suggest that you check with the Norelco Service Center in New York. The part number for your switch is 0000-2614125 and it costs about \$4 plus \$1 shipping. Write Norelco Service Co., 103 E. 41st St., New York, NY 10017, Attn. Parts Dept. Also, Norelco appliance owners who have questions or problems with their appliances can call toll-free 1-800-243-7884. **PM***

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



No problem.

Now you can take the road by storm in a Honda Civic Wagon with Real Time[®] 4WD. That's what we call the automatic, split-second engagement of four-wheel drive whenever our viscous coupling detects a loss of traction.

Then, for good measure, we added a special low-speed pulling gear, all-season radial tires and rear mud guards.

After all, if your car doesn't have to worry about the weather, neither do you.



HONDA

Civic Wagon with Real Time[®] 4WD

Outdoors



BY TIM COLE

Yamaha's New Water Sleds



WaveRunner (foreground) and WaveJammer hit the water running.

Suddenly, I found myself traveling backward down the Long Beach Marine Stadium at 30 mph. Undaunted, I clenched the new Yamaha WaveRunner's thumb throttle and reversed field. Another turn and yet another skid.

Then it dawned on me. Yamaha's new wet toy is supposed to make a wild 180° spinout with the merest suggestion of handlebar input. That's why the bottom is so flat. Let's try driving it like a snowmobile, dig that chine into the turns. Sure enough. A little leaning produced tight, controlled cornering at wide-open throttle.

And that's the only tricky thing you have to understand about Yamaha's long overdue entry in the wet toys market, which is dominated by the Kawasaki Jet Ski. It's got hop-on-it-and-go simplicity mated to a 2-stroke, 32-horse Yamaha outboard powerhead driving a conventional impeller, which resides inside a jet pump providing a top speed of 36 mph.

The WaveRunner—and its

smaller 1-person sibling, the WaveJammer—is made of sturdy fiber-reinforced plastic (FRP). The WaveRunner can accommodate two persons, weighs 328 pounds and measures 109 x 40 x 34 in., just right for the bed of a small pickup or trailer on a subcompact. The WaveJammer weighs 262 pounds and measures 88 x 34 x 37 in., slightly higher because the unit's integral leaning post permits stand-up operation.

The WaveJammer is Yamaha's acknowledgement that the more athletically inclined—Jet Ski enthusiasts, let's say—need more of a challenge. Accordingly, the WaveJammer requires quicker reactions and a more finely developed sense of balance, which in turn delivers correspondingly greater excitement.

But the WaveRunner is no dolt, seeming to strike a balance between easy operation and a demand for real skill. It's a lot easier to ride than the Jet Ski, and comparisons with the

water vehicle that practically created the market are inevitable. It's also a much more practical conveyance than the Kawasaki X-2, a 2-person water sled introduced a year ago. After a test ride last summer, I found the X-2 extremely taxing for one rider, and virtually impossible for two. Yamaha has obviously capitalized on

More jets

Around the time Yamaha introduced the WaveRunner and WaveJammer, it also rocked the industry with an innovative jet outboard for back-country applications. Using a conventional outboard powerhead and shaft, Yamaha has fashioned a classic jet pump for small flat-bottomed boats. The engine's main shaft turns an internal impeller, which draws water into an intake on the bottom of the engine, accelerates it through a duct, and spits it out the back. The pump replaces the prop and cavitation plate (photo at right). Boats using the engine can run on just inches of water, but there's an obvious loss in efficiency.

Kawasaki's misstep with a tough, simple little machine that manages to deliver on the often adversarial promise of being both easy to drive and exhilarating at the same time.

For more information about the sleds, write to Yamaha Motor Corp. U.S.A., Marine Division, P.O. Box 6555, Cypress, CA 90630.



Yamaha's jet outboard is intended for extremely shallow water.

Row, row, row your boat

By the time you read this, adventurer Ned Gillette will either be warm and comfy in his Stowe, Vermont, home, safely returned from his December row to Antarctica, or he'll be floundering around somewhere in the South Atlantic. Either way, Gillette will have made a few waves by putting to sea with an interesting agglomeration of high-tech 21st-century gear.

Gillette and his expedition colleagues have increased their chances for survival by relying on a traditional boat design equipped with modern electronics. His aluminum boat, The Sea Tomato, is adapted from the proud Swampscott dory. She's been tarted up with 8mm video cameras, an Argos satellite tracking

system, carbon-fiber oars, a Sitex sat/nav system, sophisticated single-sideband radios, an autopilot and a desalinator.

Members of Gillette's team are wearing Versatech, the latest in moisture permeable fabric, along with 3M Thinsulate and outer foul weather by Henri Lloyd. Wherever you are Ned, we're glad to know you're well-equipped.

(Please turn to page 48)



Ned Gillette aboard the Sea Tomato.



NOW, OWNING A BOAT
IS EASIER THAN
YOU THINK...



**Simon
Aboard
'87**

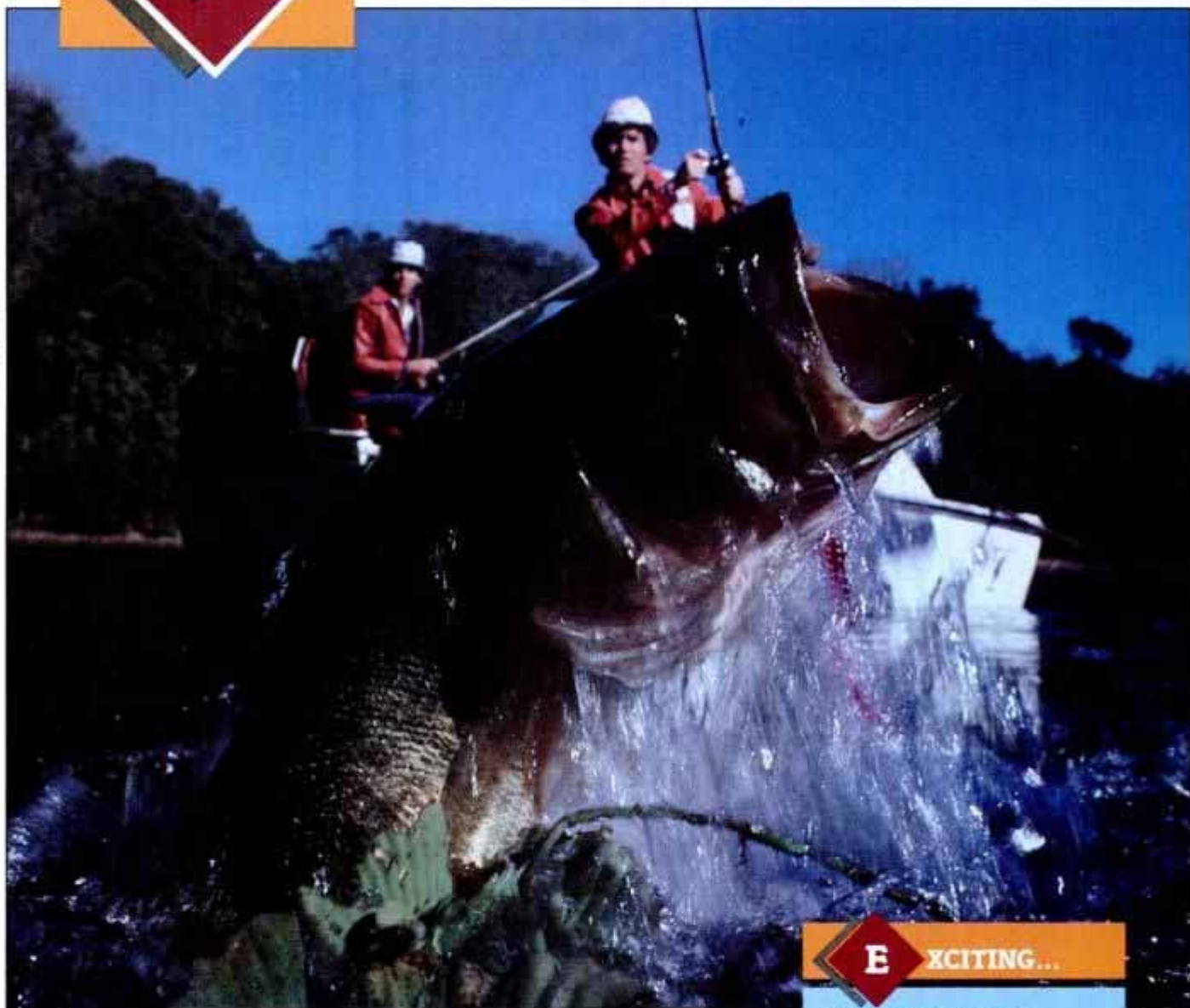
**BOAT
BUYING
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**Make your
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owning a boat
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Why just dream? Some dreams are so within reach, you'd be surprised...like the dream of owning a boat.

Right now, owning a boat is more affordable than ever before. Financing has never been this attractive or easier to obtain.



EXCITING...

The water is right, the weather is perfect, the bait is tempting. An explosion at the end of your line let's you know that this is going to be one great morning.

\$86-\$160/month*—
18 ft. bass boat
w/100 HP outboard
(total cost \$6,200-\$14,500**).

\$65-\$104/month*—
16 ft. aluminum fishing boat
w/50 HP outboard
(total cost \$3,770-\$5,990**).



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

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Today, maintaining and keeping a boat is simpler than at any time since.

Now, boats are the best value in years.

Wet and wild.

Or sunny and serene.

Make the dream of owning a boat come true. Why?

Because, now, more than ever before, you can.

Start living the boating adventure.

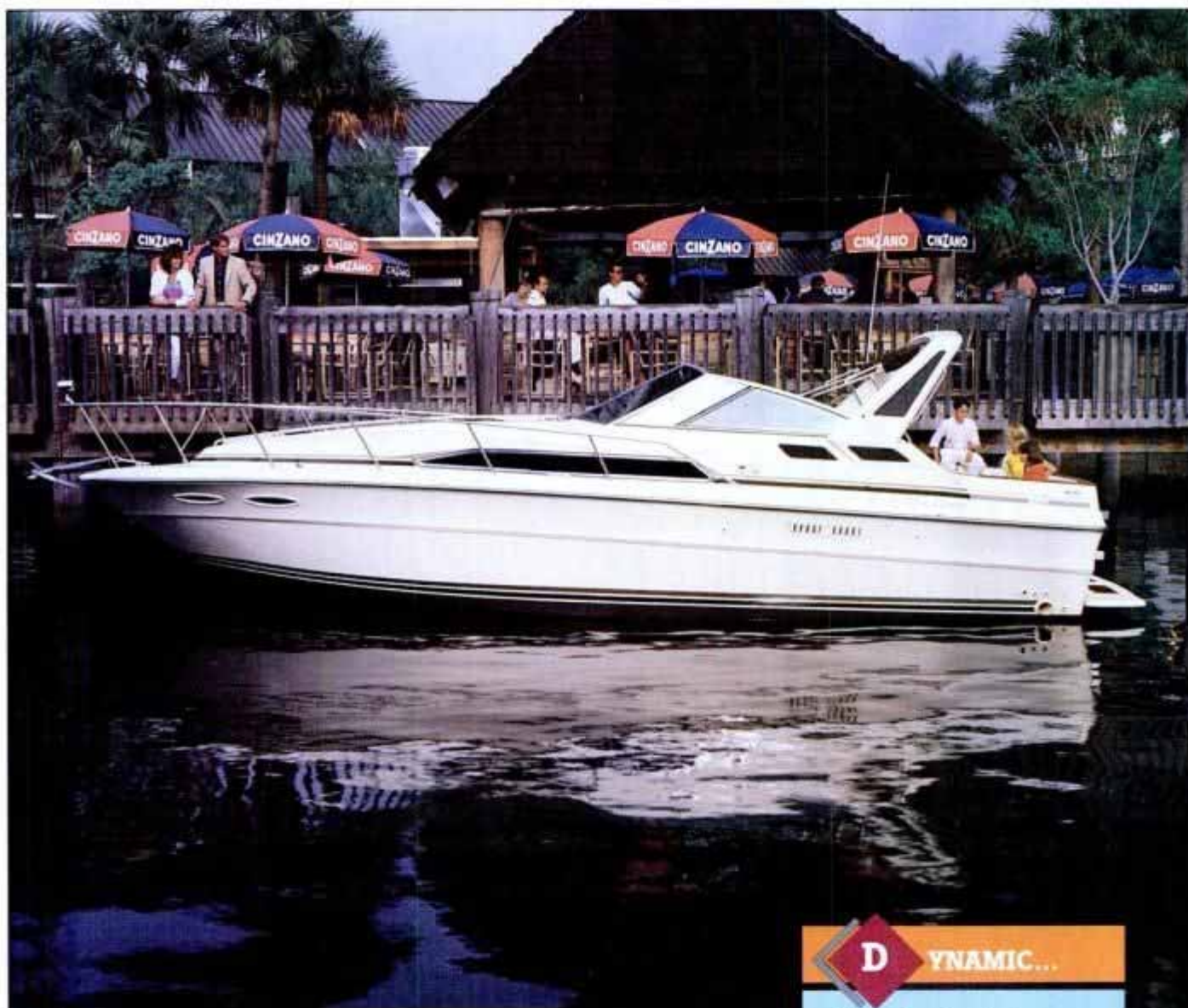
Financing is simple...

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

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

Getting started is easy...

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



DYNAMIC...

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

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

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

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

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

Boats are good investments...

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

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

Boat shows are the best place to start...

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

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

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



C CHALLENGING...

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

\$66-\$83/month*
16 ft. catamaran sailboat
(total cost \$3,790-\$4,795**).

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



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

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

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



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

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

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

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



the program can be transferred to the new owner.

We're building boats today as if our future depended on it, constantly adding value and versatility all along the line.

We have to... because the day we say Four Winns boats are good enough is the day you'll look for another boat.

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

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



FOUR WINNS

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

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



0 FREEDOM 170 HORIZON 190 HORIZON 210 HORIZON 170 CANDIA 200 CANDIA 195 SUNDOWNER 215 SUNDOWNER 225 SUNDOWNER 235 SUNDOWNER 245 VISTA 267 GUEST 211 LIBERATOR 241 LIBERATOR 241 LIBERATOR

The excitement is pure Amerosport. The quality is all Chris-Craft.



Chris-Craft introduces a new class of express cruisers, from twenty-three to forty-one feet. The Amerosport 412 is the flagship of a new class of Chris-Crafts, express cruisers of elegant design, extended range, and unsurpassed value.

As exciting as the 412's styling and engineering are, the real beauty of this cruiser lies in the quality of its workmanship. Like all Chris-Crafts, the Amerosport's graceful hull holds more than a century's experience in building boats with meticulous attention to detail.

If you need a more objective reason to appraise the 412, consider this: In a recent study, *Chris-Craft had the highest owner satisfaction rating in the industry.* That's an endorsement of quality you won't hear from any other manufacturer.

For more information on Amerosports, or any other Chris-Craft, send \$4.00 to Murray Boat Administrative Services, Inc., Dept. PM-03, P.O. Box 9450, Bradenton, FL 33506.

Chris-Craft
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If you're fishing around for an economical boat with lasting value, catch a look at the sturdy, dependable Cobia Sunskiff 177 outboard. Time has proven the Sunskiff to be a true fisherman. It has a casting platform, tackle box, aerated baitwell, self draining motor well and ice chest, plus teak rod storage. Yamaha's 3-cylinder 70 features Precision Blend Oil Injection and comes standard with Yamaha's two-year factory limited warranty. Participating dealers only. Price does not include transportation, dealer prep nor accessories. Send \$3.00 for your copy of the 1987 Cobia catalog or pick one up at your Cobia dealer.

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1987 BOAT SHOW SCHEDULE

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

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

SPECIAL BOAT SHOW PRICES ARE NOW MAKING AMERICA'S BEST-SELLING BOATS EVEN BETTER

CAPRI
BY *Bayliner*



1700 Capri Bowrider boat, motor & trailer only \$7,695*

Unbeatable Value, Unbeatable Prices

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

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

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

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



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

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

Name: _____
Address: _____ Phone: _____
City: _____ State/Zip: _____

US Marine Information Services
PO Box 24467, Dept. 037A
Seattle, Washington 98124

FORCE OUTBOARDS FOR 1987

Prices As Much As 30% Below The Others

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

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

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

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



FORCE
Outboards

Full Value Package



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

BLUE FIN ALUMINUM BOATS

America's Most Affordable Boating Packages

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

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

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

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

BLUE FIN

*Manufacturer's suggested boat show prices in effect at participating dealers. Actual prices set by dealer. Taxes, registration, freight, options and dealer prep charges extra. Prices may vary.

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When you buy select packages of Quicksilver two-cycle or four-cycle oil from March 1 thru July 5, 1987, Mercury Marine will send a rebate directly to you and make a contribution to the FishAmerica Foundation.

The FishAmerica Foundation is a non-profit organization dedicated to improving the quality of sportfishing resources. The FishAmerica Foundation's efforts contribute to increase fish populations and clean up and maintain America's waterways for ours' and future generations.

There is no limit on the number of rebate claims or contributions. Also, you can pledge your rebate to the FishAmerica Foundation. Mercury Marine will then match your rebate amount and send the increased donation to the Foundation. Just check the box on the coupon to make the donation. *

You Save Money... America's Fishermen Get the Profits

Please check off box at left indicating your purchase.

	CUSTOMER REBATE	MERCURY MARINE DONATION	REBATE AND INCREASED MERCURY MARINE DONATION
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<input type="checkbox"/> 16 OZ. BTLS. (case)	\$2.00	\$1.00	\$4.00
<input type="checkbox"/> 52 OZ. BTLS. (case)	2.00	1.00	4.00
<input type="checkbox"/> 1 GALLON (case)	4.00	2.00	8.00
<input type="checkbox"/> 2 1/2 GALLON (case)	5.00	1.50	6.00
4-CYCLE OIL			
<input type="checkbox"/> 52 OZ. BTLS. (case)	\$3.00	\$1.50	\$6.00
<input type="checkbox"/> 1 GALLON (1 btl.)	1.00	.50	2.00
<input type="checkbox"/> 2 1/2 GALLON (1 btl.)	2.00	1.00	4.00

CLAIMS MUST BE POSTMARKED NO LATER THAN JULY 18, 1987.

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Send proof-of-purchase seal, store receipt & this coupon to:
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Use the coupon from this ad or from the Quicksilver Oil display at your participating Mercury Outboard, Mariner Outboard or MerCruiser Stern Drive dealer.

PMX

OUTDOORS

(Continued from page 40)

Walk before you run

Here's a little primer for those of you who are both puzzled and amused by walking's recent rediscovery.



Overall shape of the walking shoe is rounder forward. Heel is also greatly pronounced in profile, and lace width varies for flexibility.

Whether or not you buy the new hype, there are fundamental differences between walking shoes and conventional running shoes that merit attention. We've taken as our example the new walking shoes and new running shoes made by Kangaroos. Kangaroos' claim to fame is its durable Dynacoil midsole, an intricate web of plastic coils developed by NASA for moon boots.

But Dynacoil is practically the only feature these two shoe designs have in common. Right off the bat, the walking shoe has a pronounced heel made of solid rubber that gives the walker added stability in rough terrain. It's built into the sole and angled slightly forward to

enhance "step-off." The walking shoe design also has a rounded and raised toe which makes it easier to put your shoes on. The function of running has helped develop a design that differs in several subtle but relevant ways. The running shoe usually has a flat sole and is engineered to accommodate the curve of a runner's foot strike.

Side to side, or mediolateral, control is crucially important in a running shoe to control supination and pronation (*Fancy Footwork*, page 71, Sept. '86). Rear-foot control collars on running shoes handle this motion.

Fast Fishermen

The concept is simple and alluring. Develop a center-console fishing boat that has the raked, low-slung styling of a contemporary sport boat. Invest it with stainless-steel hardware, a classy bow pulpit, large capacity fish boxes and livewells, full-size rod racks and a 100-gallon fuel tank that brings the farthest canyons within easy reach.

The concept has become reality at Donzi Marine, well known for its sleek Z-series sport boats. They've married the no-holds-barred sex appeal and speed of their sport line to utilitarian fishing machines. The Donzi ZF-33 and ZF-23 "Vest

Pocket" Fishermen combine these elements nicely. The smaller boat, pictured here, measures 22 ft. 11 in. on the centerline and has a beam of 8 ft. 6 in. Draft is a miserly 18 in., which will get you onto the flats.

But the boat has enough of a pronounced vee forward to handle the steep chop of the Gulf Stream.

It's the intermingling of styles and technologies that I find most intriguing, though. Donzi has stretched beyond the ordinary in melding the attributes of two distinct hull forms. For more information, contact Donzi Marine, 7000 Bradenton Rd., P.O. Box 987, Tallevast, FL 34270-0987. **PM**



Sporty styling enters offshore fishing in the Donzi ZF-23 "Vest Pocket" Fisherman.



LOOK WHAT YOU HAVE TO DO TO IMPROVE ON A JOHN DEERE.

This is the new John Deere Riding Mower.

And when we say new, we're not just talking about its looks.

The power-plant is new: A nine-horsepower, high-displacement, overhead valve engine that not only churns out more horses under normal conditions, but also responds quickly to tough conditions like cutting thick grass or mowing uphill.

The transaxle is new, with the kind of beef you'd expect only in a much larger tractor. And our new variable-

speed drive lets you shift on the go without clutching.

The steering system is new, quick and responsive, with a 17-inch turning radius that's tight enough for even close trimming.

There are even some new comfort features, like padded footrests. But the emphasis, as always, is on performance and durability.

It's the reason why a new John Deere takes such a long time to get old.

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the full line of new John Deere Riding Mowers, or the name of the dealer nearest you,



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NEW/HOME

Touch-Sensitive Light



Once Touchtronic's signal wire is attached to the lamp's shade harp (above), the lamp becomes touch sensitive (right) and provides 3-level lighting.



A touch of your finger is all it takes to turn on a lamp after installing the Touchtronic light-control device (Model 6603, \$15). The UL-listed control screws into the bulb socket and works with any lamp that's at least partially made of conductive material. Your touch generates an extremely small electronic signal that tells an electronic

switch to close and send power to the lamp bulb. Any conductive material on the lamp—base, finial or body—is touch sensitive. It provides 3-level lighting at 10, 50 and 100 percent brightness. A fourth touch turns off lamp. It's sold at hardware stores, lighting showrooms and home centers. Write Westek, 7100 Convoy Court, San Diego, CA 92111.

Computer color matching system

Getting the precise paint color you want can be accomplished in seconds with this new computerized color matching system by Benjamin Moore. At no cost, bring in a color sample that's at least 1/4 in. sq. and the system can match it for you on the spot. The heart of the system is a color spectrophotometer, a light-reading de-

vice that analyzes the sample. The system's computer will print out a formula to match the sample with Benjamin Moore paints. The dealer mixes the paint based on the formula. The customer can take the formula to any Moore dealer for mixing. About 200 dealers nationwide offer the service. For more information, write Benjamin Moore, Computer Color Matching, Montvale, NJ 07645.



This computerized color matching system will analyze a color sample and, in seconds, produce a paint formula to match it.

Touchup paint pumps

The next time you have a small touchup job, you won't have to reach for a can of wood filler, paint or spackle



This trio of touchup pumps is designed to take the bother out of small-scale repair jobs.

if you use this trio of touchup pumps. Each holds about 4 ounces of material and is designed for quick and easy repairs to wallboard, painted surfaces or wood. The wall-fix and wood-fix pumps come vacuum-sealed and prefilled with acrylic latex compound. The homeowner fills the



Fill the paint pump with the color of latex paint or stain needed for the touchup at hand.

paint pump with the latex paint or stain needed for re-touching. All three are disposable. Paint applied with the paint-pump tack dries in about half an hour, the spackle in 15 minutes, and the wood filler in about 1 hour. The pumps work on a piston mechanism and can be



Apply spackle without the mess of putty knives and cans with the wall-fix pump.

used on horizontal or vertical surfaces. Press forward and apply the material in even strokes. The pumps cost about \$4.50 each. They're sold at hardware stores and home centers. For more information, contact Wagner, 1770 Fernbrook Lane, Minneapolis, MN 55441. **PM**



The acrylic latex compound in the wood-fix pump can be stained after it's dried.

Finding the best auto parts is easy if you read the fine print.

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Participating NAPA AUTO PARTS stores across the United States will honor the manufacturer's warranty on any NAPA branded product they sell. The remedy available is dependent upon those actions specified in the individual manufacturer's warranty. The product need not have been purchased at that store; however, the manufacturer requirements, such as proof of purchase, duration, proper use, etc., must be met by the purchaser. Your participating NAPA AUTO PARTS store has a copy of the manufacturer warranties for all NAPA branded products, and it is available for your review prior to purchase.

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Electronics



BY STEPHEN A. BOOTH

Upward Mobility

As personal computers used in the home continue to drop in price, their mobile kin—the laptop PCs—are providing more bang-for-the-buck in a totable package. Now NEC, which impressed the traveling data-crunchers with its downsized CPM-based Starlet laptops, has applied its shrinking act to the IBM-compatible standard. The new PC is called MultiSpeed and, at this writing, it's the fastest portable money can buy.

The laptop weighs in at 12 pounds, including its rechargeable, 4-to-6 hour NiCd battery. The unit measures 1 ft. sq. x 3 in. high, and carries a suggested retail price of \$1995.

At that price, what you see is an important part of what you get. The MultiSpeed's monitor screen employs supertwist liquid-crystal display technology, which provides higher contrast and, therefore, greater visibility than conventional LCDs. The 80-character by 25-line display is detachable, so you can hook up a regular cathode-ray tube monitor when you're working at home. Another external appointment worth noting is the 85-key, full-function keyboard. There are no dual-purpose keys to tax your memory and patience, as with other portables.



MultiSpeed computer has built-in software.

Now, what does MultiSpeed have under the hood?

To begin with, there's NEC's proprietary V-30 processor, which is responsible for the laptop's name. The superfast chip will process information at either 4.77 megahertz or 9.54 megahertz. NEC claims that's twice the speed of the 8088 processor in IBM's XT computer.

MultiSpeed's operating system is the new MS-DOS 3.2—though it's compatible with earlier versions of MS-DOS. It boasts twin 3.5-in. floppy disk drives, and 640 kilobytes of random access memory come standard. In competing PCs, that much RAM would be an option.

In addition to the free RAM, MultiSpeed spots you to 512K of ROM—read-only memory—in which resides the computer's five built-in software programs. These in-

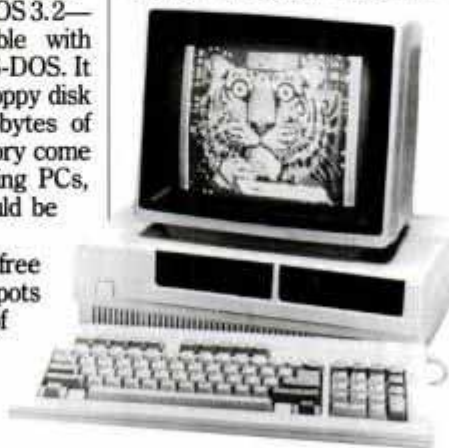
clude Outliner, Notepad, Filer, Dialer and Telcom. The first two are particularly interesting.

Outliner, in conjunction with a word-processing program, can be called up at any time to help you organize ideas as you write a long piece. Notepad will perform many of the editing chores that a separate word-processing program might, such as deleting words, adding them or swapping whole paragraphs. That ain't all: The program includes a 20,000-word dictionary, too. As for Dialer and Telcom, they let you make the most of MultiSpeed's optional telephone modem, for communicating with other computers or databases.

On the home front . . .

Way back in October, we outlined the pricing wars in IBM-compatible home computers (*Target: Big Blue*, page 80). The following month we reported on the under-\$1000, PC-compatible Blue Chip from Korea's Hyundai (*Electronics*, page 46). Now, Hong Kong's Bondwell Computer (HQ'd here in Fremont, California) has entered the fray with a \$499 clone. And Baby Blue, another California importer, slides in under the wire with a \$399 compatible. At those prices, neither comes with a monitor.

The Bondwell X'Press 16 comes with a single 5¼-in. floppy disk drive and 256K of random access memory (expandable to 640K). The company says a twin disk drive version will follow. When con-



Bondwell X'Press 16 is a \$499 IBM clone.



T-160 from BASF: Finally, an 8-hour videotape available in true production quantities.

nected to a separately purchased color monitor, X'Press 16's video display processor will deliver 16 colors and 512 by 212 pixels of resolution. This, plus three channels of sound (eight octaves each) make the computer suitable for game-playing between bouts of work.

Baby Blue, from Oakland, California, also sports a single disk drive and 256K of RAM onboard, but the memory can be expanded to 1 megabyte (1000 kilobytes). Its video processor will yield 640 by 200 pixels of resolution when coupled to a monitor of your choosing.

Stay tuned for more news from the bargain basement. Home computers in '87 will make a joke of the price-slide VCRs experienced in 1985.

Tape talk

Ever notice how broadcast TV movies run two hours and 10 minutes? Or how those wildlife documentaries on public television never quite begin or end when the TV program guide says they will? And what happens when the basketball game goes into overtime?

If you record TV shows with your VCR for later viewing, you've probably experienced the frustration of losing part of the program because the typical VHS videotape won't stretch beyond 120 minutes. Sure, you could record the program in the extended

(Please turn to page 57)

Only NRI teaches you to service all computers as you build your own fully IBM-compatible microcomputer

With computers firmly established in offices—and more and more new applications being developed for every facet of business—the demand for trained computer service technicians surges forward. The Department of Labor estimates that computer service jobs will actually *double* in the next ten years—a faster growth rate than for any other occupation.

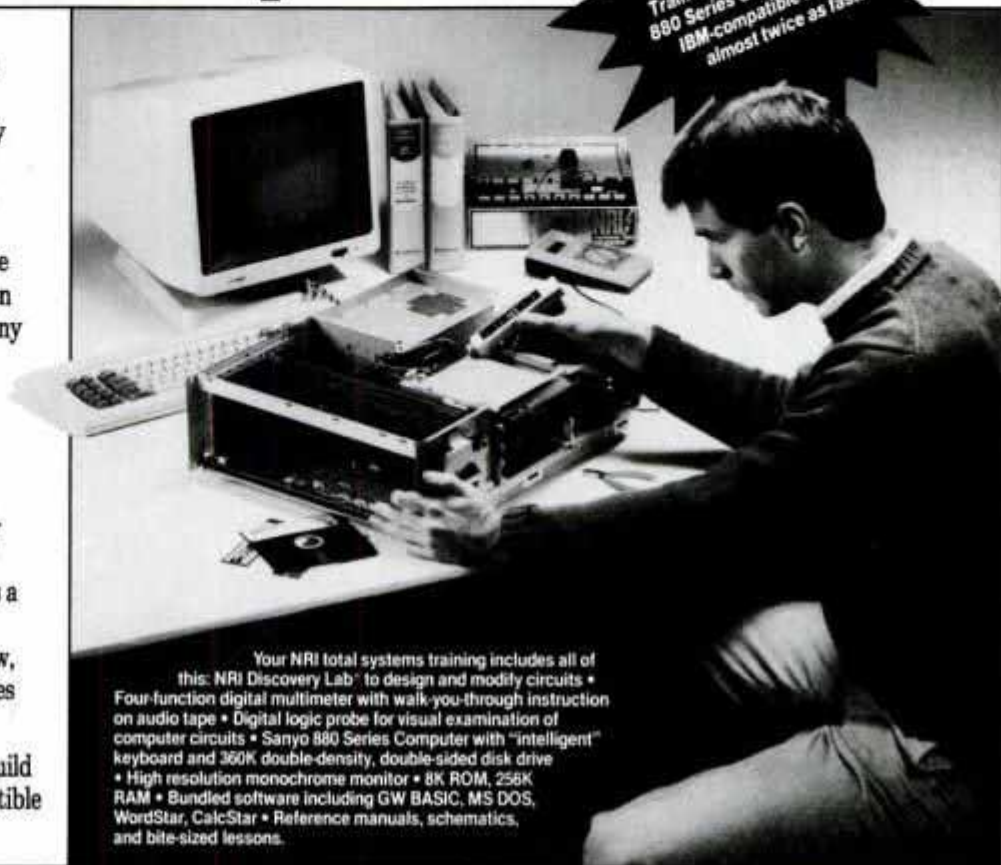
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part of your training. You even get some of the most popular software, including WordStar, CalcStar, GW Basic and MS DOS.

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ELECTRONICS

(Continued from page 52)

play, 6-hour mode. But then you're stuck with the grainy picture and low-fi sound endemic to slow recording.

Take heart, time shifters: Bedford, Massachusetts-based BASF is hitting the market with T-160 cassettes. That's two hours and 40 minutes of recording time, or eight hours in EP.

T-160s aren't new. In fact, makers of VHS VCRs always tout their machines for "eight hours recording." But how often have you actually seen, and been able to buy, a T-160 cassette? Not often, I'll bet. Most tape manufacturers don't offer them, and generally only video specialty retailers carry them.

BASF says it has cranked up the tape plant for full-scale production of T-160s, so now you're likely to see them in mass-merchandisers as well as video boutiques. The company's experience in thin-film technology—such as that used in producing the first 2-hour high-fidelity audio tape—enables it to offer 160-minute videotapes in true production quantities. At last, the VHS format might fulfill its "8-hour" promise. And you won't be forced to read about what happened in the bottom of the ninth inning.

Digital countdown

Looks as though digital audio cassette recorders will finally arrive on these shores this year. As reported last December (*Electronics*, page 16) these DAT decks (for Digital Audio Tape) are ready to hit the assembly lines in Japan, but political considerations had postponed their introduction. Namely, the recorded music industry fears that the machines will be used to make virtually perfect copies of compact discs.

To prevent such copying, the record industry had demanded that hi-fi manufacturers build an anticopying chip into DAT decks. Presumably, such a chip would shut down the deck should the user try to dub a CD, but permit the taping of other musical sources. Well, the Electronics Industries Assn. of Japan has politely declined the record industry's suggestion, and DAT decks will go on sale in Japan this spring. You can expect to find them in your local hi-fi store this coming Christmas for about \$1000. Autosound models will follow. But it's also unlikely that record companies will produce DAT music cassettes for some time.

Pig in a poke?

Remember satellite TV? Remember scrambling? Backyard dish antennas were sprouting up like dandelions until major programmers such as Home Box Office began scrambling their signal.

To watch them today, you need to buy a descrambler and you have to pay for the programs, just as cable TV subscribers

must pay.

Reportedly, some overseas operations are selling "black-box" devices which, they claim, enable satellite TV owners with descramblers to receive the programming without payment.

The way scrambling normally works, the programmer "addresses" your descrambler remotely. If your payment's overdue, the plug gets pulled and you get hash for reception.

According to General Instrument, whose VideoCipher II is the system programmers use to scramble and descramble, these black boxes can be a ripoff. The company claims that in some cases, the devices are "outright frauds." In other cases, General Instrument says it can

defeat the black boxes by using security measures built into the VideoCipher II system. The bottom line is this: If you buy a device to beat the scrambling you might wind up with egg on your face.

Sure, General Instrument's warning can appear self-serving. And it's your business if you want to pay cash for a bridge. Just be apprised that the federal rap for receiving stolen signals is \$1000 plus six months in the license-plate factory. Making or selling the devices rates \$50,000 and two years—which is why the devices come from over the border. Obviously, you won't get much sympathy from the authorities if you can't get the black-box vendor to make good on a warranty. **FM**

THE DEPENDABLES.

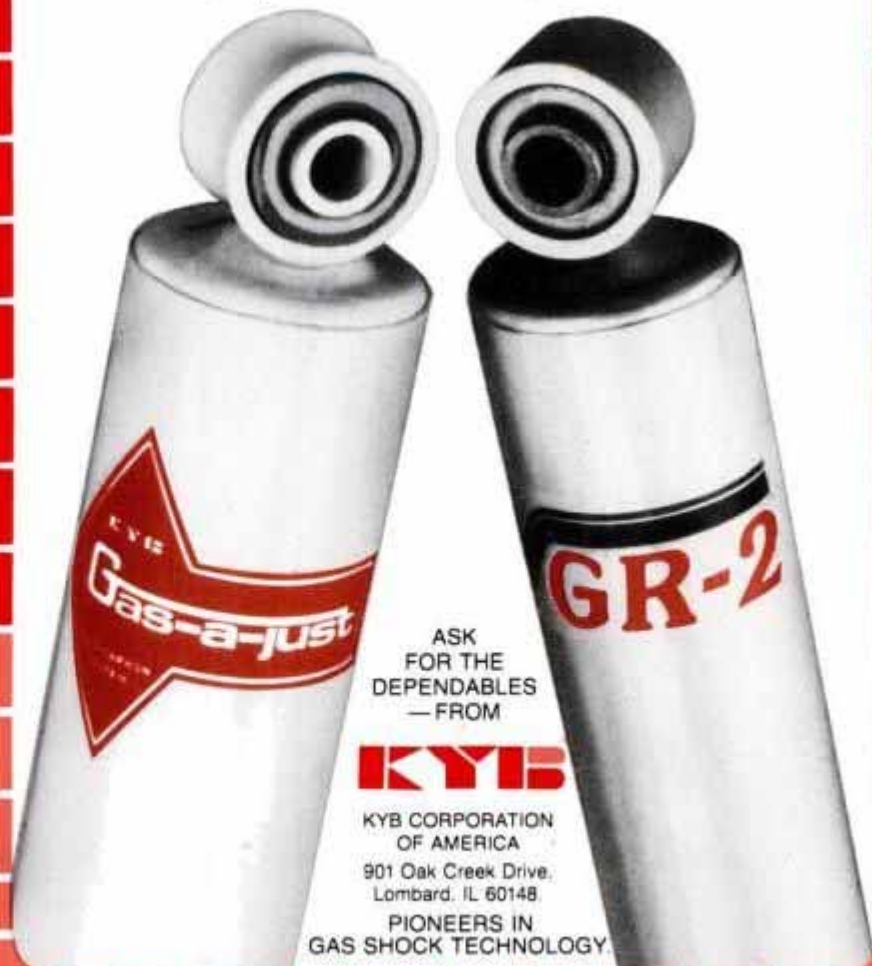
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Got too many 12-volt accessories? Or maybe you have something plugged in that you'd rather not advertise, such as a remote radar detector or charger for your handie-talkie. You can add an extra cigaret lighter, which

you can mount under the dash and out of sight. It's also handy for European cars with those different-sized lighters. The lighter is \$5.95 in auto parts stores and from Casco Products, 512 Hancock, Bridgeport, CT 06605.

Garage wall saver

If your garage wall suffers every time you try to ease your full-size car into a compact-size garage, then Car-Stop might be able to help.

Adjustable rods keep the beveled wheel chocks properly spaced from the wall, and a wall target supplied with the kit helps keep you aligned with the center of the parking space. It's easily adjustable without tools and costs \$15. It's available from Car-Stop, 875 Washington Rd., McMurray, PA 15317.



No more holes in the garage wall from parking by Braille.

Magnetic nut holder

Murphy's law says that a dropped nut invariably falls under the exact center of the car,

unless you can't find it at all. NutHolder clips to either box or open-end wrenches from $\frac{3}{8}$ to $\frac{3}{4}$ in., 10 to 19 mm. It lets you start nuts with only two hands instead of three, and disassemble without using a broom to pick up parts. It's \$2.50 in stores or from Random Industries, P.O. Box 2062, LaMesa CA, 92041.

No more chewing gum to hold nuts in weird places.



Thinner spinner ratchet

This little beauty takes the art of ratcheting to the bare minimum. By leaving the metal shrouding off the gear teeth, the diameter is reduced and you can spin on loose fasteners with your thumb. That means the usual thumbwheel can be left off, reducing the height above the socket. Full length handle turns the stubborn ones. The $\frac{1}{2}$ -in. model



This one's small all over for use in close quarters.

lists for \$33.95; the $\frac{3}{8}$ -in. for \$23.95. For more information, contact Wright Tool, 1 Wright Place, Barberton, OH 44203; 1-800-321-2902.



High-tech version of the old test light checks voltage and resistance.

Pocket voltmeter

If you can fondly remember troubleshooting automotive electrical systems with nothing more than a 12-volt test light, maybe Snap-On's MT135 mini-meter will make you feel at home again. There's a voltage and resistance scale for testing the usu-

al stuff, but it's also suitable for computer-controlled electronic fuel injection, digital instruments, electro-luminescent panels, and other applications requiring a high ohms/volt rating or a high voltage scale. Resistance scale reads up to 2 megohms. It's \$80 from Snap-On tool dealers.

Tach'er up

Monitoring performance is important to the health and economy of your car or truck. VDO's transistorized tachometers can be used with 4-, 6- and 8-cylinder engines. They're available in $2\frac{1}{16}$ -in. and $3\frac{3}{8}$ -in. dia. and 6000 and 7000-rpm calibra-

tions. Illumination is available in white, green or red-orange. The tachs cost \$85 to \$100 from VDO Instruments, P.O. Box 2897, Winchester, VA. **PM**

A good tachometer can improve both economy and performance.



Save Gas, Save Engine with "POLY"

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

The Secret is "Poly"

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

Years of Testing and Use Have Proved it True!

Slick 50 has been thoroughly tested in independent laboratories and out on the road:

The March/April 1982, p. 35 issue of "Consumer Digest" magazine stated, "Slick 50 does reduce engine heat and ordinary wear, and our informal tests indicate that it will improve gas mileage by about 2 or 3 miles per gallon."

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

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

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

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

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

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



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

It's Easy to Treat Your Engine

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

Only One Treatment Necessary

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

Works with Most Oils

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

4 Ways Slick 50 Saves You Money

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

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

3. Reduce operating temperatures, thus increasing the lubrication and life of the oil and engine

4. Minimize or eliminate costly overhauls by reducing engine wear

Up to 90% of the engine wear on a car can be caused by lubrication starvation cars experience when first started before the oil begins to circulate. Slick 50 can eliminate this problem for less than the cost of two tanks of gas.

Slick 50 Will Not Affect Your Warranty

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

There's No Risk with Our Money Back Guarantee

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

Profit from Selling Slick 50 Yourself

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

For purchase or further information call toll-free 1-800-525-8624, ext. 3 (in California 1-800-233-9559) or send to: Progressive Energy Corporation, 255 South Bent Avenue, #B-1, Dept. PM387, San Marcos, California 92069.

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

One Slick 50 at \$39.95 + \$4.00 shipping and handling. Calif. Residents add 6% Sales Tax.

Give me free shipping and handling for my order of 2 or more at \$39.95 each.

Check C.O.D. Visa/MasterCard

Card # _____

Exp. Date _____

Name _____

Address _____
(Give street address if possible for UPS delivery)

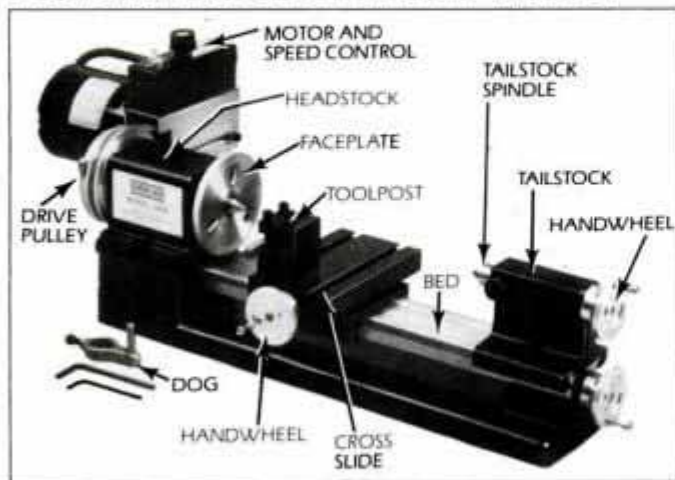
City _____ State _____ Zip _____

PEC
Progressive Energy Corporation

255 South Bent Avenue, #B-1, Dept. PM387
San Marcos, California 92069
CALL NOW, TOLL FREE 1-800-525-8624.
IN CALIFORNIA, TOLL FREE 1-800-233-9559.
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NEW/WORKSHOP

Machinist's Mini-Lathe



Compact precision lathe is designed for home machinists and model makers. It's shown with all of its major parts identified.

Sherline's 3-in. benchtop metalworking lathe offers full-size performance in a pint-size package.

The Model 4000 weighs only 20 pounds and measures 6 in. high x 7½ in. wide x 18 in. long. It's powered by a 1/5-hp, 115-volt motor. The tool measures 8 in. between centers and has a cross slide travel of 2¼ in. Standard

equipment includes an electronic speed controller, faceplate, lathe dogs, dead centers, hex keys, toolpost and cutting tool. Use the lathe to turn, drill, cut threads and perform other metalworking jobs at speeds from 200 to 2000 rpm. It costs \$320 post-paid from Sherline Products Inc., 170 Navajo St., San Marcos, CA 92069.

Power-feed drum sander

This 26-in.-wide drum sander (\$1589, plus shipping) is designed for finish-sanding or light dimensioning of hard-to-plane woods like curly maple and burls. The 6-in.-dia. drum accepts 40- to 320-grit sandpaper. The coarser grit paper can remove a maximum of 1/64 in. of stock in a single pass.

The 400-pound machine has a high-torque, 5-hp, 220-volt motor. The drum spins at 800 rpm while lumber is fed at a constant rate of 11 feet per minute to produce a smooth, uniform surface free of low spots. The tool measures 24 in. deep x 42 in. wide x 42 in. high.

A 12-in.-wide drum sander (\$725, plus shipping) is also available. For more information, contact Woodmaster Tools Inc., 2908 Oak, Kansas City, MO 64108.



This automatic-feed 6-in.-dia. drum sander can surface boards up to 26 in. wide at a rate of about 11 feet per minute.

Power tool speed control

The variable-speed control allows you to set the speed of single-speed tools to match the job at hand. Plug the tool into the control and plug the control into an electrical outlet. Dial to the desired speed and go to work—you don't have to adjust trigger pressure to maintain desired speed. Models for 10-amp (\$48.25) and 5-amp motors (\$34.75) are sold by Sporty's Tool Shop, Clermont Airport, Batavia, OH 45103.



Add the convenience of variable speed to power hand tools with this plug-in control unit.

Quick-action ladder vise



Dual spring-loaded jaws of the ladder vise open to about 1½ in. to grip work securely.



Vise holds conduit, PVC pipe and 2-by stock. It can be mounted to a bench or tool cart.

This unique, fast-acting vise (\$48) attaches to a ladder for the convenient clamping of workpieces.

The spring-loaded jaws can grip an object up to 1½ in. thick. The jaws are made of ¼-in.-thick cold-rolled steel. The vise body is made

of 18-gauge sheet steel.

The Bauer ladder vise is sold through industrial distributors. Contact Bauer Ladder Corp., Box 165, 1505 East Bowman St., Wooster, OH 44691.

Wrench replacement parts

Don't throw out that old, worn pipe wrench. Now you can breathe new life into it with replacement parts.

CMI Tools Group, CMI Engineering, Box 5339, Orchard Lake, MI 48033, sells the high-alloy steel parts in a variety of sizes. Prices range from \$3 for a 6-in. hook jaw to \$1 for an 8-in. adjusting nut. The replacement parts are sold by industrial distributors. **PM**



Pipe wrench parts, including jaws, springs and adjusting nuts, are available for 6- through 36-in. size wrenches.

HINTS FROM READERS

Shovel foot pads



Though most modern shovels have foot pads, many older ones don't. Because they don't, they are uncomfortable to use. To remedy this, you can make the pads and attach them to the shovel with $\frac{1}{16}$ -in. rivets. Use a scrap piece of steel about $\frac{1}{16}$ in. thick x $1\frac{1}{2}$ in. wide x 9 in. long. Mark the strip's center and cut it in half. Bend each piece along the center line by clamping it in a vise and folding it with a pair of pliers, or cold form it with a hammer. Curve each strip to suit the blade of the shovel. It may be necessary to cut a short slot in the pad's corner, near the shovel handle, to do this. Finally, you should deburr each pad and peen the rivets on an anvil.

—Walter E. Burton

Wire brush fix



The bristles on the front of a wire brush usually wear out first, reducing its effectiveness. Because of this, it doesn't have the bite it used to. Don't throw it away, restore its usefulness by cutting off the worn end with a hacksaw.

—Ralph S. Wilkes



If you're a friend of Jack Daniel's whiskey, raise a glass or two.

ON JACK DANIEL'S BIRTHDAY most folks like to bake a cake.



Some of our employees gather in the office Mr. Jack built when he started our distillery in 1866. And down at Mary Bobo's boarding House, Margaret Tolley has chocolate cake for everyone at her table that day. No, we never serve Jack Daniel's Whiskey on these occasions. (Lynchburg, you see, is dry.) But we hope the law is more lenient where you work or live. And that, come March 25th, you'll find time to raise a glass or two.

SMOOTH SIPPIN'
TENNESSEE WHISKEY

Tennessee Whiskey • 80-90 Proof • Distilled and Bottled by Jack Daniel Distillery
Lem Motlow, Proprietor, Route 1, Lynchburg (Pop. 361), Tennessee 37352



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More truck, more payload, more payoff. The Standard Bed hauls 1640 lbs. and gives you a 3500-lb. towing capacity† to boot. More tough truck value, that's Toyota.

DRIVE A TOUGH BARGAIN. \$6598.*

At a price like this, Toyota's Standard Bed has to be the truck value champ. It hauls the biggest standard payload in its class, 1640 lbs.** With its powerful high-torque engine, rugged full-box steel frame, front torsion bar and rear leaf spring suspension, it's ready for the tough jobs day in and day out.

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M I L E A G E **



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The fuel efficient Standard Bed is a bargain to buy and a bargain to drive.



*Manufacturer's suggested retail price. Actual dealer price may vary. Price excludes taxes, license, transportation fees, optional or regionally required equipment.

**Including occupants, equipment and cargo.

†With manual transmission, not to exceed combined GVWR of 8500 lbs.

‡EPA estimates for 4.9 liter model with 4-speed manual transmission. City/Highway estimates: 24/31. See your Toyota dealer for details.

Truck shown with optional equipment.

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WHO COULD ASK TOYOTA FOR ANYTHING MORE!

Get More From Life... Buckle Up!



SPEED THRILLS

PM drives the two fastest cars made in America:
Chevrolet's Callaway Corvette and Buick's Regal GNX.

BY MIKE ALLEN, Assistant Auto Editor

The sequentially fuel-injected, turbo-charged, turbo-cooled V6 engine whines loudly, held back by massive disc brakes, the dual exhaust pipes bellowing their protest. The yellow lights of the starting line Christmas tree tick down toward the green. Every muscle in your body is tensed, your concentration at the max, waiting for the last yellow.

This is it. The moment of truth in any car test. This is where the musclecars shake themselves loose from the wimpmobiles of the world. The quarter-mile acceleration test.

Finally, the last yellow light ticks on, and there it is—the green light. You mash down your right foot and you feel all the pent-up torque of the engine sudden-



Fender flares accentuate athletic stance and steamroller tires.

ly released. The huge rear tires spin and screech for a tortured moment, then they dig and grip. You're crushed back into your bucket seat, your eyelids peeled back against the Gs of accelera-

tion your body is feeling. Still, you keep your right foot planted through the carpeting.

The black car accelerates straight and true. Second gear comes up right at the

redline on the tach and the shift is swift and solid. The engine whines its way up through second gear, the exhaust note rising steadily with the rpm of the engine. Third gear socks in, and you're still planted back into the seat, your spine compressed into the upholstery. The finish line comes up quickly on you and you're on the brakes, easily, steadily, letting the brakes and engine work together to pull you down to a safe exit speed.

This entire sequence of events has taken just over 13 seconds in total—13.40 seconds to be precise. And your speed as you crossed the finish line was 104 mph, say the electronic timing devices.

Substitute a traffic light for the Christmas tree, and



Boost gauge on Callaway (inset, above right), calibrated in inches of mercury, reads an even 50 at full boost. Callaway badge (above), NACA ducts in hood (middle), huge exhaust tips are only external tipoff of Corvette's extras. Callaway uses as many stock Chevy fuel injection parts as possible (right), but adds turbos, intercoolers, additional fuel injectors seen at front of plenum and computer to run them, and extra oil scavenge pump for turbo sumps.

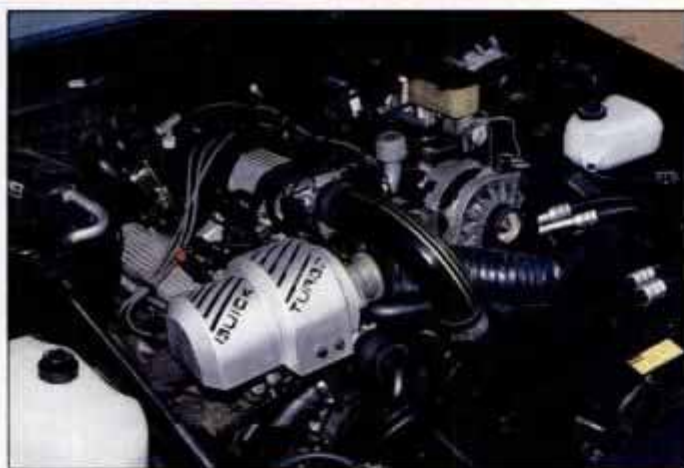
a public street for the dragstrip, and you have an entirely different tableau. But an entirely relatable one. Who among us can honestly say they haven't punched open the throttle away from a stoplight "just to see" how the car feels? Or even, perish the thought, to see if your car can take the car sitting next to you at the light? We don't think there's an American man alive in this country who can say he's never committed such an act.

And for you, that man, Detroit is once again producing high-performance automobiles. Not because you're going to race them on a dragstrip or a road course, but simply because Ameri-





The Regal GNX's fender vents are reminiscent of the familiar portholes of old, used on countless Buicks making them one of the most easily spotted cars on the road. Plastic fender flares cover fat Goodyear Gatorbacks. Above, GNX's dash carries a full complement of Stewart-Warner gauges which are mounted into a panel that is unique to the car. The single turbo V6, left, uses a new high-efficiency intercooler and blueprinted cylinder heads.



can men love the feel of a fast car under them.

Cars capable of 13-second quarter-mile times were a dime a dozen back in the musclecar era of the '60s and early '70s. Virtual race cars were built by all the Detroit manufacturers and roamed the streets freely. All of them were quite capable of humbling all but a few of the exotic Europeans like the Ferraris, Lamborghinis and Maseratis. And for a fraction of the price.

High-performance cars came back in earnest around 1982 or 1983. But for 1987, we have a watershed year. This year, we have back with us, for sale right now as you read this, cars capable of sucking up and spit-



ting out most musclecars even of the halcyon days of the late '60s. And the beautiful part is, as they're putting the '60s musclecars on the trailer, they're capable of doing it while delivering 15 to 20 mpg and handling that would have been unheard of in a race car 10 years ago.

The subject of this report is the current zenith of high-performance cars. In fact, they are the two fastest American cars you can buy. Both are capable of hair-raising performance. Yet each is an entirely different animal. One is an unabashed 2-seater sports car: the Chevrolet Corvette with the B2K Callaway option. The other is a 5-seater 2-door coupe called the Buick Regal GNX.

Both cars can turn in quarter-mile times in the low 13s, at speeds well above 100 mph, something no other domestic cars are capable of doing.

The Buick has a 3.8-liter single-turbo V6, massaged by McLaren Engines and sporting a single Garrett turbocharger with a new ceramic exhaust impeller. The Corvette uses a 350-cu.-in. V8 built by Connecticut-based Callaway Engineering Corp. and installed on special order from selected Chevrolet dealers.

We recently had a unique opportunity to drive these two very different cars back to back. The GNX was the engineering prototype for a proposed limited edition of "less than 500." Chevrolet Public Relations pried a Callaway Corvette loose from one of the engineers on the project. With a gaggle of

Buick engineers in tow, we spent a freezing cold day putting both cars through their paces at Milan Dragway in Milan, Michigan. Because of the cold weather, the elapsed times weren't representative of either car's potential.

In spite of lengthy, smoky burnouts to warm up the tires and make them sticky, there simply wasn't enough traction for full-throttle passes. But the trap speeds were certainly impressive,



Twin NACA ducts feed directly to twin intercoolers.

at more than 105 mph.

The Buick Regal Grand National has gleaned a reputation for itself in the last few years as being outrageously fast. It's been common practice in years past to claim very conservative numbers for the Grand National engine—245 hp and 355 lb.-ft. of torque. From the start, it's been faster than those numbers would lead you (or your insurance carrier) to believe. Of the limited-edition GNX, Buick and McLaren say only that they've filled out the torque curve below the peak. Not

that the engine could ever have been considered peaky. The official numbers for the GN and GNX are the same. Don't you believe it. One Buick engineer told us that the GNX version actually puts out 300 hp, but this is unofficial.

To achieve this, the turbo scroll housings are larger, and the turbo exhaust impeller is now molded ceramic rather than steel. The lighter weight, combined with a low drag seal, allows

bar-style longitudinal arm. A Panhard rod provides lateral control. Tires are Goodyear Eagle GTs, 245/50VR16 on the front end and 255/50VR16s on the rear. All four wheels are 8 in. wide. A standard Regal Grand National, by comparison, rides on 215/65R15 tires on 7-in.-wide wheels. ASC adds fender flares as well, giving the car an athletic appearance to match the enormous tires.

The instrument panel, in keeping with the no-nonsense character of the car, has a full complement of Stewart-Warner analog gauges with real dials and pointers. Very purposeful looking.

If you can still find a Regal GNX by our publication date, it should be selling for about \$25,000.

The Callaway Corvette uses two smaller IHI turbos and a pair of intercoolers fed by NACA ducts distinctively set into the hood. Maximum boost is 10 psi.

Callaway builds up entire engines from 4-bolt main bearing blocks, forged cranks and forged Cosworth 7.5-to-1 pistons. Rated horsepower is 345, torque is 465 lb.-ft.

But again, those numbers should be taken with a very large grain of salt. Very little of the Corvette needed upgrading to handle the power delivered by the specially modified hand-built engine.

In the Callaway Corvette, every trip to the car wash or even the library becomes show-and-tell. Every car freak, it seems, recognizes the Callaway from a block

(Please turn to page 114)



— PM OWNERS REPORT —

Chrysler LeBaron GTS and Dodge Lancer

After driving 1,177,047 miles, 40 percent of owners reported mechanical trouble, but 85 percent would buy another and 58 percent rate workmanship excellent.

BY MICHAEL LAMM, Contributing Editor

In the words of Lee Iacocca, "I gotta tell ya that Chrysler engineered these cars [the H-car sport sedans] to outperform Europe's best." And in a lot of important ways the LeBaron GTS and Dodge Lancer manage to do that. In price, for example: Chrysler's H-cars cost roughly half as much as the Audi 5000S, BMW 325e and the baby Mercedes-Benz 190E.

European cars have a reputation for good handling, but so do Chrysler's H-cars. Nearly 45 percent of the owners we surveyed ranked handling as the Lancer/GTS's best liked feature. A few drivers, however, apparently ended up with a suspension setup that did not suit them.

To make the LeBaron GTS and Lancer competitive in the area of handling, Chrysler offers three levels of suspension for each car. First, there's the Road Touring (standard) suspension. Next comes a Sport Handling package that adds 14-in. alloy wheels plus

tighter strut and shock valving, higher spring rates, restricted suspension travel, more steering feedback, plus front and rear sway bars. Finally, there's the all-out Sport Handling II ensemble, which adds 15-in. alloy wheels and Goodyear Eagle GT P205/60VR15 tires.

This top combination gives an utterly sensational 0.88g lateral acceleration. It does this, though, at the expense of suspension compliance and softness. Not that either Sport Handling package is bad; they're just not what the

average, traditional Dodge/Chrysler buyer expects. So, we got a few responses like the following:

"Ride feels very firm," noted a retired Texas engineering salesman. "I prefer a softer suspension; less like a sports car." A North Carolina USAF colonel: "Excellent ride on the Interstates but quite bumpy on secondary roads." And a Louisiana physician: "I like the stiff ride generally, but it does get busy on bad roads and potholes."

These owners probably bought their cars—perhaps without even realizing

it—not with the standard Road Touring suspension but with one of the Sport Handling packages. Actually, only 8 percent of our owners complained of ride harshness specifically. We heard a lot more comments like this one from a Michigan corporate vice president: "The only way to buy the Lancer or LeBaron GTS, in my opinion, is with the turbo and the Sport Handling II package."

(Please turn to page 130)



Coming or going, most buyers said the H-cars had classy styling, though a Michigan owner felt: "There should be mud flaps."

CAMERA



The photographs above illustrate techniques that yield interesting wildlife images. From top: The mountain goat seems expressive because the focus of the portrait is the subject's eyes. To freeze action, such as the flamingo taking wing, use fast films. These let you use faster, motion-stopping shutter speeds with telephoto lenses. Finally, a zoom lens proves its versatility by capturing a tight, frame-filling portrait of a bighorn sheep or a full-length profile—both from the same position.

Wildlife won't pose for portraits, so you have to bring 'em home alive on film or videotape.

BY CARL CAIATI

The best trophy—when you hunt wildlife with a camera—is a perfect image of the subject, mounted on your wall. You can't pose camera-shy creatures to capture them on film or videotape. To them, you're one of the paparazzi. This makes nature one of the most challenging subjects for creative photography, and one of the most satisfying.

The element of risk is present, too. Not necessarily to life and limb, but the risk that comes from shooting on the run. You must plan carefully beforehand. You have to know your equipment, and know the techniques that must be employed in

SAFARI



MOUNTAIN GOAT AND BIGHORN SHEEP PHOTOS
BY DANIEL J. COX; FLAMINGO PHOTO BY STEPHEN
A. BOOTH; PANORAMA OF BEARS BY ANIMALS
ANIMALS/C. LOCKWOOD

a split second to help you capture the unpredictable. Additionally, you must know the habits—and try to anticipate the behavior—of the birds and animals you're stalking.

Cameras

For serious wildlife photography, a simple point-and-shoot camera won't do. You'll need a camera that's capable of using interchangeable lenses, and most "compacts" have a single fixed lens.

A 35mm single-lens-reflex camera, or a 35mm rangefinder with interchangeable lenses, will prove the most versatile for field photography. Their size and weight make for easy handling—though some recent medium-format cameras are remarkably compact, too. A motor-drive isn't mandatory, but it's handy. Birds and animals move quickly: A motor drive can let you click away as you track them, without having to cock the shutter to advance the film for each shot. Motor drives vary in their speed. Some fire a frame a second, others zip through five or more shots in the same time. Many of today's cameras come with built-in motor drives, and accessory models are available for older cameras.

You won't have to worry about shooting speed if you take a videocamera into the field. With video, the recording is continuous, and with tapes as long as 160 minutes you won't have to reload often. In portability and ease of handling, the camcorder is hard to beat because it combines videocamera, tape recorder and battery in a single chassis. A conventional videocamera is easy to

handle too, but you'll have to lug around the separate recorder/battery pack. This could become awkward when stalking your subject.

Some videocameras and camcorders can accept interchangeable lenses, but this isn't critical because most units boast zoom lenses with up to 6-times magnification. Additionally, adapter lenses are available. When fitted on the standard lens, they'll extend the vid-



Seiko LCD color portable TV, connected to videocamera, gives larger image.

cam's vision. A portable color TV hooked up to the unit will give you a larger display of your quarry than the built-in viewfinder.

Lenses

Long focal-length lenses—telephotos and zooms—are the order of the day for capturing images of wildlife. Lenses in the 200mm to 1000mm range are ideal. The shorter focal lengths are handiest in situations where you can move fairly close to the subject.

For most wildlife shooting, a 400mm lens is a good choice. It's relatively small and light, easy to handhold and manipulate—and offers a reasonably wide aperture that lets you use slower,

At left, Tamron's 2X teleconverter (top) can double the focal length of lenses such as Tamron's 70-210mm zoom (middle). Sigma's 300-1200mm zoom (bottom) covers wide range, but requires tripod mounting.



less grainy films. But if you don't want to lug a battery of lenses with you, a zoom lens is a good choice.

A zoom lens gives you a range of focal lengths in a single lens. Those in the 70mm to 500mm range provide great versatility for wildlife shooting. In addition to giving you long-distance range, the zoom lens lets you crop as you shoot.

You might not need a super-long zoom for everyday use, where a 70-210mm will handle most situations. But for wildlife, you can increase the focal length of this zoom with an inexpensive accessory teleconverter. For example, a 2X (two times) teleconverter makes a 70-210mm zoom a 140-410mm lens. There is, however, a price to pay.

Compared to normal (50mm) lenses, most telephotos and zooms have smaller maximum apertures. This means they admit less light to the film; therefore, requiring either longer exposure times—or faster films (high ASA/ISO number). Adding a teleconverter to a lens reduces this light intake even more—by about one *f*/stop. This can present complications.

Shutter speeds, film speeds

Wildlife rarely presents a sitting target. Most animals won't hang around and pose while you make a slow exposure with your telephoto lens. You could hurry things along by using a faster shutter speed with a larger aperture that admits more light. But larger apertures reduce depth of field (focus range): If the subject bolts, it's out of focus. Yet another problem with long focal-length lenses is that they magnify any camera-shake—especially at slow exposures. If you're not using a tripod or monopod (you should, whenever feasible) this could blur your pictures.

You can minimize these handicaps by using some of the "fast" films available today. Transparency films (for slides) now come as fast as ASA/ISO 1600. Print films hit the 3200-mark. All have less grain than just a few years ago. Since these "fast" films need less light, you can use a smaller aperture and faster, action-stopping shutter speed.

Shooting tips

Man is wildlife's greatest fear and foe, so take precaution if you want good pictures. If possible, study up on the particular subjects you're likely to encounter. In general, though, remain still and unobtrusive. Use cover, or "blinds," whenever you can. When moving, do so smoothly. Animals don't see detail as well as humans, but their eyes are attuned to movement.

In photography as in everything else, practice makes perfect. If you can't get into the field, you can hone your skills at the local zoo or nature-park. **PM**



MERKUR XR4Ti

Almost 2 million owner-driven miles add up to a lot of satisfied thrill-seekers in the Lincoln-Mercury camp.

BY MICHAEL LAMM, Contributing Editor

Ford's German hotrod, the Merkur XR4Ti, has been the subject of much controversy around PM's offices ever since we called it one of the *10 Best Cars Of 1986* (page 95, Apr. '86) but admitted to having a lot of mechanical trouble with the car in our *Long Term Test Report* (page 88, April '86). We knew that our *Long Term Merkur* was an early "pilot run" car, and had Ford's promise that production line cars would not suffer the teething problems we encountered. That wasn't quite the case.

Most Merkur buyers seem to be driving enthusiasts who can tell understeer from oversteer and know how to handle a fast European sports sedan. Performance and handling brought rave reviews from these Merkur owners. Take, for example, the comments of this North Carolina serviceman: "Among the cars in its class, the Merkur stands out with the pure pleasure of performance. There's no turbo lag in acceleration from 0 to 130 mph. Most of the Merkur's competitors run out of power in the 85- to 95-mph range."

POPULAR MECHANICS • MARCH 1987

A California flight attendant: "An absolute pleasure to drive. Begs for long road trips. If only we had an *Autobahn* nearby!"

A Missouri auto service technician: "Good power and handling. Very slight understeer under full power, transitioning nicely and controllably to slight oversteer. There's just the right amount of tuck-in on hard corners. You can actually steer this car with the throttle. It handles and rides almost as

well fully loaded as unloaded, a rare trait. Most comfortable ride I've experienced." A California store owner said, "It's great fun pushing Porsche 928s and Camaro Z-28s through the corners. Trailing throttle oversteer might be a problem for some, but it's usually fun once you learn to anticipate it."

A Texas chemist: "I had the opportunity to get the car up to 115 mph and was amazed at how stable it felt. There *(Please turn to page 116)*



Merkur instrument panel has an unusual but pleasing Eurotech design that owners like.



Deeply contoured seats can be folded into various arrangements for people and cargo.

CONFESSIONS OF A JUNKYARD JUNKIE



Call them salvage yards, auto dismantlers or recyclers; there's just no substitute for a good old junkyard.

BY MICHAEL LAMM, Contributing Editor

I confess. I'm a junkyard junkie. Been one for nearly 35 years now. Still no relief in sight. Nothing I'd rather do than wander through an old-fashioned, helter-skelter car boneyard and poke around for hidden treasure.

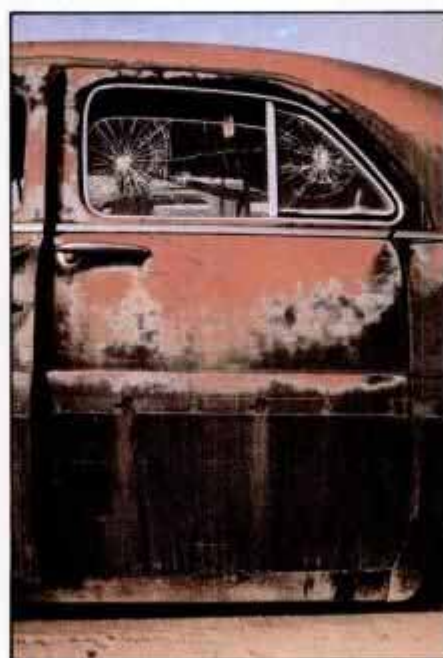
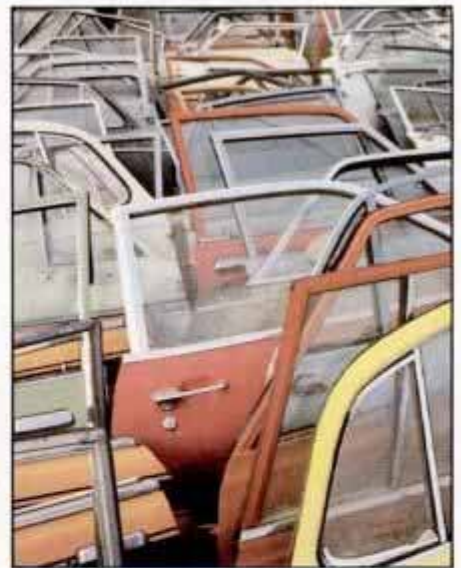
It all began in South Texas. I grew up there, learned to drive at age 12, made it legal at 14, and began buying, selling and fixing up old cars that same year—1950. Which meant rummaging through local wrecking yards for all sorts of parts.

Wrecking yards back then weren't the yuppie kinds of places they've become today. They weren't even much like businesses back then—more akin to social clubs for those of us who could never get our fingernails clean.

The junkyard owner in the 1950s had one helper, one snoozing pooch, and a V12 Lincoln or Cadillac converted into a tow truck. You walked in, told whoever happened to be up front what you needed, and he'd point you in more or less the right direction. You'd walk across the oil-soaked apron that marked the official starting gate of any self-respecting wrecking yard, amble out back, and suddenly you found yourself in an automotive Valhalla. A museum of mechanical marvels. A magical mystery tour that to me, at least, held pleasures and treasures very close to those of the flesh.

My buddies and I drove cars in those days that went out with





A trip through the local auto boneyard can range from a mystical experience to a practical one—parts at one-half to one-third what they would cost new. Most have some sort of guarantee; so if they don't work, you're only out the labor. Economics aside, a visit to a wrecking yard is also a trip down memory lane.

Prohibition. We and our cars had all been born in the '30s. Picture in your mind, then, the archetypal 1950s Texas junkyard: row upon row of wrecked 1930s parts cars, the typical first row containing, say, a retired but still restorable (by today's standards) 1932 DeSoto coupe, its high turtledeck giving the impression of a chopped top and its great balleen grille still winking in the sunlight. Next to that rested a midnight blue 1934 Ford roadster minus perhaps only its windshield.

Then came a 1938 Packard Super Eight 3-window coupe—the one with the golfbag doors and rumbleseat over the trunk. The Packard stood cheek-to-jowl with a late-model and totally ignored postwar Dynaflo Buick, and next to that stood the wooden skeleton of a supercharged Auburn sedan.

And so on and so forth, row after row, the principal players favoring the museum-goer with aesthetic and mechanical delights so sorely missing in most wrecking yards of modern times.

I did say most. There *are* a few of the old type left, and I'd like to propose here and now that the more complete old-style auto wrecking yards—like Wiseman's in Casa Grande, Arizona, and Fort Auto Parts in Sierra Vista, Arizona—be designated national historical monuments. With their passing, an irretrievable chapter of automotive history—one that fortunate members of my generation remember with great fondness—will close forever.

Changed forever

Today, for better or worse, there's no such thing as a *typical* wrecking yard. Most now specialize. Some cater to junior executives who blanch at paying factory prices for replacement BMW, Volvo, Saab and Mercedes parts. One such is All Imports Auto Dismantlers in South San Francisco, run by a gentleman named Nick Torelli. Other yards sell only Chrysler parts or AMC parts or GM or Ford parts, often neatly packaged in clear plastic and sold from sanitized showrooms that look like new-car dealerships' parts counters.

Oddly enough, though, the latest wrinkle in auto wrecking harks back to the good-old days. "U-Pull-Em" yards are popping up all over the West and seem to be spreading eastward as their popularity grows.

Here in the central California town where I now live, Pick-N-Pull invites you to come in and yank what you want. Bring your own tools, pay \$1 at the gate, and you've just earned admission to the modern equivalent of the yards of my youth, the big difference being that you won't find many cars of the 1930s.

"We deal mostly in cars of the early 1970s," says Pick-N-Pull owner Joe Faso, "because, first of all, they're

cheap for us to buy—usually around \$150 or less—and, second, because that's what people around here need parts for." Joe's yard has a menu system for parts: any hood costs \$25, any alternator \$10, a trim piece, no matter how long or from what vehicle, fetches \$2, and so on. It's a good system, and Pick-N-Pull has always been crowded when I've been there, especially on weekends.

Not that these new/old wrecking yards don't have their problems. Pilfering is one. People help themselves to little things like gas caps and knobs that they can carry out in their pocket or toolbox. Another is destruction. When a guy wants to get at a radio, for instance, he might cut the wires instead of unplugging them, and this ruins the wiring harness for the next buyer. The third and perhaps biggest problem in running a U-Pull-Em operation is liability. But all dismantlers have to have liability insurance, and rates haven't hit the heights of medical malpractice insurance, yet.

Ironically, according to Barry Isenberg, an auto recycling consultant in Cupertino, California, only 3 percent of the American public ever knowingly



deals with auto dismantlers. That figure comes as a surprise to me, not so much because I've been a junkyard junkie all my life, but because wrecking-yard wares represent such *good deals*—such unmistakable bargains.

The average car component from a wrecking yard costs about half what it lists for at a car dealership, and at the U-Pull-Em's it's a third or less than the dealerships.

Bargains in the rough

And according to ADRA, the Automotive Dismantlers and Recyclers Assn. in Washington, D.C., only 27 percent of that 3 percent who do use wrecking yards is the general public. Most parts are bought by repair shops, new-car dealers, filling stations, garages and the like. Those outfits realize what a bargain used parts are.

Not only that, recycled parts are often more complete than new ones. Say you run a body shop and a cus-

tomer comes in with a completely smashed door. You have to replace it totally. You *could* buy a brand-new door at a dealership and pay, say, \$125 for the sheetmetal inner/outer shell, then another \$35 for the glass, \$40 for the window regulator hardware, \$45 for hinges, latches, plus \$150 for the inner trim panels, garnish strips and "fuzzies." Total price: \$395 wholesale. You'd also probably have to wait for some of those parts, because no dealer stocks everything for every car.

Or you could go to your friendly auto dismantler and buy an entire door, totally complete and ready to install, for no more than \$125.

Most insurance companies allow and even encourage wrecking-yard parts in accident-claim repairs. Their contracts usually specify replacement with "like" parts, which means used, because your car is used.

What makes parts at a U-Pull-Em operation so inexpensive is that *you*



provide the labor. Joe Faso, whose Pick-N-Pull goes through 200 cars a month, estimates he'd need 18 to 20 people to run his yard the way a conventional dismantler does.

By letting customers help themselves, though, he is able to get by with three full-time employees.

I talked to a number of Pick-N-Pull customers. Joe Franco, who was looking for parts for his 1965 Chevy, told me, "It's better here because it's just plain cheaper." A couple of people mentioned that you also get the experience

of taking the part off the wrecked vehicle, which makes it easier to put it on your own car.

Ahn Trinh was taking the side window out of an AMC Matador. He also owns two Toyotas and works on all his cars himself.

"For Toyota parts," Trinh said, "I go to another yard, because they're cheaper there, but for the Matador I come here. This window here runs \$6, but it's \$30 anywhere else."

I found Bruce Pursley lying under a 1964 Ford Fairlane, unbolting the automatic transmission. "Most yards want anywhere from \$75 to \$100 for this tranny," he said. "Here it's \$50, and they give me a 30-day exchange warranty, so all I'm out is my time if it doesn't work."

U-Pull-Em fever

That's American enterprise in action. We now have maybe two dozen U-Pull-Ems here in the West, from San Diego up to Seattle. It's basically a fair-weather kind of business, so it'll probably never be very popular in the Snow Belt. The idea got its start in Louisiana, and I can see it spreading through much of the South and Southeast.

As I say, I'm a no-conflict junkyard addict, and I'm not likely to kick the habit while I can still unbolt a clutch cable. Personally, I think a lot of people waste a lot of good money by not partaking in wrecking yards, and I'm happy to see the gathering strength of U-Pull-Ems. Now could you hand me that 9/16th over there, please? **PM**





HOW TO GET AMERICA BACK INTO SPACE

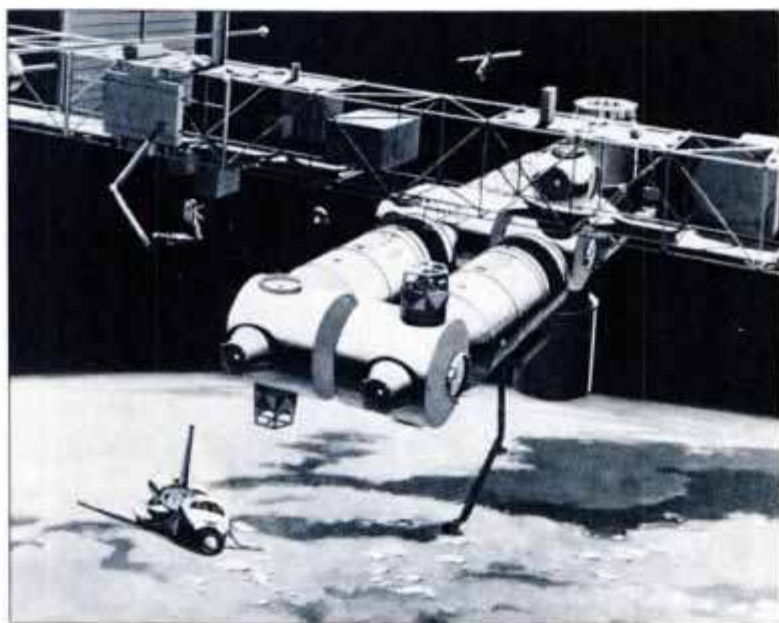
Going to Mars or building a lunar colony is dream stuff. What NASA really needs is a few new space tugs and a Space Station.

BY WALTER M. SCHIRRA

America's role as leader in space exploration literally exploded on television screens around the world on Jan. 28, 1986. It was the day the Space Shuttle *Challenger* blew up, 72 seconds after liftoff, taking seven lives, including that of schoolteacher Christa McAuliffe. Then in April, as the nation still staggered from the unexpected blow, a Titan 34D rocket exploded seconds after liftoff. Weeks later, a Delta rocket blew up during a launch. Many people were already writing obituaries for the American space program.

But the fabulous challenge that has lured us since the 1960s is too strong to keep us down. And now, the question we should be asking is: How do we get America back into space? The answer may be less complicated than it seems. We start with putting real astronauts back in the driver's seat. We drop the idea of using the Space Shuttle as a satellite delivery vehicle. We put all the "gee-whiz" of the past 10 years behind us. We design a space station to operate as a staging ground for task-oriented missions rather than glamour-oriented missions. We commit ourselves to designing space tugs, vehicles that can move between Earth orbit and the Space Station. And then, we go back to work, picking up where we left off in the early 1970s.

When I was among the first seven astronauts selected for the space program in the 1960s, candidates had to be



A Space Shuttle takes off (facing page) from Cape Kennedy, Florida. NASA concept art (above) shows module that houses Space Station crew.

graduates of the U.S. Navy, U.S. Air Force or British Test Pilot School. Each had to have an engineering degree. Thus, each of us was able to converse freely with NASA and aerospace engineers. We questioned, answered, developed and compromised.

I was pretty hard-nosed during the preparation and conduct of the *Apollo 7* flight. We were going to the moon to conduct scientific exploration, and we had to put together a transportation system with high reliability. I insisted that the mission be geared mostly to finding out if the vehicle would last the 10 days needed to go to the moon and back. Scientific experiments would be

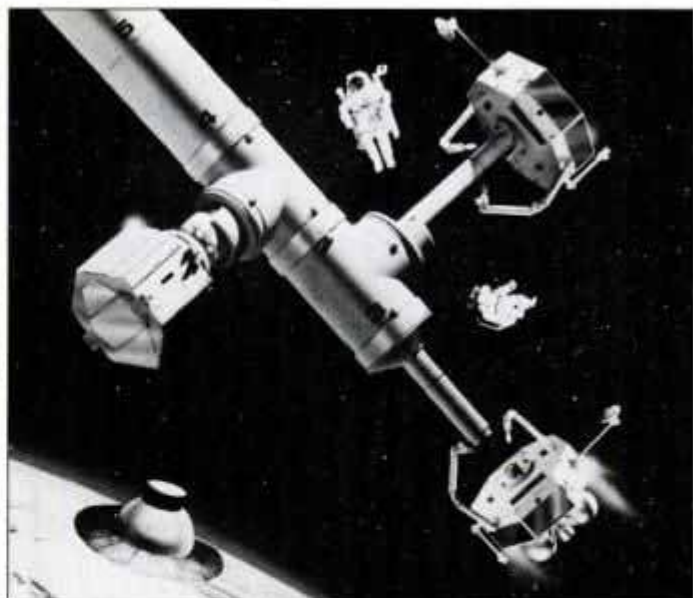
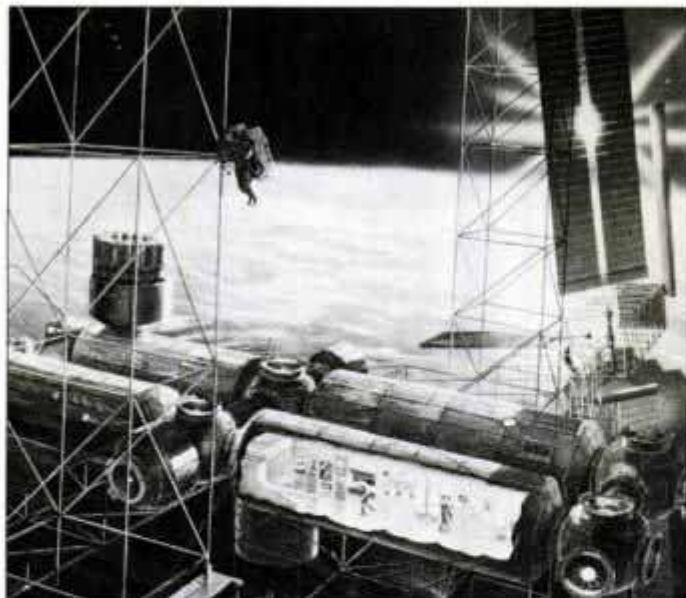
Retired astronaut Walter 'Wally' Schirra was one of the original seven American astronauts. He was commander of the Apollo 7, the first manned Apollo capsule.

performed only if we could find some quiet time. There was, at one point, the suggestion that NASA technicians work seven days a week to speed up the program. I rejected that. You don't want to rely upon people who have been working around the clock. We held work on the *Apollo 7* to five days a week, with Saturdays reserved for genuine emergencies only.

That is the value of having astronauts who know something about aeronautical engineering and the nature of test flying. The *Challenger* crew couldn't have stopped the accident that killed them

unless they had been involved in the decision-making process leading up to the launch. If they had been consulted about the faulty O-rings in the solid rocket boosters (which they hadn't) they might have scrubbed the mission. The first seven astronauts had access to anyone in the system—any desk, any office. We worked *with* NASA, not *for* the space agency.

To get ready for a serious relaunch, NASA will have to go back to using qualified test pilots only for the foreseeable future. It is ludicrous at this early stage of space exploration to allow a virtual passenger on the Shuttle to become known as an "astronaut." Such people have little to offer at an engineering skull session. I was appalled to see young women scientists in mission control acting as liaison with the Shuttle mission commander. This is not a job



PM ILLUSTRATION BY BRIAN SULLIVAN

for a "show-and-tell" celebrity.

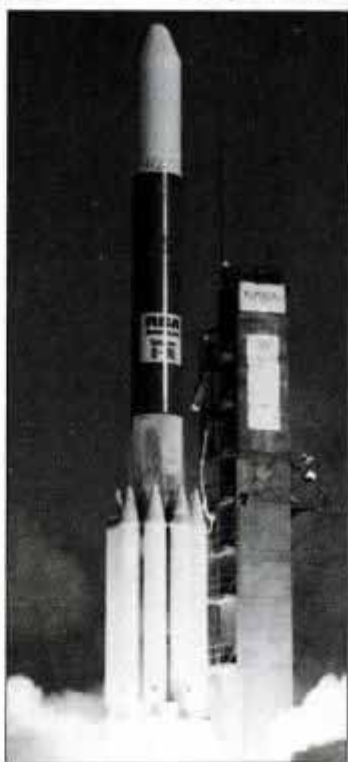
Sally Ride made the statement that she would not fly the Space Shuttle until they fixed it. What she meant was she would not fly *in* it. Non-test-pilot "astronauts" are capable mission and payload specialists, but they shouldn't be confused with engineering test pilots.

If John Young, the commander, says the Space Shuttle is ready to fly, then it's ready to fly. But you don't turn to the stewardess and ask if the plane is ready to go. Having put real astronauts back into the decision-making process, we should then look at the tools they have to work with. The most obvious place to look first is to the Shuttle itself.

The original concept for a Space Shuttle was simple, reflecting the meaning of the word shuttle: to transport people or supplies between two points.

Under increasing pressure over the past 10 years, NASA has transformed the Shuttle into the platform for a "mini" space station known as Space Lab, and a launch delivery system that has been expensive and sometimes cumbersome to operate.

Facing facts, we have to admit that if the *Challenger* accident hadn't happened, then the Titan and Delta failures of last year would have seemed troublesome, but not disastrous. The glitches would have been run down and the program resumed almost immediately. Those old rockets were very well designed to put satellites into orbit. There were failures from time to time before



Cutaway of the Space Station crew module (top left) shows setup envisioned by NASA. Schirra recommends space tugs with grappling arms (top right) to build the space station. The Titan rocket (above left) and the Delta rocket (above right) could resume service as carriers.

1986, but overall, expendable launch vehicles were and still are very reliable.

Leaving those vehicles to do the delivery work, the Shuttle's main mission would now be to help set up the Space Station and to repair some valuable satellites in orbit.

To establish the first task, a few modifications to the existing Shuttle may be in order. We may want to reduce crew size and increase cargo capability with an elongated cargo bay. Adjustments in landing systems and the steering system (as proposed by current-day astronauts) would be in order. New solid-rocket boosters would be put on the ships.

The Space Shuttle does not have to be the perfect example of an airliner to do this job, especially if it is to be manned by a fully competent crew.

For the second task, the Shuttle needs to be more flexible than it is at present. But that has little to do with the design of the craft itself.

More to the point, we need to establish a Shuttle launching facility at Vandenberg Air Force base.

Its location is perfect for putting a spacecraft into polar orbit. In polar orbit, a satellite antenna sweeps more area of Earth per revolution than possible with any other orbit. At present, only the French Ariane rocket, launched from South America, has direct access to a polar orbit. In the aftermath of the *Challenger* accident, a stampede has built up against opening the Vandenberg Shuttle facility.

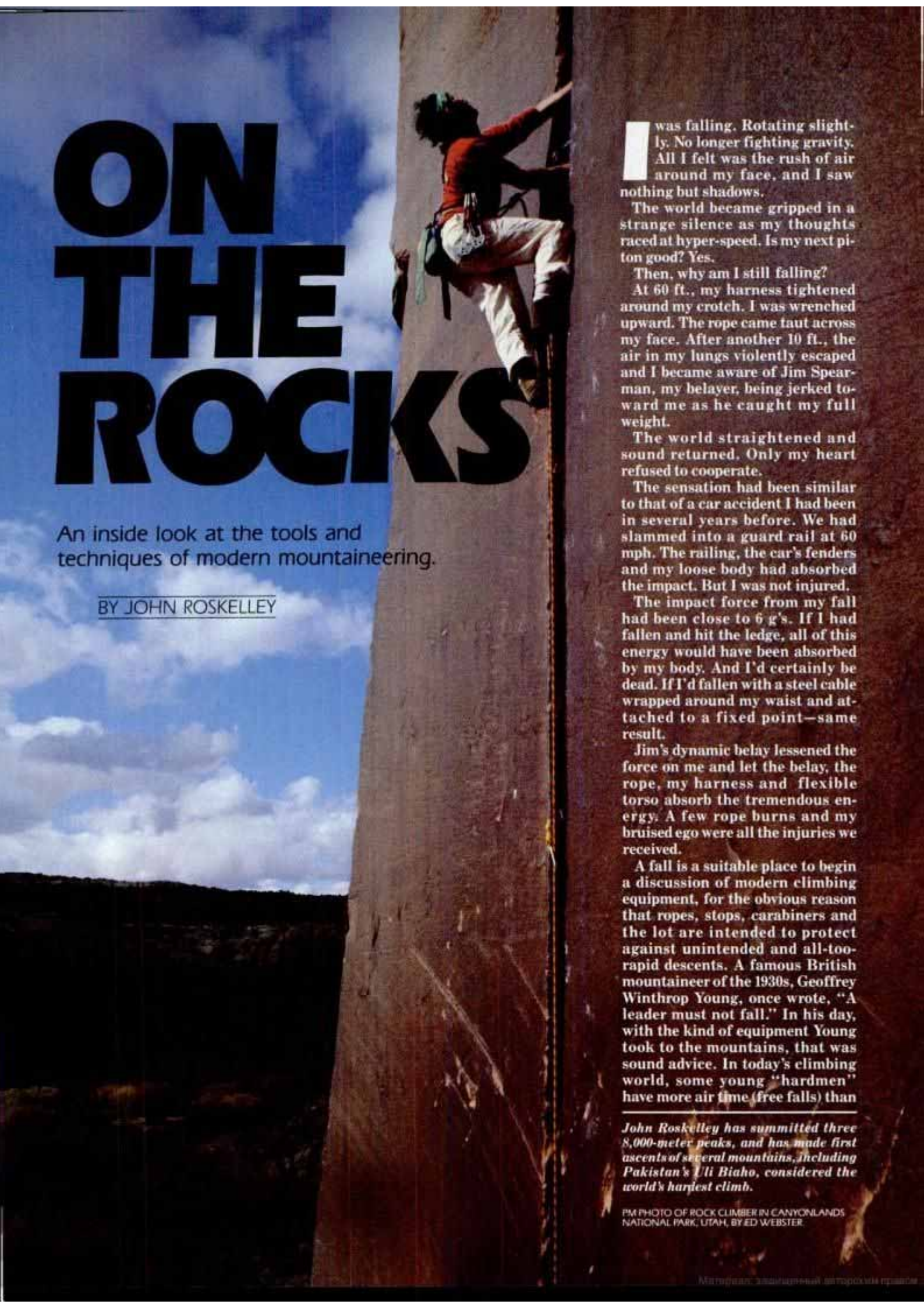
In fact, it's been put in moth balls for five years. But if we are going to relaunch a serious space program, Vandenberg Air Force base is an essential facility.

NASA has been given the go-ahead to build a fourth Space Shuttle craft. I would hesitate to build the fourth Shuttle right away. Instead, I'd do the minor redesign work on the remaining three Shuttles and do a total redesign of the next Shuttle system for a launch in three or four years.

With a clean slate for the new Shuttle, we can design the vessel any way we want to. Our aerospace technology is good, so all the industry needs to

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ON THE ROCKS



An inside look at the tools and techniques of modern mountaineering.

BY JOHN ROSKELLEY

I was falling. Rotating slightly. No longer fighting gravity. All I felt was the rush of air around my face, and I saw nothing but shadows.

The world became gripped in a strange silence as my thoughts raced at hyper-speed. Is my next piton good? Yes.

Then, why am I still falling?

At 60 ft., my harness tightened around my crotch. I was wrenched upward. The rope came taut across my face. After another 10 ft., the air in my lungs violently escaped and I became aware of Jim Spearman, my belayer, being jerked toward me as he caught my full weight.

The world straightened and sound returned. Only my heart refused to cooperate.

The sensation had been similar to that of a car accident I had been in several years before. We had slammed into a guard rail at 60 mph. The railing, the car's fenders and my loose body had absorbed the impact. But I was not injured.

The impact force from my fall had been close to 6 g's. If I had fallen and hit the ledge, all of this energy would have been absorbed by my body. And I'd certainly be dead. If I'd fallen with a steel cable wrapped around my waist and attached to a fixed point—same result.

Jim's dynamic belay lessened the force on me and let the belay, the rope, my harness and flexible torso absorb the tremendous energy. A few rope burns and my bruised ego were all the injuries we received.

A fall is a suitable place to begin a discussion of modern climbing equipment, for the obvious reason that ropes, stops, carabiners and the lot are intended to protect against unintended and all-too-rapid descents. A famous British mountaineer of the 1930s, Geoffrey Winthrop Young, once wrote, "A leader must not fall." In his day, with the kind of equipment Young took to the mountains, that was sound advice. In today's climbing world, some young "hardmen" have more air time (free falls) than

John Roskelley has summited three 8,000-meter peaks, and has made first ascents of several mountains, including Pakistan's Uli Biaho, considered the world's hardest climb.

PHOTO OF ROCK CLIMBER IN CANYONLANDS NATIONAL PARK, UTAH, BY ED WEBSTER.

ON THE ROCKS

a Pan Am pilot. Falls are expected and considered part of the sport.

But now, highly engineered equipment, described in depth here, has made it possible for a whole new generation of climbers to attempt ascents considered impossible a few years ago.

Climbing ropes

The climbing rope absorbed energy during my fall. It stretched. Not like a rubber band, but enough to partially reduce the energy my 150 pounds of gravitational acceleration generated.

Today's technical climbers use kernmantle ropes. The mantle is a woven sheath of nylon over the kern, or core, of nylon strands called perlon. The sheath contributes about 35 percent of the strength of the rope, is abrasion resistant and comes in a psychedelic collection of colors that seem to attract hummingbirds and yellow jackets.

The core can have as many as 15,000 strands of nylon (in an 11-mm rope) in twisted or braided patterns depending on the manufacturer's desired rope characteristics. I like a rope with high tensile strength with just enough elongation to eliminate any shatter-

Rock-climbing lifesavers (clockwise from below left): Carabiners festoon a Chouinard accessory harness, the REI chalk bag of 2-tone Cordura, accessory cord, wire stoppers for various crack sizes, the jumars mechanical rope ascender.

ing jolts, but not enough to send me yo-yoing into the ledge below.

I want my rope to be lightweight, flexible, hold my knots well, and have very little stretch under my body weight (for rappelling, or "jumaring" with a mechanical ascender). I normally use 165-ft. lengths, but 150 ft. is also common. Ropes come in millimeter diameters sized from 8.8 to 11. When I expect to take some serious falls, I use the larger diameter ropes. I use small diameters for general mountaineering.

Harnesses

The harness connects a climber to the rope and dissipates energy throughout the body area it covers. I've seen (and used) every conceivable model from homemade macrame "swami-belts" to full-body harnesses that include chest-seat-swami combinations.

The full-body harness absorbs the most energy of all the harnesses. Personally, I prefer a seat harness (like the model from REI pictured) that includes a 3-in. waist belt and leg loops.

The best harnesses use large webbing throughout to cover a broader surface area of the



Spring-loaded "Friend" is a cam device that can lodge in various sized cracks or fissures.

body. These harnesses have safe buckling systems and will not fail below a load of 3500 pounds.

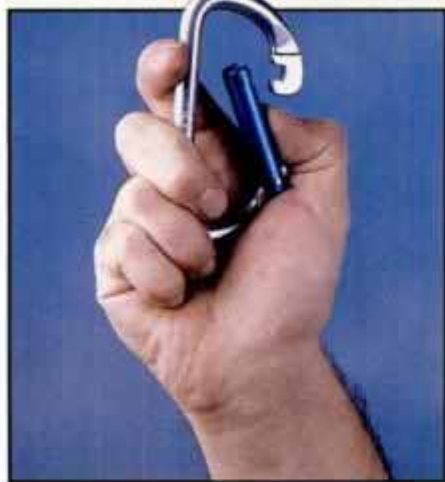
Carabiners

Carabiners connect and hold the climber's rope to the points of protection or "hardware" placed by the leader on the climb. The rounded, slick finish on the carabiners allows the rope to slide easily as the climber ascends and provides a safe edge under impact force.

The standard carabiner is made of 7075 T6 extruded aluminum bar stock. It is usually shaped in an oval or D about the same diameter as a normal-sized gripped fist. The spring-loaded gate can open approximately $\frac{5}{8}$ in. toward the body of the carabiner. This makes the entry of harness webbing, climbing rope and hardware quick and easy.

Carabiners are indispensable. A climber has one carabiner for every piece of climbing hardware, plus a dozen more for other uses.





Carabiner of rolled aluminum has a spring-loaded "gate" to accept webbing or rope.



REI seat harness of chafe-resistant webbing can accommodate hammers and other gear.



Boreal Fire Cats have high-top ankle support. Soft rubber soles grip rocky surfaces.

Webbing and accessory cord

Webbing runners or loops achieve the same effect on the rope as cutting corners with a car on a winding road. Less friction. Webbing runners are attached to the hardware and the rope, reducing rope drag. In effect, they tend to straighten a rope that zig-zags up a wall.

Webbing is tubular and comes in a variety of diameters, 1 in. being the most useful. They test at more than 4000 pounds and, depending on the length of the webbing, are worn over the neck and shoulder or hung from a hardware sling.

Accessory cord is used to sling chocks for carabiner attachment. Cord comes in six diameters, 4 mm through 9 mm. Perlon accessory cord has low elongation under stress and low tensile strength in the small diameters. I've broken small diameter cord during long falls and have begun using factory-wired nuts in the small sizes.

Kevlar cord is new from DuPont. It's expensive, but far stronger than perlon cord. A 5.5-mm-dia. Kevlar cord has a tensile strength of 4500 pounds, compared to 3300 pounds for 8-mm perlon.

Climbing protection

Free-climbing is a ballet performed in the vertical. The climber uses his hands, feet and body to move upward, relying on the rock's cavities, cracks and features to hold his weight.

A typical lead, or rope length, may have the climber jamming his fists and feet into a crack, pulling up on small fingertip ledges, using opposing pressure on two walls, or using back and legs to chimney up a large body-sized crack.

To protect the climber should he fall, hardware has been developed to use the rock's features. The climber carries the hardware with him attached to a hardware sling that sits over the shoulder and neck. When he feels a need to place protection, he places the right-sized piton, chock or cam in the crack.

Pitons, chocks and SLCDs

Climbing hardware falls into three categories: pitons, chocks and spring-loaded camming devices, or SLCDs.

Pitons are made with 4130 alloy steel, a combination of elements, including chromium and molybdenum. They're strong and can be driven into a crack and removed many times. "Chromemoly" pitons started a renaissance. When they were developed, the largest, most difficult rock and alpine walls in the world could finally be attempted with some degree of safety.

A piton characteristic is its wedge shape, smaller at the tip of the "pin," slowly thickening toward the "eye" or carabiner hole. Pitons fit a wide range of cracks, from 1/8 in. to 4 in.

Chocks use the same principle as pitons—wedging. They all have some sort of wedge design that can be slotted in a wide section of a crack and jammed or wedged into a narrowing section. More sophisticated chocks (passive cam nuts) rotate on their axis to cam against the side walls of a crack.

The original chocks came from nuts off car bolts. Today's chocks are primarily made from brass, 7075-T6 aluminum alloy, 6061-T6 aluminum and stainless steel. I use only

Climbing rope (right) ranges from 8 mm to 11 mm in diameter and has a mantle of woven nylon over a kern, or core, of nylon strands called perlon.

two or three of the most popular types out of the dozen available.

Chocks are either factory steel-cabled or must be slung with webbing or perlon accessory cord by the climber to use with a carabiner. In either case, tests have shown that the sling or cable will fail under severe load before most chocks will.

The most difficult rock climbs to protect are those with parallel or flaring cracks. The solution is a camming device (active cam nuts). Using spring tension, the cams place outward pressure against the crack walls. Once fitted into the crack, additional pull on the device secures it further.

The most popular SLCDs are Friends, developed by Ray Jardine. A

(Please turn to page 110)



A TOUCH

Fabricate custom brass hardware for your next woodworking project.

BY WALTER E. BURTON

Why make brass hardware when a wide variety of factory-made hardware is readily available? Good question. However, there are many valid reasons to fabricate your own hardware. Perhaps you need

pieces shown. More accomplished metalworkers can use a lathe, milling machine and other power tools to speed the production of some of the parts.

The hardware pieces are made from brass rods and various thicknesses of sheet brass. Brass is a nonferrous alloy that is composed roughly of two-thirds copper and one-third zinc. Small percentages of lead and iron

are also found in most types of brass. Brass is usually yellow in color, malleable and it can be soldered or brazed, and polished to a high sheen.

All of the pieces shown are made from yellow brass, except the butt hinge, which is red brass. Red brass gets its copper-like color from a high percentage of copper (approximately 78 to 86 percent). Brass can be purchased at metal supply shops, scrap-metal dealers, recycling plants, some hardware stores and through mail-order supply firms.

One such firm is Campbell Tools, 2100

Selma Rd., Springfield, OH 45505; send \$1 for a catalog.

Brass can be worked hot or cold. Here, the parts were shaped cold. To form the rosettes and keyhole escutcheon, you must first anneal, or soften, sheet brass with a propane torch. Heat the brass to a dull red color and then plunge it



DOUBLE POST PLATE HANDLE

to replace or duplicate a rare or discontinued piece of hardware on a favorite antique. You may wish to custom-make a hinge or drawer pull to a specific size, shape or ornamental design. Maybe you're just looking to sharpen-up your metalworking skills. The most common reason, though, is just the feeling of accomplishment that comes with creating something with your hands—a feeling that is familiar to most PM readers.

The eight hardware pieces seen here were made using simple hand tools—we employed no special metalworking machinery. With a little patience, even someone with no previous metalworking experience can duplicate the



DECORATIVE HINGE

in cold water. Polish the finished pieces with a buffing wheel charged with rouge or buffing compound. Then, buff the brass again with a clean, uncharged wheel. Remove minor surface scratches with superfine abrasive cloth or 4/0 steel wool. Protect the newly polished surfaces with a light spray-coat of clear lacquer. Now, let's take a look at the techniques used to make the cabinet hardware shown.



DROP-RING PULL



DROP-HANDLE PULL

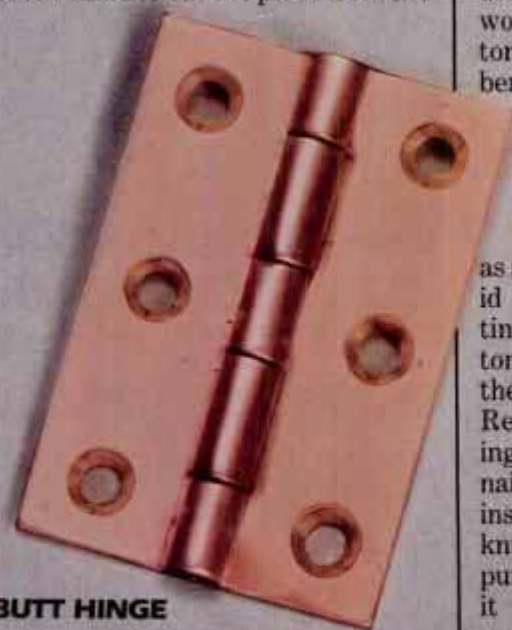
OF BRASS



KEYHOLE ESCUTCHEON

Hinges

The most difficult part of making any hinge is forming the knuckles—the curled tongues through which the pin passes. The procedure for making the butt, decorative and butterfly hinges, and the hasp shown is basically the same. Start by making a full-size paper template, as shown in the drawing. Note that the knuckles are drawn as flat tongues. Tongue length depends on the diameter of the pin. The hinges shown have tongues that are about $\frac{1}{2}$ to $\frac{3}{4}$ in long. Glue the paper template to a piece of sheet brass with rubber cement. Then, use a jeweler's saw with fine-tooth blade to cut the piece from the



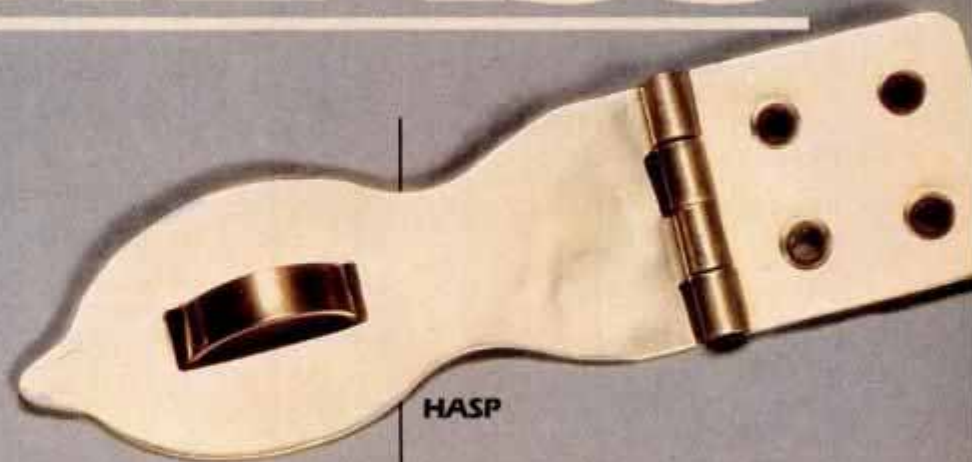
BUTT HINGE

brass. After each half of the hinge has been cut out, file all edges smooth. Form the knuckles by bending the tongues around the pin. We used a 12d common nail as the butt hinge pin and $\frac{3}{16}$ -in.-dia. drill rod as pins for the decorative hinge and hasp. Make the butterfly hinge pin from a 6-32 roundhead machine screw. Anneal the butt hinge tongues to make bending easier. The thinner brass used for the decorative and butterfly hinges and hasp doesn't need to be annealed prior to forming the knuckles. Clamp the hinge leaf in a vise with the pin in position, as shown. Next, using a ball-peen hammer and a wood block, tap the leaf to bend the tongues around pin. After leaf is bent over as far as possible, invert and reclamp leaf with partially bent knuckles and pin projecting slightly above vise jaws.

Place a steel bar between knuckles and jaw, as shown, to provide solid backing. Then, continue to hammer the tongues around the pin until the knuckles are completed. Repeat this procedure for the mating hinge leaf. Now, saw off the nailhead and join the two halves by inserting the pin through the knuckles. Strike one pin end with a punch to peen it slightly and secure it in the hinge. Finally, drill and countersink screw holes in each leaf. Drill and saw a $\frac{9}{32} \times \frac{15}{16}$ -in. slot in the hasp to accommodate the hasp staple.

Keyhole escutcheon

The keyhole escutcheon and the



HASP

rosettes used by the two drawer pulls shown, are made by embossing thin sheet brass (.0065 in. thick) over a pattern or mold. We made the escutcheon pattern from a piece of aluminum wire which was bent into an oval shape and imprinted with a row of dome-shaped bumps. Form the bumps by embossing the wire with a $\frac{1}{8}$ -in. nailset.

Next, cut the brass about $\frac{1}{2}$ in. larger than the escutcheon. Anneal the brass with a propane torch. Place the pattern on a wood block and position the brass on top of the pattern. Then, tacknail the brass to the block. Lay several thicknesses of rubber, cut from an old inner tube, over the brass and pound it with a ball-peen hammer. Continue pounding and varying rubber until brass forms around pattern.



BUTTERFLY HINGE

Color photo: Rosario Capotosto
Black-and-white photos: Walter E. Burton
Technical art: Dyck Fledderus

A TOUCH OF BRASS

Now use a round-ended wood dowel to press and rub the final, intricate details into the escutcheon. Trim the escutcheon from the brass sheet with tin snips and cut out the keyhole shape by drilling, sawing and filing.

Drawer handles

Both the double post plate handle and the drop-handle pull feature handles, or bales, made from annealed $\frac{1}{4}$ -in.-dia. brass rod. The bale on the drop-handle pull fits into posts that project from two rosettes. The plate handle's bale is held to a decorative brass plate by two eyebolts.

To make the double post plate handle, first draw a full-size paper template of the plate. Glue the template to a piece of .040-in.-thick sheet brass using rubber cement. Next, use a jeweler's saw to cut out the plate. Then, file the plate's edges smooth and drill $\frac{1}{16}$ -in.-dia. holes to accept the two eyebolt posts. File each end of a $\frac{1}{4}$ -in.-dia. \times 4-in. rod to form $\frac{1}{8}$ -in.-dia. \times $\frac{1}{4}$ -in. pins. The pins reduce the rods' diameter to fit into the eyebolts. Now bend the rod, using a vise and chain, as shown, to form the bale. Finally, bend $\frac{1}{8}$ -in.-dia. rod to form the eyebolt posts. Cut 6-32 threads on the posts to accept hexnuts.

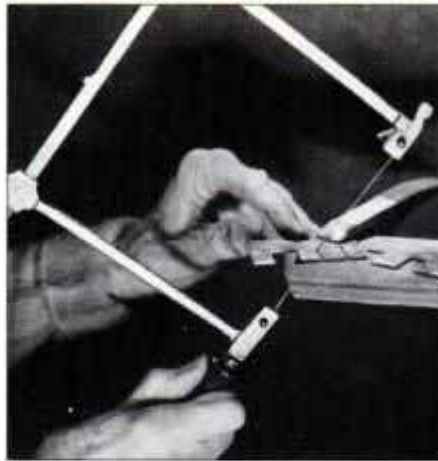
We used an alternate method to make the bale for the drop-handle pull. Instead of filing the bale ends, drill holes and insert $\frac{1}{8}$ -in.-dia. \times $\frac{1}{2}$ -in. steel pins cut from a nail or drill rod stock. Allow each pin to protrude about $\frac{1}{4}$ in. Form the rosettes by making a pattern out of a metal ring and a small disc of aluminum screen. Emboss the rosettes using the rubber-pounding technique described above for the keyhole escutcheon.

Drop-ring pull

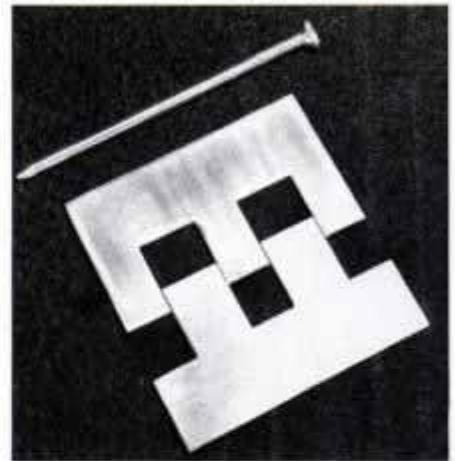
This simple drawer pull is composed of nine brass parts. Start by filing a $\frac{1}{4}$ -in.-dia. brass rod to form the post, as shown in the drawing. Also, drill and tap the post with 6-32 threads to accept the threaded rod.

Next, fabricate the two comma-shaped parts and bend a $\frac{1}{16}$ -in.-dia. rod to form the ring. Screw the threaded rod into the post and solder it in place with silver solder (4 percent silver, 96 percent tin). Then, solder the ring to the two commas and pin the commas to the post with a $\frac{1}{8}$ -in.-dia. \times $\frac{1}{8}$ -in. escutcheon pin.

Finally, make the rosette and use a washer and 6-32 hexnut to hold the pull to the drawer front. The rosette shown was embossed over a large coat button. To reinforce the rosettes and the keyhole escutcheon, fill the hollow back cavity of each part with 2-part epoxy putty. **PM**



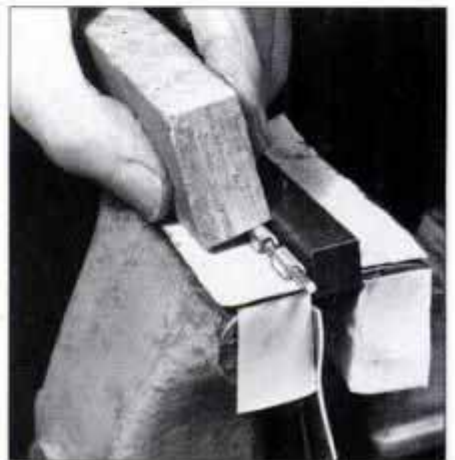
Cut the tongues in leaf of butt hinge using a jeweler's saw. Leaf is clamped to a notched board to provide support during cutting.



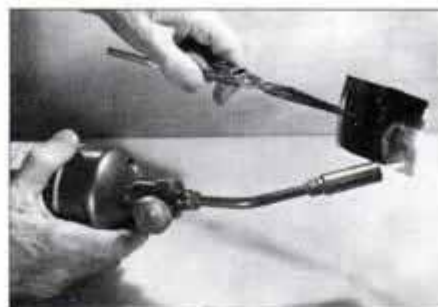
This shows butt hinge cut, filed and ready for bending. Note how well the tongues fit together. A 12d nail is used as the pin.



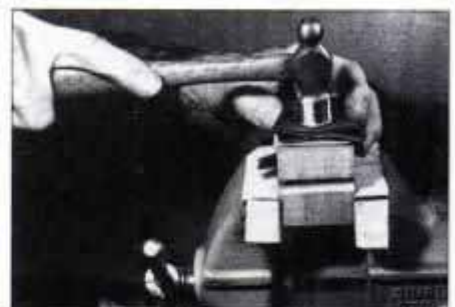
Clamp the tongue in vise with pin in position. Use a ball-peen hammer and wood block to bend the tongues around pin.



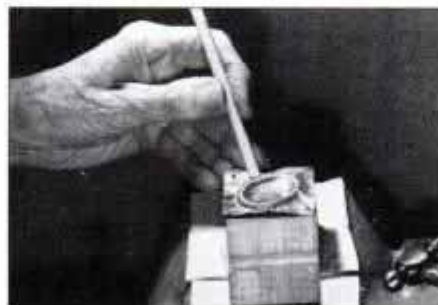
Invert hinge leaf and continue bending the tongues to form knuckles. Steel bar in vise provides solid backing while hammering.



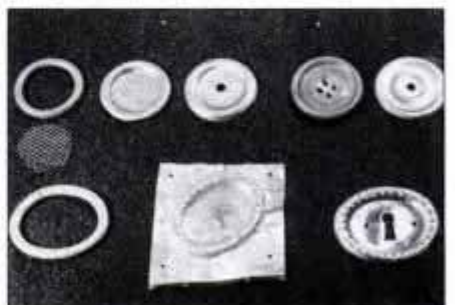
Anneal, or soften, sheet brass by heating it with a propane torch to a dull red color. Then, plunge the brass in cold water.



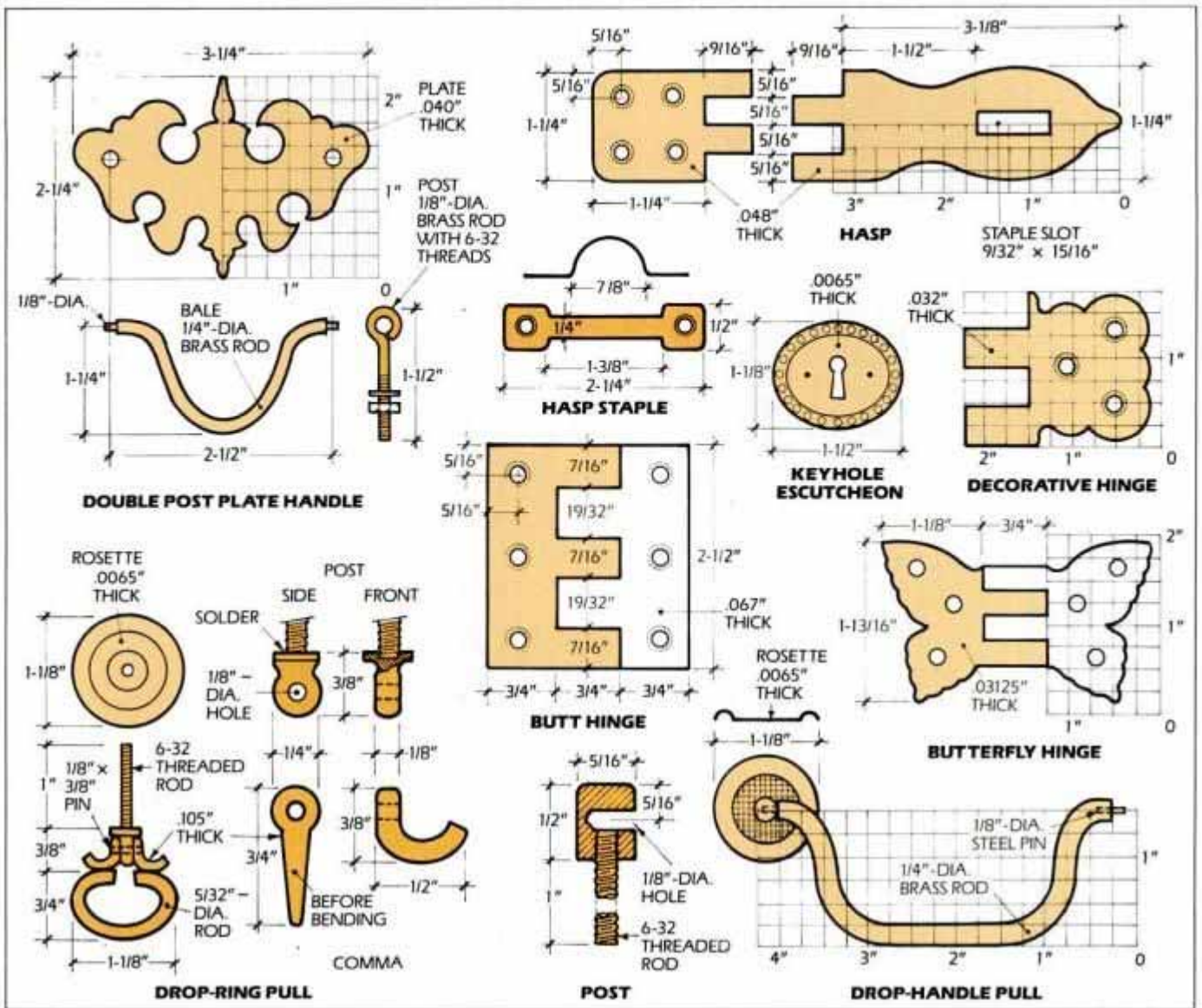
Place brass over pattern and cover it with several layers of rubber. Emboss by pounding the rubber with a ball-peen hammer.



Use a round-ended dowel to rub, press and tap the brass into the nooks and crannies. Work carefully so as not to tear the brass.



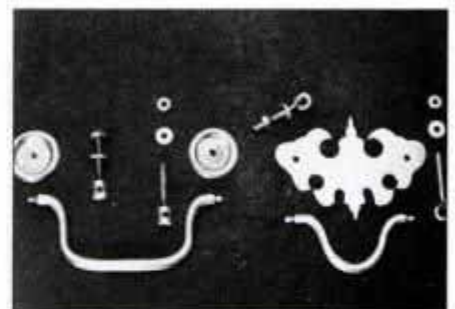
Make rosettes from (top row): metal ring with screen, and coat button. Bottom row shows ring, embossed brass and escutcheon.



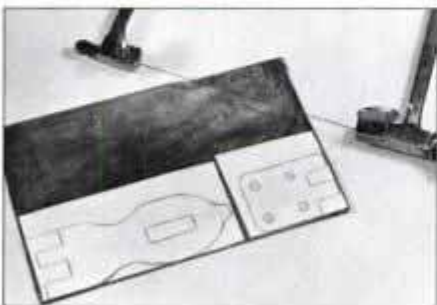
Glue a full-size template of the backplate to a brass piece. Cut out the plate using a jeweler's saw. File the edges smooth.



To form the handle, or bale, insert pipe in hole drilled in vise, hook chain on ends of bale, open vise jaws slowly to bend bale.



Two drawer handles prior to installation: Drop-handle pull (left) with rosettes and double post handle (right) with backplate.



Make a full-size drawing of hasp and glue it to a brass sheet with rubber cement. Then, cut out the parts with a jeweler's saw.



Smooth the rough-cut edges of the hasp with a Dremel tool fitted with a sanding drum. Wear safety goggles while sanding.



Here's the drop-ring pull prior to assembly. Solder the two comma-shaped parts to the ring. Attach ring to post with brass pin.



A GENTLEMAN'S WARDROBE

This spacious wardrobe features solid poplar construction and a white pickled finish.

BY NEAL BARRETT

This elegant wardrobe combines the benefits of a dresser and a closet in one piece of furniture. Its drawers and shelves keep you organized, helping you find clothing or accessories at a glance.

Also known as a clothespress or an armoire, our wardrobe's construction is straightforward, emphasizing clean lines. Design details like paneled doors and a wide crown molding give it a distinctive flair.

As a project, our wardrobe is well within the capability of a woodworker with a reasonably well-equipped shop. You'll need a table saw and the usual portable power tools: circular saw, drill and router.

As with all large case pieces, the cutting and fitting here will challenge your skills. But we believe that you'll find your efforts well rewarded in the finished piece.

Preparing the stock

Begin construction by ripping and crosscutting stock to rough size for all parts. Joint the mating edges of stock to be used for the case panels. Then, using a doweling jig and portable drill, bore holes 8 to 10 in. apart along the edges for $\frac{1}{4}$ -in.-dia. dowels. Glue and clamp up the panels slightly oversize to allow for final trimming. When the glue has dried, sand the panels smooth with a belt sander. Rip the panels to finished width on a table saw. Then cut them to length, using a straightedge and a circular saw.

Lay out the position of the dados and rabbets on the case sides, partitions and shelves. Note that the dados for the case assembly are stopped $\frac{3}{4}$ in. short of the case front. Use a straight-edge clamped across the workpiece to guide the router, then, using a sharp chisel, square the end of each dado.

Next, use the router with an edge-guide attachment to cut the $\frac{1}{4}$ x $\frac{1}{2}$ -in. rabbet along the back inside edge of the case sides. Cut the notches in the front edges of shelves and partitions.

Mark the position of the closet pole

on the right case side and center partition. Use a $1\frac{3}{8}$ -in.-dia. multispur or Forstner bit to bore a $\frac{3}{8}$ -in.-deep mortise to carry the pole. The pole itself is turned on a lathe from a blank of poplar $1\frac{3}{8}$ in. sq. x 20 in. long.

With a $\frac{1}{4}$ -in. slotting cutter and 1-in.-dia. ball-bearing pilot in the router, cut a groove in the front edge of the case sides to receive the splines that join the face frame to the case. Finally, sand all interior case parts.

Assembling the case

For ease of assembly, interior case pieces are assembled with glue and 4d finish nails. Begin assembly by joining the small shelves to the short left-hand partition and center partition. Spread glue in the dados and on the shelf ends and drive in the finishing nails. Set the nailheads and fill the holes with white wood filler. Check the assembly for square and let the glue dry.

Glue and nail the case bottom and top shelf to the center partition. Then, glue and clamp the left and right case side to the top, the top shelf and bottom, remembering to install the closet pole. Check for square and let the glue dry.

Start on the face frame by ripping and crosscutting stock to dimension. Mark the position for the dowel pins that will join the frame together and then, with a doweling jig, bore $\frac{1}{4}$ -in.-dia. x $1\frac{1}{16}$ -in.-deep holes for 2-in.-long, spiral-grooved dowels. Insert the dowels, glue and clamp the frame together, check for squareness and let it dry.

After the glue has dried, use a router and an edge-guide attachment to cut the $\frac{1}{4}$ x $\frac{3}{8}$ -in.-deep grooves in the face frame using a $\frac{1}{4}$ -in.-dia. straight bit.

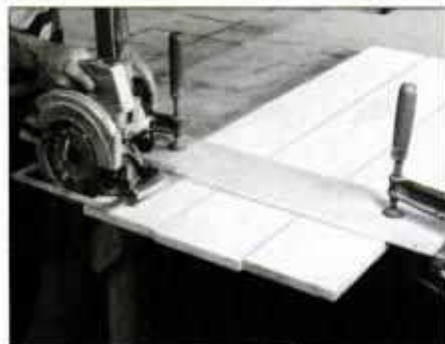
Cut the splines to size and spread glue in the spline grooves in both the frame and case sides. Spread glue on the front edge of the case top and the front edge of the case bottom, slide the



A stately 84 in. high x 41 in. wide, this wardrobe features paneled doors and a "pickled" finish of white latex paint covered with satin polyurethane.

Color photo: J.R. Rost
Black-and-white photos: Neal Barrett
Technical art: Eugene Thompson
Stylist: Gabe Herick

GENTLEMAN'S WARDROBE



1 Clamp a straight-edged board square to the panel's edge. Guide the saw along it when crosscutting panels to size.



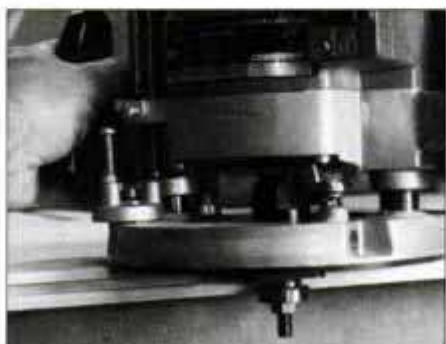
2 Use a shop-made T-square to guide the router while cutting dados. Note: the dados stop 3/4 in. short of front edge.



3 Cut the rabbet on rear edge of each case side to receive the back panel. Use a router with an edge guide or rabbeting bit.



4 Use a Forstner or multispur bit chucked in a portable power drill to bore the shallow mortises that hold 1 1/2-in.-dia. closet rod.



5 Use a 1/4-in. slotting cutter with a 1-in.-dia. ball-bearing pilot to cut the spline slots in the front edges on the two case sides.



6 Use a roughing gouge to turn down a 2 x 2-in. poplar blank for the closet pole. Mark the end cuts using a parting tool.

splines into the case grooves and position the face frame on the case. Clamp it in place until the glue dries.

Cutting and fitting trim

With a 1/2-in.-rad. cove bit in a router table or router, cut the profile on the top front edge of the base trim pieces. Cut the miter on their ends, then apply glue to the miters and nail the baseboard in place with 3d finishing nails.

You may be able to get crown molding at your local lumber supplier. If not, it's relatively simple to make.

Begin by ripping 1-in.-thick stock to 5 in. wide. Lower the table saw blade below the table and clamp a straight-edged board across the table at a 55° angle. The edge of the board should be 2 1/2 in. from the blade measured from the centerline of the arbor.

Raise the blade to a height of 1/16 in. above the table. Using push sticks, advance the workpiece over the blade. Repeat the process, raising the blade

1/16 in. at a time, until the blade is 3/4 in. above the table. Rip the board to the specified width, set the saw blade at a 45° angle and make the angled cuts on the molding's front and back. Scrape the saw marks out of the cove and finish-sand it with 120-grit followed by 220-grit sandpaper.

Making the doors

Rip and crosscut the stock for the door rails, stiles and panels. Use the table saw with dado blades to cut the tenons on the rails. Readjust the height of the dado blades and cut the 1/4 x 1/2-in.-deep groove in the stiles and rails.

Use a router with a 3/4-in. straight bit and edge guide to cut the 1/4-in.-deep x 3/16-in.-wide rabbet around the back edge of the door panels.

Glue and clamp the door stiles, rails and panels. Check diagonal measurements for square and let the glue dry. If you decide to make the panels from solid wood, do not glue them in place.

To make the panel molding, plane some stock to 1/2 in. thick. Using a router table and a bit with a profile similar to the one shown, cut the molding on the edge of the stock. Rip molding off the stock and repeat the process to make enough molding for both doors.

Using a miter box, cut the molding to length and nail it to the door panels.

Lay out the location of the door hinges on the face frame stiles and chisel out the mortises. Install the hinges. Position one door at a time in its opening and transfer the location of the hinges to the door stiles. Chisel out matching mortises and screw the hinges to the door. Test-fit each door and trim it where necessary using a block plane.

Fitting the crown

Miter the crown molding to length using a miter box, spread glue on the miters and nail the pieces to the case with the 3d finishing nails. Then cut the

MATERIAL LIST—WARDROBE

Key	No.	Size	Description (use)
A1	1	3/4 x 20 1/4 x 82 1/2"	poplar (left side)
A2	1	3/4 x 20 1/4 x 82 1/2"	poplar (right side)
B	1	3/4 x 20 x 58"	poplar (partition)
C1	1	3/4 x 20 x 35 1/4"	poplar (top)
C2	2	3/4 x 20 x 35 1/4"	poplar (bottom, top shelf)
D	1	3/4 x 20 x 27"	poplar (partition)
E	3	3/4 x 17 1/2 x 20"	poplar (shelf)
F	3	3/4 x 14 1/2 x 20"	poplar (shelf)
G	1	3/4 x 4 x 30"	poplar (case top rail)
H	1	3/4 x 8 x 30"	poplar (case bottom rail)
I	2	3/4 x 3 x 82 1/2"	poplar (case stile)
J	2	3/4 x 3/4 x 82 1/2"	poplar plywood (spline)
K	1	3/4 x 35 1/2 x 75 1/2"	poplar plywood (back)
L	1	3/4 x 5 x 37 1/2"	poplar (front baseboard)
M	2	3/4 x 5 x 21 3/4"	poplar (side baseboard)

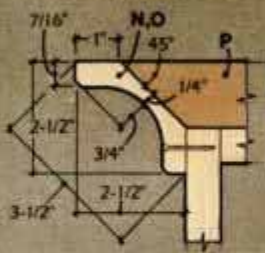
N	1	1 x 3 1/2 x 41"	poplar (front cove molding)
O	2	1 x 3 1/2 x 23 1/2"	poplar (side cove molding)
P	6	1 1/2 x 3 x 5"	poplar (glue block)
Q	1	1 1/2"-dia. x 17 1/2"	poplar (closet pole)
R1	4	3/4 x 3 x 9 1/2"	poplar (door rail)
R2	2	3/4 x 3 x 9 1/2"	poplar (center door rail)
S	4	3/4 x 3 x 70 1/2"	poplar (door stile)
T1	2	1/2 x 9 1/2 x 38"	poplar plywood (upper door panel)
T2	2	1/2 x 9 1/2 x 25 1/2"	poplar plywood (lower door panel)
U1	8	3/4 x 1/2 x 8 1/2"	poplar (door molding)
U2	4	3/4 x 1/2 x 37"	poplar (door molding)
U3	4	3/4 x 1/2 x 24 1/2"	poplar (door molding)
V	8	1/2 x 5 1/2 x 19 1/2"	poplar (drawer side)

W	8	1/2 x 5 1/2 x 13 1/2"	poplar (drawer end)
X	4	1/2 x 13 1/2 x 19 1/2"	poplar plywood (drawer bottom)
Y	6	1 1/4 x 2 1/2"	Stanley No. SP296 cabinet hinges
Z	2		magnetic catches
AA	*	1/2"-dia. x 2"	spiral groove hardwood dowels
BB	*		3/8" brads
CC	*		3d finishing nails
DD	*		4d finishing nails
EE	*		3/8" No. 5 rh screws
FF	12	2"	No. 8 fh screws
GG	2	1 1/4"-dia.	Colonial Bronze No. 192 brass knobs

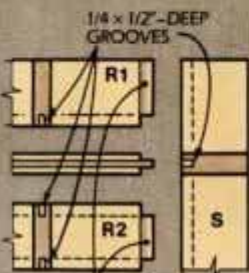
* As required

WARDROBE

23-1/2" DEEP x
41" WIDE x
84" HIGH

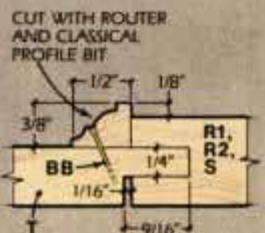


**DETAIL 1—
COVE MOLDING**

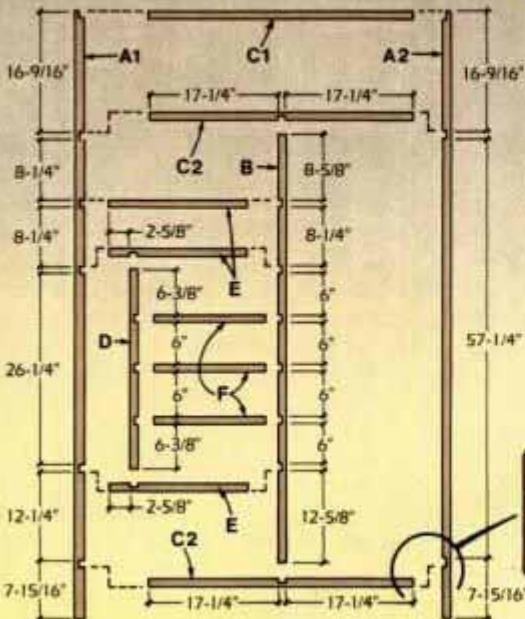
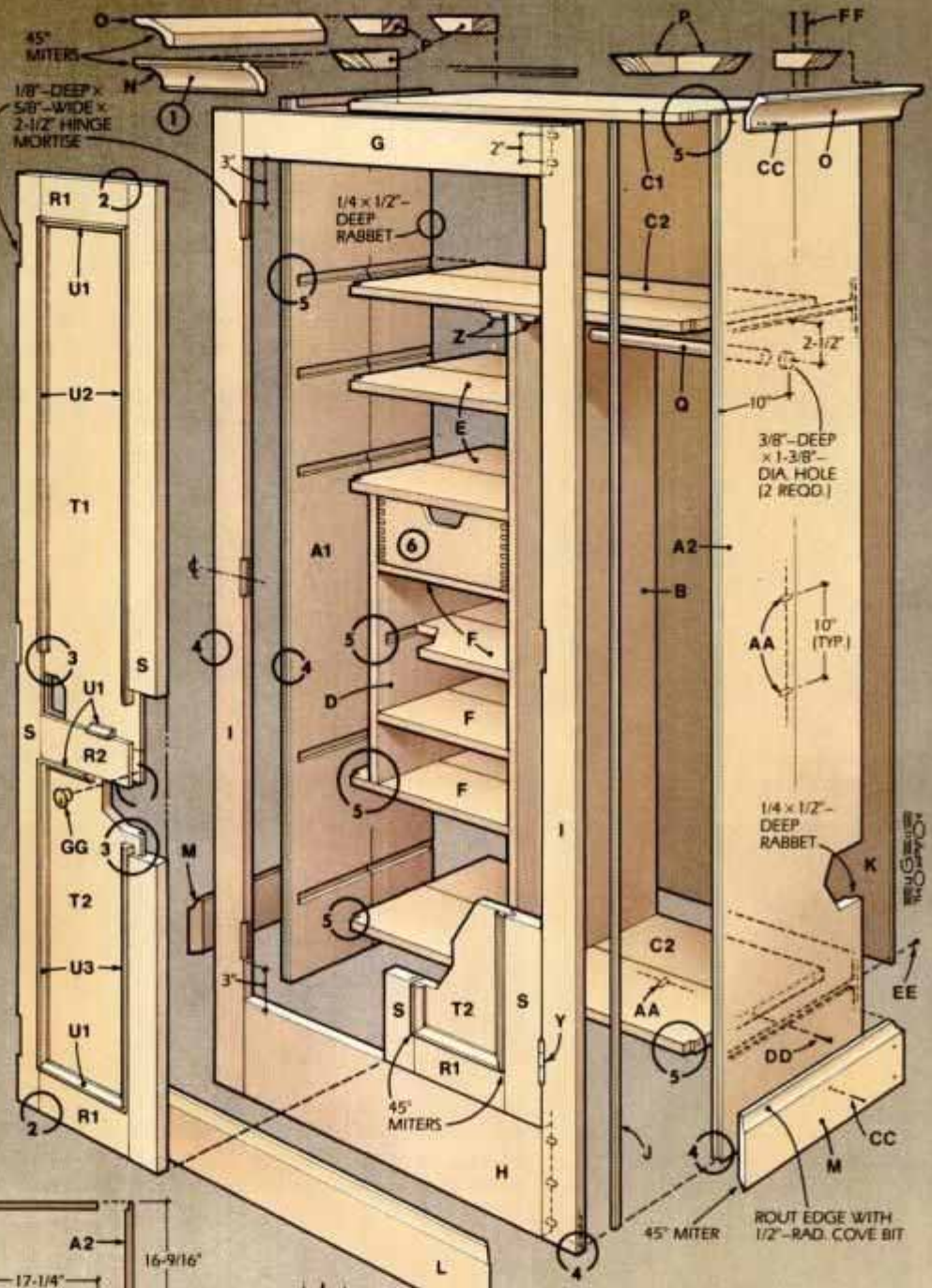


1/4 x 1/2" LONG TENONS

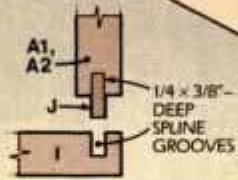
**DETAIL 2—DOOR
RAILS AND STILES**



**DETAIL 3—DOOR
PANEL AND MOLDING**



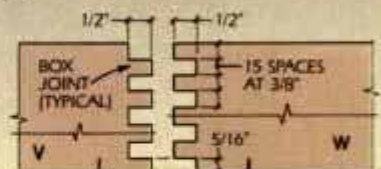
DETAIL 5—DADOES AND RABBETS



**DETAIL 4—
SPLINE JOINT**



3/8" DEEP x 3/4" STOPPED DADO AND RABBET (TYPICAL)



DETAIL 6—DRAWER ASSEMBLY



7 Glue and nail together inside case pieces; check the assembly for square. Set all nail-heads and fill the holes.



8 Mark the locations for the dowel joints in the stiles and rails of the face frame. Use a dowel jig when boring the holes.



9 Securely clamp a face frame to the workbench and then cut spline grooves with a 1/4-in.-dia. straight bit and router.



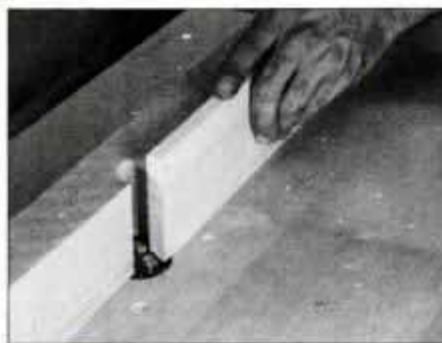
10 Cut the cove in the crown molding by making repeated passes on the table saw. Raise the blade 1/16 in. per pass.



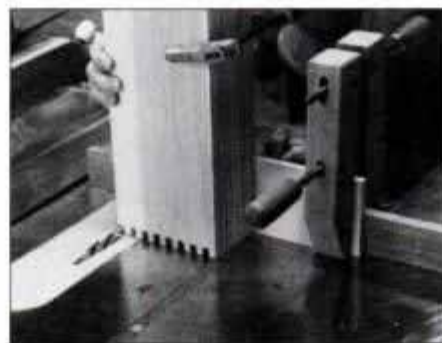
11 Secure the crown molding to the bench; remove saw marks from the cove with gooseneck scraper, 220-grit sandpaper.



12 Clamp door panels in place and then cut the rabbet along the back edges with a router and a 3/16-in.-dia. straight bit.



13 Cut profile of panel molding on 1/2-in.-thick stock, using a router table. Then rip to finished size on table saw.



14 Cut the finger joints on the drawer pieces using dado blades in a table saw. Clamp parts together and cut simultaneously.



15 The pickled finish is no more than latex paint used as a stain. Brush it on, let it sit, then wipe it off and let dry.

reinforcing blocks—which help to support the crown molding—to size. Spread glue between the blocks and the back of the molding and screw the blocks to the top of the case.

Making the drawers

Rip and crosscut stock for the drawers, the corners of which meet in a finger joint. To cut this joint, first clamp all like parts together in a stack. Then make repeated cuts to the proper depth, using dado blades, on a table saw.

Measure and mark the spacing of the fingers on the miter gauge, then clamp a stop block to the first mark. Butt the stack of drawer parts against the stop and make the first cut. Then move the stop block to the next mark, and cut again. Repeat this process until the

entire joint is cut. Use the same dado blade to cut the groove in the drawer parts to carry the drawer bottom.

Use a jigsaw to shape the handhold cutouts in the front of each drawer. Next, finish-sand the inside faces of all drawer parts with 120-grit followed by 220-grit sandpaper. Glue and clamp the drawer sides and ends together, but do not glue in the drawer bottoms. Check each assembly for square, then when the glue is dry, check each drawer for proper fit in the case. Sand or plane each as necessary.

Finishing the case

Finish-sand the exterior of the case with 120-grit then 220-grit sandpaper. Dust it thoroughly and wipe it down with a tack cloth.

Our "pickled" finish is actually a paint

used as a stain. We used Touraine Speedi-Seal Vinyl Primer Sealer thinned 30 to 40 percent with water. Brush the paint onto the piece, working in sections of no more than 8 sq. ft. at a time. Let it stand on each section for 5 to 10 minutes, then wipe it off in the direction of the wood grain and proceed to the next section.

When the pickling is complete, let the wardrobe dry overnight.

When dry, sand it lightly with 220-grit "no-fill" sandpaper, available at auto body or auto parts stores. Dust it off and then wipe it with a tack cloth. Apply two coats of satin polyurethane varnish, sanding lightly between coats. When the finish has dried, install the case back, the doors, their knobs and magnetic catches on the partition to keep the doors closed.

PM

SPECIAL REPORT

BOATING'87

RIDING THE WAVE OF NEW MARINE TECHNOLOGY

- *Special boats for every special interest*
- *The latest in hull materials and construction*
- *Engines at the leading edge of alloys and electronics*
- **PLUS: ACCESSORIES UPDATE**
What's hot in copolymer paints, performance props, nav/com gear, auxiliary power and more





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

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

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

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

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

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

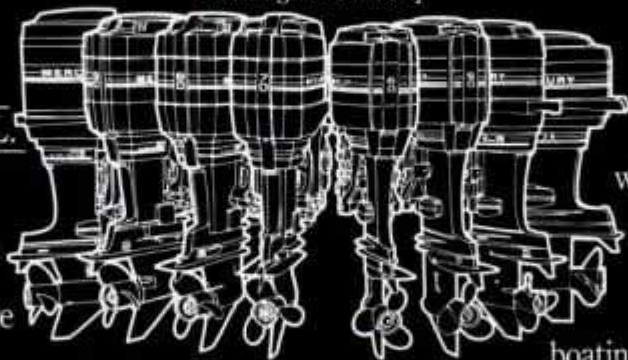
There's a variable ratio oil injection system which makes

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

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

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Midrange 115 to 35 hp



OIL INJECTION FOR ALL.

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

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

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

MERCURY
OUTBOARDS

GETTING WET

There's a boat for every budget with today's tremendous variety in state-of-the-art designs.



What's your pleasure? If it's flipping for large-mouths on the Arkansas River, Ranger, Skeeter or Stratos can fix you up with a bass rig that has the right mix of speed and utility. Waterskiing on Lake Minnetonka? Chris-Craft, Four-Winns, Smokercraft and several other builders make a performance party boat with all the requisite muscle and amenities. Cruising the inner breakwater off Long Beach? The obvious answer is a sleek sport boat from Donzi equipped with a pair of wave-punching V8 sterndrives.

No longer must a single runabout design serve multiple functions—with questionable adequacy. Now, boat builders are creating sizes, shapes and power options to suit every nautical need. But having options means making choices, and the process of choosing the right boat begins with a careful, time-consuming exercise in analysis and logic.

Price is probably your biggest hurdle. You're bound to hear your boat dealer say, "It's not how much it costs, but how much you can afford." He's right to a certain extent. The lending climate for boats is currently warm and sunny, and more than \$100 million in new boat loans were written last year. Fueling this activity are low annual percentage rates and down payments customarily one-fifth the purchase price, making boat ownership feasible for more and more people.

But remember, financing costs money over the long term. So does fuel, Coast Guard-mandated safety equipment and the usual accoutrements like water skis and fishing rods.

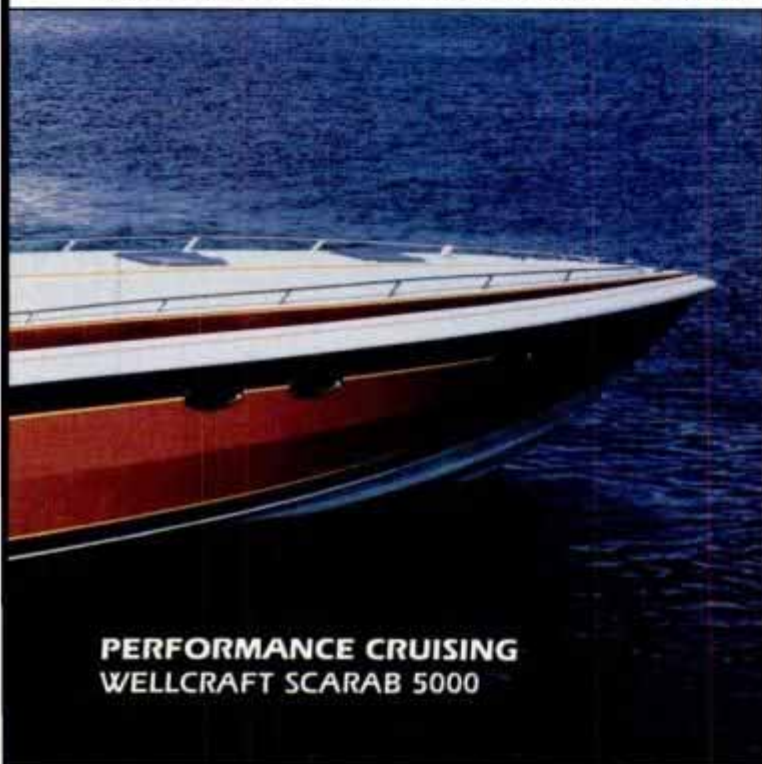
Choosing the right design is the next problem. In this age of specialization, geography and local custom play a crucial role in selecting a proper boat design. You wouldn't want to tackle the Atlantic coast off Hatteras in a boat designed for northern Minnesota. And a workaday sterndrive from Lake Erie may work in a pinch down in South Florida, but do you really want to be seen tooling around Miami in anything less than a full-blown, Don Johnson-inspired muscleboat? A trip to a local marina and a careful study of indigenous boat designs may be in order. Consider the following: Big water found around the nation's coasts requires a high freeboard, self-bailing cockpit, maximum flotation and a deep, or modified, vee for positive seakeeping. A boat with these characteristics would also be appropriate for large inland bodies of water as well. Low freeboard planing hulls with a much higher power-to-weight ratio are acceptable for flat-water inland lakes and rivers. Between these extremes are various tradeoffs between mission-specific features—like livewells—and creature comforts—like folding tops, porta-potties, convertible sunloungers, and so on.

Sheer size is another important factor. You probably don't

want to buy a boat that you can't operate solo, even in high wind and maximum current. And remember, in most areas of the country the boat you run for just under four months out of the year must spend the remaining eight months stored in your driveway (or in a costly storage shed at a marina).

Also, with a boat that requires outboard power, finding the right design is half the battle. You still have to select the right size engine, balancing power needs against initial price, maintenance and fuel costs. You can tell a lot by concentrating on top-end performance and acceleration during a test drive. Solid numbers in these areas usually mean plenty of reserve power under load. Small engines may be too anemic; large engines might not offer all that much increase in performance for the hull you're interested in.

Once you find the boat that's right for you, there are several important evaluations you have to make. First, gauge the comfort and sight lines at the helmsman's position.



PERFORMANCE CRUISING
WELLCRAFT SCARAB 5000

You'll be spending a lot of time here, so you'll want it right. Check freedom of movement in the cockpit, and stowage above and belowdecks. Make sure there are plenty of cleats, chocks and other fixtures to aid you in mooring and anchoring, and make sure they're fastened to the boat with through-bolts and backing plates. Make sure the bilges are dry, and make sure hull/deck junctions and hull laminates are sound. Irregularities in these areas may mean problems elsewhere.

Lastly, when you've found the boat that fits you, your family and the water you plan to frequent, observe the rules of the road and maintain a proper interval from bottle to throttle. Boating is safe and challenging on bright, calm, uncrowded days—dicey if you push beyond your capabilities on a boat ill-suited to your cruising area. Cautionary footnotes notwithstanding, remember that boating has evolved to become a platform for enjoyment. If you take your fun sunny-side up, with a pinch of salt, on the dry side or completely wet, there's a boat out there waiting.—*Tim Cole*

The possibilities afloat range from the \$410,000 Scarab 5000 (above left) to a wide array of boats designed for specific missions and cruising grounds (right). Each boat is the product of its environment, with hull forms, stowage and power integrated to achieve maximum enjoyment and usefulness.

FROM TOP RIGHT: PHOTOS BY RANGER BOATS, MURRAY CHRIS-CRAFT, BAYLINER, SEA RAY BOATS, SKIP GANDY

BASS FISHING
RANGER 360 V



LAKELAND PICNICKING
CHRIS-CRAFT 170
SPORT DECK



WATERSKIING
BAYLINER 1800
COBRA

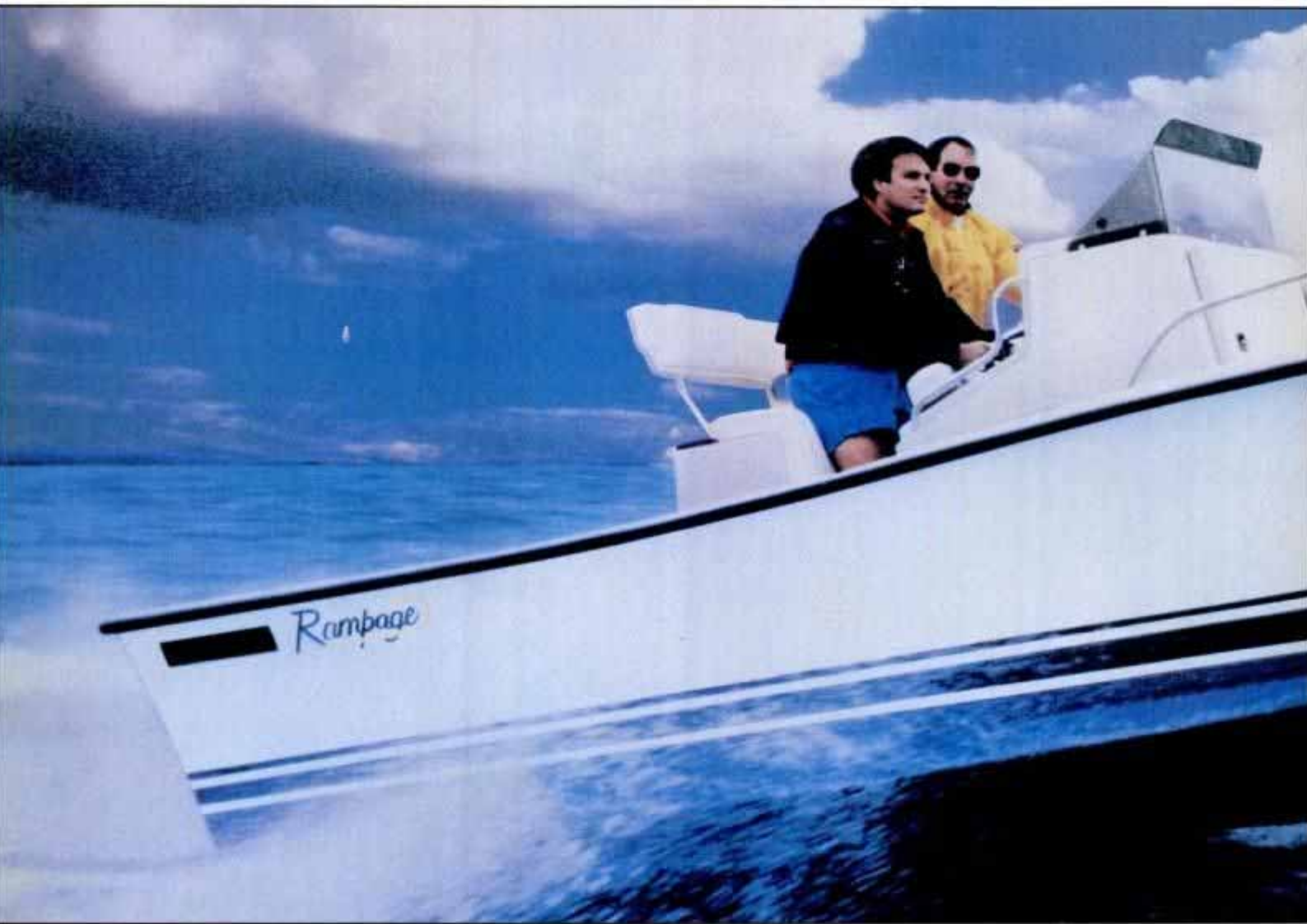


FAST TRANSPORT
SEA RAY
PACHANGA 22



OFFSHORE FISHING
STAMAS 255
FAMILY FISHERMAN

TOUGHING IT



Take the resilient materials and the complex machinery used to produce the high-speed rotor blades for the Army's latest attack helicopters. Add the honeycomb coring used in the flight decks of the hottest military aircraft. Combine them with resins developed to hold guided missiles together and, for good measure, stir in some filament created for bulletproof jackets. What's the result? Your family boat, of course!

There's a simple reason for this familiar link between ultrasophisticated defense industry products and recreational boating, boiling down to the two revolutions that have taken place in boatbuilding in the past few decades.

The first was the broader use of fiberglass construction to replace traditional wooden boatbuilding. But the second was much more subtle. There has been a slow but steady transition from conventional fiberglass to a host of exotic

synthetics applied with sophisticated building methods.

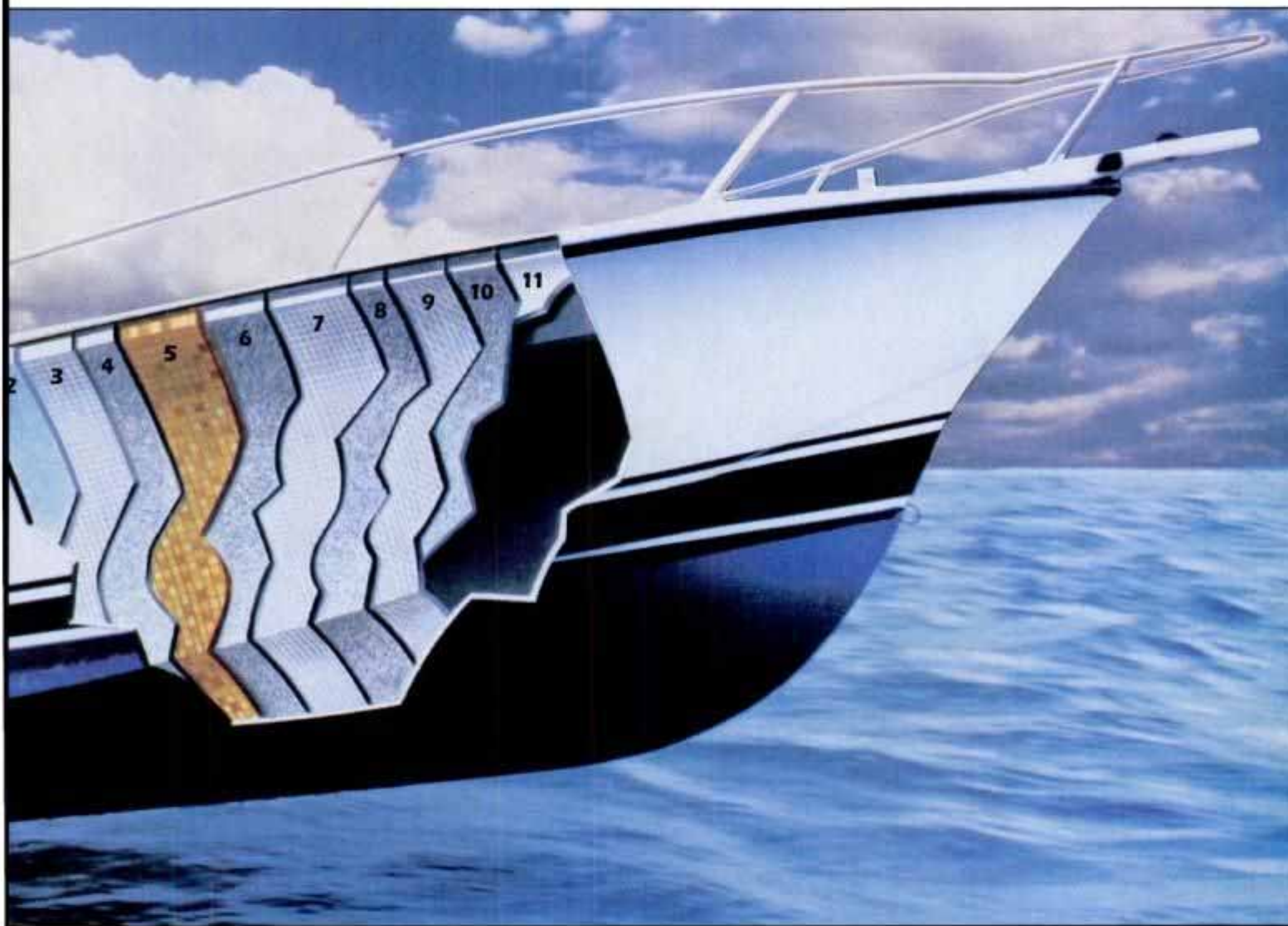
The energy crisis over a decade ago directly affected boatbuilders because fiberglass is a petrochemical product. It made sense then, in a period of skyrocketing fiberglass costs, to find a way to make boats lighter, since every pound of fiberglass a boatbuilder could eliminate saved money.

At the same time, powerboat builders were facing the problems of a gas shortage, so a light but strong boat was also more fuel efficient. And, because Detroit was responding to the problem by downsizing automobiles, the big-block V8s that powered most boats were no longer available. To maintain the same speed for their ski boats and cabin cruisers, the builders had to literally "lighten ship."

It's no surprise then that much of the research and development came from the aircraft and aerospace industries, where strength and light weight have always been a

Fiberglass boatbuilding is 35 years old, but a new generation of cloths, mats, resins and cores is already improving on this time-honored technique.

Tillotson-Pearson's Rampage 24, a diesel-powered center-console offshore fisherman, is a suitable representation of applied engineering in contemporary synthetics. Topside finish and gelcoat, with a waterproof vinylester resin, form the exterior skin in the lamination schedule (1). Then comes a 1/2-ounce chopped strand mat (2); 0 to 90° bidirectional cloth (3); 3/4-ounce chopped strand mat (4); Baltek balsa core (5); 3/4-ounce chopped strand mat (6); 0 to 90° bidirectional cloth (7); 1/2-ounce chopped strand mat (8); 0 to 45° bidirectional cloth (9); 1 1/2-ounce chopped strand mat (10); and an interior gelcoat (11).



prime concern, and the trickle-down of technology has become such a waterfall that many boat owners are unaware of the changes taking place. The materials were already being used by high-performance offshore racing powerboats, which take a tremendous beating at speeds over 100 miles per hour, as well as in ocean-racing sailboats, where cost is no object when a fractional speed increase is concerned.

But these were cottage industries which used very small amounts of the exotic materials, so the costs were correspondingly high.

It wasn't until the larger boatbuilders started using these products in quantity that the prices became competitive with more conventional fiberglass materials. The end result, however, is that technology has made boating more fun and less expensive. Let's look through the fiberglass process and define some of the new language.

Resins

The three basic types of resins—polyester, vinylester and epoxy—have their own place in the boatbuilding world. The important factor is to match correctly the resin to the type of reinforcing material being used so that the strengths are matched. A particular resin, for example, may be ideal for one type of reinforcing material. But if that resin is used with another reinforcing material, the material will fail long before the resin will fail.

Polyester—This is the resin commonly used for boatbuilding over the years, and most boat owners are familiar with it. It is inexpensive and generally all-purpose. It has poor stretch (elongation) properties so it's not used on modern high-performance boats, but it is perfectly adequate for most boats. The most common polyester is an orthophthalic base, but the newer isophthalic-based polyesters are gaining in

TOUGHING IT

popularity. The isophthalics are more resistant to water and chemicals, are more abrasion-resistant, and have higher impact and fatigue (flex) performance. Most modern gelcoat finishes are made with isophthalic resins, and it's likely that isophthalic resins will become the common boatbuilding resin in the future.

Vinylester—An alternate to polyester, vinylesters are claimed to have better stretch characteristics than polyesters, so they match more closely the strengths of the various exotic reinforcements. Vinylester has good water resistance and fatigue properties, but is also more expensive than polyester resin. One important feature of vinylester is that it has excellent secondary bonding strength, so bulkheads or engine stringers added to a cured hull will be stronger than on a polyester hull.

Epoxy—This is the high-performance resin, with a matching price tag. Epoxy will adhere better than any other resin to a wide range of materials, which makes it ideal for attaching cores, stringers or other building components.

Cloth

Cloth materials are the reinforcements used in FRP construction, much the same way that steel reinforcing rods hold together a concrete building. Woven fabrics that use continuous strands are the most common cloths, with weights ranging from 4 to 15 ounces per square yard. Heavier weights, usually called roving or woven roving, consist of untwisted yarns of fiber in weights that range up to 48 ounces per yard.

The finished roving resembles a coarse burlap and, like all cloths, has good bidirectional strength; that is, in the north-south and east-west directions. The lighter cloth weights can be found in a variety of weave patterns, such as twill, satin and matte, for different purposes.

E-glass—This is the most commonly used fiberglass cloth in boatbuilding today. You can buy E-glass at a marine hardware store, and bond it with polyester resin. It's made from molten plastic spun into fine fibers that are then either woven into cloth or loosely gathered into roving.

S-glass—This is high-performance fiberglass cloth from the aircraft industry. It's three to five times more expensive than E-glass, but it is also much stronger. Developed by Owens-Corning, it has 20 to 40 percent higher tensile, impact and flexural strength than E-glass.

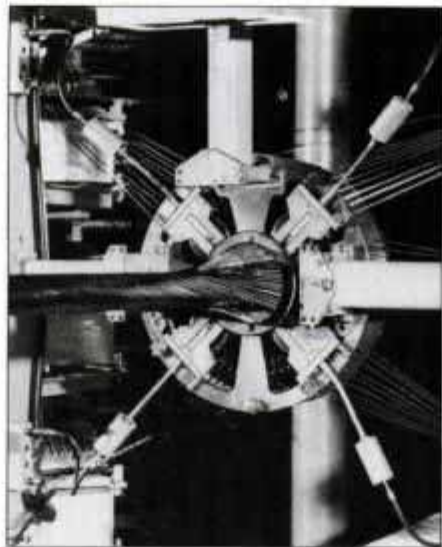
Mat—Mat is usually made of E-glass, and consists of random 2- to 3-in. fibers held in place by a binder material

that is resin soluble. Mat is used primarily for building thickness (and stiffness) into fiberglass layups.

Unidirectional fibers—This is one of the advances in reinforcing materials. It consists of strands of fiber running in one direction only, held together by single fibers that are glued or sewn laterally, much the same way that a bamboo fence is held together by a few wires. Obviously, it has very high directional strength, so it can be used in areas where the loads are specific.

Bi-axial fibers—Technically, most cloth is bi-axial, but the modern definition means a fabric made from layers of unidirectional cloth that are not woven through each other. One layer simply lays atop the next layer to produce a kink-free bank of fiber. Many bi-axials run at less than 90° angles, such as the popular +(-) 45° fabrics.

Tri-axial fibers—This is a layered



Inspired by building methods in aviation, a filament winder crafts carbon fiber at a state-of-the-art boatbuilding plant.

nonwoven material similar to bi-axial cloth, except that the fibers are oriented in three directions, often at 120° to each other to spread the loads.

Cores

A core material is a piece of solid reinforcement, sandwiched between layers of fiberglass materials and used for stiffening—to prevent the "oil-canning" of large, flat panels—and as thermal or sound insulation.

Balsa core—When first used as a hull stiffener, boatbuilders laid long planks of lightweight balsa into hulls, but this method led to rot and structural failure when water "wicked" through the entire plank. It's taken balsa a long time to live down this beginning, but modern balsa is now the most widely used coring material in boats. The solution came from slicing through the grain, turning it on edge, and producing

a checkerboard pattern of end-grain pieces that do not transmit water. The result is a stiff, light and inexpensive core with good impact quality and high compressive strength.

PVC foams—Airex and Klegecell (pronounced *klej-je-a-sel*) are the most popular commercially produced foam cores used today. Both are closed-cell foams made from polyvinyl chloride.

Honeycomb—Honeycomb is just what it sounds like: A waffle-pattern of material to give the highest stiffness of any core of equal weight. The compression and shear strengths are second to none, which might be expected from a material originally used in aircraft for flooring and bulkheads.

Materials

Much of the trickle-down of technology from aerospace has been in the actual materials used, since research has produced some alternates to conventional fiberglass construction.

Carbon fiber—These fibers of graphite provide superb stiffness as well as high tensile and compression strengths. They're often used in conjunction with S-glass or other exotics to provide acceptable impact resistance, which is otherwise quite low.

Kevlar—The trademarked name Kevlar refers to aramid fibers of which DuPont is the only producer in the world. An aromatic polyimide (usually shortened to aramid), Kevlar is a form of nylon that was originally developed in the mid-1960s as "Fiber B" to reinforce radial-tire belting. Its unique properties soon were put into other uses, and the public usually thinks of Kevlar in terms of bulletproof jackets. There are, in fact, two forms of Kevlar available. Kevlar 29 is used for lines, cables and flak jackets, while Kevlar 49 is used as a reinforcement fiber in plastic composites. On a strength-to-weight comparison, Kevlar has the highest specific tensile strength of any commercial fiber. It is five times stronger than steel, and twice as strong as E-glass, which allows a Kevlar hull to maintain the same strength as an E-glass hull at a fraction of the weight. The negative side to Kevlar is a marked weakness in compression, so it is often used in conjunction with other fibers that balance that trait.

Nomex—A chemical developed by DuPont, Nomex is most famous for its fireproof qualities, and it is used in fire-resistant suits for firemen and race-car drivers. It is an aramid, which is turned into a paper-like substance for use in honeycomb coring.

Hybrids—These are reinforcing fabrics that combine two or more different types of fiber. One common hybrid is a mixture of Kevlar with carbon fiber. The Kevlar provides high impact-resis-

TOUGHING IT

tance, while the carbon fiber supplies the stiffness. Combinations of S-glass, Kevlar and carbon fiber are also available to optimize certain properties.

Methods

It's no surprise—with all the new resins, fabrics and materials available—that new methods of construction had to be created.

Pre-preg—This term refers to both the material and the technique where a fiberglass cloth is pre-impregnated with catalyzed resins.

Because the resins are forced into the material under ideal manufacturing conditions, the optimum resin/fiber ratio is maintained.

The finished matrix must be stored and transported in a frozen state to keep from curing, but it offers the lightest weight and highest strength of conventional fiberglass construction. When the material is being fabricated, it must be cured in an autoclave.

Vacuum-bagging—This is a method used to ensure complete saturation of the fiber reinforcing material with resin, as well as a way to compact the structure for maximum strength. An air bag, often simply a large plastic sheet, is placed around the curing laminate and the air is then removed to create a vacuum. This compresses the laminate and distributes the resin uniformly. In many cases, excess resin is removed at this stage to further reduce the weight of the finished product.

Filament winding—Tillotson-Pearson, the same company that builds the Rampage shown on the previous pages, also produces a line of sailing yachts that feature unstayed masts. A normal mast could never withstand the strains of wind and sails without a network of steel rigging. But by using filament-winding machines and a blend of carbon fiber and resins, a mast of exceptional strength and flexibility is produced that can survive without support. The winding machines were originally designed to produce automobile driveshafts, but have been adapted to produce such items as high-performance helicopter rotor blades, springy high-jump poles and fishing rods.

There, in a sizable nutshell, you have it. The fiberglass of today is barely recognizable from the fiberglass of three decades past. Considerable thought and engineering has profoundly changed the industry, but not without a lot of help. Automobile racing has brought safety and reliability to street cars, so it should be no surprise that the aerospace and military sectors have contributed so much to make your boat safer, stronger and faster.

—Chris Caswell

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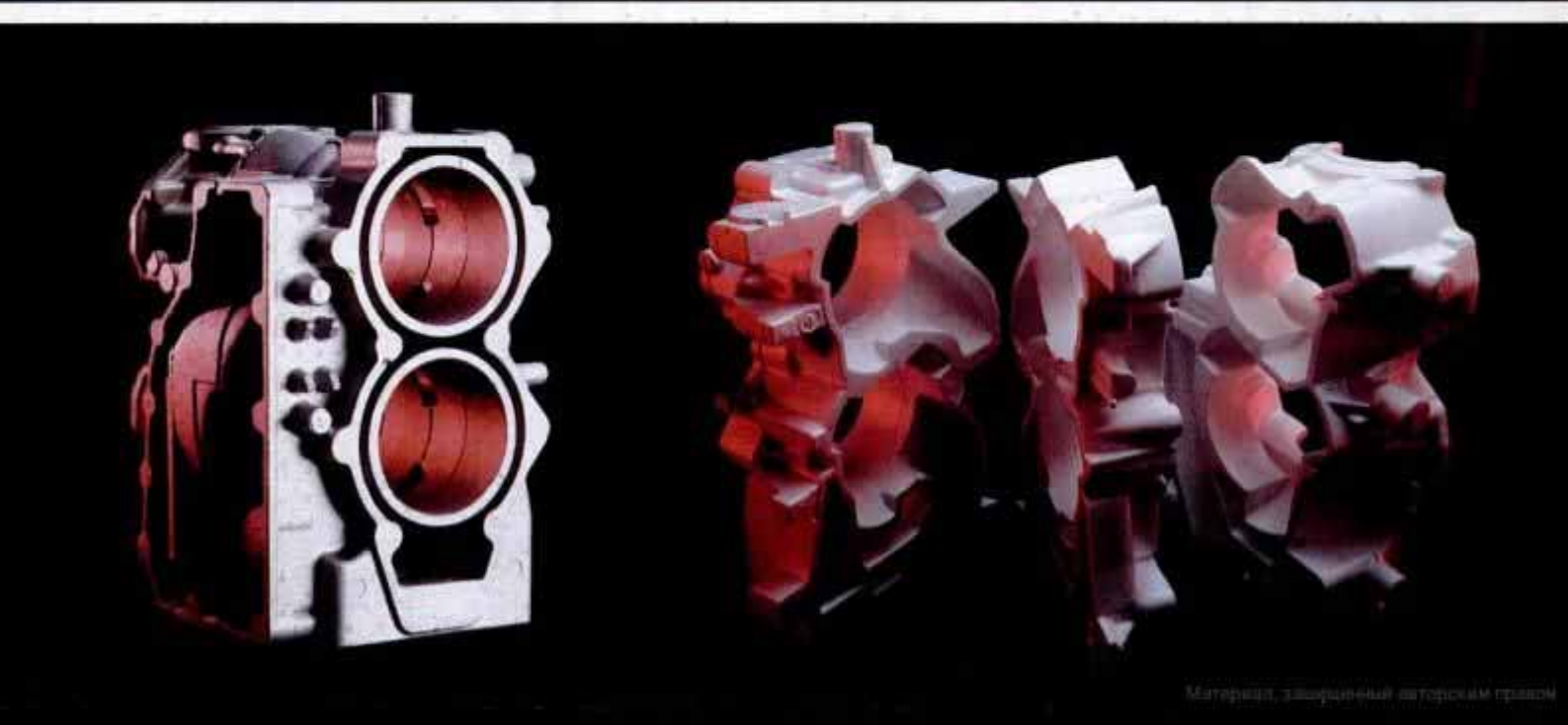
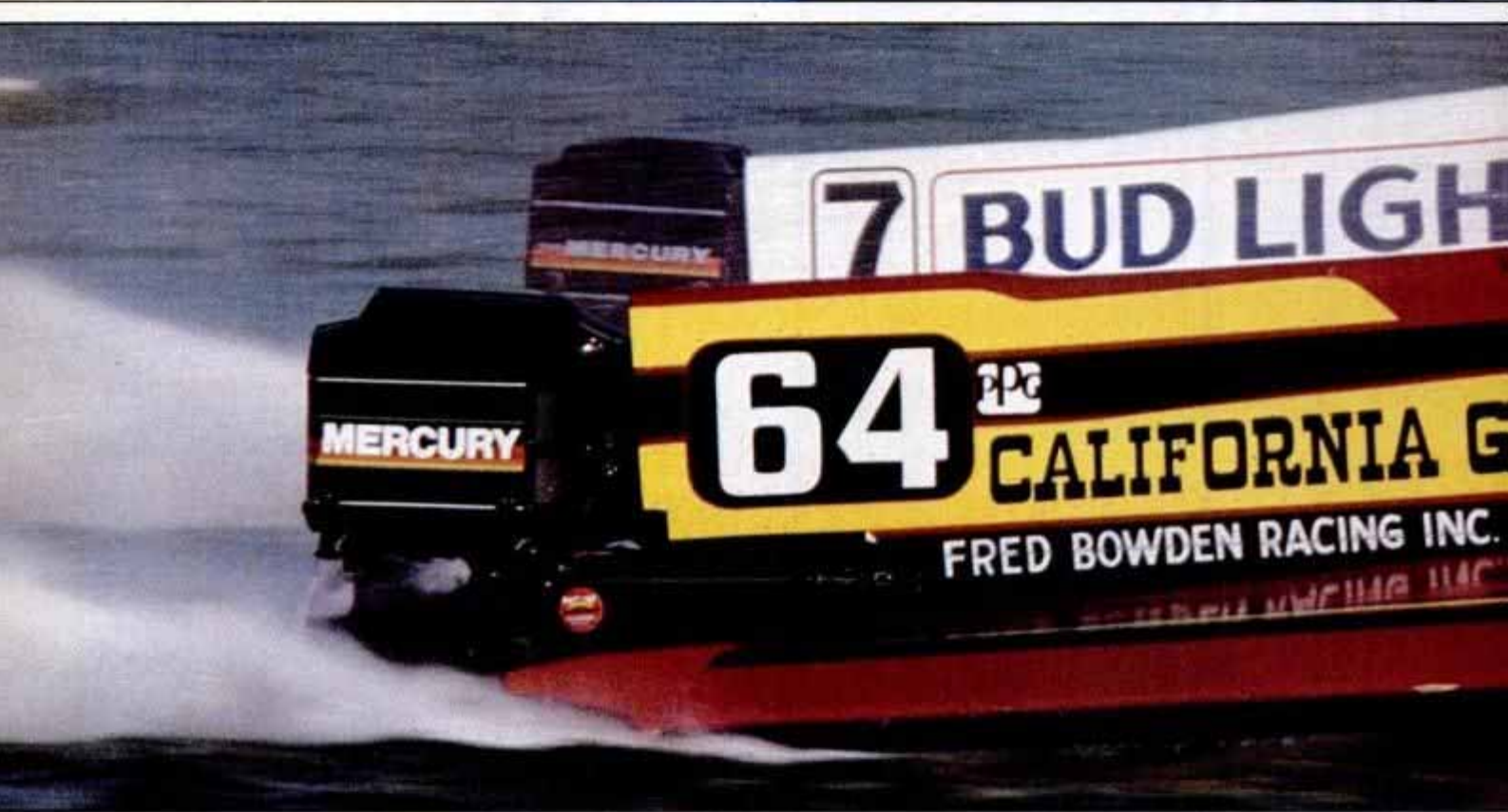
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POWER PLAY

Born on the racecourse, perfected on our recreational waterways, today's large outboard powerplant achieves both extra muscle and operational simplicity.



Maybe you've seen them mounted on motor stands at boat shows, or linked across the transom of some tricked-out boat in the local marina. They're distinctly larger than the average outboard, some approaching the size of a broad-shouldered linebacker, and they pack the horsepower necessary to run your Scarab to the Bahamas for lunch, or to speed your Skeeter to the five best fishing spots ahead of the pack, or to move out in the family cruiser for a distant anchorage. Even to power your APBA-class racing boat at speeds approaching 80 to 90 mph and up.

These high-performance outboards, rated 200 hp and above, weren't always available in the numbers that you see them sold today. As boat construction changed to emphasize the benefits of performance—with lighter, stronger struc-

Twin Johnson V8s adorn the transom of an Aquasport 270XF Fisherman (top left). They evolved from competition, where Mercury-powered Champ boats romp (above). The lost-foam casting technique—which relies on intricate polystyrene moldings to create light, strong blocks (left)—is one performance offshoot.

tures that could withstand the stresses of operation at speeds in excess of 50 mph—buyers realized the advantages of extended range and better fuel economy by mounting one or more high-horsepower outboards on the transom. Owners gained more room in the cockpit and, perhaps more importantly, achieved a combination of greater top-end power and breathtaking acceleration.

But the four major engine makers approach the problems and enormous possibilities of large outboard power from different angles.

For instance, only Mercury has an in-house high-performance products group in its engineering department. The group is structured to produce a few, or a few hundred, highly specialized engines in pursuit of research goals, and it is through this group that high-technology has entered into Mercury's manufacturing and quality-control.

Current star in Mercury's upper strata outboards is the 2.4 Litre EFI (for electronic fuel injection). It's a V6 sharing the same 60° block and the same basic stats as the Merc 200, 175 and 150 XR2 engines, displacing 142.2 cu. in. (2330 cc), bored at 3³/₈ in. (86 mm), with a 2⁵/₈-in. (67 mm) stroke.

POWER PLAY

The Mercury 2.4 EFI is set up to burn regular leaded or unleaded premium 89 octane gasoline, like its cousins, but the similarities stop there. This powerhouse will crank out a remarkable 275 horses at WOT (wide-open throttle) readings of 6800 rpm.

How does Mercury squeeze so much performance out of the same block that produces 150 hp at the other end of the spectrum? To begin with, higher engine speeds require better breathing, which required a new front induction ABS cowl, baffled and ducted to improve airflow while prohibiting water from entering the velocity stacks.

Mercury Performance engineers developed what they call "2-stage reeds" in the carburetors. The system combines a stiff reed for higher rpm airflow with a soft reed for mid- to low-range rpm running.

Better breathing also requires larger intake and exhaust ports. But larger ports allow ring expansion, which greatly reduces ring life. Mercury turned to bridgeporting, a machining process producing ports that are wider and more rectangular than conventional ports, with a bridge in the center to hold in piston rings. Bridgeports offer more total width and breathing area for higher rpm production, with less height for improved low-end torque.

Combustion chambers are shaped to create turbulence, causing a uniform mixture of fuel in the cylinder, which will burn evenly and more completely. It's called loop-charging, and it allows the best fuel economy in high-performance engines. Production versions of the 2.4 EFI are qualified on gas of lower standards than is available at most fuel pumps.

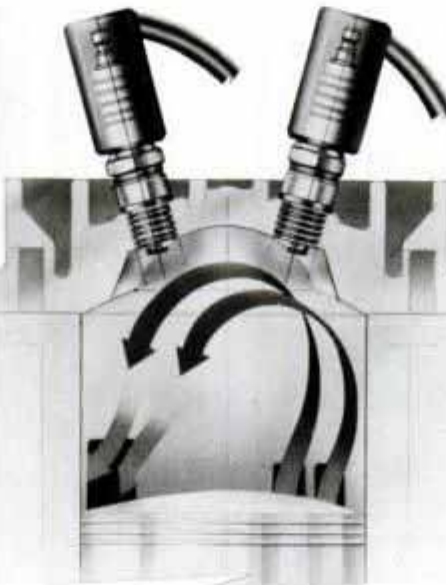
Mercury has invested a mint in anti-corrosion. Its XK-360 aluminum alloy is very low in copper content, probably lower than what's available on the open market. To achieve this purity, Mercury had to import high-tech furnaces from Europe, and find efficient ways to furnish it with aluminum to be used in powerheads or gearcases, to name a few. Mercury also relies on the electro-deposition process, or EDP, which carefully cleans and negatively charges unpainted parts going into a positively charged epoxy paint vat. The resulting finish is a multicoat protective system that adheres to the base metal.

High-tech performance in OMC's Johnson and Evinrude outboards currently centers on the 275 and 3.6 GT V8 powerplants, which are dubbed "the world's most powerful production motors." They are both based on 90° V-blocks and displace 220 cu. in., the former producing 275 hp and the latter about 300 hp.

The latest generation of plastics technology plays an integral part in the development of higher horsepower in both the powerful V8 and the more compact V4 engines.

The carburetors are die-cast aluminum assemblies with inner bodies and a venturi made of DuPont Minlon, a high-quality cousin to nylon. Six-petal flexible plastic reeds behind the carb in the 3.6 GT replace stiffer, longer-lasting steel reeds, with the advantages of improved performance across a wider range of operating speeds and longer potential engine life.

Plastics, and the lost-foam process, also play a key role in the casting of intricate manifold parts as one piece on the V8 blocks, eliminating the need for multiple fasteners and gaskets. Inexpensive polystyrene blanks, shaped exactly from a master mold, are buried in



Suzuki achieves a more efficient fuel burn in its Super Six high-performance 150 by loop-charging under twin sparkplugs.

sand. Molten aluminum is introduced, vaporizing the foam and displacing it. Allowing precisely for shrinkage, the cooled aluminum part is extracted, a stronger, lighter 3-dimensional shape not previously attainable.

There's even an easily removed 2-piece lower motor cover made out of tough molded plastic, allowing outstanding access to virtually all powerhead components.

To handle the inner stresses of wide-open throttle (5000 to 6000 rpm for the 275 and 5750 to 6250 rpm for the 3.6 GT) speeds for extended periods, both engines use single-piece forged steel crankshafts and take advantage of loop-charging technology to use flat-top pistons and cut down on total piston mass, which considerably lengthens engine life. Loop-charging, incidentally, offers more complete and powerful combus-

tion of the air/fuel mixture by swirling it into the cylinder, an effect that is caused by cylinder-dome and piston-head shape, as well as precise intake and exhaust porting.

The high-performance end of Suzuki's lineup of 20 outboards includes two 150-hp models, the DT200 and the DT200 10th Anniversary Edition. Suzuki's expertise in 2-stroke technology is the result of more than 25 years of motorcycle racing, and more than 18 years of building outboard motors.

When you talk about oil injection, the discussion naturally turns to Suzuki's pioneering advances in 2-stroke engines. One is automatic oiling and oil injection, a system that adjusts the gas/oil ratio to match the needs of the outboard at any given performance level. Less oil is required by the engine at light load, idle or low rpm running speeds, so the gas/oil ratio is adjusted to 150:1. Compare that with the standard 50:1 ratio you once mixed in your fuel can, the same 50:1 ratio that an outboard motor needs when running under heavy load or at full-throttle, high-rpm settings. Suzuki engineers have devised a system to link the oil mix to the actual lubricating needs of the powerhead at various rpm.

Oil enters the air/fuel mixture through nozzles downstream of the carburetor, delivered by a crankshaft-driven pump that is linked directly to the throttle. This system responds precisely to engine requirements across a wide band of power output. Uniform mixture and lubrication is achieved when the oil is finely atomized by injecting crankcase pressure just ahead of the oil-injection nozzles. As on most advanced high-performance outboards, Suzuki relies on precise porting, exhaust tuning and dome-topped pistons to promote loop-charging.

But the engineers at Suzuki looked beyond loop-charging and further boosted performance and reliability in both their 150 Super Six and their 200 Anniversary Edition by adding another sparkplug to each cylinder, causing a more efficient fuel burn.

Suzuki has also developed an advanced cooling system, which it calls the 2-Loop, 2-Bypass system, to cope with varying engine temperatures found in different parts of the block. Simply stated, water is circulated in both the cylinder block (loop 1) and the cylinder head (loop 2). Water from hotter engine zones is shared with water from cooler zones, creating a more uniform system temperature, which lowers the average operating temperature, extending engine life.

It's only fair to say that most of the engine manufacturers have some form of low-oil warning system. Suzuki's gauge precisely monitors four levels of

engine oil, monitors engine coolant and oil flow, and even warns of over-revving (a warning you should heed before the engine takes over and automatically reduces excessively high rpm in an effort to protect from damage).

No stranger to the high-performance motorcycle racing tracks of the world, Yamaha has translated its 2-stroke expertise into a powerful line of big outboards. Yamaha's four big-bore outboards are all based on a 158.4-cu.-in. block, producing a power range from 150 hp to 225 hp. The company's most advanced engine by far is the 225-hp V6 XL, a loop-charged powerhouse that features a microcomputer brain to control all of that brawn, and Yamaha's own brand of oil injection, termed Precision Blend.

Precision Blend utilizes a crankshaft-driven pump, an integral oil reservoir, an on-board control unit and injectors that are downstream of the carburetors (injecting oil into the manifold between the carb and the reed valves). Precision Blend varies the mixture of gas to oil based on engine speed and load, varying from 200:1 to 50:1 in ratio.

In addition, Yamaha equips its V-block models with a remote oil tank that automatically feeds the engine-mounted integral oil reservoir when it is less than half full. This extra tank can give you more than six hours of running at wide-open throttle settings before you have to replenish the system.

One of the keys to Yamaha's state-of-the-art performance is the combination of 90° V-block and an offset crankshaft. The offset crank is a performance add-on that allows the engine to fire more frequently, on every 60° turn of the engine, to smoothly spin the shaft at constant high rpm speeds. Yamaha uses it as standard equipment on all V4 and V6 outboards.

Yamaha labels its 225 hp V6 XL "the outboard with a brain," a reference to a microcomputer ignition system that uses eight sensors to constantly monitor performance information, from engine load and speed to operating temperature and fuel quality.

Every idea for improved outboard performance discussed here has run the long road of initial design and development, has been through exhaustive lab testing, and has finally been forced to the limits of endurance and durability on the racing circuits of the world. Quite often, consumers don't realize that they are the ultimate recipients of technology that has first trickled, and then flowed, down from tens of thousands of hours of development.

It's something to think about as you slide the throttle forward and pull a skier out of the hole, or accelerate for that favorite fishing spot.

—John Wooldridge

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GREAT GEAR

Microchips and cathode-ray tubes are a signal of things to come in marine equipment. But high technology is also at the forefront of boating basics, from compasses to bottom paint.

In an age when space vehicles routinely probe the Venusian atmosphere, and a jaunt to Mars is under serious contemplation, it's little wonder that sophisticated gadgetry is finding a home in the boating world. Microprocessors and video screens are indeed becoming commonplace, but interesting, useful technologies are also finding their way into more prosaic equipment categories. In fact, accessories these days range from the simple to the sublime. Compasses, auxiliary power, props, even paint, are feeling the heat of technological advancement. While back on the leading edge, visionary manufacturers are establishing the epitome of art in engineering, like the \$171,000 dash panel found aboard Wellcraft's Scarab 5000 (right). It's getting so that wherever you ride—up the creeks in an outboard jon boat, or down the cuts in a twin-screw thoroughbred—technology is riding with you.—*Tim Cole*

Even the ensign has gone high-tech. The Radar Flag's silver anodized lining (below) reflects signals at 8½ miles. Contact Radar Flag, 2430 E. Commercial Blvd., Ft. Lauderdale, FL 33308.

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Wellcraft asked HWH Electronic Corp. to assemble and install the finest navigation and communication gear available for its \$410,000 Scarab 5000. The space-age dash panel (above) is the result. In the upper left is the ship's functions monitor, which incorporates running light ON/OFF indicators. Just below and to the left, HWH positioned a Furuno FCV-661 color video depth finder, used for tracking bottom topography in





navigation, or finding fish. The Furuno FR-805D radar is positioned in the lower left. It has a 48-nautical-mile range and an alarm if a target comes within a specified perimeter.

Taking center stage is the Cetec Benmar autopilot. This device steers the vessel electronically, and integrates with the Ioran C, sat/nav and digital navigation plotter. Clustered around the autopilot are specially designed LCD powerboat readouts from Brookes & Gatehouse. Boat speed is on the upper left. Depth is on the upper right. The two LCD modules to the lower left and lower right indicate a

variety of different information—rudder angle and plane angle, for instance, or wind direction and sea temperature.

Conventional analog engine instruments have been replaced aboard the Scarab 5000 by the Javelina Audit Mark 5 Marine System. Three CRT screens installed just above the steering wheel indicate speed, rpm, oil pressure, voltage, water temperature, fuel level, trim position, etc.

HWH installed the Scarab's navigation gear on the right. At top is the Furuno LC 90 Ioran C, which gives the operator real-time position. The Ioran

dead-reckons between passes by orbiting Transit satellites, whose signals are captured by the Furuno FSN-70 satellite navigator. Loran and sat/nav position is indicated on the Furuno GD-170 color video plotter below the sat/nav and is displayed in latitude/longitude coordinates.

While the prudent mariner should never expect these bells and whistles to replace a human being standing vigilant on the bridge deck, the ultimate is always interesting. For more information, contact Kevin Sherburne at HWH, 4215 Gulf Blvd., St. Petersburg, FL 33706.

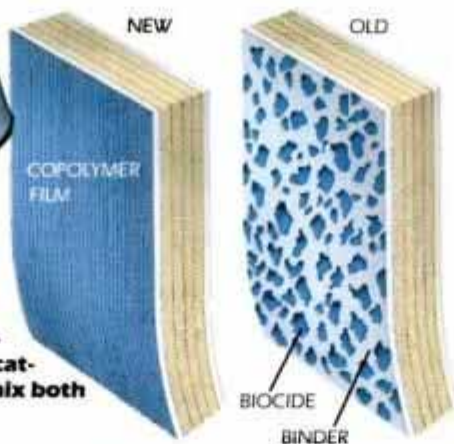
GREAT GEAR



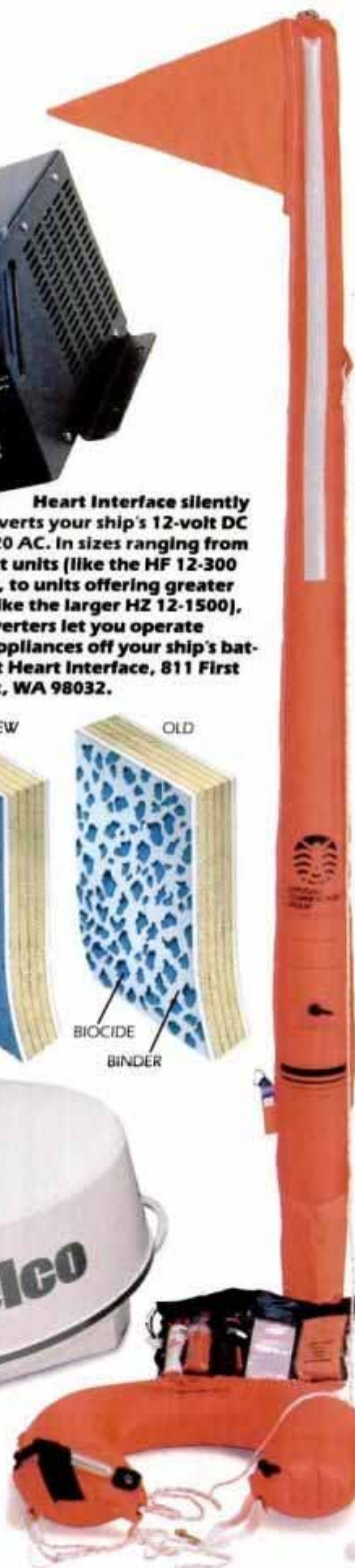
Heart Interface silently converts your ship's 12-volt DC current to 120 AC. In sizes ranging from tiny 300-watt units (like the HF 12-300 shown here), to units offering greater AC output (like the larger HZ 12-1500), HI power inverters let you operate household appliances off your ship's battery. Contact Heart Interface, 811 First Ave. S., Kent, WA 98032.



Interlux Micron 44 bottom paint fights weeds. Old-style paint combined growth-killing biocide and binder. When biocide depleted, binder remained, complicating refinishing. New paints mix both agents in a single, consistently toxic coat. Interlux, 2270 Morris Ave., Box 386, Union, NJ 07083.



The Apelco LDR 9900 radar relies on simple, readable LCD technology in a highly compact 9 x 7 x 3 3/4-in. display, making it the world's smallest radar. It has night illumination and a 1000-dot pixel density for enhanced resolution. The accompanying scanner weighs just 16 pounds. Contact Apelco Marine Electronics, 1107 N. Ward St., Tampa, FL 33607.



Tanaka has developed the QEG-250 lightweight portable generator to tackle smaller requirements. The 18.7-pound unit fits anywhere and supplies 12-volt DC current for recharging batteries or powering tools. Handle makes it stowable and convenient. Contact R.E. Jarvis, Rt. 9, Fayville, MA 01745.



Sea-Air Emergency Descent Air Supply is intended for situations when you have to go underwater. The handheld tank is 15 in. high and weighs 2 pounds. Air supply lasts 8 to 10 minutes at a maximum depth of 8 ft. Contact Survival Technologies Group, 11600 Ninth St. N., St. Petersburg, FL 33702-1098.



The Man Overboard Module offers quick-release assistance to overboard victims by putting a self-inflating horseshoe and locator pylon in the water in about four seconds. A pull on one strap deploys the system. Inflatable components are 6-ounce nylon painted orange. Contact Survival Technologies Group, 11600 Ninth St. N., St. Petersburg, FL 33702-1098.



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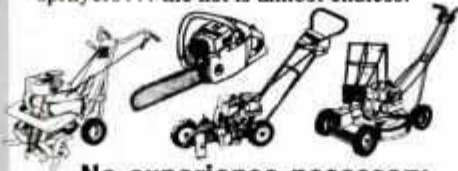
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ON THE ROCKS

(Continued from page 81)

solid bar with a 2-finger trigger and cable system operate the two sets of two opposing cams. Trigger pull reduces the cams to their smallest diameter for placement. Springs flare the cams and hold them against the rock when the trigger is released.

Ascenders and descenders

Ascenders are spring-loaded cam devices used primarily for climbing rope. Once attached to the rope, a jumar (generic for ascender) is pushed upward, easing tension on the cam. The cam activates under load and holds the climber in the higher position. Two are normally used.

Descenders are rappel devices and can be used for belaying. A descender loops rope around or through itself to create friction. The climber attaches it to his harness system and feeds the rope through the device.

The sport of climbing

Mountain climbing equipment has improved faster than my ability to use it. I climbed my first crack 22 years ago, and at that time some books had photos of mountain walls that were called "impossible." They've since been climbed.

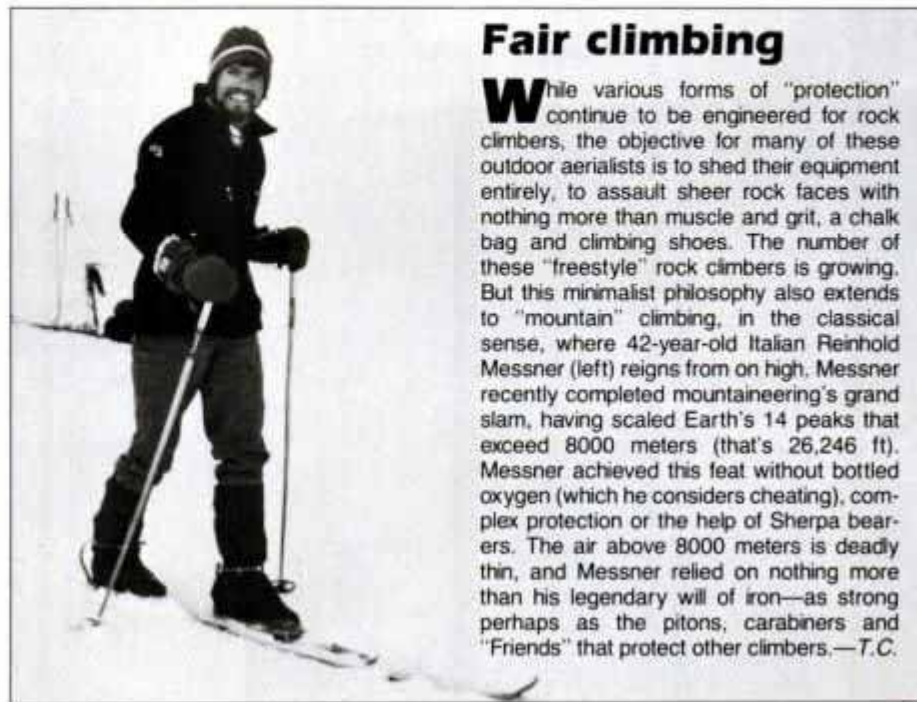
Climbing is a sport that offers the participant an unusual blending of physical and mental challenges. The danger is real, a mistake often fatal.

The most important piece of equipment the climber can learn to use is his brain. But it sure doesn't hurt to have a few "Friends."

PM

CLIMBING GEAR SOURCES

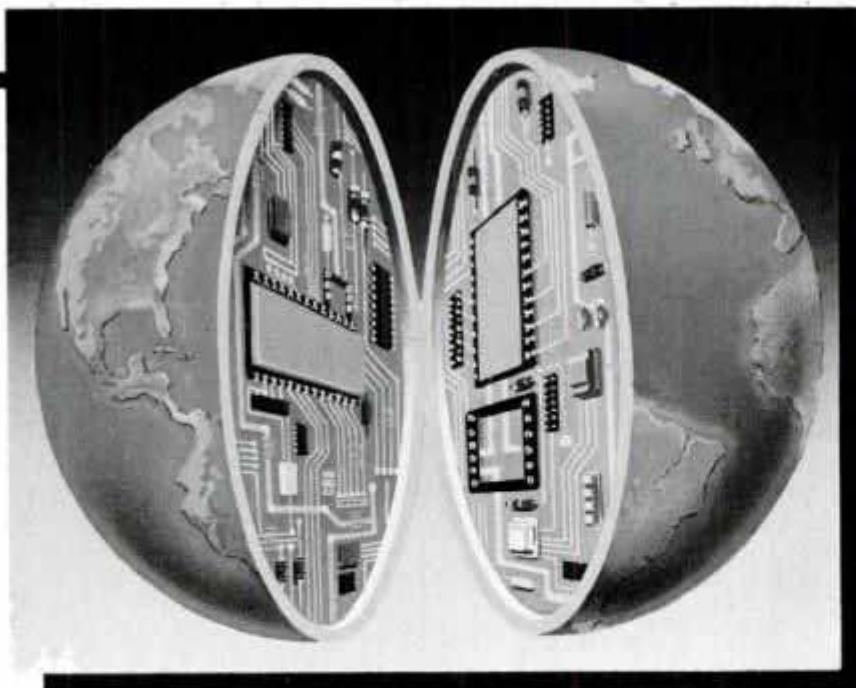
- Recreational Equipment Inc., P.O. Box C-88125, Seattle, WA 98188; (206) 433-0771, ex. 443.
- Chouinard Equipment Inc., 245 West Santa Clara St., Ventura, CA 93001; (805) 653-6417.
- Climb High Inc., P.O. Box 9210, South Burlington, VT 05403; (802) 864-4122.
- Lowe Alpine Systems, P.O. Box 189, Lafayette, CO 80026; (303) 465-3706.



Fair climbing

While various forms of "protection" continue to be engineered for rock climbers, the objective for many of these outdoor aerialists is to shed their equipment entirely, to assault sheer rock faces with nothing more than muscle and grit, a chalk bag and climbing shoes. The number of these "freestyle" rock climbers is growing. But this minimalist philosophy also extends to "mountain" climbing, in the classical sense, where 42-year-old Italian Reinhold Messner (left) reigns from on high. Messner recently completed mountaineering's grand slam, having scaled Earth's 14 peaks that exceed 8000 meters (that's 26,246 ft). Messner achieved this feat without bottled oxygen (which he considers cheating), complex protection or the help of Sherpa bearers. The air above 8000 meters is deadly thin, and Messner relied on nothing more than his legendary will of iron—as strong perhaps as the pitons, carabiners and "Friends" that protect other climbers.—T.C.

PM PHOTO BY GALEN ROWELL



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SPEED THRILLS

(Continued from page 66)

away, and insists on being shown the engine, if they don't demand a ride outright. Attention has been the Corvette's traditional panache, and the Callaway has it squared.

The Z-51 performance handling package ride can only be categorized as stiff. Race-car stiff. And the fiberglass creaks and pops over anything but the smoothest roads. It's the price you pay for a totally flat cornering attitude. The shifter feels as if it were bolted directly to large pieces of metal. The heavy but

responsive steering and brakes assure that this is not a car for the weak or timid. It simply reeks of make-my-day macho in a fashion unapproachable by any other vehicle. Add \$20,000 to the price of a normal Corvette for the Callaway option.

And few are the vehicles capable of the Callaway's 173 mph top speed, which we simply had no opportunity or inclination to test. The Buick is hampered by a 124-mph shutoff built into the fuel-injection computer, so no top speed comparison was possible even if the aerodynamic disparities were not so great.

After some arm-twisting by the engineers present at Milan, we did square off the two cars. Because Chevrolet and Callaway don't think the current crop of GM automatics can deal with the V8's torque, the Corvette is available only with a 4-speed manual transmission, which incorporates overdrive on the top three gears. The Buick comes only with a 4-speed automatic.

The automatic-equipped Buick proved to be more suited to dragstrip testing because it provided full-power upshifts that didn't let the boost fall off between gears. The Corvette required a fine balancing act between clutch slippage, wheelspin and turbo boost off the line that made it tough to drive consistently. And turbo lag between shifts didn't help, either.

The Buick was faster off the line, right from the start. About the time that we started to figure out the Corvette, it's alternator expired. Vanishing voltage sapped the high end output of the engine, preventing more than 3 to 4 pounds of boost, but the handwriting was on the wall before then—Buick all the way up to the point where aerodynamics become involved.

The Buick, of course, doesn't have the high profile around town that the Vette has. It's really just a nicely rounded car that looks mean and thoroughly nasty in all black. Despite its sinister appearance, you could loan it to your sister-in-law to take shopping. She'd feel comfortable in it. But if she likes to go fast, you might not get it back for a while.

The Vette is more of a driver's car: great fun to downshift out on the parkway and blast past those annoying left-lane hogs. It will also attract the attention of every cop in town, even when it's going the speed limit. Which it's not likely to very often. If you like Corvettes, you'll love the Callaway—distilled essence of Corvetteness.

What we find most intriguing about both these cars is that, under normal conditions, both these cars are calm, even docile, in the way they treat their driver and passengers. You can putter along in traffic, sit idling, drive slowly and get 20 mpg. Yet, lurking under your right foot is enough power to blow away just about any car on the road, anytime you're so inclined.

We were drawing parallels to the musclecars of the '60s. In the intervening years, progress hasn't stopped. Tremendous advances in tires, suspensions and brakes have made these modern musclecars much better all-around vehicles. And much safer.

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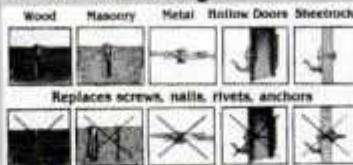


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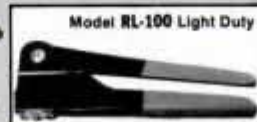
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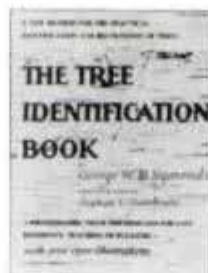
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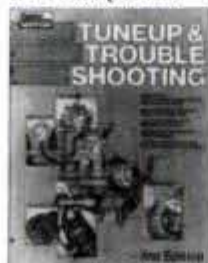
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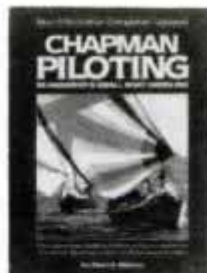
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MERKUR XR4Ti

(Continued from page 71)

was an ample reserve of power and very little wind roar." A California engineer: "Rear-wheel drive is more entertaining than fwd. The feel of this car is very balanced. There's enough power to break loose the rear end at will. The transition from understeer to oversteer is very controllable."

We could go on and on, quote after quote. The Merkur XR4Ti's greatest strength, obviously, lies in its ability to please the person behind the wheel.

The 5-speed manual transmission, though, brought more driver complaints than any other aspect of the car. "The shift gate feels notchy," wrote a Michigan physician, "and hangs up between FIRST and SECOND; delays shift-

ing." A few owners also had a hard time going into REVERSE. Others noted 4-cylinder vibrations in the gearshift lever, despite the oil-cushioned engine mounts.

And a New York forester volunteered, "The safety switch that makes you put the gearshift into NEUTRAL to start the engine should be eliminated. It's not only bothersome, but unsafe,

SUMMARY OF MERKUR XR4Ti OWNERS REPORTS*

Total miles driven	1,881,528	Specific dislikes:		Average	1.2	Number of vehicles owned:	
Average miles per gallon:		Hard to shift	19.0%	Poor	0.3	This car only	25.4%
5-speed manual		No complaints	14.1	Rear seats		Two cars	39.6
In town	19.9	Fuel mileage lower than expected	6.3	Excellent	59.9%	Three cars	21.1
On the highway	25.0	Noises and rattles	5.3	Good	38.6	Four or more cars	13.8
3-speed automatic		Not enough power	4.9	Average	1.6		
In town	18.0	What changes would you like?		Poor	0.0	Makes of other cars owned:	
On the highway	22.9	Improve the shifter	18.2%	Had any mechanical trouble?		Ford	33.3%
Option choices:		Make cruise control available	14.9	Yes	57.4%	Mercury	19.5
Power windows and door locks	97.3%	No changes	12.5	No	42.6	Chevrolet	13.8
Moonroof	69.2	Add intercooler to turbo	8.1	What type of trouble?		Honda	8.5
Heated front seats	59.1	More horsepower	7.1	Air conditioner	17.8%	Volkswagen	7.3
Leather upholstery	25.6	How much did you pay?		Transmission	14.1	Would you buy a Merkur again?	
Why did you choose the Merkur?		Average	\$17,563	Electrical system	11.0	Yes	70.2%
Styling	69.4%	Range	\$14,900-\$21,000	Instrumentation	8.4	No	3.3
Performance	40.6	Workmanship opinion:		Door locks	7.3	Maybe	26.5
Handling	22.8	Excellent	74.5%	Brake lamps	6.8	Would you buy another Lincoln-Mercury product?	
Quality	14.4	Good	23.3	Dealer repairs satisfactory?		Yes	44.8%
Good price	12.2	Average	1.8	Yes	67.9%	No	13.0
Specific likes:		Poor	0.3	No	32.1	Maybe	42.2
Styling	61.9%	Comfort opinion:		Dealer service opinion:		Age distribution of owners:	
Handling	54.7	Front seats		Excellent	31.2%	Under 29 years	16.3%
Performance	43.1	Excellent	80.5%	Good	40.7	30-49 years	64.2
Comfort	40.3	Good	18.0	Average	20.9	50-plus	19.5
Power	26.4			Poor	7.1		
Ride	23.3						

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

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because too much time is lost going back into NEUTRAL when you stall in heavy traffic or on a hill."

Unfortunately, nearly 60 percent of our respondents reported mechanical problems—mostly minor ones. Several owners noted a coolant leak between the turbo and the engine. The fix involved just tightening a hose clamp. Dealers took care of two-thirds of all problems to most owners' satisfaction—a decent but not outstanding showing.

Then, too, service wasn't available everywhere. A South Carolina pilot told us, "I moved from Tucson to Myrtle Beach, and although there's a Lincoln-Mercury dealer here, he doesn't sell or service XR4Ti's. The nearest Merkur dealer is 90 miles away."

Despite 175 turbocharged horses with the 5-speed (or 145 hp with the more recently released automatic), some owners felt the need for added power. "Needs more low-end torque," insisted an Alabama TV producer, "like a turbo V6 with different gearing." Several drivers suggested adding an intercooler to the turbocharger, as on the Mustang SVO.

Ford's Motorsports Div. does have an aftermarket intercooler kit that will fit the Merkur and is not difficult to install. Most Lincoln-Mercury dealers just don't know it exists.

Real-world fuel mileage lived up to EPA estimates—in fact, beat them slightly. However, as a Massachusetts mechanic observed, "They boast of good mileage, but you have to use premium fuel at a premium price. What's the advantage?"

Catching the eyes

To its credit, the XR4Ti definitely turns heads. Many owners appreciate that, especially since styling was the first thing that tempted them. A Michigan businesswoman and consultant told us, "Nobody else around here has one, so I really enjoy the stares other drivers give this car. It's one fun aspect of the Merkur—a sign of success—and that's important to a woman with her own business."

Several respondents worried aloud about the XR4Ti's eventual resale value, among them this California aerospace worker: "I'm somewhat concerned," he wrote, "because the Merkur doesn't seem to be selling all that well."

It would sell better, felt an Ohio engineer, "if the Merkur were wearing a badge that said Porsche or Audi or BMW. I'm positive it would be a smashing success that way."

Admittedly, the Merkur XR4Ti hasn't lived up to its early sales estimates. According to *Ward's Auto*

World, Lincoln-Mercury hoped to sell 15,000 cars in calendar 1985 and ended up barely moving 6000.

The fault lies not with the car because, as we've seen, our respondents tell us it's one of the best put-together, quickest, most sensuous and comfortable automobiles they've ever owned. A lot of the XR4Ti's lack of early popularity probably had to do as much with identity as with stiff competition.

Lost in the crowd

The XR4Ti tends to get lost in a sea of sport sedan rivals like the BMW 318i, Volvo GL, Saab Turbo, Alfa GTV-6, Audi 5000S and Peugeot 505. But more than that, the Merkur suffers terribly from not being *recognized*. A California industrial designer put his finger on it when he said, "Even here in this car-conscious state, most people are unaware of the Merkur. They just don't know what it is. It's different, and they realize that, but few can name it."

Ironically, even some XR4Ti owners don't really know what they have. A Massachusetts photographer scribbled the following note on the bottom of his questionnaire: "This is the first American (!) car I've ever owned. If more cars like the Merkur were available from U.S. dealers, many people would probably buy American over foreign." This guy obviously has no idea that his car came from Ford of Germany, with the body built by Karmann and the engine made in Brazil! These same owners, however, would probably recognize a BMW or Volvo or Audi a block away.

Like its rivals, though, Merkur's quality of workmanship received a good to excellent rating from 97.8 percent of our sample. That's up there in Mercedes territory.

Front-seat comfort likewise brought praise, with 98.5 percent scoring this aspect good to excellent. Even the split folding rear seats prompted an amazing 98.5 percent to score comfort good to excellent—virtually unheard of in a 2-door sedan of this type and size.

"More comfortable than any other car I've ever owned," said a Kentucky pharmacist, "and much more comfortable than my friend's BMW 325e, with more room and no electrical gizmos to go wrong in the driver's seat." An Arizona machinist: "I'm over 6 feet tall, and there's plenty of legroom. More of a sports car ride than a sedan ride, but that's what I like."

A New York mental health professional summed up the feelings of most current owners when he said, "The XR4Ti uniquely combines racy looks, good performance and handling, plus progressive design with solid German attention to detail and quality." Who can ask for more than that? **EM**

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AMERICA IN SPACE

(Continued from page 78)

know is: What do you want the new Shuttle to do? If you want to build a machine that carries schoolteachers and journalists into space, we can build it. An ultrasafe system that is more an airliner than a space vehicle is within our reach. But that isn't what we need.

America's next Shuttle should be designed for one mission only—building the Space Station on schedule in 1992. Instead of building a ship with a 60-ft. x 15-ft. cargo bay, thereby locking us into building Space Station modules that will fit, we should have a flexible system that can have either a long, thin cargo bay or a short, wide one.

The new Shuttle should be built for short missions. A 3- or 4-day mission gives NASA enough time to unload the Space Station parts onto a vehicle that can move between Earth orbit and the Space Station orbit.

The next task: the design of space tugs. NASA has already put out design requests for a space vehicle that can haul material from Shuttle to Station. The Orbiting Maneuvering Vehicle (OMV) and the Orbital Transfer Vehicle (OTV) are two NASA concepts for tugs. The OMV would be used to move between the Shuttle and the Station. The OTV would be used to put objects into geosynchronous orbit.

The space-tug design poses fewer problems than we faced with the Lunar Landing Module. The tug won't have to be as light, for example, since it won't have to lift off from the moon. It will travel from point to point in space. It can have some creature comforts inside for the crew that will have to man it. It can carry radiation shielding to allow it into geosynchronous orbits. I'd give it grappling arms like those on submarines. It doesn't have to look pretty, just function in space. And there is no need to return such a vehicle to Earth. It can be refueled and resupplied by the Shuttle, which can also transfer crew.

With these vehicles in place, we will be ready to build a Space Station. As construction modules are delivered, we can leave a crew permanently on the Space Station. I can envision having a payload specialist stationed permanently on the Station, keeping inventory as the systems are assembled and calling down to Earth for more payload as needed. Mission specialists could man the space tugs and talk between the Space Station and the Shuttle as they bring supplies and people aboard.

With the Space Station orbiting about 300 nautical miles above Earth, a bank of thrusters on the Station—or a bit of maneuvering with space tugs—could reset it in orbit any time the Station begins to slow down, causing

the Station's orbit to decay. NASA has indicated the Station will be designed for 25 years of use. Putting some kind of "microflection" or thrust mechanism into the system will keep it up that long. We thought we would keep Skylab in orbit a lot longer than we were able to maintain it. Skylab's orbit eventually decayed and fell to Earth because we didn't have the Space Shuttle ready in time. It could have reset the Skylab in orbit. With the new Space Station, if we learn from history, that will not happen again. All those little thrusts will keep it in place.

If we don't continue the myth that the Space Station must be all things to all men, it will be easy to build and maintain. In recent years, people have suggested the Space Station should be used as a manufacturing facility, a scientific research outpost, even a launching point for deep space missions.

I would like to see a Space Station developed where a man could work in space long enough to feel his way along. Right now, space is an experiment. We really haven't accomplished a good "task" up there. We've played games and assembled things like tinker toys. I define a task as doing *real* work, bringing back material that is worth more than the raw material you started with. To get to that point, you first have to be at home in the environment.

Our task for the next 10 to 15 years should be setting up the Space Station. Missions to Mars and mining the asteroids are great things to think about in the 25- to 50-year planning stage. But if we want to be realistic, then we have to talk in terms of a 10- to 15-year building program. Once we start building a space station, we don't need very complicated structures to keep a crew.

Some in the aerospace community argue that the presence of a crew would disturb microgravity. In fact, it would be no trouble at all to build a totally unmanned space station with a small module that flies in formation with the station. All tasks performed on the station itself would be remotely controlled by the crew in the smaller vessel.

I don't claim to have the best, or the only, solution to our space program problems. There are many competent people active in the current NASA program who have more technical information than I. But I feel strongly that any attempt to get ourselves back into space should be thought out and managed in a better way than it has been in the past. And I feel strongly that it is time for NASA to stop coming to Congress with hat in hand and a glamorous selling program. It's time to get back to the nuts-and-bolts decision-making process that took us to the moon in less than 10 years from the word, Go!

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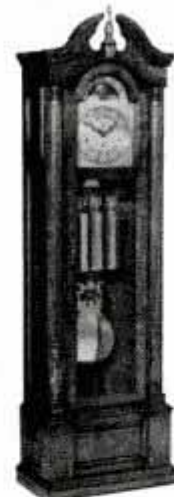
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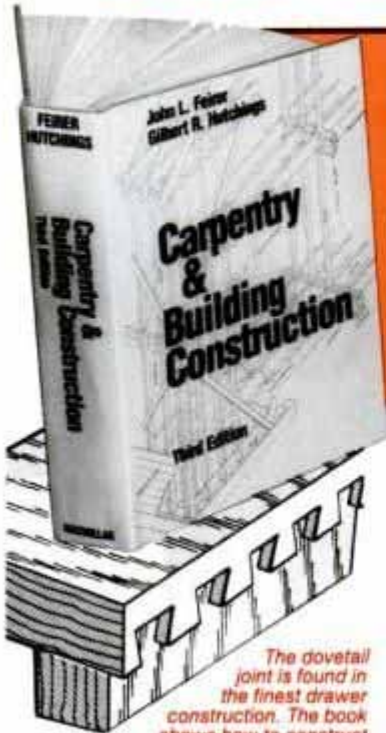
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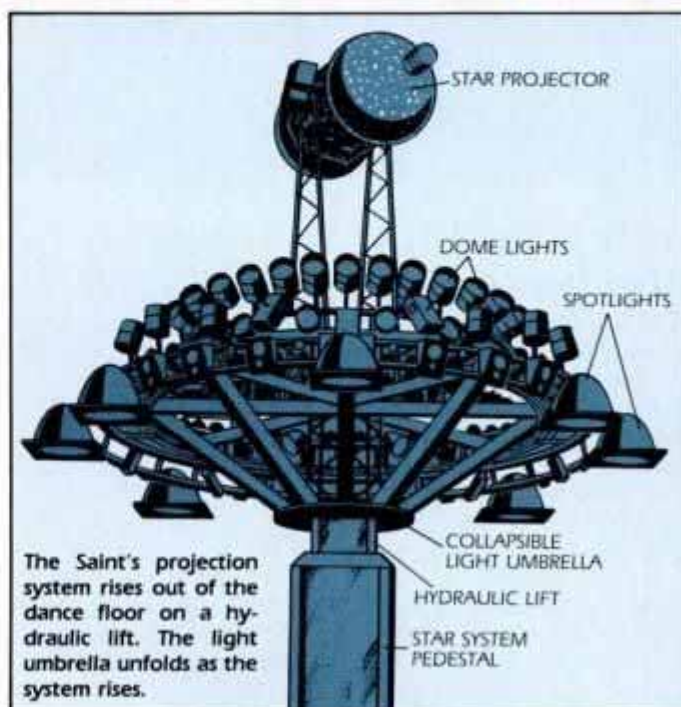
Stars Come In At Night

Dancing under the stars has taken on new meaning in New York City, where The Saint nightclub has installed a \$5 million high-tech dance floor. The centerpiece is a collapsible "light umbrella" that rises out of the dance floor on a hydraulic lift set in a cement pedestal. As the umbrella rises, it fans open, exposing banks of spotlights and dome lights. And, as the lights move into place, a planetarium star projector emerges as a tower atop the whole affair. When the music begins, the house lights go down and the lights and planetarium projector go to work. A spectacular night sky scene, with clusters of stars, comets and meteor-

ites, covers the 76-ft. x 38-ft. perforated aluminum dome. The dome, which is larger than the one atop the Hayden Planetarium, covers 4800 sq. ft. of dance floor.

With such spectacular viewing, a nightclub needs an equally spectacular sound system. And The Saint has gone to great lengths with the installation of a 26,000-watt sound system. The heart of the system is an Audionics Space and Image Composer that separates the music signal into four quadrants, each with 14 channels of amplification.

Editor: Dennis Eskow
Contributors: Frank Lusk, Lee Green,
Deborah Frank, Steve Eskow,
Jack Hammond, Carmelo Ramos



The Saint's projection system rises out of the dance floor on a hydraulic lift. The light umbrella unfolds as the system rises.

P M ILLUSTRATION BY HANK IEN

TECHNOLOGY UPDATE 3/87

AVIATION

PHOTO ILLUSTRATION BY ED VALIGORSKY



New SST is all business

British Aerospace, coproducer of the supersonic *Concorde* jet, says it will build a prototype Mach 1.5 business

jet. British engineers feel they've learned how to make the jet acceptably quiet on takeoff during the past 10 years of flying the *Concorde*. The 3-engine craft will seat up to 20 passengers and two

crew. It is to be designed for cross-Atlantic flight and relatively short takeoff and landing. An early design of the British business jet calls for a forward canard to be placed over and to the rear of

the cockpit. It will sport delta wings, for fast takeoffs and landings. The British also are working on a supersonic airliner called *Hotol*, which may compete with the American space plane.



Jump seat for the jump jet

The Harrier jump jet has been a single-seater for the first seven years of its existence. Pilots who flew it had to be experienced at operating other attack aircraft. But the Marines wanted to put younger pilots into the supersonic craft. Late last year, McDonnell Douglas rolled out the first Harrier trainer, a 2-seat version of the real thing. The trainer

has an instructor seat behind and slightly above the student cockpit. With a slightly elongated fuselage, the trainer would have had different handling characteristics than the combat craft. To overcome this problem, designers made the trainer's tail 17 in. taller. The trainer is slightly ahead of the combat Harrier because it carries a Rolls-Royce Pegasus II engine. Combat Harriers will get this powerful engine next year.

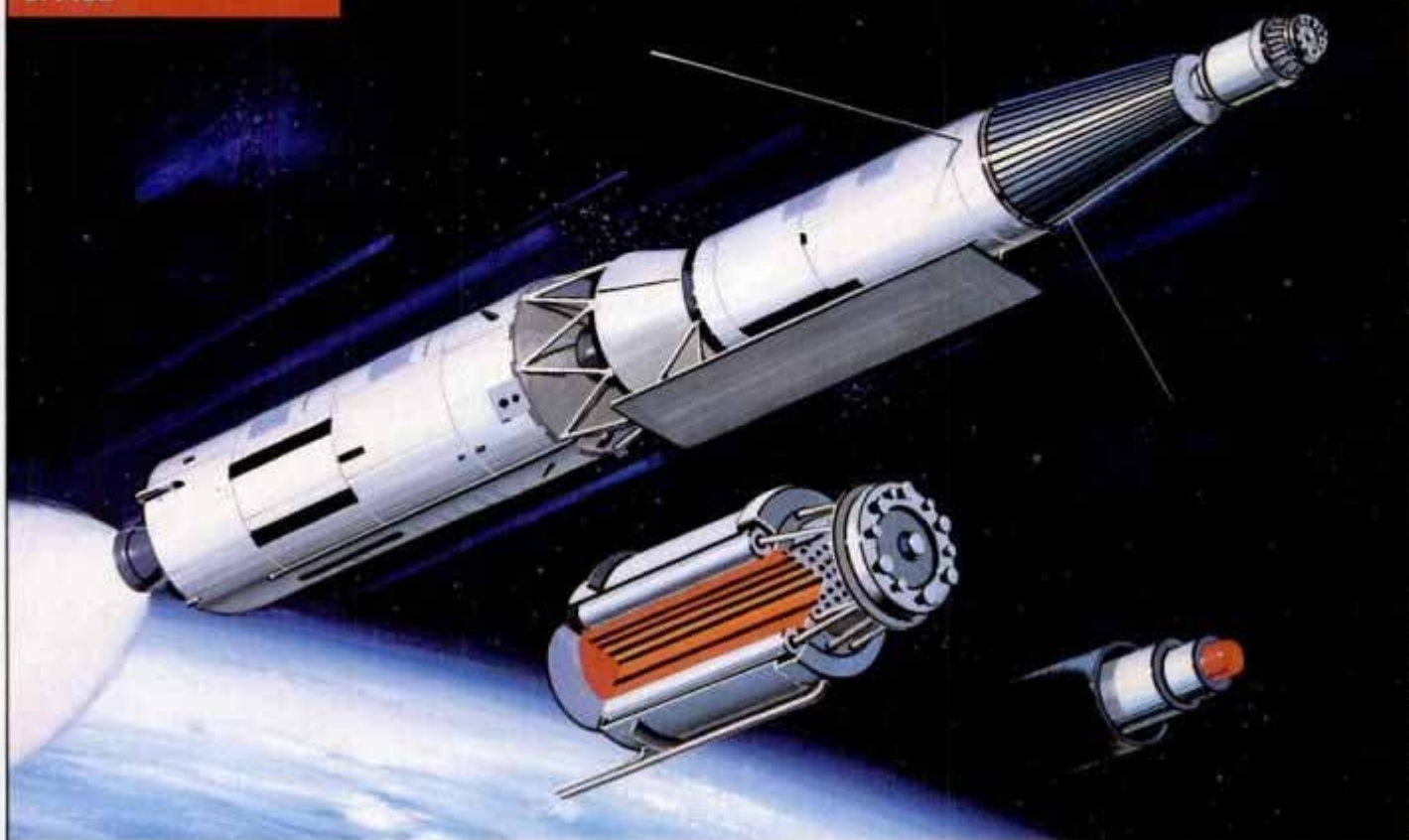
Chopped traffic reports

Helicopter traffic reports have become commonplace on radio and TV stations across the United States and Europe. But Sweden's National Broadcasting Service is experimenting with a revolutionary wrinkle. It's a



1.2-hp mini-helicopter designed by Yngve Klintmab and Josef Barabas of Stockholm. The 3-ft.-long remote-control chopper is powered by a hedge-trimmer motor. It carries a Sony Handycam at altitudes of up to 1000 ft. (above) and provides pictures of vehicle traffic below. The traffic reporter controls the chopper from a mobile studio on the ground at distances of up to 3 miles. The chopper's wooden rotors (left) sit on an aluminum tilting shaft for optimum pitch, roll and yaw control. If the experiment works out, real helicopters will be grounded.

SPACE



PM ILLUSTRATION BY ED VVALIGURKY

Soviet ships a space threat

NASA is reviewing a report by Teledyne Brown Engineering that points to a serious threat posed by orbiting

Soviet spacecraft. The report, prepared by Nicholas Johnson, an expert on the Soviet space program, says that about 50 nuclear-powered Soviet space vessels are decaying in orbit or

moving toward a collision course with American satellites. The standard Soviet space vessels involved have elongated nose cones which carry fuel rods. Just beneath them is a rotating drum sys-

tem that carries the generator and coolant sections. There is no threat of nuclear explosion, but radiation hazards to Earth and to communications satellites are under study.

MARITIME

Oil driller is mobile, agile

A new oil exploration vessel may replace current oil-drilling platforms for seabed test-well drilling. Current platforms have to be tugged to sea and put in position at

great expense. England's new Sunderland Stena has a flat, angled hull that lets it move into position without assistance. The Stena can sink a test well at North Sea depths. It carries two remotely piloted diving bells with grappling arms to help set test rigging in place. The Stena sails in June.



The pilot is a laser

The world's first marine data chart system capable of storing thousands of marine pilot charts is being tested in the North Sea. Disc Navigation's system uses optical laser discs and a high-speed microprocessor to provide

piloting data for inland waters and harbors. When connected to radar and sonar detectors, the system is designed to pilot a boat into a harbor automatically. It is expected to see its first application in Norway, Denmark, Sweden and England next summer and the marine pilot may soon vanish.



TECHNOLOGY UPDATE 3/87

ELECTRONICS

Plastic card has chemistry

McDonnell Douglas engineers have gone one step ahead of the plastic card you can't leave home without. The new Vitek card contains tiny veins filled with biochemicals. When a patient goes into a hospital for tests, samples of his blood can be dropped onto the card. The blood is absorbed into the veins and the card is slipped into a sleeve in a computerized analyzer. An ID number is marked on the card. Inside the analyzer, tiny vacuum capillaries remove the blood and chemical mixture, shunt it to test tubes and perform various medical tests. Chemistry that once took days to perform is now done in about four hours.



ENERGY

Strike match, save lives

Some accidents predicted in nuclear reactors would occur when hydrogen gas leaks in the main containment system. There would be no danger of explosion at the beginning of a leak, but as gas built up, a blast could occur. Sandia National Laboratory has developed an "electronic match" with a hydrogen sensor in its core. Near the beginning of a hydrogen leak,

the match would ignite automatically, burning off tiny amounts of gas and sending an alarm to the control room.



Laser soldering

Soldering circuits onto a microchip is a tall order. But Hull Unico of England has developed a laser soldering system that eliminates most of the inaccuracies associated with traditional soldering. The system uses an infrared laser that puts out heat to thousandths of a degree accuracy for each operation. The British firm is hooking the

new laser tool to a robotic system for automation. It could be on the market within the next 18 months.



Water power provides heat

Northern Europe's most bountiful resource is water. And the European firm of Stal-Laval is introducing a new way to harness the resource. It's a computerized, mobile heat-pump station that can deliver heat or air conditioning to a community or provide heat to drive turbines anywhere near water. Several variations of the sta-

tion have been designed, but the most promising can be floated to a site by barge and placed on a concrete slab about half the area of a football field. The pumping station has two intake lines, one dipping into the water near the surface, the other pushed into the water at depths of up to 30 ft. The shallow intake operates in the summer, providing heat for generation, or providing air conditioning when the



pump is reversed. The deep-water intake provides heat in the winter months. **TU**



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LEBARON GTS AND LANCER

(Continued from page 67)

These set Chrysler apart from all other mid-sized cars."

Styling and performance also brought an armload of bouquets. An Illinois doctor rhapsodized, "Gorgeous, roomy car, with excellent turbo power reserve. The turbo makes my GTS highly responsive." A North Carolina manufacturing executive: "Classy looks and performance. I love the acceleration. Fun to drive! Power!" And a Michigan engineer: "I leave a lot of other cars in my dust without guzzling an entire tank of gasoline."

Fuel mileage pleased the majority of owners, although 10.2 percent said it



Interior was generally praised, but a California owner complained, "the seatback falls forward whenever the brake is applied."

fell below expectation. "I feel that with a 4-cylinder, fuel-injected engine, my unturbocharged Lancer should be getting better than 20/25 mpg," said a Michigan retiree. Actually, most drivers did do better, ranging up to nearly 30 mpg on the highway with the 5-speed manual transaxle.

Interior roominess and comfort received excellent marks overall. "I'm 6-5," wrote a Wisconsin optometrist, "but am able to fit very comfortably."

Three minor ergonomic boo-boos, though, showed up in our survey. First, shorter drivers, notably women, reported that the nonpower seat sits too low and too far away from the accelerator pedal. Second, the tilt wheel at its lowest setting obscures the digital speedometer. And third, the power-seat controls, plus those for the remote hatch and fuel filler, are hard to reach with the driver's door shut.

An area of minor controversy showed up, too, in the H-car's manual shift mechanism. Only 9.5 percent of our respondents had ordered the standard 5-speed, but that 9.5 percent let us know they weren't totally happy with the shifter's actuation. A California attorney, the owner of a LeBaron GTS, told us, "The standard 5-speed doesn't shift as easily as it should," and a California pilot echoed, "Shifter very stiff and sometimes cantankerous."

That was the consensus, but, in fairness, one Wisconsin Lancer owner

countered, "Shifting was stiff at first. I'm finally starting to find FIFTH gear, but sometimes still hit THIRD instead." In this department, the Europeans hold a definite edge.

Owners rated quality right up there with the imports. Nearly 60 percent gave workmanship a mark of excellent, with 39 percent judging it good, and that's praise indeed.

A Minnesota salesman: "Zero defects. I'm still looking for one. Everything lines up."

A Georgia professor: "Everything fits. Doors, panels and trim all align. Paint job is smooth and covers well." Except for pointing out a few annoying rattles, owners couldn't say enough about their vehicles' assembly and finish.

Nearly 60 percent also had experienced no mechanical problems. Dealer service and repairs were satisfactory in 75 percent of all cases—another admirable record. Engine computer failure plagued several cars, as did frayed speedometer cables and faulty sending units for the digital fuel gauge. Dealers sometimes didn't have parts, and this led to delays and several gripes. All in all, though, reliability stood out as one of the H-cars' strongest suits, and when it didn't, Chrysler's 5/50 warranty came to the rescue.

Customer satisfaction ran high, and owners expressed that satisfaction in a number of different ways. A Tennessee public health physician wrote, "I'm more and more pleased with my GTS every time I drive it." An Ohio quality control manager: "The hatch is great



Turbo motor's 146 hp was plenty for most owners, but over 10 percent griped about poor gas mileage of 21.3 to 26.5 mpg.

for hauling things, especially with the versatile 60/40 split rear seats folded down to create additional space."

A Michigan office technician added, "So many items came standard on my Lancer ES, such as electronic instrumentation, AM/FM radio, clock, reclining bucket seats, remote hatch and fuel-door releases, map pockets and storage compartments everywhere. Even the location of the fuse box, with spare fuses and a puller, show that Chrysler has given a lot of thought to the details. I don't believe there's an imported

(Please turn to page 138)



How To Install VINYL GUTTERS

I had put it off too long already. Our old aluminum gutters and downspouts needed to be replaced. Although the system had served us well, it was now a leaky, corroding, dented eyesore. While shopping for a replacement, I decided to look into plastic (vinyl) gutter systems.

Vinyl gutters have been available to homeowners for nearly nine years. However, only recently have they become popular due to newly designed systems that stress easy, do-it-yourself installation and new features, colors and styles. Vinyl seems to be a near-perfect material for gutters and down-

BY JOSEPH TRUINI
Shop And Tools Editor
Illustrations by George Retseck

spouts. It won't dent, rust, chip, peel or corrode. It's resilient enough to bounce back from the blow of an errant baseball and vinyl never needs painting. Although, you can paint it, if desired, to match existing trimwork or siding. Vinyl gutters are available in white, brown and gray, with more colors to come in the near future.

But best of all, vinyl gutters are a pleasure to work with. Vinyl is light-

weight, smooth-surfaced with no sharp edges or corners and it cuts easily with any fine-tooth handsaw. One problem with vinyl is that on very cold days it becomes brittle and it will crack if struck sharply.

The major differences between the various vinyl gutter systems are the shape and size of the gutters and downspouts and the method used to join the parts. Gutters range in size from 4 in. to 5 in. wide and in lengths from 10 ft. to 32 ft. long. They come in three basic shapes: modified U-shape (as shown in the drawings), half-round and K-shape that resembles a standard aluminum



1 Snap a chalk line on the fascia. Be sure line slopes toward a downspout. Highest point of line is $\frac{1}{4}$ in. below roof shingles.

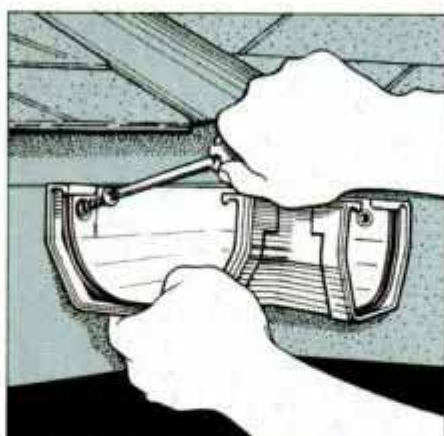
gutter. Downspouts come square, round and rectangular.

More important than the size or shape of the gutters, is how the vinyl parts are joined together. The two popular methods used are solvent weld and snap-together parts with gasket seals. Since snap-together systems are easier and quicker to install and more forgiving—they allow adjustments and reassembly—the choice is easy.

I installed a solid PVC, snap-together system called Raingo by Genova, Inc. The system consists of $4\frac{1}{2}$ -in.-wide \times 10-ft.-long modified U-shaped gutters and $2\frac{1}{2}$ -in.-wide \times 10-ft.-long square downspouts.

Genova has developed an ingenious system of fittings, brackets, strap hangers, galvanized clips, drip edging, couplers and wedge-shaped vinyl shims to make Raingo gutters and downspouts adaptable to virtually any building.

The drawings show the most typical

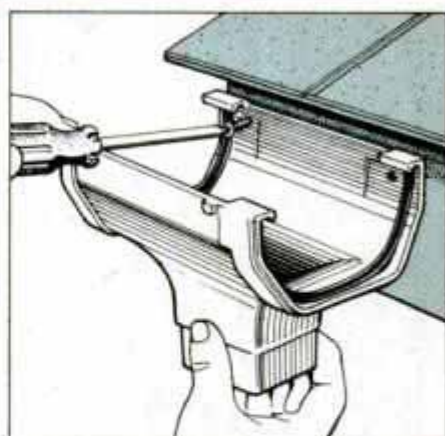


2 Attach inside corner fitting with its top edge on the chalk line. Avoid overtightening the screws that could crack the fitting.

situation: installing gutters on a vertical fascia. You can also install the system on a sloping fascia and directly to exposed rafter tails. If the house has no fascia or rafter tails, use special strap hangers that attach to the roof. Raingo also offers some unique features to combat a problem that plagues all gutter systems: the accumulation of wet leaves and debris. The interior surface of each gutter is lined with triangular-shaped ridges that permit water to pass under the leaves to carry them away.

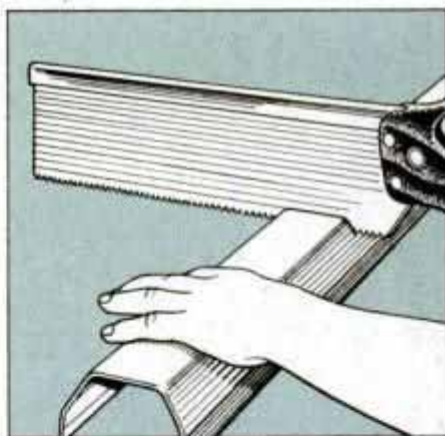
Besides a standard drop outlet, the fitting that joins the gutter to the downspout, Raingo also has a high-flow outlet that has a larger opening with curved sides to draw and flush more water, more rapidly.

Use a high-flow drop outlet to move excessive amounts of rainwater or when you'd like to reduce the number of downspouts. One high-flow outlet will serve up to 1200 sq. ft. of roof area as compared to 700 sq. ft. per standard



3 Secure the drop outlet to the fascia with two screws. Be sure outlet extends beyond shingles to catch rain runoff.

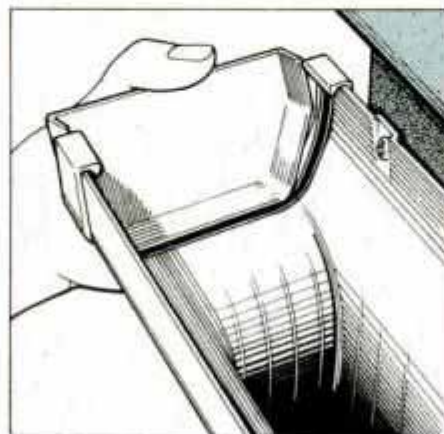
outlet. For areas that collect lots of leaves, install a leaf separator to the drop outlet (drawing 13). This unique fitting has an angled screen that rejects leaves, twigs, acorns and other debris



7 Hold gutter upside-down and cut it to length with either a fine-tooth hand saw, radial-arm saw or power miter saw.



9 The high end of a gutter run doesn't require a drop outlet. In such a case, install an end cap with gasket over gutter.

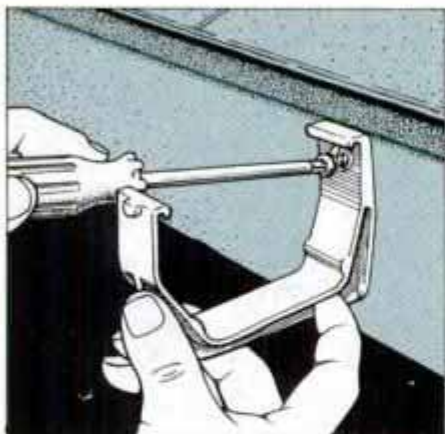


10 The end cap for the drop outlet fits inside of the outlet. The gasket on the drop outlet creates a watertight joint.

while water passes through to the downspout.

At the end of each downspout install a flip-up splashblock (drawing 16) to carry water away from the foundation. Lift the splashblock out of the way when mowing and trimming the lawn.

Also, vinyl downspouts are adaptable to most other types of gutter systems. If your aluminum gutters are in good condition, but the downspouts need replacing, then install new vinyl downspouts to the existing gutters using a special adapter fitting. For more information on the Raingo gutter system contact Genova, Inc., 7034 E. Court St., Box 309, Davison, MI, or call toll-free 800-521-7488; in Michigan: 800-572-5398.



4 Install a gutter bracket, with a single screw, every 30 in. Be sure to keep the top edge of each bracket on the chalk line.



5 Attach a gutter bracket about 2 in. from each side of the inside corner to provide additional support of the gutter ends.



6 Here's a quick way to position slip-joint fittings: Align gutter end with insertion mark in fitting and pencil a line on fascia.

Cost considerations

Okay, it's agreed: Vinyl gutters are easy-to-install and virtually maintenance-free. The next question is obvious: How much do they cost? Generally,



8 Apply silicone lubricant to gasket seals of slip-joints to promote smooth sliding action as the gutters expand and contract.

vinyl gutters are comparable in price to painted, heavy-gauge aluminum gutters. A typical 40-ft. vinyl gutter run with two downspouts, using standard fittings, costs about \$80 to \$100. A 10-ft. gutter costs about \$5; a 10-ft. downspout about \$7. Prices vary around the country. Keep in mind that a complex job requires more fittings and is, therefore, more expensive. Vinyl gutter systems are sold at hardware stores, home centers and lumberyards.

Gutter installation

The first few steps taken are exactly the same regardless of the type of gutter system being installed including vinyl, aluminum or steel. Start by drawing a rough sketch of the house

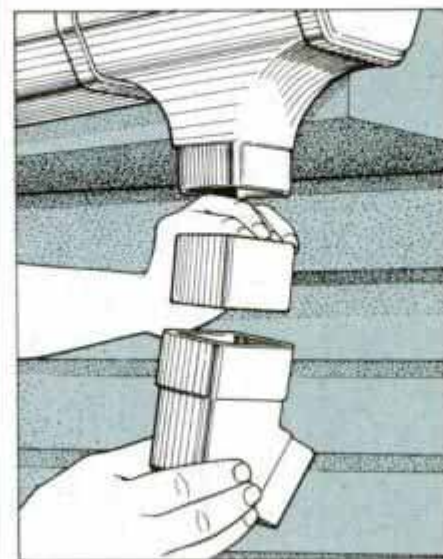
showing all gutter and downspout locations. Measure the house and add these dimensions to the sketch. Using the sketch as a guide, list all the vinyl parts needed to complete the system. Most manufacturers offer a parts booklet that makes it easy to order the right components for your house.

Next, take down the old gutters and downspouts. Pull the gutter spikes and cut strap hangers to free the gutters. Use a flat pry-bar to remove the straps that hold the downspouts to the house. This is a good time to repair and repaint the fascia, if necessary.

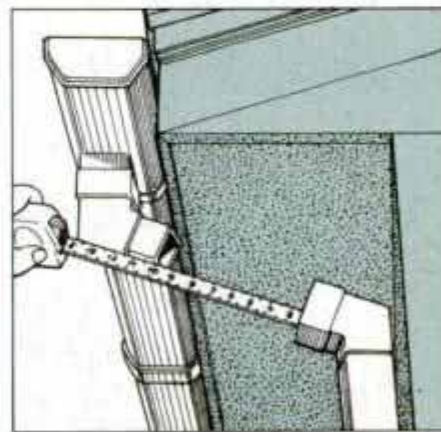
Now prepare to snap a chalk line to establish a reference mark for installing the drop outlets and gutter brackets. Be sure the line slopes slightly toward the downspout to drain water from the gutters. If the gutter run has a down-

spout at each end, start at the center and snap a line that slopes toward each downspout. The recommended slope to drain water properly is between $\frac{1}{4}$ in. and $\frac{1}{2}$ in. for every 10 ft. of gutter. Therefore, a 40 ft. gutter run will slope about 1 in. to 2 in. Position the highest point of the chalk line about $\frac{3}{4}$ in. below the roof shingles. Once the chalk lines are snapped, attach the drop outlets, gutter brackets and corner fittings with the rust-resistant, Phillips-head screws provided. Space the gutter brackets about 30 in. apart (24 in. apart in heavy snow regions). However, skip a bracket every 10 ft., or wherever two gutter ends meet, to leave a space for installing a gutter slip-joint. Be sure that the top edge of each fitting is on the chalk line to maintain the proper slope.

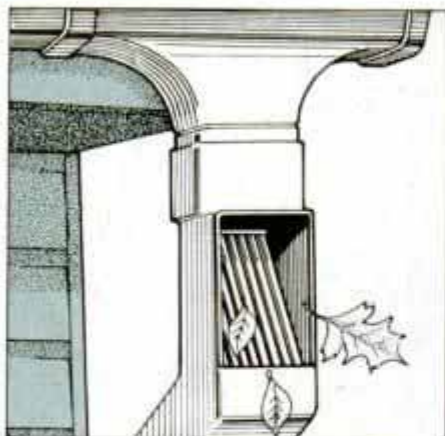
The inside surface of each drop outlet, corner fitting and slip-joint has insertion marks that indicate how far into the fitting the gutter should enter. It's important to align the gutter ends



11 Connect elbow to drop outlet with 2 in. sleeve cut from a length of downspout. Sleeve fits inside elbow and over outlet.



12 Hold a downspout and elbow against the wall and measure between the two elbows. Cut downspout to match.

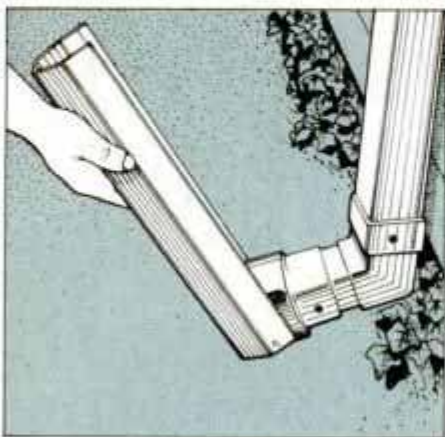


13 Optional leaf separator has an angled screen that allows water to pass through to downspout while rejecting leaves.

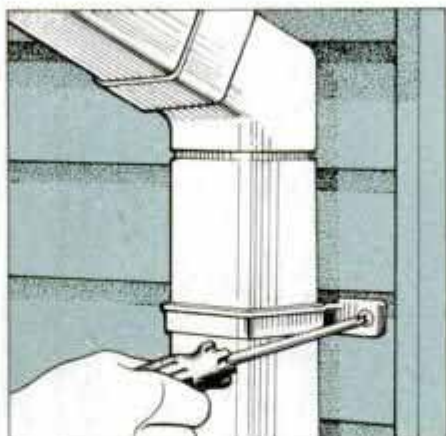
with the insertion marks to ensure proper spacing; this allows the gutters to expand and contract freely without buckling. Starting at a corner fitting or drop outlet, lay a gutter section across the gutter brackets, but don't snap it into place yet.

Place the gutter end on the insertion mark in the corner or drop outlet and move to the other gutter end to position a slip-joint fitting. Align the gutter end with the mark on the slip joint and draw a pencil line on the fascia to indicate the fitting's position (drawing 6). Screw the slip-joint to the fascia and apply silicone lubricant liberally to the gasket seals. The silicone maintains smooth sliding action between the gutters and the flexible neoprene seals.

Also, apply silicone to the seals of the corner fitting or drop outlet. Align the gutter section with the insertion marks and slip the rear gutter edge under the back lips of each fitting and bracket. Now rotate the gutter down and in to

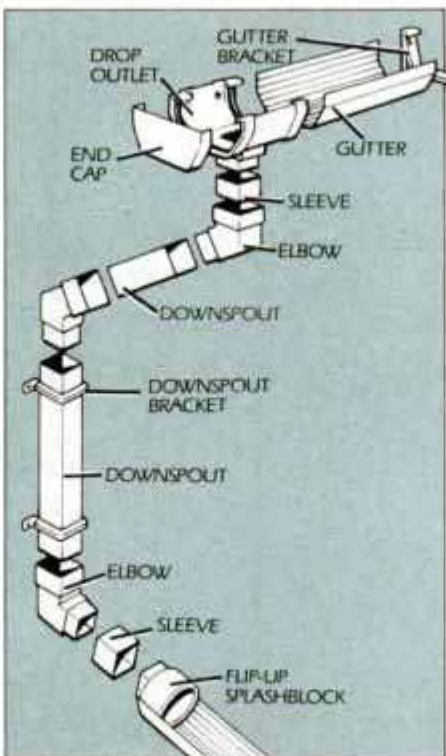


16 Swing-up splashblock makes it easy to mow around downspouts. It's 3 ft. long to carry rainwater from foundation.

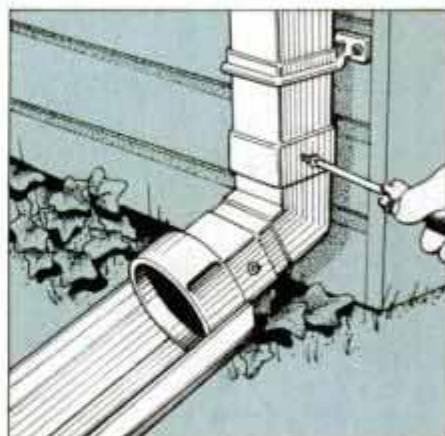


14 Secure downspout with brackets. Note that a 1/4-in. space between elbow and downspout is required for expansion.

snap its front edge under the front lips of the fittings and brackets. Use your thumbs to apply upward pressure on the front lip of each gutter bracket to compress the seal and snap the gutter in place. Continue positioning slip-joints and installing gutter sections to complete the run. When you must cut a gutter or downspout length, use any fine-tooth hand or power saw. For the cleanest, quickest cuts, use a radial-arm saw or power miter saw. Finally, install end caps to the drop outlets or gutter ends (drawings 9 and 10).



17 Here are parts for a typical gutter and downspout. Snap-together parts speed installation.



15 Attach elbow to bottom of downspout with a sheetmetal screw or solvent-weld the parts with PVC cement.

Downspout Installation

Start at each drop outlet and work down, piece by piece, toward the splashblock. Most installations will require an offset to reach from the drop outlet back under the house eaves to the house wall. Make the offset using two elbows connected by a short section of downspout. Note that a 2-in. sleeve, cut from a piece of downspout, is needed to join the first elbow to the drop outlet (drawing 11). To determine the length of the offset, put an elbow on a length of downspout, slip two downspout brackets onto the downspout and hold this assembly against the house. Now measure the distance between the two elbows (drawing 12) and cut a section of downspout to match.

Next, install the vertical downspout to the house wall with downspout brackets. Two or three brackets is sufficient for a typical 8-ft. to 10-ft. downspout. Be sure to leave about a 1/4-in. space for every 10 ft. of downspout to permit expansion. Position the 1/4-in. space just below the second elbow at the top end of the downspout (drawing 14). Now fasten the third, or lowermost, elbow to the bottom of the downspout with a 1/2-in. No. 6 sheetmetal screw. You could also solvent weld the parts together with PVC cement.

Then, join the splashblock to the elbow with a 2-in. sleeve. Again, fasten the parts together with a sheetmetal screw or PVC cement. To carry rainwater farther from the house, replace the sleeve with a longer section of downspout. A special adapter is available to connect the downspout directly to a 4-in.-dia. sewer drainage pipe, too.

Although we've shown a typical installation, remember that vinyl gutters and downspouts are adaptable to work efficiently on virtually any building. **PM**

LEBARON GTS AND LANCER

(Continued from page 130)

high-performance sedan in the Lancer's price range that can match it in value, quality or performance."

And a Michigan personnel administrator summed it up by saying, "I've been buying very practical, economical family sedans for the past 10 years. This year, I decided I owed myself a car that was fun to drive, had a little kick to

it, that had the look of class, but with some fuel economy. I looked at the Mercedes 190E, but price put the Mercedes out of my picture. My GTS turbo is still as much fun as the day I bought it. It's the right choice for me." **FM**

SUMMARY OF LANCER AND LeBARON GTS OWNERS REPORTS*

Total miles driven	1,177,047	Why did you choose the Lancer/GTS?		How much did you pay?		No	24.3
Average mpg (by engine)		Styling	52.3%	Average	\$11,893	Dealer service opinion:	
2.2-liter fuel-injected ohc Four		Handling	18.6	Range	\$9040-\$15,310	Excellent	36.3%
In town	22.2	Performance	13.6	Workmanship opinion:		Good	43.9%
On the highway	28.2	Roominess	11.8	Excellent	58.0%	Average	12.2
Turbocharged 2.2-liter ohc Four		Economy	11.5	Good	39.0	Poor	7.6
In town	21.3	Price	11.1	Average	2.7	Number of vehicles owned:	
On the highway	26.5	Specific likes:		Poor	0.3	This car only	28.7%
Average mpg (by transmission)		Styling	47.5%	Comfort opinion:		Two cars	43.6
Manual 5-speed		Handling	44.9	Front seats		Three cars	18.2
In town	23.5	Comfort	31.9	Excellent	65.7%	Four or more cars	9.6
On the highway	29.5	Performance	25.7	Good	31.0	Makes of other cars owned:	
Automatic		Economy	22.5	Average	2.0	Dodge	20.6%
In town	21.6	Riding qualities	19.2	Poor	1.3	Plymouth	19.7
On the highway	27.3	Specific dislikes:		Rear seats		Chevrolet	19.3
Engine choices:		No complaints	19.9%	Excellent	42.2%	Ford	13.8
2.2-liter fuel-injected ohc Four	62.8%	Fuel mileage below expectation	10.2	Good	51.6	Buick	7.3
Turbocharged 2.2-liter ohc Four		Uncomfortably harsh ride	8.0	Average	5.9	Would you buy a Lancer or LeBaron GTS again?	
	37.2	Noises and rattles	7.1	Poor	0.3	Yes	72.0%
Transmission choices:		Digital instruments hard to read	4.9	Had any mechanical trouble?		No	6.7
3-speed automatic	90.5%	Too expensive	4.9	Yes	59.8%	Maybe	21.3
5-speed manual	9.5	What changes would you like?		What type of trouble?		Would you buy Chrysler again?	
Model choices:		No changes	24.2%	Electrical	18.2%	Yes	85.7%
Chrysler LeBaron GTS	41.8%	Redesign front seats	5.9	Transmission	14.0	No	2.0
Dodge Lancer	29.9	Better fuel mileage	5.9	Wipers	9.1	Maybe	12.3
Chrysler LeBaron GTS LS	14.6	Get rid of noises and rattles	5.9	Fuel gauge	8.3	Age distribution of owners:	
Dodge Lancer ES	13.6	Softer ride	5.5	Air conditioner	8.3	Under 29 years	13.2%
				Dealer repairs satisfactory?		30-49	38.2
				Yes	75.7%	50-plus	48.6

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

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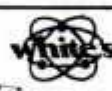
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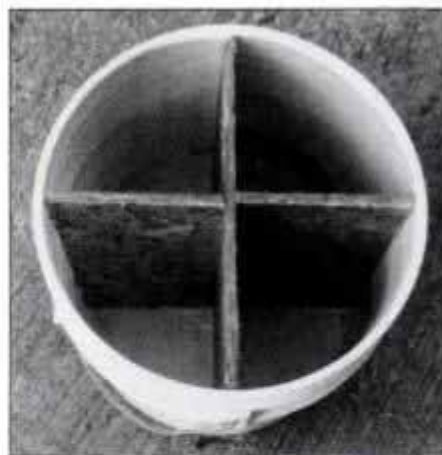
Nail organizer



Large plastic buckets, like those for taping compound, make excellent carriers for nails and assorted hardware. They're almost indestructible and, if you save their lids, they're weathertight.

Cut two pieces of scrap particleboard or plywood to the bucket diameter and trim their lengths to the bucket height. Then cut centered slots in each piece about half the overall length and interlock the pieces in the bucket to create four compartments.

—Judy and Garfield Gosa



Squeegee paintbrush

Painting behind old-fashioned cast-iron radiators is nearly impossible with standard brushes, pads or rollers. A better way is to use an inexpensive window-washing squeegee. The sponge end absorbs paint and it easily fits into the narrow space behind radiators.

—George Thompson

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Even Though You Really Don't Want To Quit!



That was me. A pigheaded, "didn't want to quit", die-hard smoker. Trapped in an aggravating love-affair—with cigarettes.

Openly, I cursed their choking grip on me. Inwardly, I was totally unwilling to do anything else but puff away. Your typical chain-smoker wildly raving about kicking the habit—and *not meaning one single word.*

It was a joke. Unfortunately, the laugh was on me. The grim warnings of the Surgeon General, the American Cancer Society, and my worried doctor all went in one ear and out the other. My tobacco addiction was like a runaway train. Completely out of control and destined for disaster. *Unstoppable!*

Me give up smoking? Better ask for my right arm!

Every so often, I would make a good old college try at quitting cold turkey. Before you could say "Jack Robinson", there I'd be. Frantically scrounging in the garbage for soggy butts. As usual, my good intentions went up in smoke. I was hooked—*again.*

Who was I kidding? Smoking was an undeniable necessity. Super-important to my daily life. How I enjoyed that first eye-opening drag in the morning—that satisfying end-of-the-meal lighting up—that nerve-settling inhalation when things got hectic. Me give up all these irreplaceable pleasures? Better ask for my right arm!

Cancer or no cancer, doctor or no doctor, I loved smoking much too much to ever stop. But one day, I discovered a secret that turned my burning passion into red-hot hate. A secret that set me free in just 30 minutes flat. *Not a single cigarette in 20 years!*

Freed me in 30 minutes! Not a cigarette in 20 years!

My smoking is past-history. Gone without hypnosis, behavior modification, pills, drugs, classroom courses, nail-biting, will-power or climbing the walls. Gone without such games as switching brands, chewing gum, fake candy, diary-keeping or saving dirty stubs in a messy jar.

Gone, too, without gaining an extra ounce. Matter of fact, my wife says that I even lost a couple of pounds. And I never felt better.

Running into an old buddy brought back memories of those "didn't want to quit" days. This 3-packs-a-dayer had tried everything but still couldn't stop. He begged me to outline the details of my remarkable secret.

That night, I wrote it out in plain, step-by-step language anyone could understand and mailed him a copy. After it did the trick for my buddy, he told some of his friends. Soon, I was hunted out by pleading strangers for the same "Stop Smoking Secret."

If you can lick a stamp, you can lick your cigarette habit just as I—and they—did. I know what it's like to have that compelling urge to light up. And I know what it's like to be able to smilingly pass it by without pangs of yearning.

What's more, I know that you can honestly and truly stop smoking for keeps in half an hour flat—even if it's the last thing in the world you'd rather do. All for a ten dollar bill.

© MCMLXXXIV Stop Smoking Co.,
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Simply send for my "Stop Smoking Secret" and read it. Yes, it's as easy as that. Just *read* it. I can't tell *how* it works. It just *does*. I guarantee it, with no strings attached.

Guaranteed to work— or your next pack's on me!

If you ever start smoking again after reading my secret—and I mean *ever*—you haven't lost any money. Merely return it for a full, every-penny-back refund plus \$1 extra for a pack of cigarettes! *My treat!*

OK. I know exactly what's running through your mind. Even with my fool-proof, risk-free, money-back plus guarantee, you're still looking for a way to get out of sending for my secret. You can't fool me. It's not the money. You'll pocket 100 times your investment in cigarette savings alone. The bottom line is this: You really don't want to quit—and *you'll do anything to avoid it.*

But just this once, listen to that little voice inside your head. Just this once give in to your common sense and give my secret a "look." Watch it automatically work for you in the only way that counts. Permanent no smoking! *Or your next pack's on me!*

Stop Smoking Co.
8 West 36th St., Dept. SS-161
New York, N.Y. 10018

OK—I'll take a risk-free look. Here's my \$10. Rush the "Stop Smoking Secret." If I ever start smoking again, I can return it for \$11 refund. (That's \$10 back plus \$1 extra for a pack of cigarettes—**GUARANTEED!**)

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PM LONG-TERM BOAT TESTS



Despite easy-does-it family styling, the MTC 195 shows sufficient kick-up-your-heels *machismo* to satisfy the nautical extrovert.

MARK TWAIN MTC 195

Strong overall impressions—and some minor complaints.

BY TIM COLE, Boating/Outdoors Editor
PM photos by Skip Gandy

And so we bid farewell to the Mark Twain MTC 195, the sterndrive that was ranked No. 1 in our July '86 feature *Sport Boat Sextet* (page 70). We vowed at the conclusion of our cuddy-cabin performance comparison to subject the overall winner to the same kind of in-depth, long-term scrutiny PM normally reserves for automotive products. Everybody knows that only long-term evaluations uncover the soft spots—or accentuate the strong points—in any kind of high-ticket bauble. And we had our share of nits to pick, but our overall impression of the MTC 195 remains high.

Let's start with the peripherals. We selected a Heritage dual-axle trailer for our test rig, and we were so delighted with it that we didn't want to turn off the exit to our Connecticut test base—after a trouble-free 1300-mile jaunt from Florida's west coast. It tracked superbly behind our Olds Custom Cruiser, and maneuvered with alacrity through congested rest-stop parking areas. But perhaps its nicest feature



Leaving out traditional sunloungers in the cockpit was chancy but sensible.

was the Bearing Buddy grease caps on each wheel, which allowed proper bearing maintenance. You only have to lose a trailer wheel once—which happened to me one time outside Fremont, Ohio—to realize how valuable this addition can be. They permitted swift, pain-

less lubrication to a couple of tepid hubs at one Virginia waystation, for instance, and looked snappy in profile at the center of the trailer's twin white-walls. On the launching ramp, the Heritage's carpeted longitudinal bunks permitted easy entry and egress, making it truly a 1-man operation.

We selected Mercury Marine's 205 V6 sterndrive for our test power when we ran our performance comparison. So we were glad for the opportunity to put this engine from their new Alpha One series under the microscope. Last year, Mercury Marine introduced the Alpha One package, which boasts several improvements to their workhorse stern-drive line. The changes included larger diameter pistons for extra torque during acceleration (this is a biggie), power steering, larger trim cylinders and an electro-deposition paint process that's turning the tide against salt water corrosion. Mercury's diligence in smelting aluminum that's low in copper content is also a critical factor in this important

(Please turn to page 149)

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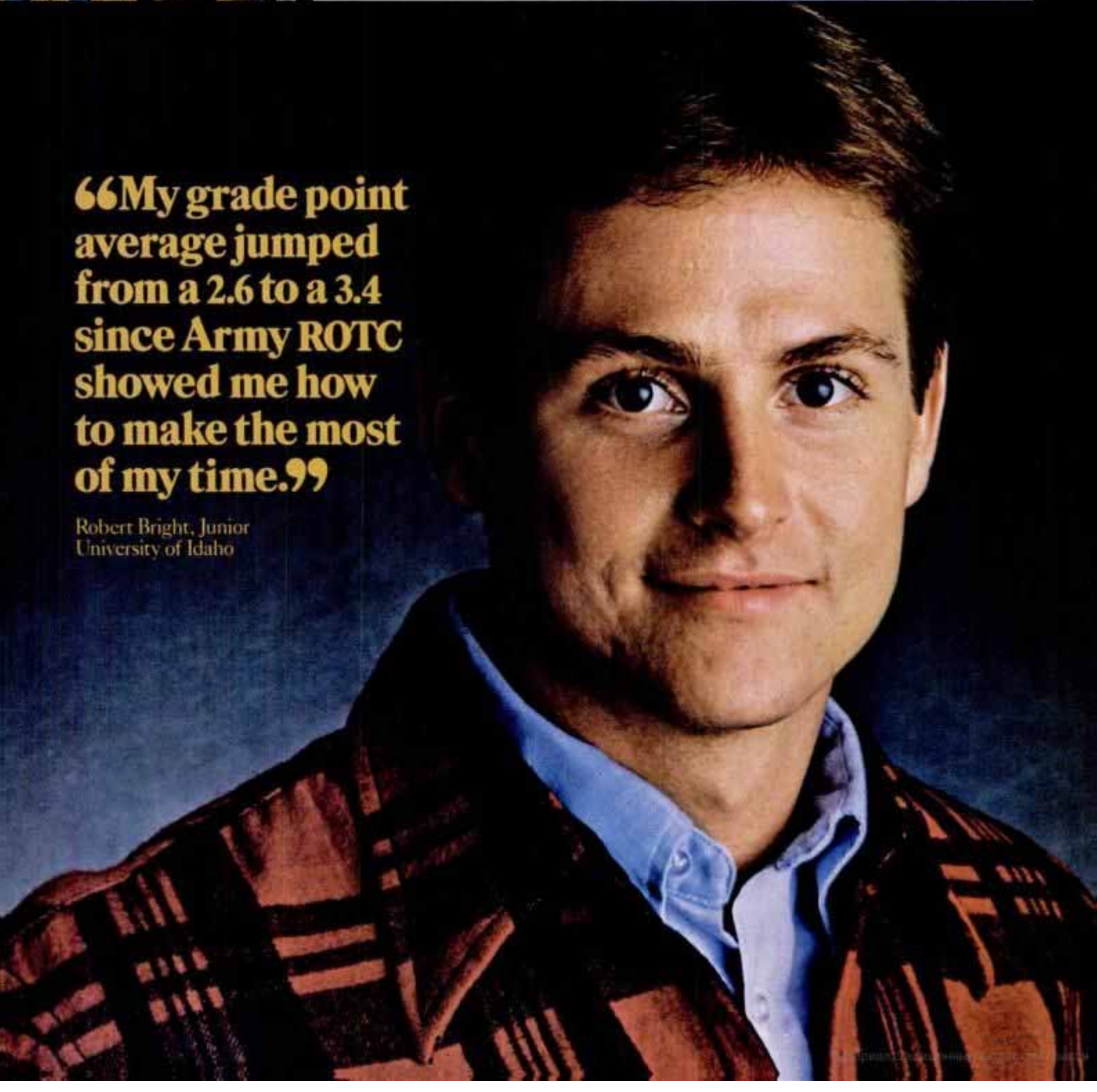
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Robert Bright, Junior
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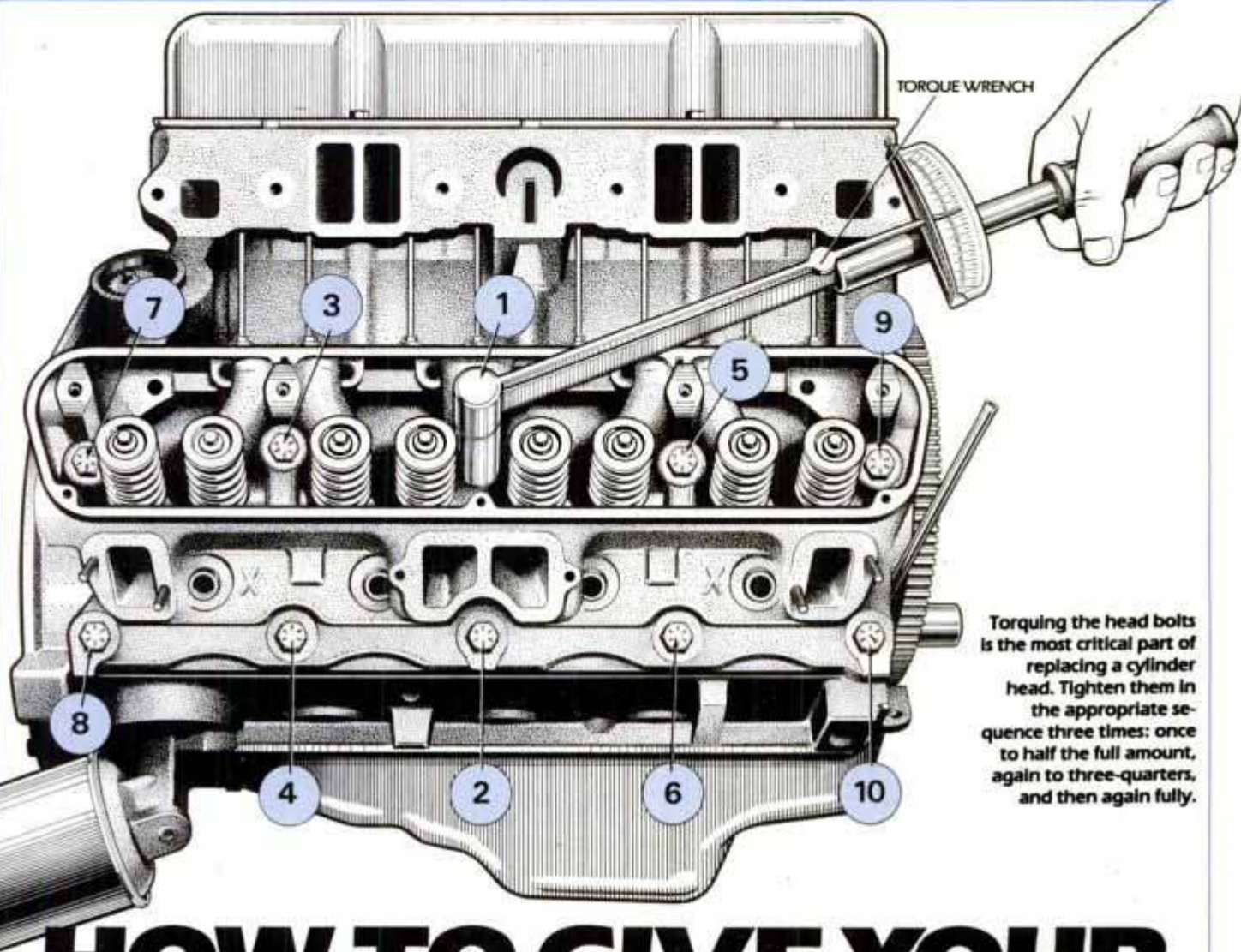


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Torquing the head bolts is the most critical part of replacing a cylinder head. Tighten them in the appropriate sequence three times: once to half the full amount, again to three-quarters, and then again fully.

HOW TO GIVE YOUR ENGINE A VALVE JOB

There are a lot of good looking 7- to 10-year old domestically-built cars out there that might deliver another decade of use. Unfortunately, a large percentage of these 6- and 8-cylinder machines don't run as well as they look. When the light goes green, these oldies are left in the lurch. In most cases, burned valves and poor valve seating due to worn guides are the culprits.

A good valve job and guide replacement can put one of these engines right back in the pink. However, the machine work and the new parts are expensive enough on their own. Add the cost of having the heads removed and replaced (R+R) and you're talking more money

BY PAUL STENQUIST

than you'd want to spend on a 10-year-old buggy. The solution is do the R+R yourself, then find a top-notch machine shop to prepare the heads.

Tools and equipment

You'll need a complete set of mechanic's tools, as well as a torque wrench, a compression gauge, masking tape, a ballpoint pen, a grease pencil, a gasket scraper, some nonflammable solvent and a pan to wash parts.

Do you need a valve job?

While the symptoms described above

are a good sign that your car may need a valve job, a compression test and/or cylinder leakage test can provide better evidence.

To test engine compression, remove the sparkplugs and prop the throttle valves and choke valve completely open. Disconnect the wires from the coil and make sure they don't short out. On GM HEI disconnect the "BAT" terminal from the distributor.

Hold the compression gauge snugly against the plug hole of the first cylinder to be tested and crank the engine five times or until you get a maximum reading. Write down the number and repeat for all cylinders. If one or more do not fall within 75 percent of the

strongest, you have bad compression.

You can usually get a somewhat better idea of the cause by squirting a couple of spoonfuls of oil into the offending cylinder through the plug hole. If valves are the leaking point, the compression reading should only rise slightly or not at all when the compression test is repeated. If compression rises to normal with the oil in the cylinder, worn rings are probably at fault.

Removing accessories

Before you start unbolting things, study the underhood layout. Note which accessories are bolted to the cylinder heads or restrict access. Study the wiring and vacuum hoses. Since you'll be removing the carb and intake manifold as one unit on most cars, some hoses can remain in position.

Refer to the vacuum hose diagram located somewhere in the engine compartment (Fig. 1). If you can't find this label or if the diagram doesn't make sense to you, photograph the engine to get a good perspective on all areas where there are hoses and wires.

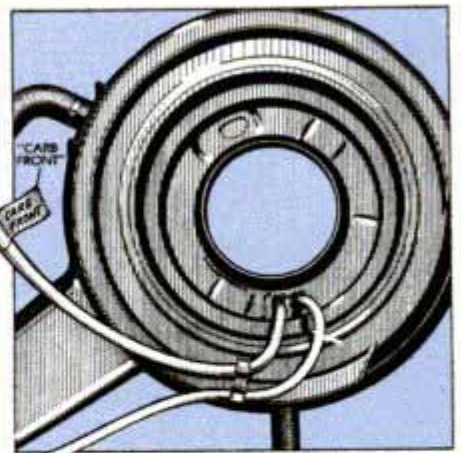
Before doing anything else, discon-

nect the battery's negative cable. If you haven't already done so, remove the sparkplugs. Label each plug wire by writing the cylinder number on a piece of tape and folding it around the end.

On most cars you'll have to move the air-conditioning compressor. Determine where the compressor's brackets attach to the engine and move the compressor to the side of the engine compartment without disconnecting its wiring or hoses.

On some cars you'll have to remove the alternator, air pump and steering pump as well. The steering pump should just be unbolted and relocated in the engine compartment as the a/c was. If necessary, you can remove the alternator from the car, but make sure you label all wires with tape.

On some engines, including Chevy V8s, the distributor passes through the intake manifold and must be removed. Before doing so, turn the engine to the firing position for the No. 1 cylinder (the mark you use to set ignition timing) as indicated on your front pulley. Use a wrench on the crankshaft pulley bolt to turn the engine.



2 Label each and every one of the hoses and wires before you remove it.

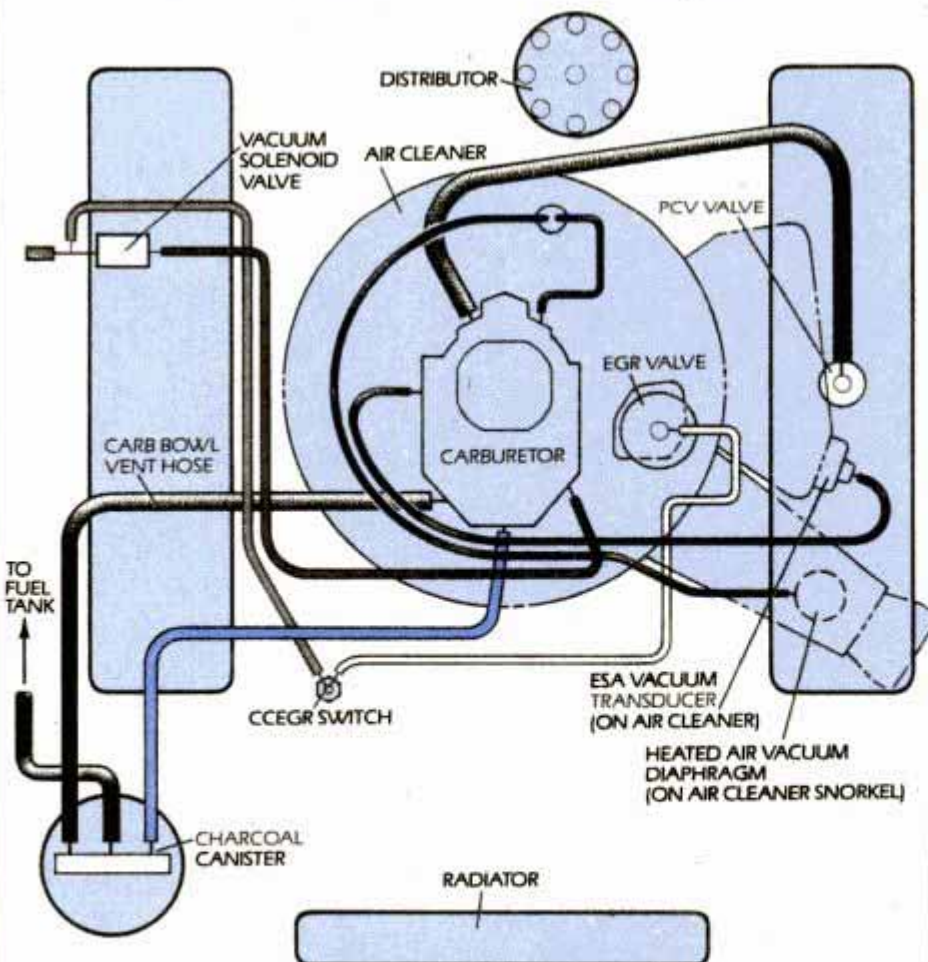
Find the sparkplug wire for No. 1 cylinder, and, with a grease pencil, mark its location on the cap and on the distributor, right below the cap. Remove the distributor cap with all the plug wires in place, disconnecting only the coil wire from the center tower. If the distributor's rotor isn't pointing to the spot you marked for the No. 1 cylinder's wire, rotate the engine one complete revolution. Note the positioning of the distributor and, if you can, mark it and the intake manifold so you can relocate it precisely.

Once the distributor has been marked for repositioning, disconnect the wire that joins it to the coil or ignition wire harness and label it. Remove the distributor clamp and distributor. Reinstall the distributor cap with all its wires connected and store the unit in a dry place on your workbench.

Disconnect every vacuum hose and wire that will prevent removal of the intake manifold and/or cylinder heads and label each (Fig. 2). Using a rag to catch spilled gasoline, disconnect the fuel line. Use two wrenches: one on the fuel line nut, a second on the fitting it screws into. On some cars you'll have to remove other components or accessories as well. These may include the AIR pump or AIR system diverter valve, cruise-control components and ignition coil. But if any of these parts are attached to the intake manifold in such a way that they don't prevent its removal, leave them in place.

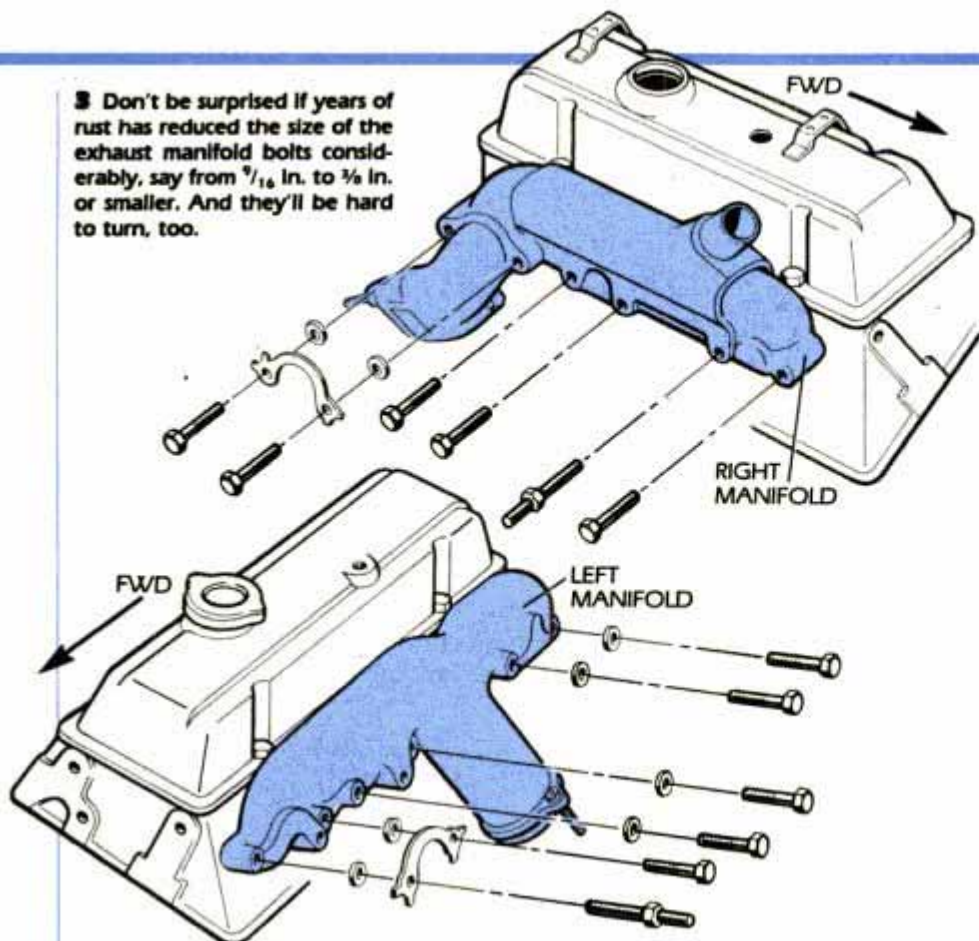
Unbolting the manifolds

Before you can remove the intake manifold, the engine coolant must be drained. To drain the engine and radiator, remove the radiator cap and open the petcock at the bottom of the radiator. When the flow stops, open the petcock at the bottom of the engine



1 Typical vacuum hose routing diagram: Don't panic! Just keep track.

⚠ Don't be surprised if years of rust has reduced the size of the exhaust manifold bolts considerably, say from $\frac{9}{16}$ in. to $\frac{7}{8}$ in. or smaller. And they'll be hard to turn, too.



block or remove the lower radiator hose to drain the coolant.

When the coolant has drained, unbolt the intake manifold. The engine must be completely cold before any components are unbolted or parts warpage may occur. Make sure you've removed all the bolts and check for any debris on the manifold that could fall into the engine. Then, grab the manifold front and rear and pull up hard. If you can't find a place to grasp the manifold, you can pull on the carb, but be careful not to bend any linkages. On some engines with separate valley covers you can insert a pry bar under the manifold runners if it is stuck. On others, including Chevys, you can't because the manifold doubles as a valley cover.

Once the manifold has been removed, unbolt the valley cover (if applicable) and cover the engine valley with a rag.

The exhaust manifolds are next. On most cars, the best strategy is to unbolt the manifolds from the heads (Fig. 3). Check for locking tabs next to the bolt heads. These must be bent back with a small screwdriver before the bolts can be loosened.

On some engines, the manifold bolts are almost impossible to reach. If this is the case, unbolt the exhaust pipes from the manifolds and remove the manifolds along with the heads.

Off with its heads

Before unbolting the heads, you'll have to remove the valve covers and valve train parts. It's essential that you arrange some sort of system for keeping valve train parts in order because rocker arms and pushrods mate to each other as they wear. If your engine has rocker stands, like some Fords and most Chryslers, simply mark the stands for each side before unbolting them. If you have stamped rockers on studs like those used on Chevrolets, unbolt each rocker and tie a wire through the rocker, nut and ball joint, then attach a label to each with a number on it. Shipping tags work well.

Once the rockers have been removed, find an old shoe box, punch 16 small holes in the bottom (for 8-cylinder engines) and number each hole for a corresponding spot on the engine, inserting each pushrod into its appropriate hole. With valve train parts removed, loosen the head bolts. Make a note of the location of any bolts whose threads are coated with sealant. With all the bolts removed, the heads should come off fairly easily, since gasket sealers are usually not used. If you can't get the heads off, check to make sure you've removed all the bolts.

Once the heads are off, examine them and the gaskets for signs of combustion

gases leaking past the gasket's sealing ring. Save the gaskets so you can match them up to the new ones.

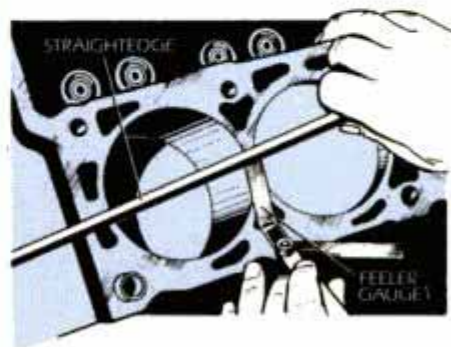
Choosing a machine shop

Don't take your heads to any auto parts store that happens to have a machine shop in the back. Instead, find an advanced, well-equipped shop that specializes in engine machine work. The most sophisticated are frequently those that do high-performance work. Explain to the counterman that, in addition to a valve job, you want the head gasket surfaces checked for straightness, the guides checked and the spring pressure checked and adjusted. If the man in the machine shop doesn't know what you're talking about, find a new machine shop. If the head surfaces aren't straight, have them resurfaced. If they're cut more than .010 in., the intake manifold gasket surfaces will have to be machined as well.

Prior to reassembly

While you're waiting to get your heads back, wash all other parts in non-flammable solvent. If you have stand-mounted rockers, disassemble them. String the rockers, washers and springs on wires so they can be kept in order. Check all valve train parts for ridges or flaking that indicate excessive wear and replace as necessary. Check pushrods for straightness by rolling them on a flat surface.

Clean the block decks of all carbon and dried gasket compound with a gasket scraper. (If your engine is aluminum, use a soft brush and gasket solvent.) Make sure all deposits are removed, but don't scratch the deck surface. If you have one, use a bottoming tap to clean the head bolt hole threads. If your head gaskets were blown, check the block decks for straightness with a straightedge and feeler gauge. Check with the straightedge positioned lengthwise and then



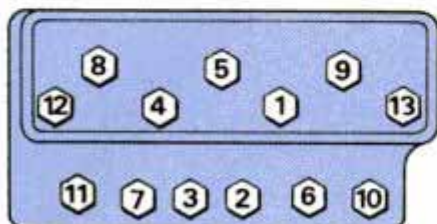
⚡ Check the head for warping with a good metal straightedge and feeler gauges.

SATURDAY MECHANIC

across the deck. If you can slip a .004-in. feeler gauge under the straightedge anywhere on the block, you're in trouble (Fig. 4). For inline Sixes, the limit is .006-in.

However, if the engine deck variation is only slightly more than 0.003 in. and the car's age and condition don't justify a full engine rebuild, you might want to try buttoning things up and hoping for the best.

Today's sophisticated head gaskets can frequently hold things together even with parts that are warped beyond normal tolerances.



5 This Chevy V6's torque sequence is common to all 5-bolt-per-cylinder engines.

Reassembly

Use premium, brand-name head gaskets for reassembly. The latest designs include silicone sealing beads around water and oil holes and a stainless-steel ring around the bore. Compare the new gaskets to the original ones to make sure that oil and water holes correspond. The new head gaskets and all the other gaskets needed can be purchased in a "head set." Embossed shim type gaskets or metal-faced sandwich gaskets should be sprayed lightly with

a nonhardening gasket compound. Those with special coatings and/or sealing beads should be installed as is.

Intake manifold gaskets should be attached to the heads with fast-drying adhesive so they'll remain in place while the manifold is installed. Use a light coating of gasket adhesive on the manifold side. Valve cover gaskets should be attached to the valve covers with the fast drying adhesive. Exhaust manifold gaskets are installed dry.

To install your heads, place the new gaskets over the dowel pins on the engine block. Make sure that the correct side is facing up; most gaskets are marked. Carefully locate each head on the dowel pins. Lubricate the head bolts and screw them in by hand. Pay attention to the length of each bolt. Some engines may have bolts of three or four different lengths. If some of your head bolts screw into the water jacket, apply a light coating of thread sealant to the threads of these. Run the bolts down with a speed handle until they're just touching the head. Then, starting with the center bolt and working your way out in a clockwise circle, tighten all the bolts to half the head bolt torque spec.

When every bolt has been torqued, repeat the process, tightening each to an amount 50 percent higher than the first figure. Finally, torque all bolts, in sequence, to the final figure. For example, if the head torque spec is 80 lb./ft., torque the heads to 40 lb./ft., then 60 lb./ft., and finally 80 lb./ft.

Install the intake manifold next. If



7 Adjustment procedures for ball-and-socket rockers differ; read the shop manual.

your manifold doubles as a valley cover, attach the end seals to the block with heavy-duty, fast-drying adhesive, like 3M 8001 weatherstripping cement. Allow the adhesive time to dry before installing the manifold.

Apply silicone gasket sealer on top of the seals before carefully lowering the manifold in place. Lube the manifold bolts, then torque them in sequence (Fig. 6) to half the specified figure, then full tightness.

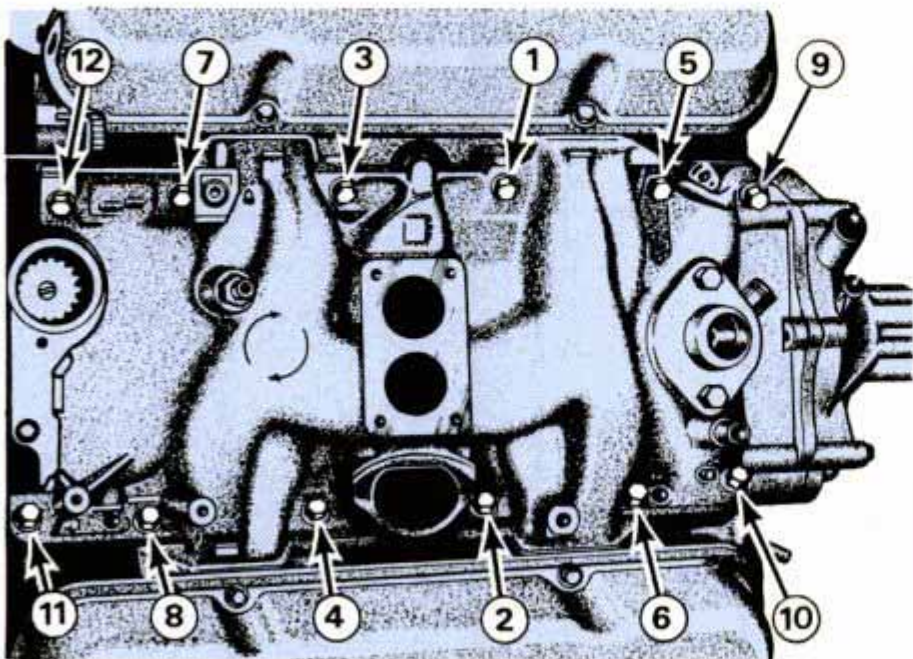
Lube the valve train parts with engine oil and install them, tightening fasteners to the torque specs indicated.

Most engines with hydraulic lifters require no valve lash adjustment. However, some with ball-and-socket rockers do require adjustment. On engines with rocker stands you may have to shim the stands if the heads were resurfaced, by an amount equal to what was removed from the heads.

Install the valve covers, taking care not to overtighten the bolts. Attach all vacuum lines and wires, then reinstall all accessories. If you removed the distributor, position it according to your reference marks with the rotor pointing to the mark for number one cylinder. Fill the engine with new anti-freeze mixed 50/50 with water. Then, after starting the engine, check timing with a timing light.

If the engine runs rough after timing has been corrected, make sure that the rocker arms are allowing the valves to close when the lifters are on the base circle of the cam. If they're not, adjust or shim accordingly.

After the engine has warmed fully, allow it to cool completely then remove the valve covers and retorque the heads to the final spec. Do this again after driving the car for 500 miles. **PM**



6 Tighten to half torque first, then full. Remove carb if needed to use socket.

MARK TWAIN MTC 195

(Continued from page 142)

area. The 262-cid 205 turned a 16-in. prop with conventional (and truly quiet) through-hub exhaust. The engine did experience the inevitable "top-end fade" all marine engines manifest when a hull is fully loaded, however. During our original 6-way test, our MPH Radar established the MTC's top speed at a respectable 46.8 mph. That dropped to 40.2 mph during long-term test conditions with two adults, two children, an anchor and related Coast Guard-mandated safety equipment aboard. But I found the boat's ultimate top end acceptable, particularly in view of the 205's torque acceleration.

I've got an argument with Mercury's Quicksilver throttle, however. A linkage problem occasionally prevented the engine from shifting into neutral on the first try, which was a real attention getter during dockside maneuvering. A little finesse with the shifter was usually necessary to disengage the prop. And the tilt/trim button eventually grew temperamental, offering only spotty performance. The MTC's out-drive trim gauge, a really useful dashboard item, failed altogether.

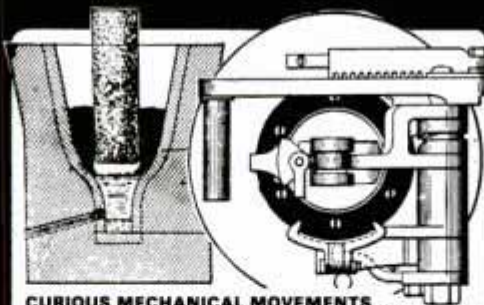
Under way, the MTC's handling remained one of her strong suits, even though speed at wide-open throttle (WOT) was unremarkable. And cornering was swift and error-free. For typical "Sunday" driving conditions, the MTC tracked well, turned without chattering or chine-walking—even at top speed—and stopped dead. The overall impression was one of confidence, which I don't take lightly when shipmates Peter and Sasha Cole (aged 6 and 3) are on board. Problems with the throttle/shifter notwithstanding, the boat also handled well while docking, and tracked well in reverse.

The boat's topside layout was greatly appreciated, and our original judgement about the MTC's cockpit philosophy proved correct. While most makers opt for fore and aft facing sunloungers, Mark Twain prefers space-saving pedestal seats, which opened up the cockpit considerably. The cockpit's teak-covered locker stowage was also perfect for the anchor. But while we're on that subject, the Mark Twain was clearly lacking in the number of deck fittings. They're tough (particularly the transom padeyes), but the foredeck needs proper hawser chocks forward—instead of skimpy dock-mooring cleats port and starboard—and a man-sized cleat on the centerline.

Mark Twain designer Peter Granata took time with the position of the dashboard instruments. It's hard to get important gauges like trim, speed and

(Please turn to page 150)

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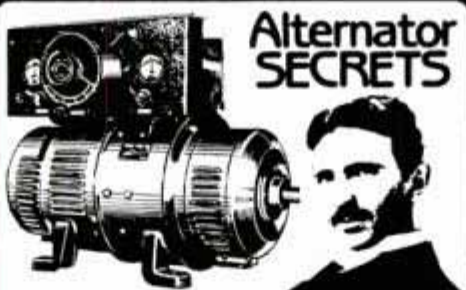
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MARK TWAIN MTC 195

(Continued from page 149)

tach out from behind the steering wheel, but Peter pulled it off nicely. And placing the fuses just underneath the toggle switches for lights and other systems was also appreciated.

The real shining star of the MTC is her cuddy cabin. Compared to her peers, the MTC offered head room, width, comfort, light, easy access and sensible stowage. We'd generally banish the children belowdecks under way where it's safe and out of the wind, and relied on the stowage beneath the twin berths for spare life jackets. The space was comfortable during weekend overnights, too, transforming into a queen-size double.

However, the padded veneer along the portside stowage shelf warped halfway through our test period, and the basketweave teak door to the stowage compartment forward eventually succumbed to rough-water pounding. These details aside, the Mark Twain shined in sheer cabin volume.

Obviously, the company has discovered something that other makers haven't. Namely, why have a cuddy cabin at all if you can't have one that works? Mark Twain clearly decided to borrow from the cockpit, foregoing sunloungers for instance, so they could invest the cabin with more space. And it succeeds nicely.

Fit and finish

Fit, finish and general construction also held up extremely well over a long summer of hard use. We take a gingerly approach to docking, but the odd smudge is inevitable. The MTC happily rebuffed this kind of minor cosmetic calamity because of Mark Twain's unusual success in perfecting paint and gelcoat. The exterior gelcoat skin is 12 mils thick, followed by a light, 75-mil first skin of chopped continuous roving. The second skin consists of a 250-mil-thick layer of chopped continuous roving, a layer of 24-ounce woven roving on both sides of the hull that is overlapped by 12 in. at the keel.

Stringers, floor timbers and other wood reinforcements add localized support in the chine and transom areas and overall stiffness and rigidity. These members are encapsulated in glass, and a closed-cell polyurethane foam is injected into the incomplete hull form for flotation. The deck is constructed similarly, incorporating balsa coring.

The whole package—\$15,077 as tested—winds up being tough—and smart. Yes, we were kind of sad to see it go. But we're contemplating a mini-cruisers test, and Mark Twain just happens to have . . .

PM

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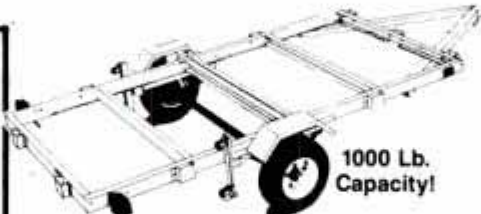
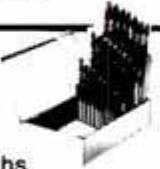
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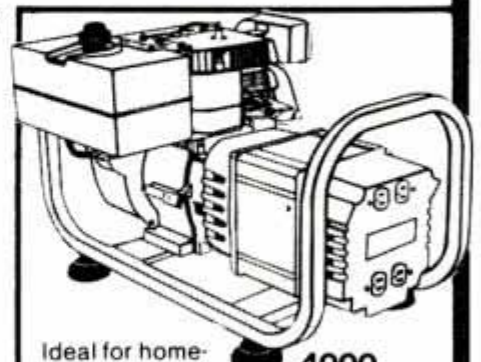
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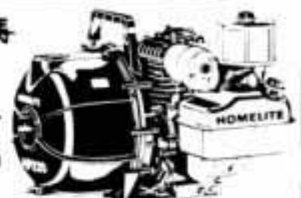
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Ladder handle



Stepladders can be very awkward to carry around. To make transport easier, locate the balance point of the ladder and screw a hefty swinging handle onto a side rail. When folded flat, the handle should not interfere with normal ladder operation. Be sure to buy a handle that is plated or made from corrosion-resistant material so it won't rust. The one shown in the photograph above is a 3½-in. chest handle available at hardware stores.—*Walter E. Burton*

2-faced tape

You can use 2-faced tape—tape with adhesive on both faces—to attach sandpaper to sanding discs, drums or custom-shaped blocks or sticks. I purchase rolls that are 1½ in. wide x 150 in. long. They are available at hardware stores. To use, cut the tape to length and fasten it to the disc, drum or block and then fasten the sandpaper to it.

—*Anthony S. Pauloski*

Hammer bumper

When assembling woodworking projects, your hammer can double as both mallet and nail driver with this handy tip. Simply drill a small hole in the end of your hammer handle and install a rubber bumper such as the cleansing tip from a toothbrush, or the eraser from a pencil. With this modification, you can safely align sanded wood by tapping it with the hammer handle end, and then turn the hammer around to complete the nailing.

—*Lane Olinghouse*

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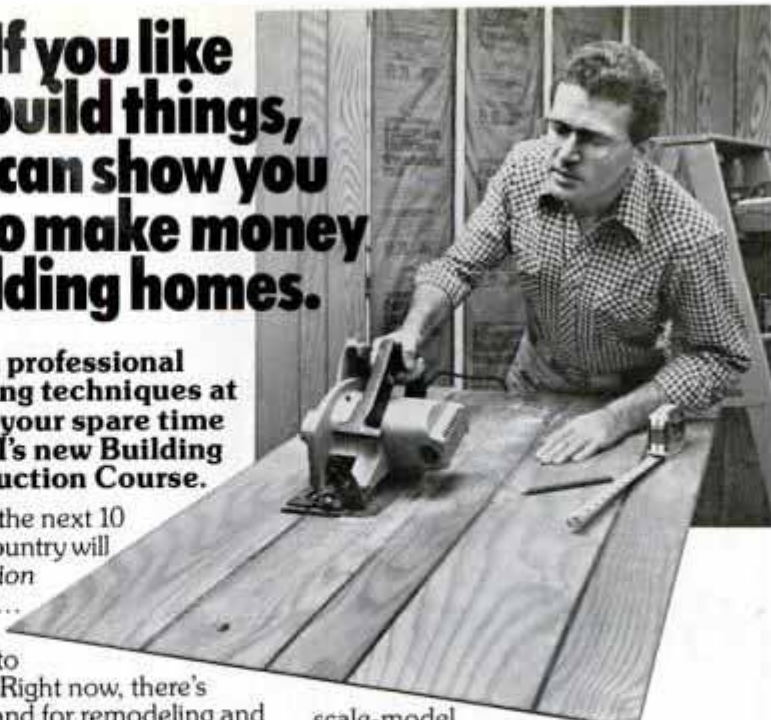
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TIME MACHINE

75 YEARS AGO: March 1912



Transatlantic dirigibles flew.

Dirigibles fly

The dirigible loomed large over the horizon in 1912 as the War Department ordered tests of its capabilities as a bombing platform. The Navy was interested in using dirigibles for patrol well beyond American coasts. Meanwhile, German entrepreneurs were promoting dirigibles to replace steamships for transatlantic travel. Several American shipping companies asked to take part in the naval tests "to examine the suitability of using dirigibles to carry passengers from New York to Paris."

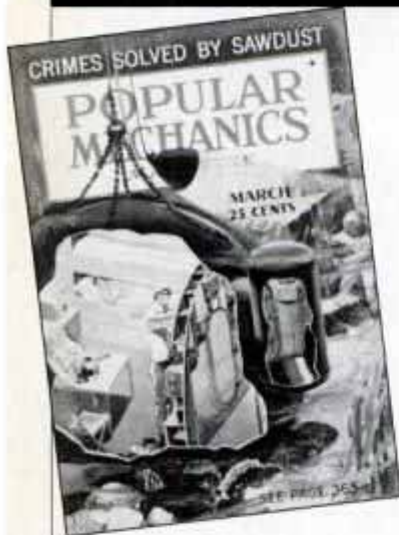


Under the sea in ships

The Navy committed itself to ordering six new submarines, capable of firing coastal cannons and of launching a "new, high-powered torpedo after submerging." The subs carried crews of 25, and

could speed up to 8 knots below the surface and an astounding 15 knots above the surface. With submarine rescue equipment in place, the Navy had confidence in the success of the new vessels.

50 YEARS AGO: March 1937



Undersea world was visionary.

New worlds below

With submarine service established in 1937, the Navy and several independent universities created a design for undersea habitats. These pressure vessels to be constructed of steel could be set in the ocean at depths greater than 250 ft., it was thought. Labs and small factories inside the pressure vessels could do the pioneering work for a future city beneath the sea. The project was scrubbed because it was feared that its \$10 million budget was too low ball, and costs would get out of hand.

Television in home?

Radio was the medium of 1937, but some forward-looking scientists believed that a new technology called television might one day compete. Scientists at the Rochester Institute of Technology had come up with a "dream machine" that could produce an image quite a bit larger than the 2-in.-dia. screens envisioned by pioneers in the field. "It is conceivable that we can create an image three times the area now envisioned," said engineer Malcolm Rice. Most people were skeptical.



And, on the tube

The radio industry began experimenting with a new "remote studio system" of "full studio quality" that was so compact, live radio programming could be run from the back of a small truck.

25 YEARS AGO: March 1962



PM's boat went anywhere.

The PM Jet

It could carry two people and a lot of fishing and camping gear, or six people and a picnic lunch for everyone. PM readers were invited to build an 18-ft. boat that could serve as a coastal cruiser or a quiet fishing platform. Built of wood, the PM Jet could be powered by a mid-sized outboard motor. Our own model used a 30-hp Evinrude. The boat had a slightly contoured bottom, making it water-worthy in shallow fishing grounds as well as on the open water. It could be built for \$1200.



Space suit

A modified flight suit incorporating some diving-suit characteristics was introduced by NASA and the Defense Department. It would be used by America's first astronauts, and possibly by test pilots. The new suit was flame-proof and carried rebreathing equipment.

Water rights wrongs

Who owned the water from the Colorado River water basin? The thorny issue was raised as the state of Arizona began developing plans to build new highway arteries between Phoenix and Flagstaff. At the moment, California and Colorado were in court fighting over a plan by California to build a pumping station that could reduce the river basin's level. The Arizona Highway Department, meanwhile, said in court that it would develop a roadside park to stave off development.

PM

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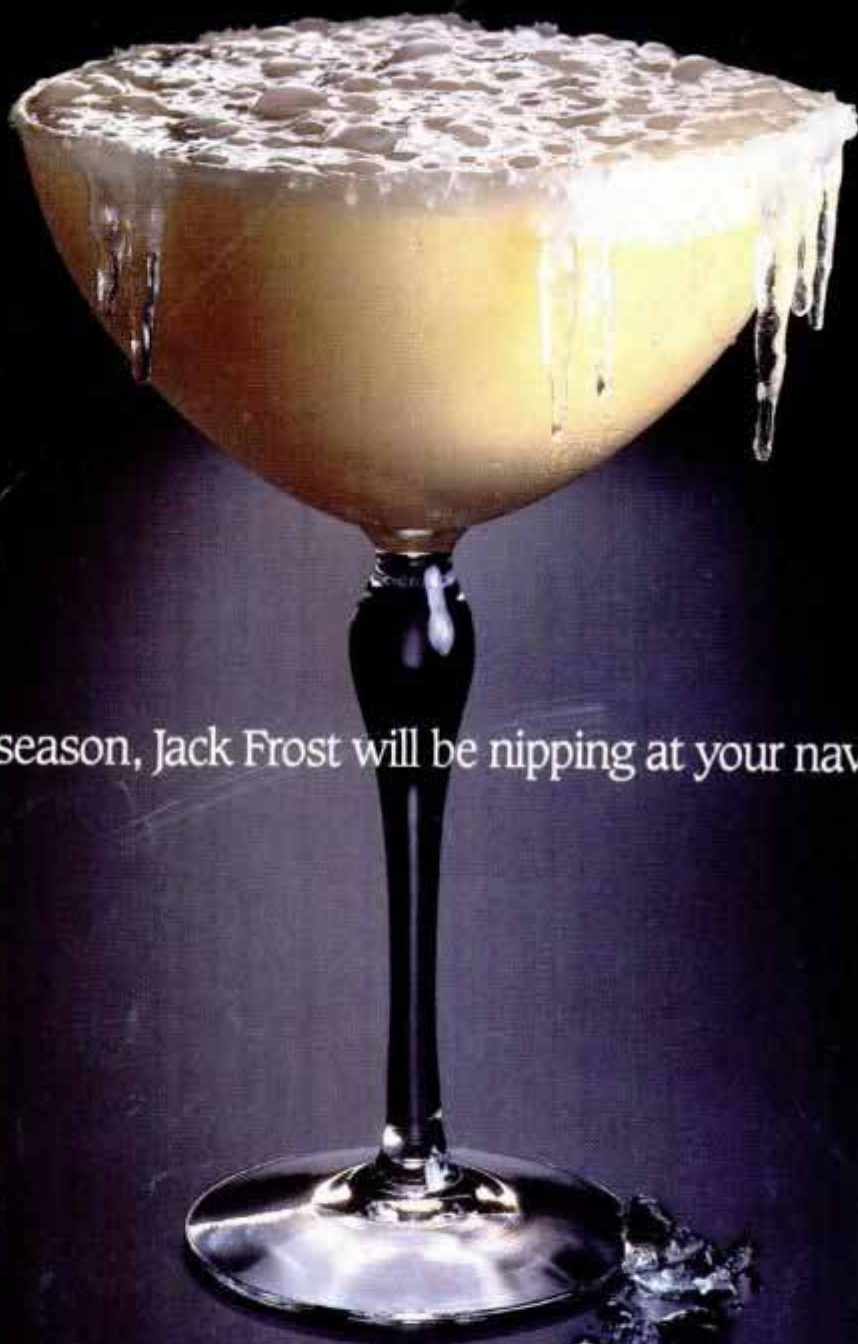


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