

BONUS SHOP GUIDE: GREAT PROJECTS YOU MAKE FOR YOU

JULY 1987 \$1.95

Popular Mechanics

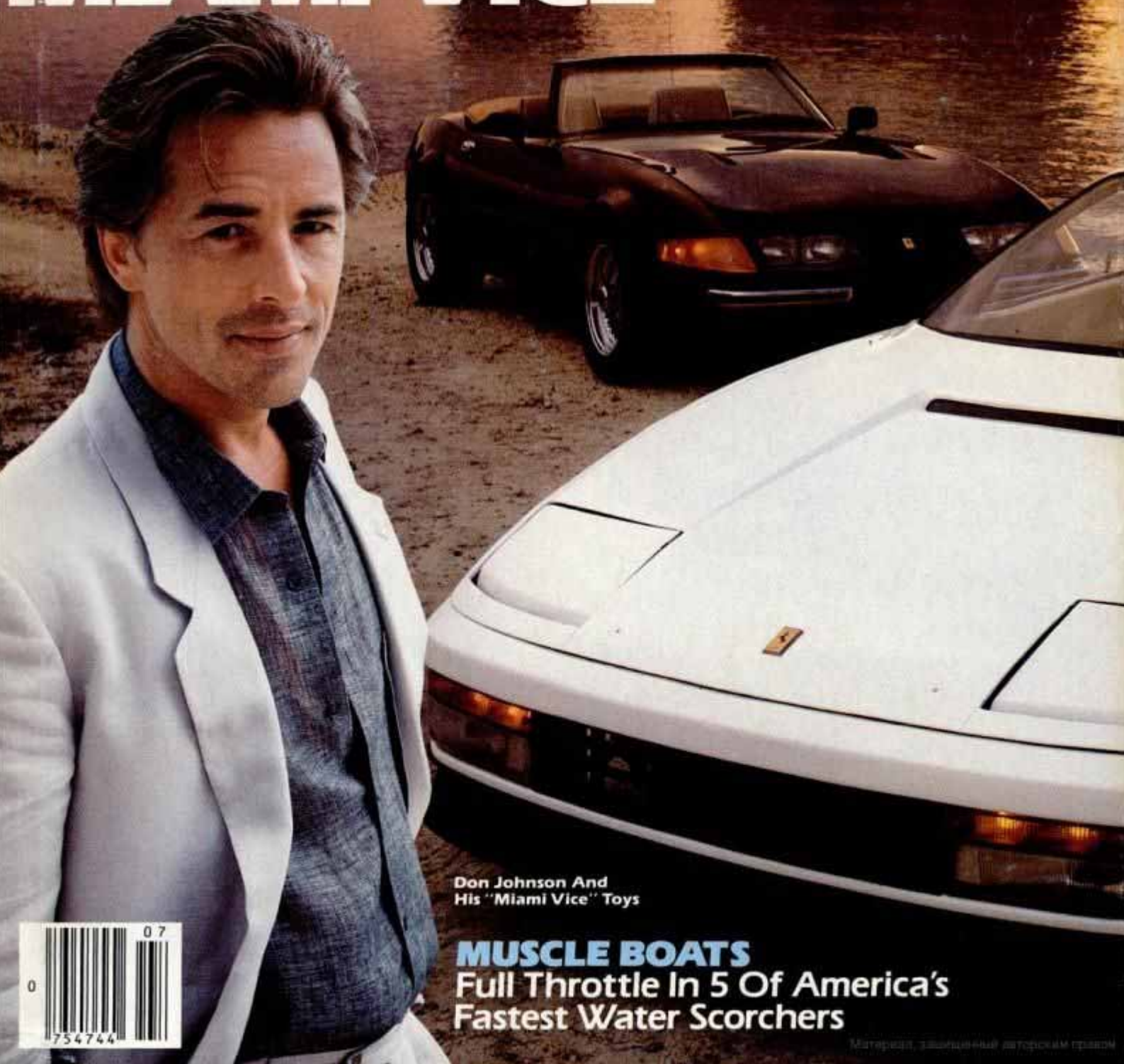
**'HOW I
BOMBED
QADDAFI'**



**An Eyewitness
Report From The
Cockpit By An
Air Force Officer
Who Flew
The Mission**

TV'S HOTTEST WHEELS

THE CARS OF MIAMI VICE



**Don Johnson And
His 'Miami Vice' Toys**

MUSCLE BOATS
Full Throttle In 5 Of America's
Fastest Water Scorchers



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A good smoke at the end of a long workin' day.



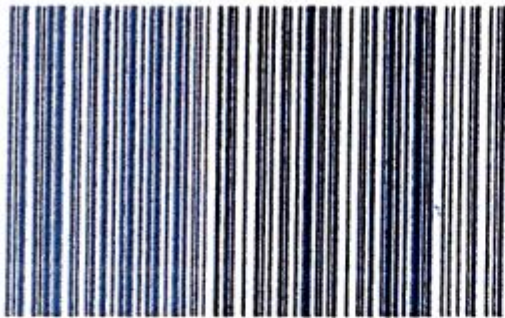
nicotine—Kings & 100's & Menthol:
FTC Report Feb. '85—
av. per cigarette by FTC method.

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1. Follow instructions on the other side

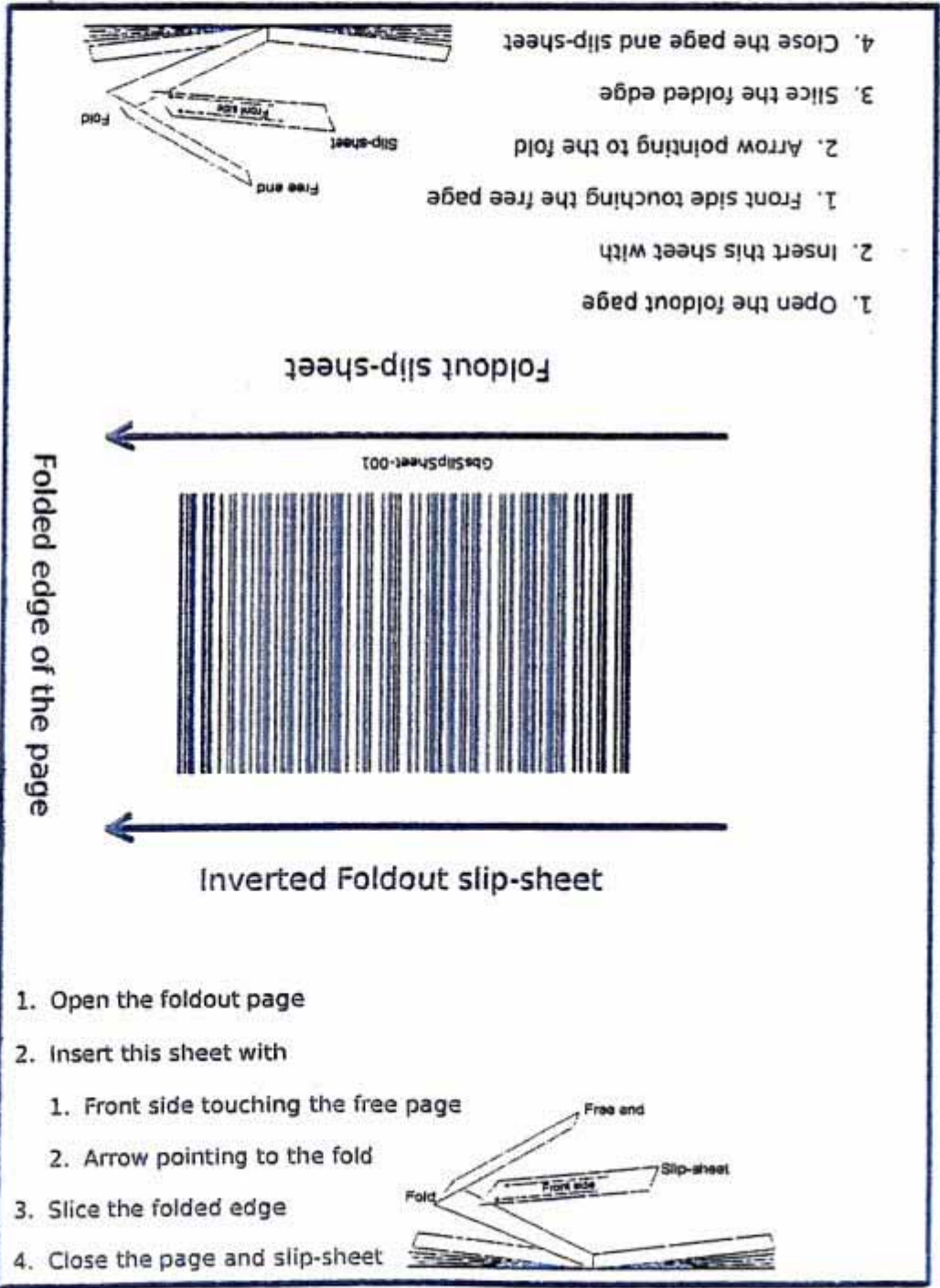
Back

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Inverted Back

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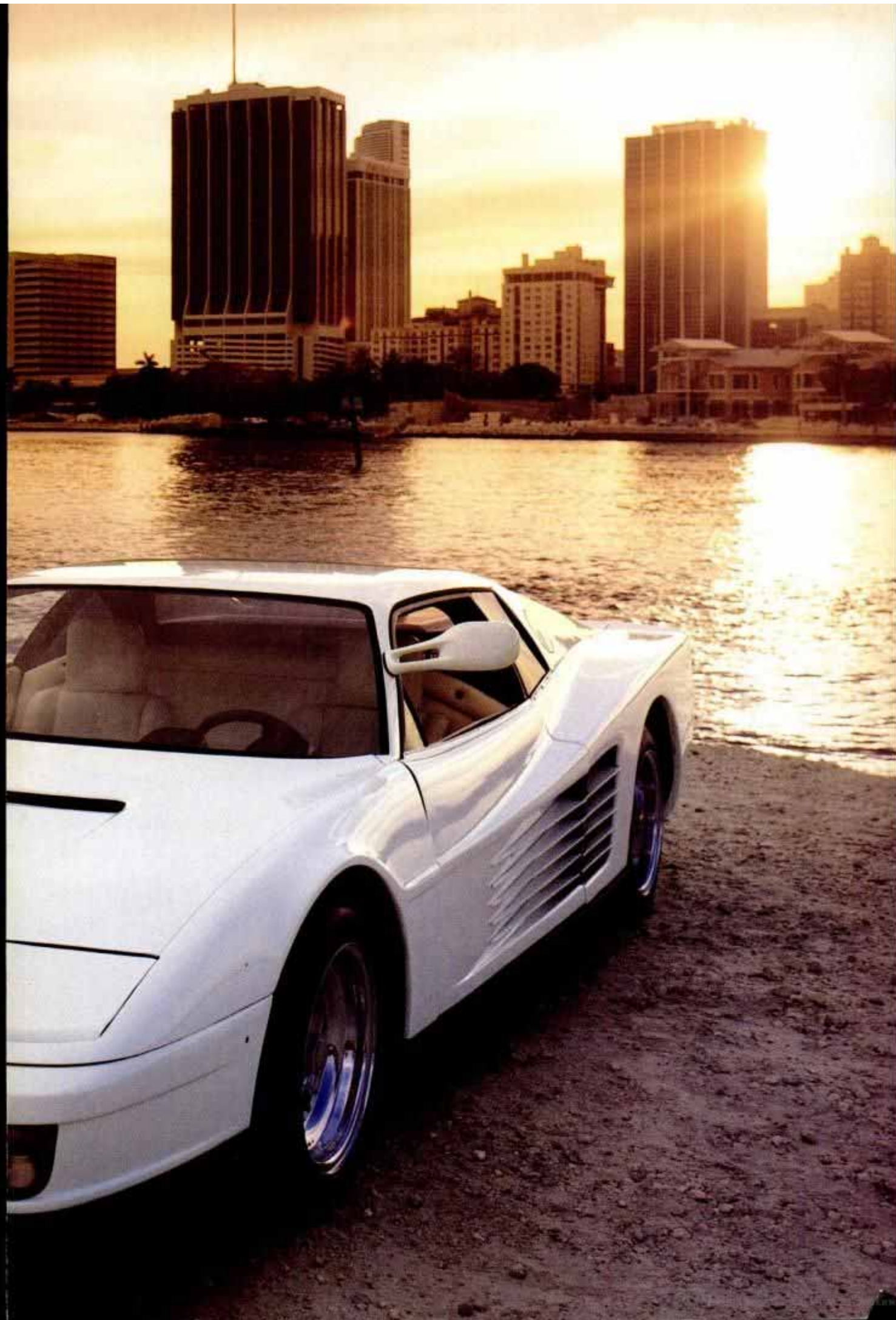
Marlboro.

© Philip Morris Inc. 1987

SURGEON GENERAL'S WARNING: Smoking By Pregnant Women May Result in Fetal Injury, Premature Birth, And Low Birth Weight.

Lights Kings & 100's Soft: 10 mg "tar," 0.7 mg
16 mg "tar," 1.0 mg nicotine av. per cigarette.
Lights 100's Box: 11 mg "tar," 0.8 mg nicotine

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с

This One



5HWW-QS2-9EKO

Матрица штрихкода

AMERICA It Still Works.



DICKIES The Brand It Works In.

Dickies, for a complete line of work clothes, jackets, jeans, shirts, thermal underwear, socks, work boots, gloves, caps, belts and leather goods.

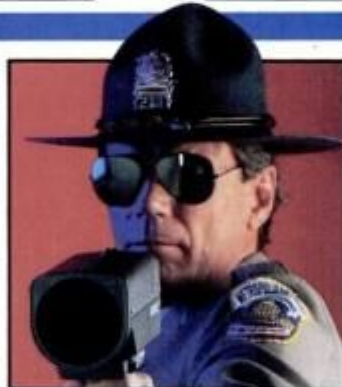
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**85 COVER STORY**

A sort of cult program for car lovers, "Miami Vice" exhibits rare and unusual wheels that set the show's tone and establish the unique style. Get a behind-the-scenes look at these conceptual engineering innovations in our exclusive story.

—PM photo by
Brian King and
Nancy Ellison/Sygma

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Editor's Notes



To tell you the truth, I'm pretty sick of Don Johnson. I'm tired of hearing from all the women here in the office about what a hunk he is. I'm tired of seeing his rock videos on television. I'm tired of seeing him in Pepsi-Cola commercials. I mean, really. Can one guy be this good looking, this cool, this successful, and be *real*? The only thing about Don Johnson that I'm not tired of is his car on "Miami Vice." This year, it's a Ferrari Testarossa. For the past two years, it's been a Ferrari 365GTB4 Daytona Spyder. At least that's what I thought, until we started to research this month's cover story on all those fabulous cars you see every Friday night on "Miami Vice." As it turns out, the cars driven by Don Johnson aren't always quite what they appear to be. Some



One of the Liberty Squadron heroes.

of his "Ferraris" are replicas or kit cars or even built-from-scratch stunt cars. You'll also see everything from exotic imports to customized street machines to perfectly restored 1960s musclecars in any given episode of the show. And even if the plot stinks some weeks, if you're a car freak like me, "Miami Vice" can still be a treat for the eyes. . . . Since April 16, 1986, we've been trying to develop the article that begins on page 110. April 16, 1986 is the day after the bombing of Libya by U.S. Air Force and Navy planes. In all those months, our requests for interviews of pilots who flew the mission fell onto deaf ears at the Pentagon. "Can't do it for security reasons," was the usual reply. Then, suddenly, in April of this year, almost a year since the day of the original mission, attitudes changed. We suddenly received permission from the Department of Defense to speak not only to pilots who flew the mission, but even to the mission commanders. Our article, *How I Bombed Qaddafi*, is a first-person, eyewitness account of what it was really like in the cockpit of the lead F-111F that swooped in on Tripoli in those fateful minutes last year. Because there is still a fear that Qaddafi has death squads in this country trying to identify pilots who took part in the attack, we promised not to reveal the officer's name who wrote the article for us. Too bad. We like to give credit where it's due. And this Air Force officer is a hero in my book. . . . Those of you who read magazine mastheads will note lots of changes on ours this month. Let me bring you up to date on what's been going on around here. First, just when he was getting good at being our Boating/Outdoors Editor, we switched Tim Cole over to our Science/Technology/Aerospace Editor slot. Joining our staff several months ago as Aviation Contributing Editor is Fred Mackerodt, who flies a 1971 Piper Aztec Turbo and is multi-engine and instrument rated. Mackerodt will be giving you the pilot's-eye view of everything happening in sport aviation in the coming months.

Taking over Tim Cole's slot as the Boating/Outdoors Editor is Joe Skorupa, an avid outdoorsman and a guy who will be putting the pedal to the metal in all our future boat tests. Lastly, in our Editorial Production Department, Deborah Frank steps into the hot seat as Production Editor, no easy job. 'Til next time.

of his "Ferraris" are replicas or kit cars or even built-from-scratch stunt cars. You'll also see everything from exotic imports to customized street machines to perfectly restored 1960s musclecars in any given episode of the show. And even if the plot stinks some weeks, if you're a car freak like me, "Miami Vice" can still be a treat for the eyes. . . . Since April 16, 1986, we've been trying to develop the article that begins on page 110. April 16, 1986 is the day after the bombing of Libya by U.S. Air



Skorupa, Frank, Mackerodt.


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When ESCORT was introduced in 1978, its radar warning was merely astonishing. Then the improvements began

"If you can imagine the Turbo Porsche of the radar detectors, this is it!" That was *Car and Driver's* verdict on the first ESCORT.

The comment referred to ESCORT's astonishing performance, but it anticipated something more. Just as Porsche keeps refining its classic 911, our engineers now have nine years of technical advancements built into ESCORT.

More power under the hood

While car makers talk about horsepower, engineers measure a detector's radar-finding ability in dB. Today's ESCORT is significantly more powerful than the one that drew superlatives from *Car and Driver* nine years ago: 10 dB more sensitive on X band, 13 dB on K band.

Our engineers never stop researching, and when they make a breakthrough, it goes into production immediately. Consequently, ESCORT performance is always at the forefront. In its most recent test of ESCORT, *Road & Track* wrote, "... it is highly recommended."

Since then, our engineers have added an extra 2 dB to ESCORT's sensitivity on both bands. Imagine what *Road & Track* would say now.

Rashid rejection too

Of course, there's more to detection than simply issuing a long-range warning. The warning must be real. No false alarms.

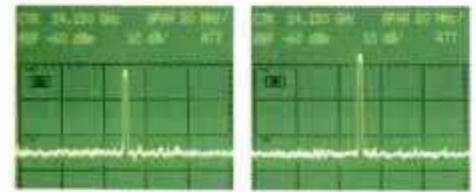


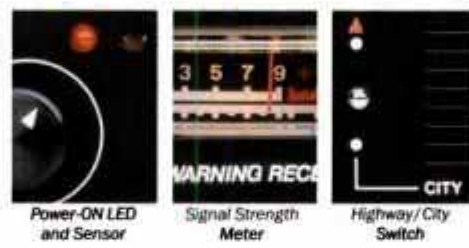
Figure 1: A digital spectrum analyzer scanning the entire width of K band can't see the difference between radar and Rashid.

When the FCC cleared the Rashid VRSS collision warning system for operation on K

band, there was no known way to distinguish between Rashid and radar. But our engineers came through again. Our AFR™ (Alternating Frequency Rejection) circuitry automatically isolates and neutralizes Rashid signals, yet leaves ESCORT's radar detection capability undiminished for your protection.

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In addition to long-range warning, ESCORT also pioneered a full-disclosure warning system that tells you everything you need to know about the radar it finds. At first radar contact, the alert lamp responds and the analog meter indicates radar strength. Simultaneously you will hear an audio warning—pulsing slowly when radar is weak, quicker as you near, then constant as you approach range.



ESCORT also provides separate warning tones for each radar band. And we've added a Mute function for your convenience: once you've noted the warning, touching a switch mutes the audio warning, yet leaves the detection circuits fully armed for the next encounter.

Character reference

Our policy of continuous refinement has prompted the experts at *Road & Track* to say, "Externally, the ESCORT has changed hardly at all over the years; internally, it has undergone several major revisions, each establishing new performance standards in the field."

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By mail send to address below. All orders processed immediately. Prices slightly higher for Canadian shipments.

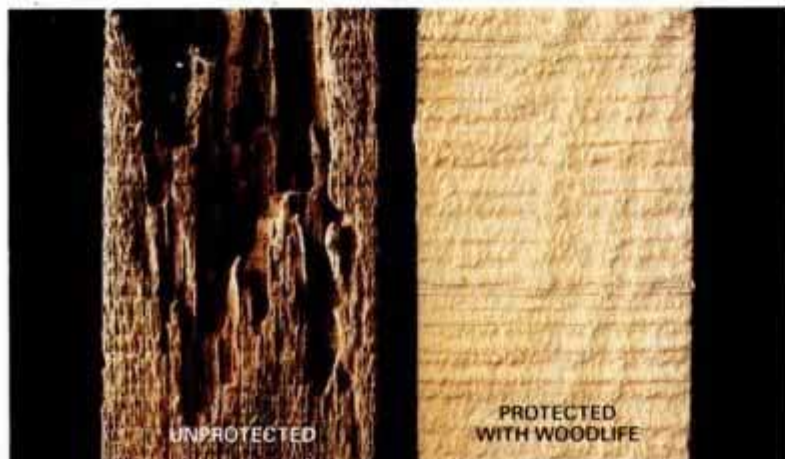
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RADAR WARNING RECEIVER

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Letters



Dream Car Come True



Restored '66 Mustang convertible is the handiwork of Schlegel.

I want you to know what an inspiration POPULAR MECHANICS' May 1985 *Car Care Guide* was to me. Your feature *Affordable Dreams* (page 138) is the story that led me to choose an American car, 10 to 20 years old, to restore to like-new condition.

My choice of car was, as you can see from the photo, a Mustang convertible. I owned a '36 Ford convertible in college so the Mustang was a natural follow up.

I found the '66 in Chicago in the fall of '85, with 88,000 miles on its odometer. After checking over the sheetmetal with a magnet to see if any body putty was hiding collision damage, I took the convertible for a test drive. The exhaust manifold was blowing like a jet plane, but the car was actually in quite good condition—except for some serious rust on the trunk floor, some on the frame, pan and fenders.

I got to work in my small, unheated garage attached to the house and by the Fourth of July last year it was ready to roll—so ready that it led the parade in our Edgebrook celebrations on the Fourth.

My daughter, Margie, is now using it at Indiana Uni-

versity. She's got her college convertible just as I had mine! Thanks for starting me on the project. It was a tough job, but I had more fun with it than anything I've tackled in years.

JACK SCHLEGEL
CHICAGO, IL

Great Projects—By Any Name

The description "shed" in your fabulous project Multipurpose Utility Shed (page 60, Apr. '85) undervalues a building that houses my Honda Accord, tractor, mower, snowblower, small tiller and a few other pieces of equipment as well. I built mine last summer and refer to it more accurately as my "garage."

DAVID CUMMING
WARNER, NH

I've received a lot of compliments on my Backyard Barn which I modified to suit our needs. My wife enjoys gardening, and for my work I installed water and electricity and have an infrared gas portable heater that I use on chilly spring and fall days. The loft stores all of our seasonal furniture.

FRED J. PALMER SR.
BROADVIEW HTS., OH

Readers For Life

Thanks from the bottom of my wallet for your item, "Caddy Oilers Revised" about excessive oil consumption in the 4.1-liter V8 engine (*Car Clinic*, page 24, Aug. '86). I was burning 3½ quarts every 1000 miles and the Cadillac dealer said it was normal! I received no notice from Cadillac and was at wits' end until I saw your explanation about GM's robots not installing piston rings at the required offset. I contacted another dealer who also saw your article. He found that six of my eight pistons had the wrong setup and corrected it at no cost. I now use no oil whatsoever. I don't know how much you saved me, but I know it was a bundle! Once again, when one of my four boys asks, "Where'd you learn that, Dad?" The answer will be, "In PM." A subscriber for life.

RICHARD L. LANG
SWARTZ CREEK, MI

Little did I realize that I'm older than PM, which I now know is celebrating its 85th year (*Editor's Notes*, page 6, Apr. '87). July 17, '01 is my launch date, so I've been reading PM all its life, at least since I was old enough to look at my Dad's. When I left home I got my own subscription, and have been receiving and enjoying it ever since. How many other old faithfuls are out there, I wonder?

CHARLES E. HUOT
CORPUS CHRISTI, TX

Making Waves

Stop ignoring the sailors among your readers with miniscule coverage of sailboat technology! Your *Boating '87* section (page 90, Mar. '87) is full of fuel-hungry powerboats.

STAN BALICK
BALDWIN, NY

Barn/Garden Shed in PM's Plans And Ideas catalog modified by reader Palmer. Plan PL-1278 is \$10.50. Reader Cumming's "Utility Shed" is PL-4-85; it's \$17.50: Popular Mechanics, P.O. Box 1014 Radio City Station, New York, NY 10101.



We know you feel becalmed, so we'll let you know that our boating editor just tested a handful of under 20-ft. sailboats for a future story.

And we hope you didn't miss Sails & Science (page 67, Feb. '87), our report on the America's Cup 12-meter sailboats.

I can't believe the QEII is getting a speed boost from 28 to 42½ knots by changing engines from steam to diesel during her refurbishing. (*PM Technology Update*, page 151, Apr. '87).

ALBERT W. BAILEY
ANCHORAGE, AK

Belay that! A stowaway dig-it boarded our floppy disc; the QEII will make 32½ knots.

Unkind Cut

When cutting a closed miter on a ceiling molding, turn the molding upside down in the miterbox, not as shown in illustration 16 on page 118 (*How To Install Trimwork*, page 115, Dec. '86). The molding may move and give a bad cut the way you show.

JAMES L. KITTLE
WARREN, MI

Your method is more controllable, but it would require the novice to make a difficult visualization to keep track of the proper orientation of the cut.

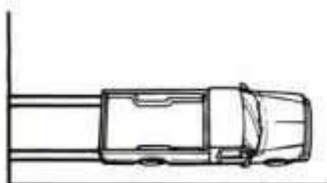
Our depiction is easier for the beginner to understand—and we did emphasize that the molding should be held firmly against the fence.

Also, the trim is soft pine so any miterbox should cut it successfully. When working with hardwoods, we agree that your technique would have an advantage.

PM

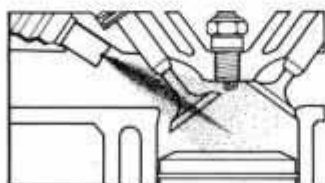
The new shape of tough: The '87 Ford pickup.

America's best-seller* gets even better!
Advanced aerodynamic design. Multiple-port fuel injection
for 20% more power standard. Luxury interiors.
Rear antilock brakes, first in any pickup.



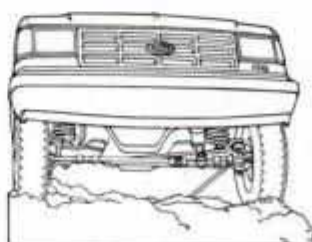
Rear antilock brakes standard.

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



Multiple-port fuel injection.

Now 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 1987, 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 ten straight years.*



Luxurious cab interiors.

Inside, you enjoy a high level of comfort and luxury. Behind the sporty A-frame wheel is full instrumentation backed by a dozen labeled indicator lights — all standard.

6-Year/60,000-Mile Powertrain Warranty.

New Ford limited warranty covers powertrains for 6 years/60,000 miles and provides protection against body-panel rust-

through for 6 years/100,000 miles, whichever comes first. Restrictions and deductible apply. Ask to see a copy of this limited warranty at your Ford Dealer.

Buckle up — together we can save lives.

*Based on '86 calendar year manufacturers' reported retail deliveries.

**When properly equipped and with a fifth wheel.

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





Imports



BY BILL HARTFORD

1988 Merkur Scorpio



Scorpio 5-door hatch has joined the XR4Ti at L-M Merkur dealers.

FoMoCo strikes again. The Scorpio just went on sale here and already it's a winner: It comes from Europe with the Car of the Year award for 1986, and over a dozen other honors. The German-built, Eurolux touring sedan is one of the few cars to offer the astounding versatility of a hatchback built into a 4-door sedan—all the while appearing to be a notchback. As owners of Saab's 9000 and Mazda's 626 5-door know, this configuration is unbeatable for practicality—and no sacrifice of performance or sportiness is required. The Scorpio has everything you'd want packed onto a single chassis. It's a mid-\$20,000, aerodynamic, 3-liter, fuel-injected, 144-hp V6-powered, antilock-

brakes-equipped rear-drive sedan that offers optional leather seats; power sunroof; 4-speed overdrive automatic transmission; touring package and long-legged comfort



Wraparound-type cockpit greets driver.

for five. On rough roads, 4-wheel i.s. and a soothing 7.7 in. of wheel travel keep the seat of your pants where it belongs. At 3240 pounds, the Scorpio's a solid setup. We've already got staff miles on this one and we'll be logging more.



Scorpio measures up big: Wheelbase is 108.7 in., length, 186.4 in. Cargo volume with seatbacks down, 37.2 cu.ft. and fuel 16.9 gallons.

Way-Out

The Monster is just the vehicle for muscling through snow-bound mountain passes. It may be Franco Sbarro's wildest creation to date.

Recently shown at the Geneva Auto Show, the Monster joins a long list of specialty machines from the Swiss auto manufacturer. His one-offs are imaginative flights of fancy, like the Mercedes-Benz 500 SEC that was fitted with gull-wing doors. The company's staples, though, are replicas of classics, like BMW's old 328 roadster.



Sbarro's Monster, perfect for off-road warriors, packs a small 2-wheeler in the back.

Supercoupe

At a time when the average price of an automobile going out the showroom door is a good \$12,000, for a car that may very well be the lowest priced in an automaker's

161 horses worth from its 2.7-liter, 24-valve, sohc, V6. And the stop is sure, swift and steerable with antilock braking. There are three versions: base, L and LS. The L and LS, in addition to ALB, get features like leather seats, computer center, automatic climate control and antitheft system. On top of that, the LS has driver's-side airbag and BOSE sound system. Other than



New Acura Legend has all the right stuff.

model range—like a Honda Civic—it's no wonder that all the good stuff is \$20,000 or more. The Honda Acura Division's new Legend Coupe is an example of that good stuff. It's in the "personal luxury" class, which means no back doors for back-seat drivers. It's the front-seat driver's car from stop to go. The go is

those extras, there's nothing base about the basic Legend Coupe. It has all the essentials from the ground up: 4-wheel disc brakes to power-operated sunroof—and all the same drivetrain and chassis hardware as the upscale versions. Choose it, and you can keep the price closer to \$20,000.

Open BMW

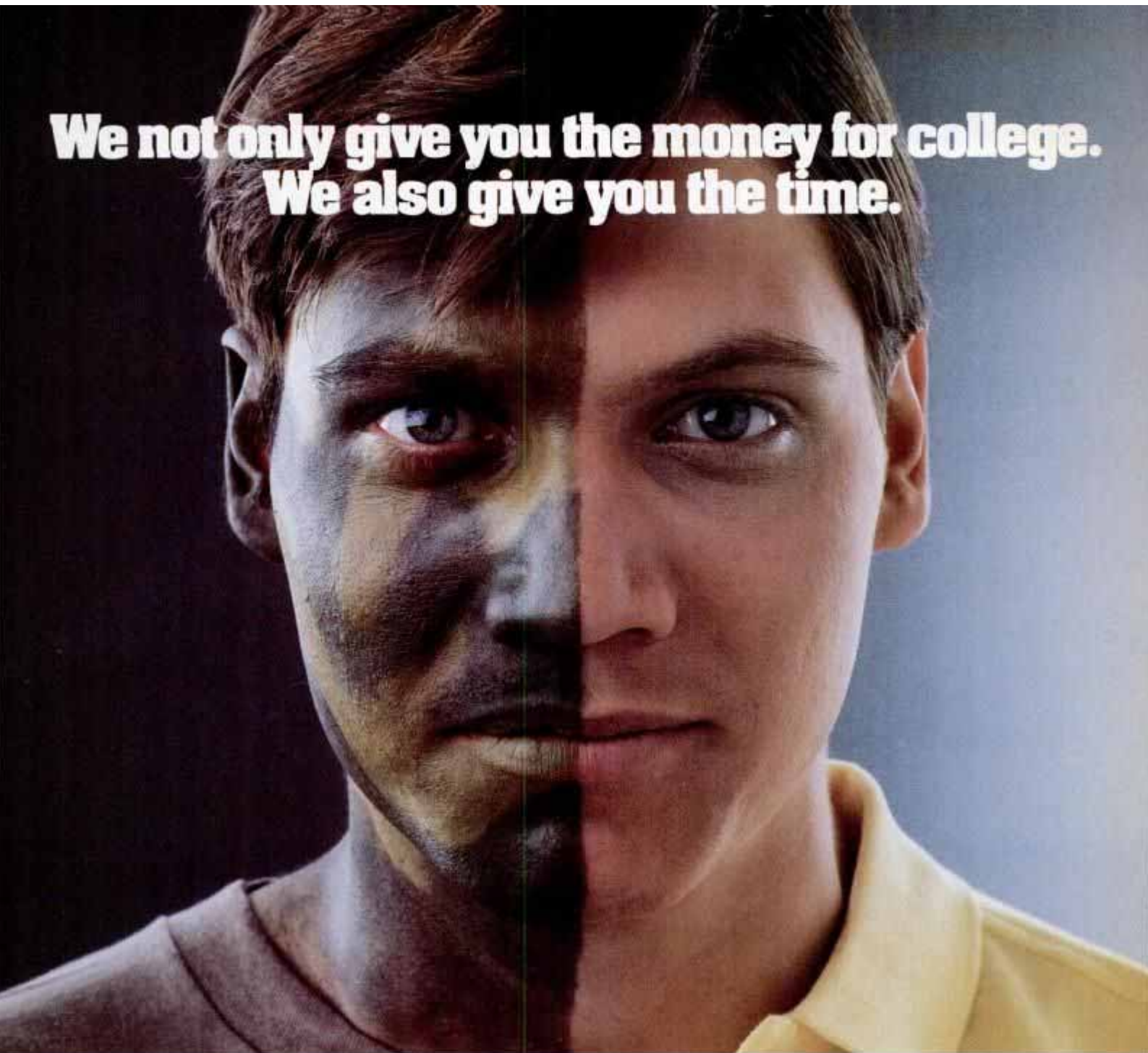
The 325i convert wasn't here in time for our open-air test (*Ragtop Fever*, p. 71, June '87), but it's here now in all its glory and impeccable workmanship. If it had been in our comparison, the new BMW would have been the most expensive: \$28,875 base price. A winter hardtop is \$2495. Other specs: Engine is 168-hp, sohc, 2.5-liter inline Six; transmission, 5-speed or auto; wheelbase, 101.2 in.;



BMW 325i's folded top is covered with a rigid plastic boot.

length, 175.6 in.; weight, 3015 pounds and EPA mileage, 18 city/23 highway, with either transmission. **PM**

**We not only give you the money for college.
We also give you the time.**



If you think the best way to pay for college is to put it off for a few years and join the military, you're half right.

Because with the New GI Bill, you can join the Army National Guard and get a guaranteed minimum of \$18,000 for college.

But best of all, you serve two days a month and two weeks a year. Which means you can go to school full-time. Right now. On us.

So the question you have to ask yourself is not, can you afford college.

The question is, can you afford to wait.

For more information about the Army Guard and the New GI Bill, fill out the attached coupon and mail it in. Or call **800-638-7600***

*In Hawaii: 737-5255; Puerto Rico: 721-4550; Guam: 477-9957; Virgin Islands (St. Croix): 773-6438; New Jersey: 800-452-5794. In Alaska consult your local phone directory.

MAIL TO: **Army National Guard**, P.O. Box 6000, Clifton, NJ 07015

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ADDRESS

CITY/STATE/ZIP

AREA CODE PHONE US CITIZEN YES NO

SOCIAL SECURITY NUMBER BIRTH DATE

OCCUPATION

STUDENT HIGH SCHOOL COLLEGE
PRIOR MILITARY SERVICE YES NO

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Outdoors



BY JOE SKORUPA

Jet Ski's Big Brother



Kawasaki's JS650 sets new pace among beach bombers.

Possessing the kind of roll-on power you'd normally associate with upstart café racers and top-of-the-line snowmobiles, Kawasaki's new Jet Ski 650 is destined for greatness in the expanding personal watercraft market. Recently, we had a chance to take Kawasaki's latest water toy for a spin along Florida's Gulf Coast, and we found some profound differences between the 650 and her smaller-displacement older siblings.

Start with the thumb throttle. In addition to the instantaneous response it offers from the 635-cc liquid-cooled 2-stroke under the engine cowling, it's also been repositioned slightly for easier operation. Complete freedom of maneuverability is now possible, and all that muscle in reserve can be used to power out of the tight spots. That's 25 percent more power with a mere 30-pound increase in weight. A slightly redefined bottom shape also helps create an almost effortless cruising experience.

The 650 has a sleek molded profile, and Kawasaki has wisely repositioned the exhaust outlet behind the driver. That eliminates the snootful of CO that normally accompanies startup on some older models.

Other features of this 282-pound unit include oil injection, electric start, remote choke and fuel reserve.

Kawasaki's new beach bomber will help rewrite some rules. It's easier to train on, easier to drive for the already-initiated, and, for you experts, it has enough top-end speed to pin your ears back.

Jet Skis have always been marketed for the young and agile, but the 650 is so smooth and docile that older neophytes will no doubt take to it easily.

Only one complaint: The side rails are a little too narrow to comfortably rest your elbows on during startup. For more information, contact Kawasaki USA, 9950 Jeronimo Rd., Irvine, CA, 92718; (714)770-0400.

Aerodynamic Air

How do most motor-roamers spell summer-heat relief? Until recently, it was spelled like one of several models of Coleman RV air conditioners, starting with the Polar-Pal introduced in 1967.

But now it's being spelled Super-Mach, thanks to a new aerodynamic unit that is a significant advancement over previous models. The Super-Mach is small and sleek, only 9½ in. high, yet it has a 13,500 BTU cooling capacity.

The design features a horizontal compressor, dual blowers and a wraparound coil, allowing it to fit into an ultralow shroud for better aerodynamic performance.

How will RV owners spell relief next year? Coleman is currently developing a new unit with an electronic thermostat that automatically adjusts fan speed to maintain a constant temperature. It's scheduled to go into production by the end of the year. For more information, contact the Coleman Co., Recreational Vehicle Div., PO Box 1762, Wichita, KS, 67201; (316)261-3348.

New Sport Designs Afoot

Need a pair of shoes with razor-sharp needle spikes? How about ones with hard-gripping suction cups? If these aren't for you, that's because they're custom-



Super-Mach chills RV air with new low-profile configuration.

signed by Adidas for bobsleders and boardsailors.

But there are about 75 other designs in Adidas's new specialty shoe line, each with its own sport-specific features. And one will fit both you and your favorite recreational pastime.

Firm footing is the bare-foot boardsailor's biggest worry, so suction cups are a step in the right direction. But the Windsurfer Super II offers more than a hard-gripping sole. Its high-top boot design supports extreme positions achieved when pulling against a fiesty wind. The ankle collar is angled away from the Achilles' tendon for freedom of movement, while lateral ball and rear heel straps anchor the foot inside the shoe. Upper is made of water-repellant nylon with synthetic suede.

For soft landings, Adidas makes a high-top Parachuting shoe that has a full-length midsole padded with resilient EVA (Ethyl Vinyl Acetate).

It has a uniform thickness

(Please turn to page 14)



Windsurfing



Parachuting



Bobsled



Motorcycling

Adidas's new specialty shoes offer sport-specific design features.

THE BEST GENERATORS ARE POWERFUL, RELIABLE AND QUIET. THAT'S WHY THEY'RE CALLED HONDAS.

Currently, Honda generators are the most widely-used, widely-trusted generators in the world.

Which should come as no surprise.

Especially when you consider that most Hondas are built around fuel-efficient, trouble-free Overhead Valve engines inspired by decades of world-class automobiles and motorcycles.

Or that Honda has the world's broadest range of multi-purpose generators from 650 to 6500 watts. For camping, boating, construction uses, power outages, outdoor parties, recharging car batteries—or most electrical needs at home or away-from-home.

Still, the real difference between an ordinary generator and a Honda generator can most accurately be summed up in one word: reliability.

The power you need is there when you need it. Because we engineer every single generator to ensure easy starts, quiet operation and durability that's measured in years—not months.

Honda generators. Quite simply the finest machines your money can buy. A claim no one else has the power to make.

HONDA

Power

Equipment

IT'S A HONDA



For optimum performance and safety, we recommend you read the owner's manual before operating your Honda Power Equipment. Connection to house power requires transfer device to avoid possible injury to power company personnel. Consult a qualified electrician. © 1986 American Honda Motor Co., Inc.

Attack the paint. Defend the wood.

Removing layers of paint from wood is difficult. Removing the paint *without harming the wood* may be one of the world's *toughest* tasks.

Homer Formby has the solution: Formby's® Wood Formula Paint Remover.

Independent tests show Formby's Wood

Formula Paint Remover is better at removing layers of paint than the most commonly used brands. And it won't raise wood grain or discolor the wood.

Formby's Wood Formula Paint Remover is the one to use on wood. Homer has done it again.



PAINT REMOVER

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Astounding stories

Monumental misunderstandings
in car care



Some car owners don't realize a radiator cap is more than just a plug—it's a vital part of the cooling system. Don't let an inferior or worn-out cap turn your next trip into an overheated nightmare. Test your cap before the summer driving season begins. If necessary, replace it with one of the quality radiator caps from Stant. For testing information, write for our new Cooling System Fact Book. For help in selecting the proper Stant cap for your car or truck, see a Stant retailer near you.



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Connersville, Indiana 47331-9990
A Purolator Company

OUTDOORS

(Continued from page 12)

of 8 mm, except for the heel, where it widens to 10 mm. Additional shock-absorption is provided by a deep saw-tooth cut into the rubber outsole, which also propels landing skydiver forward.

Nothing beats a hard-nylon plate imbedded with razor-sharp needle spikes for traction on ice. This is the essential feature of the Bobsled Sprint shoe. The spikes are anatomically positioned to give traction to weight-bearing portions of the foot. For heel support, it features an EVA midsole shaped like a wedge that tapers to zero at the spike plate.

Tony Mang, the name of a motorcyclist and now a new performance shoe, has an outsole made of a gasoline-and-oil-resistant rubber compound, which prevents slipping when shifting gears. It also features a specially padded and reinforced toe box for bruise protection. A Velcro tongue covers the lacing system to keep out dirt and water.

For more information, contact Adidas, 200 Sheffield St., Suite 300, Mountainside, NJ, 07092; (201)789-9292.

Sharp Solution

For light wilderness duty nothing beats the versatility of a Swiss Army knife, but what do you do when you need to chop firewood, dress game or clean large fish? The answer is the Solution.

The Solution is a new knife/ax combo tool made by Alcas Cutlery. It has a 5-in., razor-sharp blade and a 3½-in. curved ax head. Move the swing-away handle to one side, it's a knife; move to the reverse, it's an ax. The handle locks in either position.

The Solution is 12½ in. long and weighs 1 pound, 9 ounces. The knife and ax blades are made of high-carbon 1095 tool steel. While the handle is glass-reinforced Zytel nylon.

Designer Dan Harrison didn't stop with knife and hatchet functions. He added a 3-in. alternating double-toothed saw and a 3/32-in.-radius game hook on the back of the knife blade. It also has a 4-in. watertight storage tube. Retail price for the Solution is about \$165. For more information, contact Alcas Cutlery, 116 E. State St., Olean, NY 14760; (716)372-3111. **PM**



The Solution knife/ax system shown in transition between lockable function modes.

The most famous knife in American history.

JIM BOWIE'S KNIFE

First authorized replica of the blade carried by the great Western hero at the Alamo.



They called it "the Arkansas toothpick." It became an American heirloom. The very knife which the courageous patriot Jim Bowie carried at the Alamo in 1836.

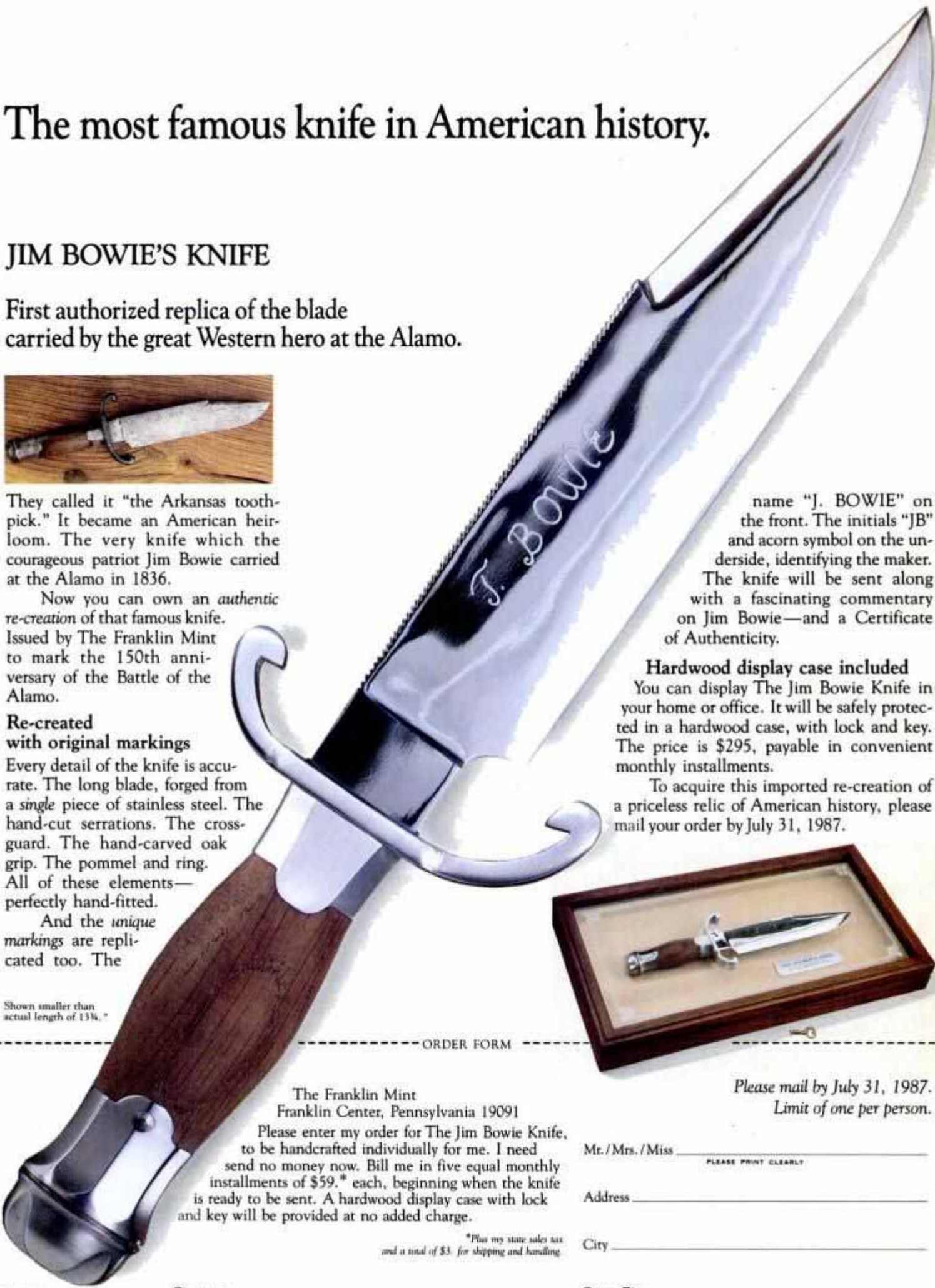
Now you can own an *authentic re-creation* of that famous knife. Issued by The Franklin Mint to mark the 150th anniversary of the Battle of the Alamo.

Re-created with original markings

Every detail of the knife is accurate. The long blade, forged from a *single* piece of stainless steel. The hand-cut serrations. The cross-guard. The hand-carved oak grip. The pommel and ring. All of these elements—perfectly hand-fitted.

And the *unique* markings are replicated too. The

Shown smaller than actual length of 13 1/4."



name "J. BOWIE" on the front. The initials "JB" and acorn symbol on the underside, identifying the maker.

The knife will be sent along with a fascinating commentary on Jim Bowie—and a Certificate of Authenticity.

Hardwood display case included

You can display The Jim Bowie Knife in your home or office. It will be safely protected in a hardwood case, with lock and key. The price is \$295, payable in convenient monthly installments.

To acquire this imported re-creation of a priceless relic of American history, please mail your order by July 31, 1987.



ORDER FORM

The Franklin Mint
Franklin Center, Pennsylvania 19091

Please enter my order for The Jim Bowie Knife, to be handcrafted individually for me. I need send no money now. Bill me in five equal monthly installments of \$59.* each, beginning when the knife is ready to be sent. A hardwood display case with lock and key will be provided at no added charge.

*Plus my state sales tax and a total of \$3. for shipping and handling.

Please mail by July 31, 1987.
Limit of one per person.

Mr./Mrs./Miss _____

PLEASE PRINT CLEARLY

Address _____

City _____

State, Zip _____

Signature _____

ALL ORDERS ARE SUBJECT TO ACCEPTANCE.

Freewheeling



BY WADE HOYT

Fastest U.S. Car?



Aerodynamic Pulse GCRV has tandem seating for two, training wheels in the little winglets, and a Honda motorcycle drivetrain.

Vette fans! Throw away your fiberglass dinosaurs and get into the '87 Pulse GCRV, said to be "faster than any production car built in America." Powered by an 86-hp, 1.2-liter Honda Gold Wing engine, the Pulse has a 0-to-60 time of 6 sec-

onds and a calculated top speed of 180 mph. Weight is 1080 pounds and "unofficial wind tunnel tests" give it a C_D of "0.18 clean; 0.19 dirty." It costs about \$15,000 from Owosso Motor Car Co., 501 S. Chestnut St., Owosso, MI 48867.

Bag It

Ford safety experts point out that a 3-point lap/shoulder belt is still the best way to ride out an accident. In a head-on collision, 40 to 50 percent of serious injuries can be prevented by a 3-point belt; 35 to 50 percent with a passive (shoulder only) belt; 20 to 40 percent by an air bag alone; 40 to 50 percent by an air bag and lap belt combo; and 45 to 55 percent by an air bag used together with a 3-point belt.

The smart move is to always use a full 3-point harness, even if the car has air bags or a passive shoulder belt that automatically wraps

around you. Air bags help reduce head, chest and facial injuries, but only belts protect from rollovers, side impacts and rear-end collisions.

Although Ford has 11,000 air bag cars in the field, only 749 retail customers paid \$815 for the setup. The rest are in government and fleet sales. So far, there have been 91 deployments and no inadvertent pops.

Those dubious about air bags may not be comforted to hear that Morton Thiokol—the company that made the space shuttle's infamous O-rings—is in the field. Thiokol will build bag modules for Chrysler in 1988, and has

been making explosive gas generators for Mercedes.

Faded Glory

Ask any successful yuppie which luxury car he lusts after and you're almost certain to hear the name of an expensive European import, probably German or Swedish. Cadillac, Chrysler and Lincoln seem to be forgotten names among the rich and pretentious. Why?

At one time, American carmakers built vehicles that were competitive with the best Europe offered. Paradoxically, they were made during the Great Depression. While luxury carmakers like Auburn and Duesenberg were withering away, others thrived by supplying ostentatious transportation to a still-rich clientele that saw no reason to hide its wealth.

Luxury carmakers who survived The Great Crash did so by offering the highest technology then available. Few cars produced in Europe could outshine the 1930-'40 Cadillac V16s or the 1932-'35 Lincoln V12s (see photos below). Many sported custom bodywork by such great American coachbuilders as LeBaron, Fleetwood, Fisher, Waterhouse, Rollston, Brunn, Derham, Brewster, Dietrich, Murphy, Willoughby or Judkins—all gone now, save for the occasional nostalgic use of an old name.

World War II turned Detroit's attention from cars to tanks and aircraft. During the postwar boom years, Detroit took a more democratic turn, mass producing luxury cars in the hundreds of thousands for the emerging class of *nouveau riche* entrepreneurs and executives. Throughout the '50s and '60s, they symbolized wealth, quality and the fact that their owners had made it. These buyers did not demand leading-edge technology, only big, comfortable cars with prestigious nameplates.

Two energy crises and more sophisticated tastes among the affluent have changed all that. Lincoln's square-rigged Town Car, while still popular, is no longer at the leading edge of technology or sophistication. And the Mark VII, though sleek and fast, is little more than an optioned-up T-Bird.

Cadillac and Chrysler's expensive new Allante and Maserati 2-seaters are an attempt to reenter the ultraluxury market and attract a more youthful and sophisticated clientele. Ford's attempt to do the same thing by selling high-tech European models under the Merkur nameplate has been less than a roaring success. It remains to be seen whether chopped Seviles and LeBarons with fancy European names and megabuck sticker prices will be any more successful. **PM**



This 1930 Cadillac formal 7-passenger limousine featured an exotic 16-cylinder engine and absolutely oozed world-class sophistication.

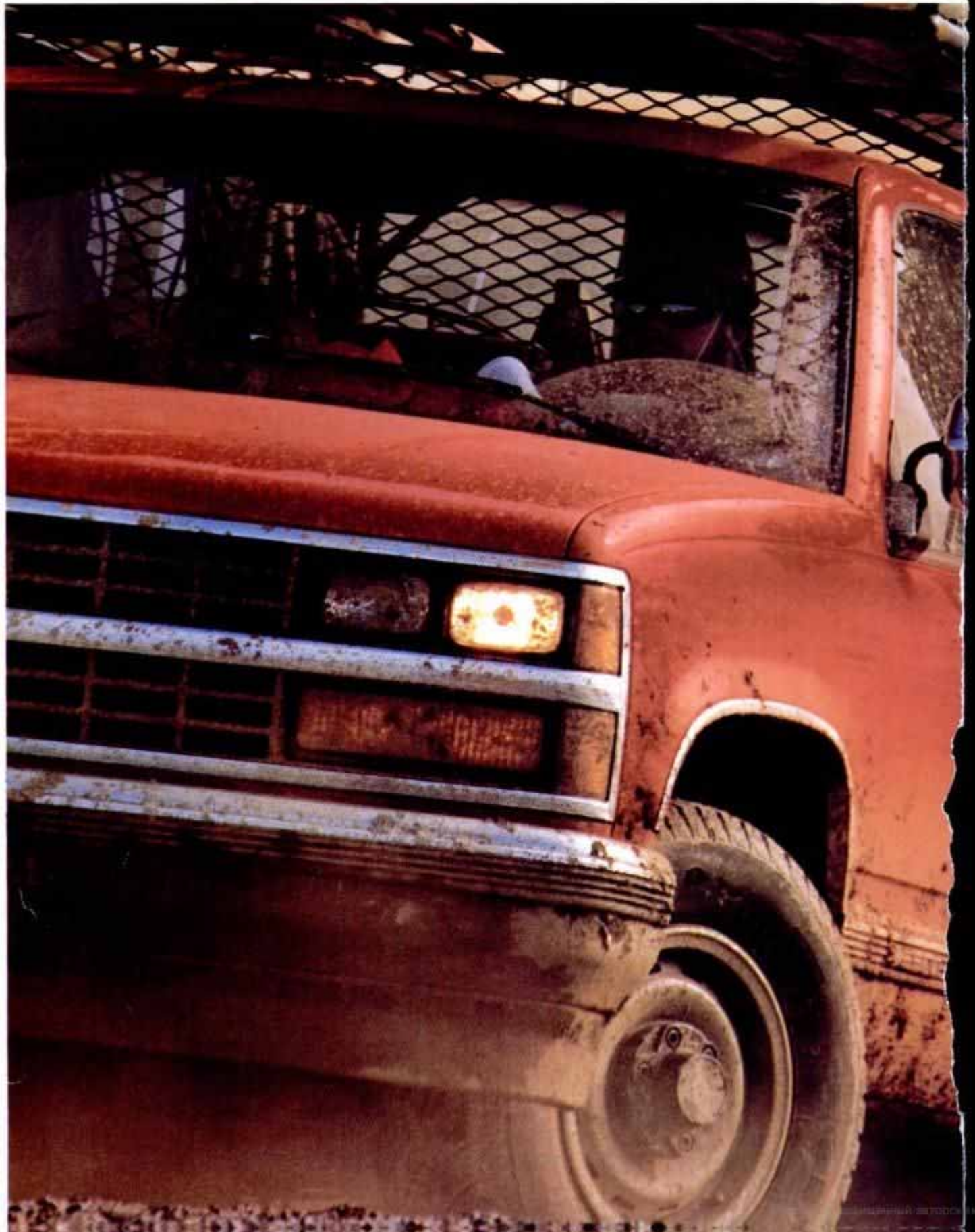


1932 Lincoln KB roadster with V12 and rumble seat was the apex of conspicuous consumption and leading-edge technology in its day.

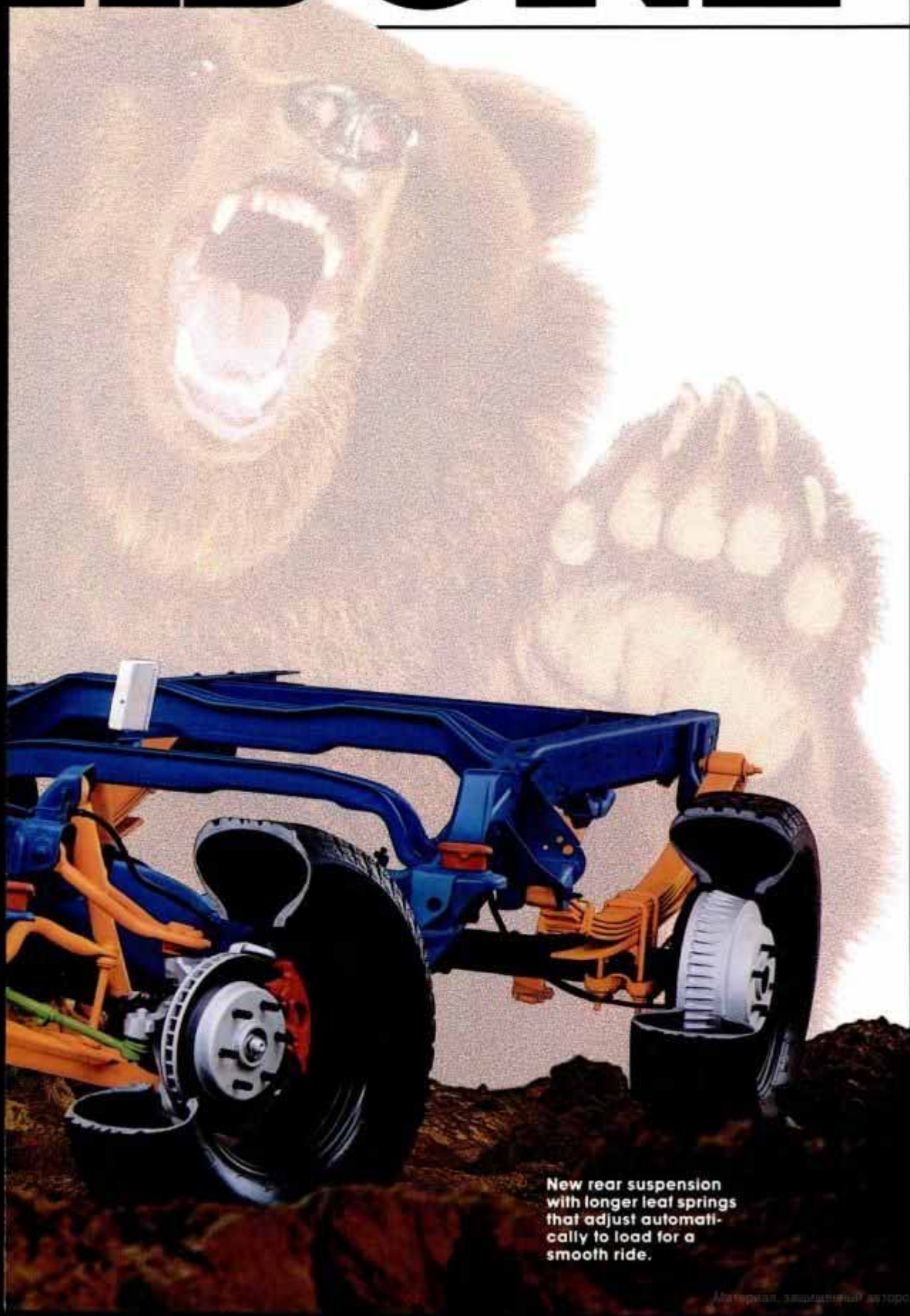


**INTRODUCING A
WHOLE NEW ANIMAL.
A LEANER, MEANER
FULL-SIZE 1988
CHEVY PICKUP.**

ANIMAL



KBONE

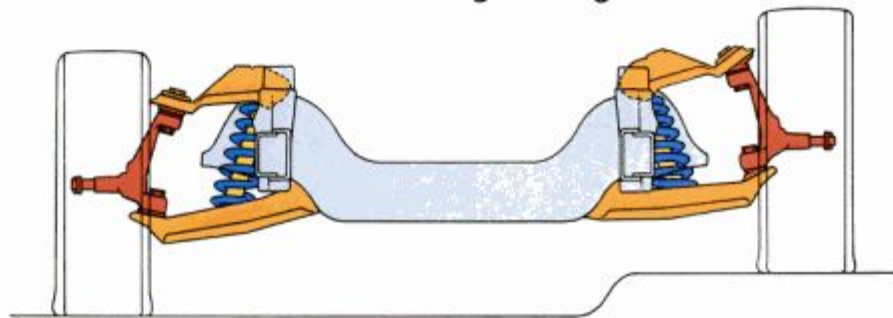


New rear suspension with longer leaf springs that adjust automatically to load for a smooth ride.

The new 1988 Full-Size Chevy Pickup. V

1 **The front suspension.** There are actually two: one designed specifically for two-wheel drive, the other specifically for four-wheel drive.

Both are fully independent, which means both are designed to give you a smooth ride. In fact, out on the highway, our 4x4 rides so smoothly you tend to forget it's also a tough, rugged off-road animal. And that should give you an idea of how smoothly our 2WD trucks ride, including our big one-ton truck.



2 **The rear suspension.** Our new rear springs are longer than on some other pickups. (To understand the advantage, hold your thumb and fingers together and try to balance a ruler on top of them. Now extend the distance between your thumb and fingers. See how much more stable the ruler rests on top of them?)

The rear leaf springs are also engineered to adjust to load weight, to give you a smooth ride empty or loaded.

3 **The ground clearance.** See how the front suspension's tucked up within the frame instead of hanging down below it? That gives you the high ground clearance you want. Yet you don't have to step up high to get in the truck.

ART



New-design fuel tank mounted inside the frame rails.

Highest highway gas mileage of any full-size pickup;* EPA est. 23 highway MPG.

*Excludes other GM products.

New rear suspension with longer leaf springs that adjust automatically to load for a smooth ride.



12 **The visibility.** We've added over a thousand square inches of glass. Plus a new wiper system to make the most of it all. And notice how much of the road ahead you see over the new, aerodynamically sloping hood.

13 **The new instrument panel.** You see the Silverado here,



with gage package and other optional equipment. New 4-spoke wheel; clean, clear, easy-to-read information, all easily at hand. A reminder of just how new your new Chevy is. Every time you take the wheel.

14 **The doors.** Notice how easy our new pickup is to get in and out of. That's because the doors are wider and the cab floor's lower than on our past pickups.

15 **The cargo box.** It's a new all-welded design with no exposed bolt heads to trap water and cause rust. The tailgate's removable. And special indentations in the sides of the box let you build a platform of 2x6s across the top of the wheelhousings to haul double-tier loads.

16 **The room.** It's what you buy a full-size pickup to get. And the new 1988 Chevy has more cab room than Ford or Dodge. In fact, the new Chevy has the longest cab of any full-size pickup*.

17 **The finish.** That smooth, deep, wet-look finish is going to stay looking that new and that good for a long time. Because it's topped by a new clear coat that helps seal and protect the finish.

18 **The interior.** It's more complete than you might expect.

Even our least expensive model gives you a full-size glove box with lockable door, sun visors, armrests, power steering and brakes and a whole lot more. To give you a whole lot more truck for your money.

19 **The corrosion protection.** There's more of it in more places than any full-size Chevy before—as many as seven layers in critical areas. And that's on a truck with exterior body panels built almost entirely of two-sided galvanized steel.



E

Heaviest standard payload rating of any 1/2-ton pickup.*

More visibility front, back and sides than our previous pickup. Plus an aerodynamically sloping hood to let you clearly see the road ahead.

New flush-mounted glass reduces wind noise. To give you a quieter truck inside.

Two-tier loading. Cargo-box side indentations let you build a platform of 2x6s across the top of wheelhousings.

New-design fuel tank mounted inside the frame rails.

Highest highway gas mileage of any full-size pickup.* EPA est. 23 highway MPG.

*Excludes other GM products.

New rear suspension with longer leaf springs that adjust automatically to load for a smooth ride.

Two-sided galvanized steel protection on all exterior body panels except the cab roof.

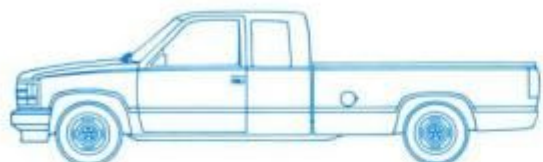
Anti-chip protection against stones and gravel covers all lower body side panels.

THE WHO

A full-size pickup built new from the inside out. To give you remarkable handling, excellent ride and quietness. While working harder than any big pickup before.

24 **The new Cheyenne.** A new base truck ready to work for you. Complete with chrome bumper, rubber mats, glove box, armrests, sun visors, power brakes, power steering and more.

25 **The new Scottsdale.** A noticeable step up inside and out. Open it up, look it over, drive it and you may decide it's all the full-size pickup you need.

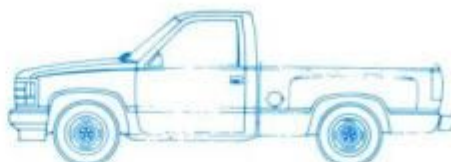


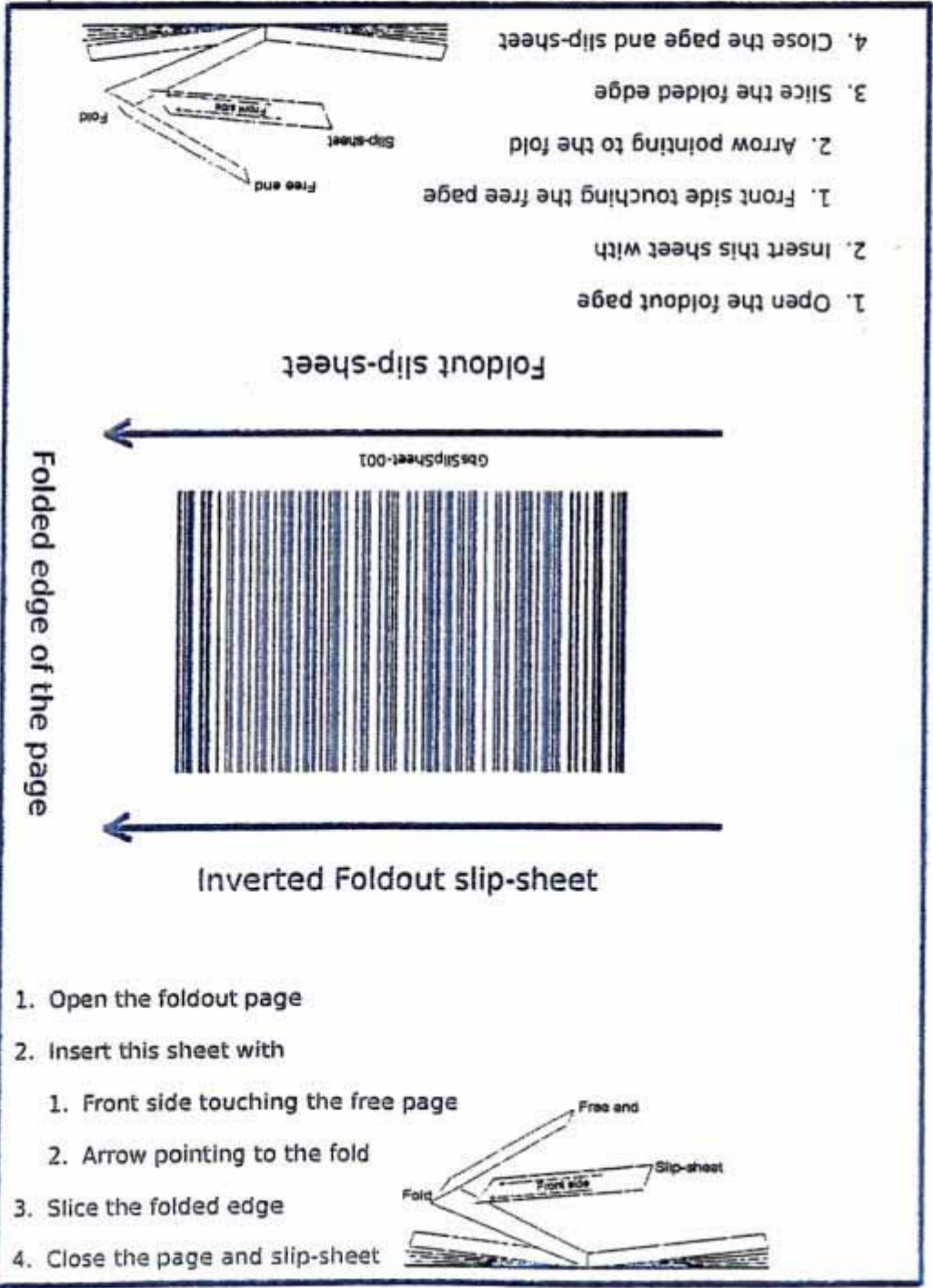
26 **The new Silverado.** The ultimate 1988 Full-Size Chevy Pickup. Deluxe quad headlamp front end, deluxe side and rear treatment. And inside is everything you expect a Chevy Silverado to be. Plus a lot more.

27 **The new Extended Cab.** Introducing the roomiest of all extended cabs.* So roomy, six adults can sit comfortably facing forward. The available full-width rear seat flips down, the cargo box is a full 8 feet.

28 **The new Sportside.** It's coming this fall and a sweeter, smoother short-box you've never seen. Drop in the available 350 V8, dress up the wheels and you've got a street truck ready to light up your life. Guaranteed.

*Excludes other GM products.

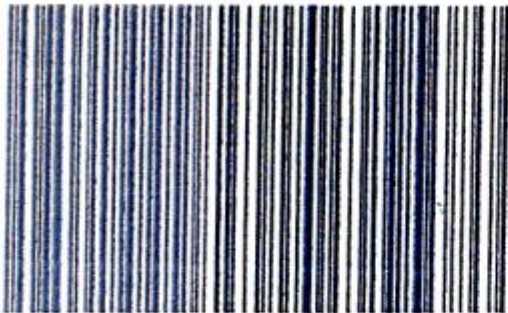




1. Follow instructions on the other side

Back

gpslipback-0018




Inverted Back

1. Follow instructions on the other side

THE BACK

A pickup built new from the inside out. With a bigger, heavier, more massive new frame. Plus advanced new front and rear suspension, new rear-wheel anti-lock brake system. For new levels of ride and braking control in a full-size pickup.



Massive boxed channels up front for added strength under the engine.

New fully independent front suspension on both 2WD and 4WD.

Standard power brakes. Big discs up front, massive drums in rear.

Standard rear-wheel anti-lock brake system for stable, smooth stops empty or loaded, on slick or dry pavement. System operates in 2WD only.

What makes it a better pickup for you.

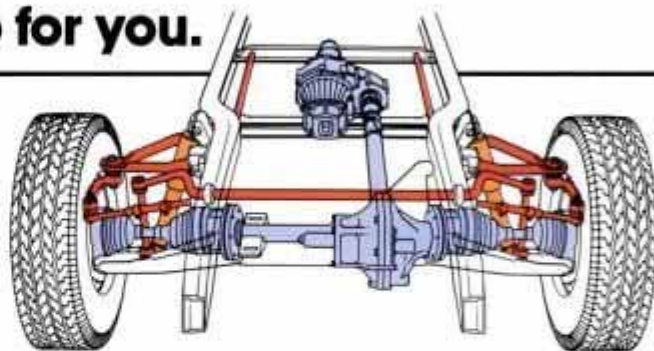
4 **The new frame.** With its massive boxed channels under the engine, it's one of the heaviest frames ever put under a Chevy pickup. The result is a degree of stability we think you'll notice when you test drive our new 1988 Full-Size Pickup. Which we invite you to do at your earliest opportunity. And feel how impressive a pickup can be when it's engineered new from the inside out—the first all-new full-size pickup in eight years.

5 **The cab-to-box alignment.** The back of the cab and front of the cargo box are both mounted on a single, one-piece bracket for a more even fit. An example of the quality fit and finish you'll see throughout our new pickup.

6 **The standard engine.** It's a modern, high-compression Vortec V6 that gives you 15 more standard horsepower than Ford's half-ton pickup, 60 more than Dodge. Combined with our new standard 4- or 5-speed manual transmissions, you're likely to find it's all the engine you need for just about everything you do. And that includes pulling a good-sized trailer.

7 **The new 4- and 5-speed manual transmissions.** They're a new design built to world-class quality standards. And you'll feel it with every smooth, short, easy shift you make.

8 **The brakes.** The rear brakes are connected to a computer that modulates rear brake line pressure. This controls rear-wheel lockup to give you directional stability under heavy braking.



9 **The Insta-Trac.** It's a 4x4 advantage Ford doesn't give you. And we're the *only* full-size 4x4 with both Insta-Trac and independent front suspension*.

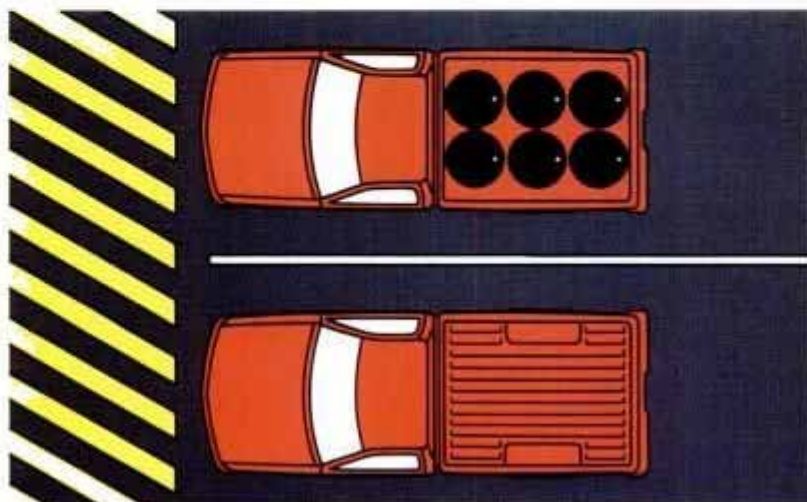
10 **The clean thinking under the hood.** Notice the working room around the engine. And how clean and uncluttered our fuel-injected engines are compared to Ford and Dodge pickups.

Notice, too, the new single serpentine belt that replaces the three or four belts you see on older engines. It's designed to last. And even comes with built-in tension adjustment.

And don't look for the jack under the hood. We've moved it inside the cab. And given you a convenient scissors-type jack.

11 **The tires.** We've made premium all-season steel-belted radials standard on all models. And big 16-inch tires standard on all 4x4s.

*Excludes other GM products.



THE HEA

**It builds with fuel-injected power:
The most standard power,
the most available V8 power
in half-ton pickups. Plus
standard shift-on-the-fly
Insta-Trac on 4WD
pickups.**



Massive boxed channels up front for added strength under the engine.

New 4- and 5-speed manuals feature short, easy shifts. Five-speed manual standard on 1/2- and 3/4-ton 4WD and 3/4-ton 2WD.

New fully independent front suspension on both 2WD and 4WD.

Most V8 power and torque available in pickups under 8,500 lbs. GVWR: the fuel-injected 350 V8 available in all models.

Most standard power in 1/2-ton pickups: the 160-HP, fuel-injected Vortec V6.

Standard power brakes. Big discs up front, massive drums in rear.

Standard Insta-Trac shift-on-the-fly on all 4WD models. Small trucks have it. Now you can have it on a big Chevy Pickup. And as standard equipment.

Standard rear-wheel anti-lock brake system for stable, smooth stops empty or loaded, on slick or dry pavement. System operates in 2WD only.



20 **The driving position.** The seat-back's more reclined than in other pickups, the steering wheel's at a more comfortable angle. And when you order the Custom Cloth option in the Silverado, you get a totally new kind of contoured seat for even more support, even more long-distance-driving comfort.

21 **The grille.** It's a new one-piece design. To make it easier for you to replace should the need ever arise.

22 **The quiet.** It comes from the aerodynamics of the smooth, rounded shape, the flush-mounted glass, the tight window and door sealing, the hidden drip moldings, the insulation. A level of quietness to help see you through a full day. And feel less tired at the end of it.

23 **The options.** There's more than ever before. New bucket seats, for example. Delco/Bilstein front shocks in the available 4WD off-road package. New sound systems that rival those available in the most expensive cars. And an advanced new air conditioning system.

*Excludes other GM products.



THE HIDE

It continues with strong, two-sided galvanized steel. A body shaped to give you more room, more comfort, more quiet. Backed by the heaviest standard payload of any half-ton pickup.*

More shoulder room than Ford or Dodge.

More total cab room than Ford or Dodge.

High-pressure Delco/Bilstein front shocks included on available 4WD off-road package.

Massive boxed channels up front for added strength under the engine.

New 4- and 5-speed manuals feature short, easy shifts. Five-speed manual standard on 1/2- and 3/4-ton 4WD and 3/4-ton 2WD.

New fully independent front suspension on both 2WD and 4WD.

Most V8 power and torque available in pickups under 8,500 lbs. GVWR: the fuel-injected 350 V8 available in all models.

Most standard power in 1/2-ton pickups: the 160-HP, fuel-injected Vortec V6.

Standard power brakes. Big discs up front, massive drums in rear.

Standard Insta-Trac shift-on-the-fly on all 4WD models. Small trucks have it. Now you can have it on a big pickup. And as standard equipment.

Standard rear-wheel anti-lock brake system for stable, smooth stops empty or loaded, on slick or dry pavement. System operates in 2WD only.

OLE NEW



HEAVY DUTY CHEVROLET TRUCKS ARE AVAILABLE AT CHEVROLET DEALERSHIPS

© 1994 GM



SERIES	MAXIMUM GVWR ^o (lbs.)	MAXIMUM PAYLOAD* (lbs.)	MAXIMUM GCWRT (lbs.)	FUEL-INJECTED GASOLINE ENGINES					DIESEL MODELS		TRANSMISSIONS						
				4.3L V6 262 Cu. In.	5.0L V6 305 Cu. In.	5.7L V6 350 Cu. In.	N.D. 5.7L V6 350 Cu. In.	7.4L V8 454 Cu. In.	6.2L V6 379 Cu. In.	H.D. 6.2L V8 379 Cu. In.	4-SPD. MANUAL	4-SPD.** MANUAL	5-SPD. MANUAL	3-SPD. AUTO.	4-SPD. AUTO.		
1500 (½-ton) 2WD-SWB	5200-5600	1639-1918	12,000	STD	OPT	OPT						STD	OPT	OPT	OPT	OPT	
	-LWB	5200-5600	1464-1844	12,000	STD	OPT	OPT					STD	OPT	OPT	OPT	OPT	
4x4-SWB	5600	1504	12,000	STD	OPT	OPT							OPT	STD	OPT	OPT	
	-LWB	5600	1422	12,000	STD	OPT	OPT						OPT	STD	OPT	OPT	
2500 (¾-ton)	2WD	7200	3267	13,500	STD	OPT	OPT			STD				OPT	STD	OPT	OPT
	4x4	7200	2916	13,500	STD	OPT	OPT			STD				OPT	STD	OPT	OPT
3500 (one-ton)	2WD	8600-10,000	4176-5197	19,000				STD	OPT		STD			STD		OPT	
	4x4	8600	3817	16,000				STD	OPT		STD			STD		OPT	
1500 Extended Cab	2WD	6000	1925	12,000	STD	OPT	OPT						STD	OPT	OPT	OPT	OPT
	4x4	6200	1680	12,000	STD	OPT	OPT							OPT	STD	OPT	OPT
2500 Extended Cab	2WD	7200	2977	13,500	STD	OPT	OPT			STD				OPT	STD	OPT	OPT
	4x4	7200	2621	12,000	STD	OPT	OPT			STD				OPT	STD	OPT	OPT
3500 Extended Cab	2WD	8600-10,000	3907-4927	19,000				STD	OPT		STD			STD		OPT	
	4x4	8600	3538	16,000				STD	OPT		STD			STD		OPT	

^oGVWR - Gross Vehicle Weight Rating includes truck, passengers, cargo and equipment.

*Payload with standard angles includes passengers, equipment and cargo.

[†]GCWRT - Gross Combination Weight Rating includes truck, trailer, passengers, cargo and equipment.


**With low-ratio first gear. STD - Standard OPT - Optional

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



QUALITY COMMITMENT PLAN

See your Chevrolet dealer for terms and conditions of the new limited powertrain warranty.

THE
Heartbeat
OF AMERICA

TODAY'S
CHEVY TRUCKS

Workshop Minicourse

BY ROSARIO
CAPOTOSTO



A miterbox guides a fine-tooth backsaw for cutting accurate 90° square and 45° miter cuts. The saw slides in guide-slots cut in the box sides. Hold work securely to prevent shifting.

Making A Miterbox

A miterbox and backsaw are essential for cutting trimwork, picture frames and other small-dimension stock accurately. A wide variety of store-bought miterboxes are available at hardware stores, home centers and through mail-order tool firms. Prices range from \$12 to more than \$300. However, you can make your own miterbox; simply follow the plans shown here.

Make the box from three pieces of maple, birch or beech. Use 3/4-in. stock for the sides and 4/4 for the bottom. Join the parts with glue and 1 1/2-in. No. 8 screws. The box shown allows you to cut 90° square and 45° left and right. If desired, you can cut additional saw guide-slots for other angles such as 22 1/2° and 30°. Also, the box dimensions given can be altered, if desired, but note that the inside depth of the box must be 1/8 in. less than the saw blade height as measured from the teeth to the bottom edge of the saw's spine.

The accuracy of the miter box depends entirely on how accurately you cut the guide-slots. Don't try to cut the slots freehand. Instead, clamp wood blocks to the box, as shown, to guide the saw and ensure perpendicular, accurate cuts.

When using the miterbox, clamp its overhanging bottom edge in a vise. Hold the work firmly in the box and start cutting by making a few light backstrokes. This will help to establish a starting kerf for the saw.

FM



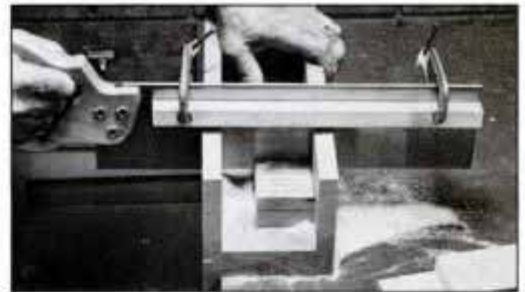
Glue and screw together the box. Then, use a combination square to mark cutting lines on the top edge of the sides. Mark 90° and 45° lines.



Clamp wood blocks to the box to guide the saw and hold it on the cutting lines. While sawing, the saw's spine should be against blocks.



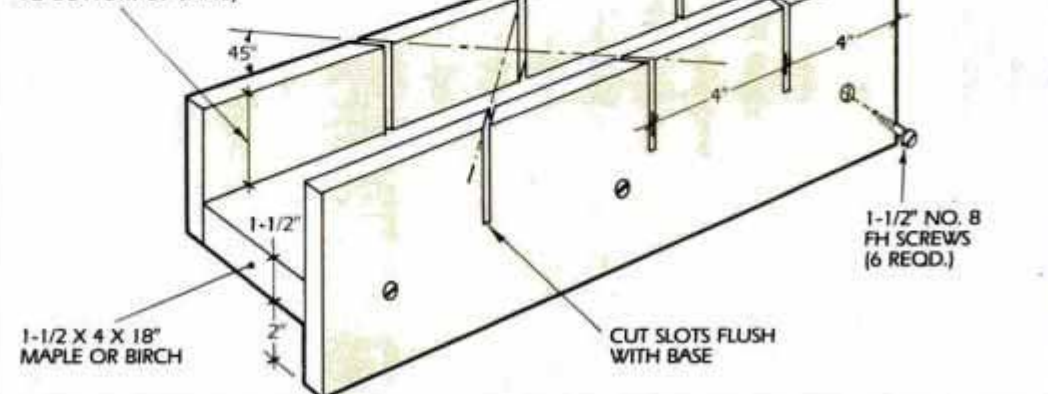
When cutting crown molding, insert a spacer strip to prop it up at the correct angle. Make a 45° cut to produce a compound-angle cut.



Clamp a wood strip to the saw blade to act as a depth-stop. Here, it's used to cut halfway through the stock to produce a half-lap joint.

MITER BOX

1/8" LESS THAN HEIGHT OF
BACKSAW BLADE (FROM TEETH
TO BOTTOM OF SPINE)

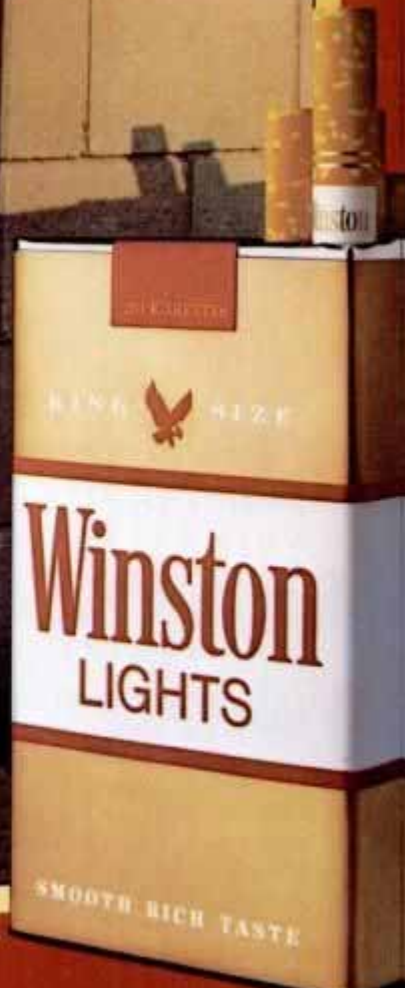


Real Dreams.



**Real people
want real taste.
Winston**

SURGEON GENERAL'S WARNING: Cigarette
Smoke Contains Carbon Monoxide.

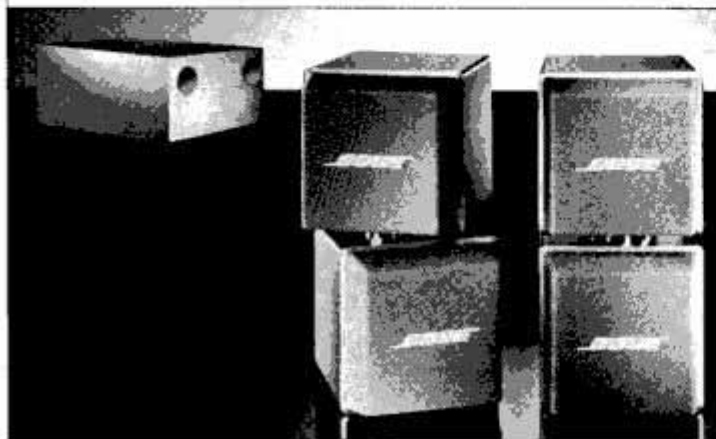


Audio



BY FRANK VIZARD

Heard But Not Seen



Acoustimass speaker system uses hideaway bass module (left).

If the floorspace often required by speakers upsets you, then Bose has the answer to your problem.

The company's AM-5 Acoustimass Speaker System might be the most invisible speakers ever offered. The AM-5 "system" is actually comprised of three individual pieces. The key element, though, is a bass-producing module weighing about 20 pounds and measuring 8 x 12 x 20 in.

Inside this module are two 6-in., low-frequency drivers that fire into two internal chambers. The front of each driver cone sends sound into a ported chamber tuned to 90 Hz. The back of each cone fires into a second ported chamber tuned to 45 Hz. Both port openings are located on one of the smaller ends of the module.

The low-frequency energy generated within these chambers is then released into the room. This procedure differs

from conventional loudspeakers, which rely exclusively on movement of the driver cone to produce low bass frequencies. An added benefit, reports Bose, is reduced cone motion and reduced harmonic distortion.

The bass module can be placed anywhere in the room (at the demonstration I attended, the module was placed behind a sofa) because bass is omnidirectional.

Accompanying the bass module is a pair of 2-cube speakers, each set having one cube mounted on top of the other. Each set of cubes is smaller than a 1-quart milk carton and weighs about as much as a standard desk telephone. Inside each cube is a 2½-in. driver. The cubes radiate most of the treble and midrange sound since the crossover frequency to the bass module is 150 Hz. Each cube can swivel 360° to provide whatever balance of direct and reflected sound suit-

able to your liking and listening environment. Flexibility is also enhanced by a variety of mounting brackets and other accessories that enable you to mount the cubes virtually anywhere.

The Bose AM-5, listing for \$699, is an impressive achievement that takes a novel approach to the problem of sound dispersion. I do have some reservations about midrange response, the absence of which is most apparent on musical material lacking deep bass. Still, the AM-5's deep bass, wide soundstage and inconspicuous appearance might be a more than adequate trade-off, depending on the type of music you listen to. If space is a problem, the Bose AM-5 is a solution worth hearing.

Self-sufficient CD

Audio manufacturers are intent upon designing a compact disc player for every conceivable situation.

Sony, for example, now offers a CD player with a built-in 25-watt-per-channel amplifier and packaged with a pair of shelf-size speakers. No additional components are necessary. The charcoal gray CD player weighs just about 5 pounds and is small enough, as are the speakers, to fit into tight spaces encountered in studios, second bedrooms, dorms and even offices. At \$600, this product has many of the high-end features that will appeal to the dedicated CD listener although I feel a unit such as this would have a lot more versatility if it included an AM/FM tuner.

Sharp, meanwhile, is putting its eggs all in one basket with a unit that includes a CD



Gold-plated Ultradisc CD.

player, AM/FM tuner, and a seven-band graphic equalizer. Power output is rated at 100 watts per channel. This \$899 "CD/receiver" does offer the convenience of an all-in-one package and presumes the customer isn't willing to deal with individual components. The machine's target audience, however, might justifiably opt for a full component rack system at about the same price, and get a cassette deck and a pair of speakers in the bargain.

All That Glitters...

Though CD players of different designs and disc-loading capabilities have appeared on the market, the one constant has been the compact disc itself. Mobile Fidelity Sound Labs (MFSL), a Petaluma, California-based audiophile label, now says all CDs are not alike.

The company is introducing gold-plated Ultradisc CDs with a list price of \$29. MFSL claims the gold-plating prevents any chance of oxidation, which could affect conventional aluminum CDs if their plastic lamination has flaws. In addition, the splattering effect achieved by the

(Please turn to page 36)



New Sony CD player has built-in, 25-watts-per-channel amplifier.

Your home workshop can PAY-OFF

BIG...

Earn Extra Income
Right At Home.

START YOUR OWN MONEY MAKING BUSINESS!



FOLEY BELSAW

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Power Feed Power Tool.

SEND FOR FACTS TODAY!

Planer Molder Saw

Three power tools in one — a real money-maker for you!

The Planer/Molder/Saw is a versatile piece of machinery. It turns out profitable precision molding, trim, flooring, furniture... in all popular patterns. Rips, planes, molds separately... or all at once. Used by individual home craftsman, cabinet and picture framing shops, lumber yards, contractors and carpenters.

Never before has there been a three-way, heavy-duty woodworker that does so many jobs for so little cost. Saws to width, planes to desired thickness, and molds to any choice of patterns. Cuts any molding pattern you desire. Provides trouble-free performance. And is so simple to operate even beginners can use it!

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YES, please send me the FREE Booklet that gives me complete facts about your Planer-Molder-Saw and full details on how I can qualify for a 30-Day Free Trial right in my own shop. I understand there is No Obligation and that No Salesman will call.

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Address _____

City _____

State _____

Zip _____

AUDIO

(Continued from page 35)

gold-plating cuts down imperfections on the information-bearing surface of the disc, says MFSL, reducing the potential drop-out rate from a maximum of 40 percent to a maximum of 4 percent.

While MFSL's technical arguments are plausible, I perceived no audible difference between the conventional and Ultradisc versions of MFSL's Jazz Sampler that would prompt me to pay twice the price of a normal CD. If nothing else, however, the Ultradisc is an interesting novelty that might make a good gift.

DAT: Going Mobile

With digital audio tape decks being touted as a home recording medium on par with the sonic performance of compact discs, it is only a matter of time before car DAT players become available.

DAT for the car makes more sense, in fact, than compact discs.

With a disc 4¾ in. in diameter, an autosound compact disc player can only be so small. But a DAT cassette is half the size of a conventional analog cassette, so it is less likely that car DAT players will be adversely affected as dashboards become more shallow.

With DAT's small size, it might also be possible to make car players with built-in amplification and radio—the same as today's analog cassette/receivers. The compact disc's large size makes a separate amplifier a necessity, whether it be an independent unit or configured as a subchassis tied to the main unit. (The first autosound DAT players, though, will be offered as player-only devices.)

DAT's small size makes it destined for use in the car, but will the car unit be comparable to the home player? The



Clarion plans to offer this DAT for cars.

answer is yes. But just as there are some minor differences between home and car CD players, it seems there will be some minor differences between home and car DAT players.

Clarion, one of the world's largest car audio manufacturers, already is producing DAT players in Japan. The initial production run was just sent to car manufacturers in Europe, Asia and the U.S. as samples for review (the biggest part of Clarion's business is in supplying car radios to auto makers). But Clarion plans to offer car DAT players at retail too, with U.S. introduction expected to come in January. A tentative retail price for DAT model PA-5500A-A is \$1399, a

whopping figure that will probably drop as 1988 progresses.

Specifications obtained from Clarion for the PA-5500A-A show a variance with the published specifications for a typical home DAT player such as Sony's DTC-1000ES. While both players show a claimed dynamic range and signal-to-noise ratio of 92 dB, there are slight differences in the frequency response and distortion specifications.

Sony's home DAT player has a stated frequency response from 2 Hz to 22,000 Hz plus or minus ½ dB. The Clarion car player, by contrast, offers frequency response from 20 Hz to 20,000 Hz plus or minus 1 dB.

Sound above the 20,000 Hz level is generally recognized as being inaudible, and there isn't a home speaker (let alone a car speaker) that can reproduce sounds as low as 20 Hz. What these numbers do indicate is that autosound DAT's specs are favorably comparable to car CD players—and vastly superior to current car cassette/receivers. Present-day cassette/receivers average a frequency response from 40 Hz to 15,000 Hz in the tape department.

The second point of difference between home and car DAT is in the measurement of distortion. Sony's DTC-1000ES offers a total harmonic distortion (THD) figure of less than .005 percent while Clarion's PA-5500A-A car player weighs in at less than .05 percent. The lower the THD the better, but the difference here is purely a numerical one and should not produce an audible difference in performance.

Like a home DAT player, the Clarion car unit has two sampling frequencies, 44.1kHz for prerecorded digital tapes and 48kHz for homemade tapes. This dual-frequency system was instituted to prevent direct digital-to-digital copying. To make a tape of a CD on a home DAT recorder the signal must first pass through an analog conversion stage.

Clarion's PA-5500A-A does not have a sampling frequency of 32kHz, something included on some home DAT players, particularly the XD-Z1100 model introduced in Japan by JVC. This third sampling frequency is essentially a long-play mode which doubles the amount of recording and playback time to four from two hours. Frequency response at 32kHz is only 5 Hz to 14,500 Hz which limits its use to off-the-radio recording.

The car player does have the same fast-forward and rewind speed as a home deck—200 times faster than normal play speed. A 120-minute tape takes approximately 10 seconds to rewind.

In sum, we're going to have to wait a while before car DAT machines appear, but the wait will be worth the return. (The technical and legal aspects of DAT are covered in *Digital Audio Cassettes*, P. 106, and *Electronics*, P. 46.) **FM**

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."

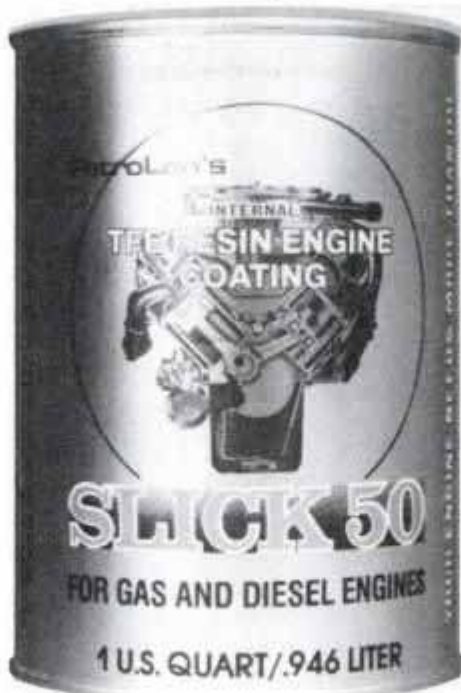
"Dune Buggies & Hot VWs" magazine April 1983 issue records the results of their one year testing of Slick 50. "We can indeed say scientifically that Slick 50 does work, and that it does reduce engine wear!... for the price of one treatment when compared to engine rebuild, we feel that you'd be money 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 7 (in California 1-800-233-9559) or send to: Progressive Energy Corporation, 255 South Bent Avenue, #B-1, Dept. PM787, 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 _____

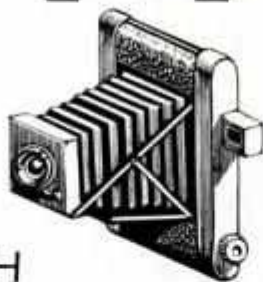
Address _____
(Give street address if possible for UPS delivery)

City _____ State _____ Zip _____

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Photography



BY STEPHEN A. BOOTH

Mobile Image-Makers

Summertime is open season for snapshotting. The temperate weather, and additional leisure time, combine to provide a wider variety of subjects and more photographic opportunities than any other time of year.

Summer's also the time when most of us prefer to dress and travel light. Whether you're daytripping to the beach, hiking a mountain trail, or clocking an evening of thrills at the amusement park, a full-dress pack of photo gear is probably the last thing you'll want to carry.

This column has often addressed the flexibility of conventional, single-lens-reflex 35mm cameras and their battery of interchangeable lenses to handle any photographic sit-

uation. We've also discussed the convenience, compact size and carefree operation of the point-and-shoot autofocus 35mm rangefinder. The latter is the ideal on-the-go imaging device, easily tucked into a beachbag, backpack or an especially spacious pocket.

Now you can have the best of both worlds, in the form of auto-everything rangefinders with variable-focal-length lenses built-in.

These supercompacts are advertised under a variety of aliases. Most often, they're dubbed bifocal, a.k.a. dual-lens autofocus cameras. What they offer, in most cases, is the ability to switch

from the normal lens to a telephoto, internally—without physically removing and installing a lens. Usually, the transformation is accomplished by manipulating a lever on the back of the camera. Sometimes, you have to rotate the lens turret itself. In either case, the business end of the lens changes perspective instantly, enabling you to zoom from a group shot to a tightly cropped closeup.

basic features shared by bifocals yet bring some extra surprises to the party.

Most bifocals offer you a choice between a semi-wide-angle 35 or 40mm lens (in the normal mode) and a 70mm moderate telephoto. In fact,



Pentax IQZoom (above) and Canon Sure Shot Tele zoom from normal to close-up telephoto.



40mm and 70mm is exactly the either/or focal range you get in the Canon.

Bifocals are now offered by just about every major camera manufacturer. The two I've been working out with, the Pentax IQZoom and Canon's Sure Shot Tele, offer all the

The Pentax IQZoom is a bit more flexible, as connoted by its name. By a neat application of electromechanical engineering, the powered lens of the IQZoom can be set to any focal length you desire between 35 and 70mm. You simply press the power zoom switch until the subject is cropped the way you wish it to be.

To assist you in this composition, the viewfinder optics follow the lens adjustment millimeter-for-millimeter. This means that what you see is exactly what you'll get. As the lens and viewfinder zoom, so does the built-in flash. Meanwhile, your subject remains consistently focused by the infrared autofocus sensor.

The viewfinder optics of Canon's Sure Shot Tele also change when you slide the 40mm to 70mm switch on the back of the camera. Though it is limited to either/or focal lengths, the Canon compact offers two built-in features for

(Please turn to page 43)

PM Photo Album—Tips For Better Pictures

Autofocusing point-and-shoot cameras make everyday photography simple. But there are occasions when some control over the autofocus function is desirable.

For example, when shooting through glass, water or fog, the camera's infrared autofocus sensor will reflect off the transparent surface rather than home-in on the object behind it that you're trying to shoot. The result is a perfectly focused image of, say, your windshield, rather than the scenery beyond it. Water and even fog have the same reflective effect.

Some autofocus cameras have a focus-lock feature. This lets you focus on a reference subject, then holds the reading until you recompose the actual shot and press the shutter release. If your camera lacks this feature, or if there's no way for you to prefocus, just cover the autofocus sensors as shown here (top left). The camera's focus system will default to infinity and let you shoot right through glass (bottom left).—Armand Ensanian



There's no other truck like it.



The Mid-Sized Dodge Dakota.

With full-sized ability and compact agility, Dodge Dakota is in a class by itself. Ready to haul with available V-6 power, eight-foot bed and 2,550 lb. payload. The rival of some full-sized Ford and Chevy pickups. And the envy of every compact around. What's more, when you choose Dakota as your pickup, you get plenty of choice. From a no-nonsense Dakota S at only \$6,590,* to the dressed-up and ready-for-Saturday-night Dakota LE shown above. Still, only \$9,769.† So buy or lease a new mid-sized Dodge Dakota. It's a singular sensation.

*List prices exclude tax & destination charge.

†Best Built* based on survey of owner problems with '86 light trucks designed & built in No. America & sold Oct.-Nov. '85 (5 mos. avg. usage). See 7/70 powertrain & 7/100 outer body rust thru limited warranty at dealer. Restrictions apply.



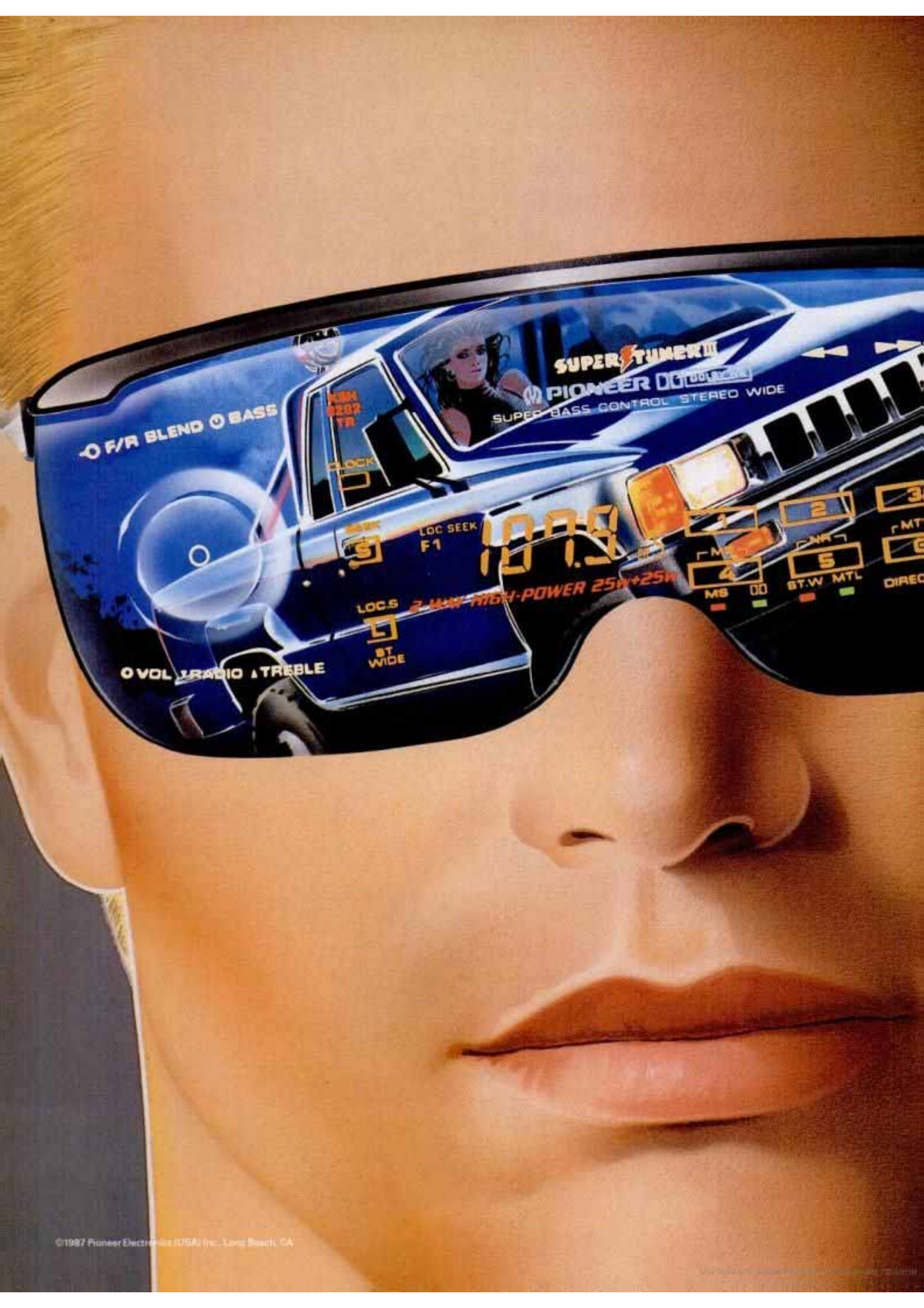
Dodge

7/70

DIVISION OF CHRYSLER MOTORS

THE BEST BUILT, BEST BACKED AMERICAN TRUCKS ARE RAM TOUGH!†

BUCKLE UP FOR SAFETY.



F/R BLEND BASS

SUPER TUNER III

PIONEER

SUPER BASS CONTROL STEREO WIDE

KRM
6202
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LOCK

SEEK

LOC SEEK
F1

107.9

LOC.S

2 x 15W HIGH-POWER 25W+25W

ST
WIDE

4

MS 00

2

5

ST.W MTL

3

MT

DIRECT

VOL RADIO TREBLE

The World's First Truck Stereo Kicks Bass.

Introducing Pioneer's Truck Riders™. The first audio systems designed exclusively for trucks. Understand, this isn't a car stereo attached to a pair of car speakers. This is a complete truck sound system designed to work as one.

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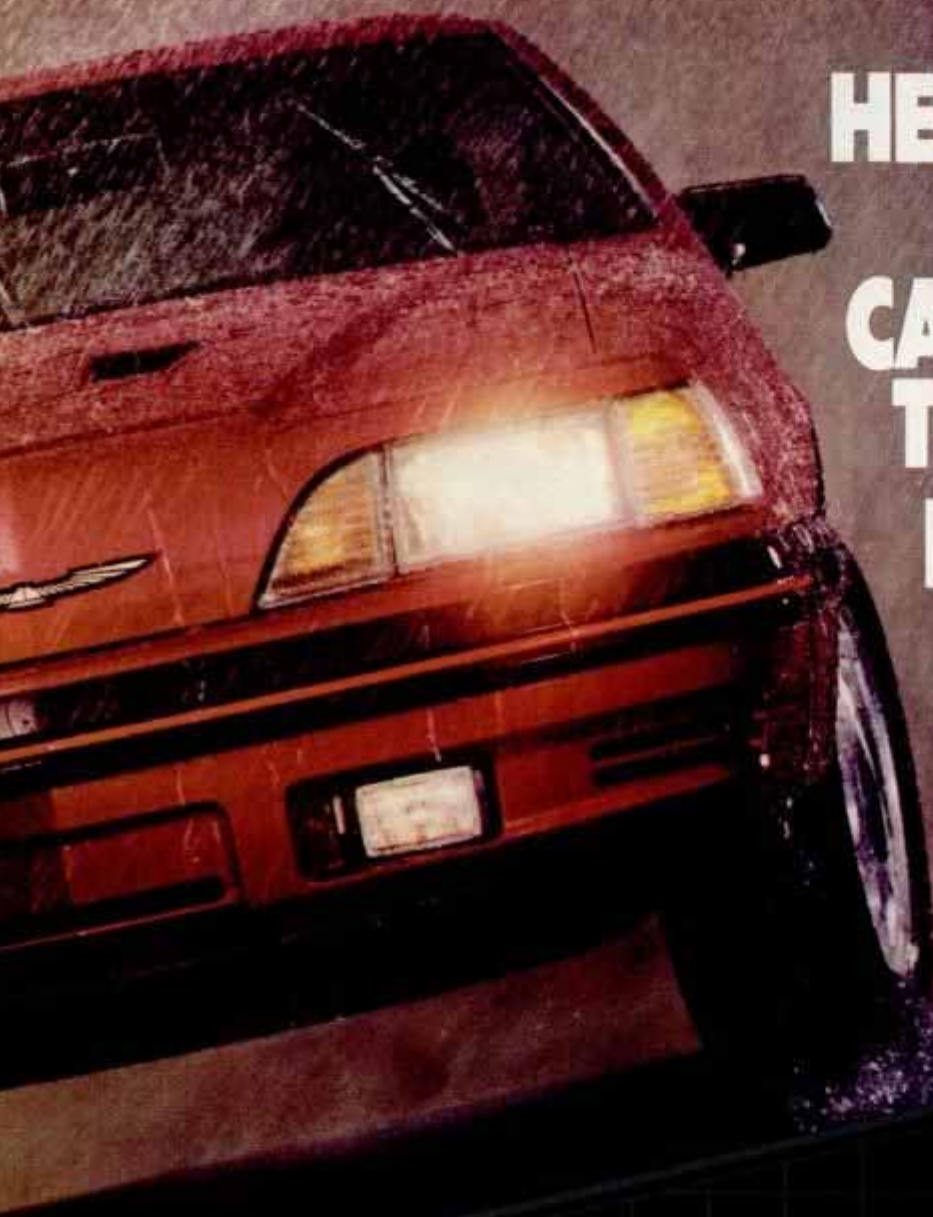
TS-TRX5 Truck Speakers



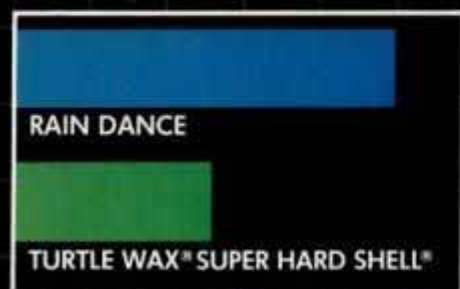
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So if you want the longest-lasting car wax, get Rain Dance. The wax that polished off the competition. © Borden Inc 1987



RAIN DANCE. INTENSIVE CARE FOR YOUR CAR.

PHOTOGRAPHY

(Continued from page 38)

creative photography. One is a soft filter that drops in front of the lens at the touch of a button, to lend a dreamy quality to portraits or landscapes. The other creative feature is the ability to make multiple exposures on the same frame of film. In fact, the Sure Shot Tele comes with a lens-mounted adapter for making trick special-effect multi-exposures.

Both cameras offer the usual complement of automatic-exposure and film-handling features. The Pentax focuses down to 2 ft.; the Canon to 3 ft. Additionally, each is available in a data-back version that imprints date and time information on the exposure. The Pentax IQZoom and Canon Sure Shot Tele list for about \$350. Add \$35, respectively, for the data-back versions.

Summertime Clues

As long as we're on the subject of summertime photography, here's a potpourri



Trek-50 is moisture and debris resistant.

of tips for film and camera handling.

■ Airport security regulations require you to submit your carry-on bags for X-ray inspection. And increasingly, even luggage stowed in the hold is subjected to X-ray examination.

X-rays can affect film adversely—whether it's unused or already exposed. According to the National Association of Photographic Manufacturers, the low-dosage X-ray machines used in the U.S. will let films of ASA/ISO 400 and below pass through five times before visibly affecting them. Fast films with higher ISO numbers stand a greater risk, and should never be exposed to X-rays. The machines used overseas can administer higher dosages.

Why take chances with your valued pictures? In the U.S., you have the right to request hand-inspection of your baggage. Simply remove your camera and film from the bag and hand them to the security guard.

Security at most overseas airports will also accommodate this request—if you can communicate it. You might have to insist over the guards' assurances that the X-ray machine is "film-safe."

Some countries do not permit any hand-inspection. In this case, protect your pictures by enclosing the film in one of the

many lead-foil bags sold for this purpose. Make sure your foil bag hasn't sprouted leaks caused by overuse or age. Even a pinhole fault will admit X-rays.

■ Heat, humidity, water and debris can foul your film and camera, too. Excessive heat can cause LCD displays to go blank and electronic microprocessors to go goofy. Internal lubricants might soften and run to places they don't belong. As for film, high heat and humidity can alter the chemistry of the photosensitive emulsion, resulting in fogging and color imbalances. Trouble is, you won't know until after the film is processed.

Cool is the rule. Don't leave your photo gear in direct sun or in enclosed spaces (such as cars) where the mercury's likely to rise above a comfortable room temperature. If you've got a beverage cooler on hand, sacrifice some brew capacity for camera and film protected in polybags. When you shift the package from cold storage to the heat, leave the gear in the bag a while so that any condensation forms on the bag instead of its contents. No cooler? Keep the photo paraphernalia in shade or covered under light colored, heat-reflecting material.

The damaging effects of water, sand and dust are pretty obvious. If you expect to take your camera along for bodysurfing or mud-wrestling, get one of the readily available moisture- and debris-resistant cameras such as Vivitar's Trek-50.

New And Noteworthy

Two new SLR cameras have joined the exclusive autofocus fraternity. They are Yashica's 230AF and the Pentax SF1. Notably, they share a built-in flash. Stay tuned for a hands-on report. **PM**



Built-in flash is an added convenience of the Yashica 230AF (above) and Pentax SF1.



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These courses are offered by ICS and North American Correspondence Schools.

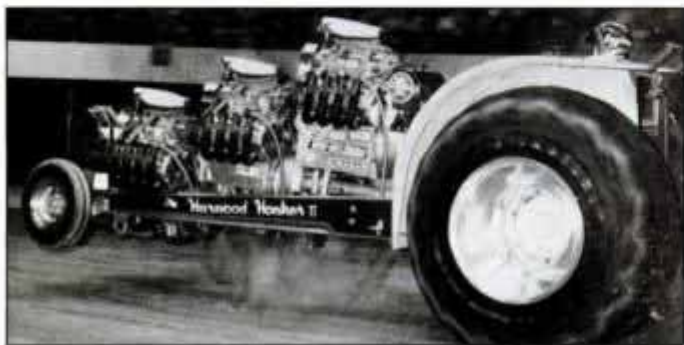
NAME _____ AGE _____
STREET _____ APT. _____
CITY/STATE/ZIP _____

Motorsports



BY NORMAN
MAYERSOHN

Pull Right Up, Please



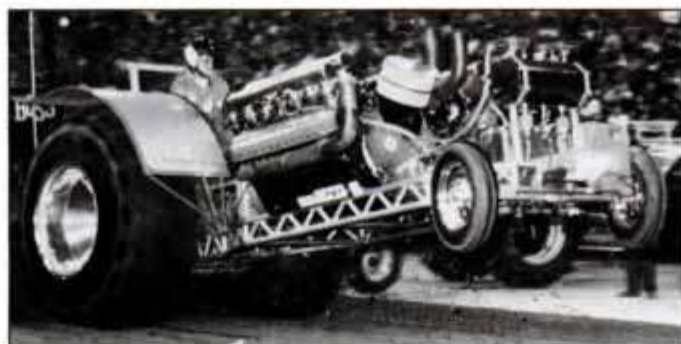
Trio of blown Hemis in staircase layout equals 4500 hp.

If you look no deeper than the freak show spectacle of it all, tractor pulling would seem the most ludicrous of motorsports. Just consider the numbers: \$150,000 machines with up to six engines and 8000 hp or more, dragging a 70,000-pound sled down a dirt track.

Certainly there must be more than meets the eye in order to pack a sports arena with fans for an evening of mud-slinging, engine-roaring entertainment.

There's lots more—a mechanical wonderland, in fact. What makes the machinery so interesting is its specialization. Just one tractor is on the course at any time, and its true competition is a dead-weight sled. It's more like the Olympic pole vault than any other motorsport—each puller is trying to exceed a measured mark rather than defeat the competition in a side-by-side matchup.

While other racers abide by the maxim "there's no substitute for cubic inches," tractor pullers pass on the tedious standbys of increas-



A pair of aircraft Allison V12s provide 3000 hp of pull.

ing bore and stroke by simply multiplying the number of powerplants. Currently, the top bracket (11,200-pound class) is limited to a maximum of six engines for outdoor events, or three powerplants for indoor meets like the Red Man Chewing Tobacco/TNT All-American Pulling Series, a show we took in at Long Island's Nassau Coliseum.

The multi-engine tractors are built on custom rectangular tube framework with engine mounts that allow drivers to choose the number of engines for the weight class and course location they'll be running. Engines are linked either by a direct crankshaft

coupler, nose to tail, or through a specially built gear-case that positions them side-by-side or in a terraced "staircase" layout. A purpose-built, twin-countershaft transmission offers the choice of three gear ratios, though there's no shifting of gears once a tractor pull has started.

Drag-racing style centrifugal clutches enable smooth launches, and a Rockwell rear axle out of an 18-wheeler is modified with an additional Caterpillar bulldozer planetary reduction gear-

set to help move the weight.

Engine choices in the top classes range from the latest dragster setups of Arias-Root 604-cu.-in. Hemis, complete with GMC 12-71 superchargers, to World War II surplus Allison V12 aircraft powerplants. A mix-and-match attitude is perfectly acceptable—Allison devotee Hale Woodward, for example, will be adding two 427 Chevrolets to his tractor, just for "something different." Engine location itself is a topic of much discussion, since the motor mass can act as



Two-wheel-drive trucks go wheels up when hitched to weight sled.

movable ballast, and at least one competitor has chosen a sideways-mounting scheme in an attempt to control torque reaction.

Pulling is a long way from the Indianapolis 500, but for the hard-core motorsports fan it's terrific entertainment with a great advantage: Pulls run nearly every weekend of the year, if not locally, then on cable television. **PM**

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The International Camaro Club will also be on hand to celebrate that model's 20th birthday at the Camaro Street National East. Camaro fans will see a Camaro-only car show, swap meet and Camaro Corral at the race track.

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tions of the light spectrum that have been proven to be harmful to your eyes. By filtering out these dangerous rays, not only are your eyes protected from damage, but your vision is enhanced to a new level of perceptual eyesight!

A New World Through New Eyes

Just imagine what it would be like to look through glasses that make the world seem sharper, more vibrant, more alive and more cheerful. Slip on a pair of these sleek designer sunglass "look alikes" and you'll notice a marked improvement in your vision. Everything will appear sharper and more defined. Objects will take on an enhanced three dimensional (3-D) effect. This vision enhancement experience is so incredibly phenomenal that it has been widely publicized by others as a "Vision Breakthrough". You literally "won't believe your eyes!" Thousands of professional golfers, hunters, and skiers have already discovered and reaped the benefits of these indispensable Super-Glasses — now you too can experience the excitement of ENHANCED EYESIGHT!

Sunglass Danger?

The unbelievable truth is that ORDINARY sunglasses may be dangerous to your eyes. When you put on sunglasses, although you reduce the amount of light that enters your eyes, your pupils open wider (just like the aperture on an automatic camera) and actually allow more of the dangerous ultraviolet rays into your eyes.

These "Super-Glasses" are especially designed to shield out overhead light. Doctors will tell you that the CR-39 lens used in

these glasses are one of the finest materials available for glasses and is manufactured under license. The lightweight frames are designed for ultra comfortable wear and tear and the molded nose rest will fit any size nose. The hinge design of these frames allows them to be the perfect "one size fits all" eyeglasses. Each pair comes complete with a padded carrying case and an anti-scratch coating. No wonder these are the most popular and fastest selling sunglasses ever sold by this giant new home shopping club!

These Ambervision™ Super-Glasses will not be sold to any wholesalers, dealers, or retailers at this price. They are only available through this special publicity campaign for a limited time. There is a limit of two (2) pairs per address at this price, but requests that are mailed early enough (before July 20), may request up to five. Each pair of Super-Glasses is covered by a full one year money back guarantee.

TO ORDER, mail this original publicity ad (no copies or photostats) together with your name and address and \$10 for each pair. Add only \$3 for FIRST PRIORITY shipping, handling and insurance no matter how many pairs you are requesting. MC & Visa users please supply Account No., Expiration Date and Signature. (State sales tax included in price). Allow up to 60 days for shipment. Mail to:

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Electronics



BY STEPHEN A. BOOTH

Enemies Of Promise

In case you haven't already noticed, this month's issue contains our exclusive hands-on test of the new digital audio tape (DAT) format recently introduced in Japan. That test report might be as close as you'll ever get to a DAT recorder, if the corporate entities collectively known as the music industry have their way.

DAT, within the confines of its tiny cassette shell, has the potential for the same high-quality sound you'll hear from digital audio compact discs.



The digital audio tape recorder might be an endangered species.

Unlike CDs, the DAT format permits recording, either commercially or in the home. It's the home-recording aspect of DAT that the music industry objects to. Consequently, that industry has lobbied Congress for restrictions on DAT. Some of these restrictions are included in proposed legislation now before our elected representatives.

Though the immediate and apparent target of the music industry's lobbying is DAT, I'm probably not alone in suspecting that the ultimate goal is to restrict (or even prohibit) private home taping of any kind, including video. DAT, because it is new technology and highly publicized at that, appears merely to be a convenient vehicle for a renewed attack on home recording of copyrighted works.

There is much that I and others find objectionable in the music industry's campaign. Its very premise—the alleged loss of revenues—is questionable. But whatever be the rights and wrongs of home taping, banning or crippling a new technology isn't the solution. It's a narrow-minded action that would deprive us of the benefits and promise of digital audio. I even think it's shortsighted from the point of view of the music industry's own self-interest.

In seeking restrictions on DAT, the music industry has endowed it with the nonexistent ability to make perfect digital clones of the compact disc. The music industry argues that given this ability, people will stop buying CDs. Instead, they'll buy DAT machines, and either borrow CDs from friends or cage DAT copies of the discs.

To prevent this swapping and borrowing, the music industry has proposed a ban on the importation of DAT decks that lack a built-in, anticopying device developed by CBS. This chip would prevent the machine from recording any specially encoded CD (and presumably LP, cassette or radio broad-

(Please turn to page 48)

Magic Wand

Remote control, wireless or otherwise, used to be a premium feature found only in top-of-the-line electronic entertainment products. Nowadays, it's hard to find a VCR or TV set that doesn't come with a remote control handset of the wireless infrared variety. Besides video products, just about every compact disc player sold comes with a remote.

So do many hi-fi receivers and rack-mounted audio component systems.

When you begin amassing more than one remote-control component, you begin to realize that this electronic solution to one problem (inconvenience) has engendered yet another one. Your coffee table now is cluttered with a variety of remote controls. You have to select the right one—possibly in semi-darkness—to control the component in use. Furthermore, you have to refamiliarize yourself with the placement of the functions on that particular controller so that you don't shut your VCR off when you merely want to advance the tape.

Electronics manufacturers have attempted to solve the problem of redundant remotes in two ways.

Some companies sell their products with a remote control that will operate their other remote-control products. This is a step in the right direction—but it limits your selection to products of a single brand. Other companies sell, for example, a TV whose remote will control VCRs of any brand. This gives you more flexibility, but you're still limited to controlling only two components.

Yet another solution has been the so-called universal remote control. This clever bit of engineering, first introduced in General Electric's Command Central remotes, can learn the operating codes of virtually any component that uses infrared control.

The Command Central can operate up to four components—a reasonable number.

Its limiting factor is the number of functions it can perform. For the most part, it issues only basic commands such as power, channel selection, stop-start-and-pause, and audio volume. It won't let you control the track selection on a CD player, for example, or let you alter the bass, treble or left/right stereo balance of your hi-fi system.

Now, the infrared remote controller that will do all those things and more is available from hi-fi manufacturer Onkyo, of Ramsey, New Jersey.

The model RC-AVI Unifier (about \$120) can learn the code of virtually any infrared remote-control device. Moreover, it can duplicate and operate the functions of the related component. In all, more than 100 different functions can be stored in the Unifier's microprocessor memory. The Unifier is simply placed head-to-head with the original remote to learn its codes and functions.

Besides operating audio and video gear, the Unifier has an Auxiliary mode that can handle any infrared-controlled product—including home security systems. It runs on four AAA batteries.



Unifier remote by Onkyo operates any audio/video unit.



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OTHER OPTIONS: Comanche already has a lot going for it. And there's a long list of available equipment that includes a responsive new 4-speed automatic transmission with overdrive.

Check out the new SportTruck and all the other Comanche pickups. It's the kind of truck just about anybody can afford. But it's also the kind of truck only Jeep can build.

MSRP. Manufacturer's suggested retail price. Title, taxes and destination charges, and options are extra. Price may change without notice. Safety belts save lives.



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ELECTRONICS

(Continued from page 46)

cast). The so-called encoding that triggers the chip is actually a notch of music in the high-frequency 3715-Hz to 3965-Hz range that is removed from the performance momentarily.

The chip's proponents claim that the encoding scheme doesn't distort or adversely affect the music during normal playback. Opponents strongly disagree, pointing out that the 3715- to 3965-Hz bandwidth is well within the range of hearing and that its removal audibly distorts the music.

To my thinking, the music industry's contention that DAT makes perfect CD clones is either misinformed, or intentionally exaggerated. Our firsthand experience with a DAT recorder demonstrates that the machine isn't the bogyman the music industry alleges it to be. You can read exactly what the decks can and can't do, described in our story titled *Digital Audio Cassettes* starting on page 106.

As for the CBS-developed anticopy system, it seems unworkable—and it's certainly unnecessary.

The affected bandwidth is certainly within the audible range, and besides the momentary loss of sound, any alteration in this band is likely to affect stereo imaging—the direction from which we perceive the sounds to come.

If the notch system is implemented, it would impose inferior music recordings on anyone who buys a CD or LP, not just the folks trying to record one onto a DAT recorder.

Why isn't the CBS anticopy system necessary? Because as our feature article points out, DAT players already have a built-in "copy prohibit" system that prevents the machine from making a digital recording of any CD (or future prerecorded DAT cassette) that has an anticopy code. Most CDs sold today already have this nonavailable code.

Technical reasons aside, I'm also skeptical of the music industry's contention that DAT's introduction will prompt widespread source-swapping and copying. It just doesn't make financial sense.

DAT isn't cheap. In Japan, the decks cost about \$1300 and the cassettes about \$13. They'll cost more when they get here—but let's assume for a moment that the prices drop by half in a year's time.

I can't see why a person—or an overwhelming number of persons—would pay \$650 for a DAT deck and \$6.50 for a blank cassette when one could buy a CD player for less than \$200 and CDs probably at \$10 a pop next year. You'd still have to get a CD player and CDs to copy on the DAT deck. And the copy you'd get won't be a digital-to-digital transfer. The need to go through

an analog stage on current machines prevents that.

For anyone looking to obtain the maximum benefit from DAT, we're looking at an expensive proposition. Copying a CD onto the DAT format only makes sense if the tape copy is to be used in a DAT car player (or possibly in a future DAT headphone portable). I can't imagine why anyone would make a DAT copy of a CD to listen to at home, when that person could listen to the original, all-digital CD.

To outfit your car for DAT, you're looking at a retail ticket of about \$1300. The home deck needed to make the copies cost as much—and you'd still need a CD player and CDs to copy from. I find it hard to believe that many people willing or able to go to such expense will try to save a few bucks by copying someone else's CDs. As for using DAT to copy LPs, cassettes or broadcasts—why bother? Existing, inexpensive analog recorders already do the job.

Prospective owners of DAT hardware wouldn't have to copy CDs at all—or want to—if music companies were to sell prerecorded DAT cassettes just the way they sell CDs.

At this writing, no prerecorded DAT is available at retail, and no major music label has expressed an interest in selling the format. Theoretically, a prerecorded DAT cassette made from the same digital master as a CD should sound just as good as a CD—some folks say better. Before our test report on DAT went to print, we were unable to acquire any digitally mastered (at 44.1kHz) DAT tapes. Soon afterward, we did get such an opportunity. The prerecorded tape sounded as good as any CD I've ever heard. It's for this reason that I suggested, earlier, that the music industry's antipathy to DAT might work against its own self-interest.

DAT players for the car are already being made in sample production runs. Walkman-type DAT portables are on the drawing boards. DAT, because of its size and immunity to vibration and shock, is a more sensible format for mobile use than CD. For many years, the music industry took a lackadaisical attitude toward prerecorded analog cassettes. Then the Walkman boom woke up the music giants. Cassettes today far outsell LP records. Had high-quality, reasonably priced, prerecorded cassettes been readily available soon after the first car players and headphone portables arrived, there probably would be less home recording (from LP or other sources) today.

When the music industry bellyaches about lost revenue, I have to ask the question: Who lost it? If you want to save DAT, tell your representatives that you're opposed to Senate bill S.506 and House bill HR-1384. **FM**

Inside Detroit

BY JIM DUNNE



Tracker Tracked Down



A PM reader spotted these two Suzuki/Chevy Tracker 4x4s on test in North Dakota. He said their interiors looked "quite roomy."

Suzuki will build a small sports/utility vehicle for Chevrolet called the Tracker 4x4 next year. Tracker will be bigger than the tiny Samurai that Suzuki now builds, but smaller than the S-10 Blazer. "It will be bigger and higher priced than Samurai," confides one Suzuki source. "It will also be more car-like inside and in its ride." That sounds like GM all right.

The Tracker will be built in a new plant in Canada. Suzuki is aiming at first production in July of next year. Shortly after Chevy introduces the Tracker, Suzuki will offer its own version, as an addition to the Samurai line.

Bye To Burnouts

Ever get your car stuck in a slippery place where the wheels just spin and the car

doesn't move? It's a common occurrence on icy or muddy roads, and a headache for drivers who get stuck. Sometimes

only a tow truck will get them out. But that problem may be solved if traction control works out.

Auto engineers want to stop that spinning, let you pull right out of the mud. They are developing traction control systems for low-price cars of the 1990s that prevents useless spinning of the wheels. What happens is that sensors in the wheels detect a spin and signal the engine to slow down, so the wheels can get a grip. As the tires slow down and dig in, more power is allowed from the engine.

Then, you can accelerate again without spinning your wheels. As for burnouts—the spinning of tires on high-powered cars that photographers love so much—they will stop too.

What makes traction control so easy to put on cars is the same thing that made antilock brakes possible. Sensors that watch the speed of the wheels turning, or not turning, are the key to both systems. Traction control uses the same sensors.

With antilock in place on many cars, it is a relatively simple matter to include traction control. The essential sensors and computers are already on board and just need to be reprogrammed.

Hot Bonneville

Pontiac will change the Bonneville just as it did the 6000 model—that is, make a special version that will offer many of the features you get on sporty sedans. In this case, it's called the Bonneville SSE, a stablemate of the STE. Features on prototypes under test at GM's proving grounds include aero flanges along the bottom of the body sheetmetal, gold-tone finish to wheels and parts of the grille, a spoiler atop the trunk, and what may be a lightweight plastic hood. Features you can't see on the high-performance SSE are a firmer ride, faster steering, all-wheel antilock brakes and probably an all-leather interior.

Fiero Cool Down

After a torrid first three years, Fiero sales have cooled off to a level that is more in line with predictions of the car's popularity. The tiny 2-seater has fallen from an annual sales rate of almost 100,000 to 71,000 last year. This year, it may drop all the way down to the 40,000 sales-rate level.

Reasons for the slide: more competition from CRX, EXP and MR2, plus the natural fall-off of interest from buyers who want the latest things.

Pontiac is fighting back with changes in the Fiero content, and the company already has a new model in the works for 1989. More powerful V6 engines, a better ride, a slicker manual transmission and the availability of air conditioning and automatic transmissions on the cheapest models are content changes. Also, incentives up to \$1200 are being rebated on some models.

Quad Four

Olds' new 2.3-liter Four will be shared with other GM divisions in several strengths. Top-performance version will be a turbocharged, 4-valve design for elite models like the Toronado. A premium motor for the Cutlass, Regal and GP will produce 180 hp without the turbo.

Standard dohc version will make 150 hp for compact cars like the Grand Am. A single-cam version will get the nod for the upcoming Saturn line.

Mazda Mustang

Early next year Mazda will begin production at its new Flat Rock Michigan plant of the so-called Mustang IV, a front-drive sporty car based on the Mazda 626 chassis. Early samples of prototypes of

(Please turn to page 52)



Bonneville SSE sports a plastic hood.

INSIDE DETROIT

(Continued from page 51)

the car have already arrived at Dearborn where Ford is installing its own 2.3- and 2.5-liter 4-cylinder engines.

While Ford and Mazda are secretive about details of the car, some facts are known. The body will be a fastback design with 2-plus-2 seating. Rear-seat passenger room will be tight, even tighter than that of the current Mustang. Tires are Goodyear 15-in. Eagle Plus-4 all-season high-performance models.

This does not mean the end of the current Mustang. Ford plans to continue to build the Mustang GT with its V8 engine and rear-wheel drive into the 1990s as a separate model from the Mazda design.

King Corvette

Still striving for "King of the Hill" recognition among the world's sports cars, Corvette engineers are developing the King Corvette, the quickest, most advanced car Chevrolet has ever produced. The car is being developed in Europe and Detroit with an introduction date set for after 1989. Among its outstanding features are an advanced, no-spring, active suspension developed in conjunction with Lotus, a 6-speed ZF transmission and a superpowerful 4-cam, 32-valve, V8 engine, also

tweaked by Lotus. Displacement is said to remain at 5.7 liters, with as much as 400 hp rumored. Chevy expects that its Corvette will be able to challenge and whip marques like Lamborghini, Porsche and Ferrari.

More Cush For Allante

Cadillac will have a variable suspension system for Allante within a year, if current development targets are met. I spotted a test Allante outside GM's proving grounds in Arizona that was working on the new system. It had a tiny control panel, about the size of a hand calculator, mounted on the center console. On its face were buttons for SPORT, NORMAL, COMFORT and for BRAKE, SPEED.

The three ride settings are easy to understand. But the other two, BRAKE and SPEED, indicate that the system is being set up to make the shock setting firm when brakes are applied or when a certain speed is reached. Not much new here. Imports and Ford have had ride control for a few years now on models that cost far less than the \$50,000-plus Allante. What is new is that Cadillac is planning to add even more goodies for its newest flagship.

Fancy Survey

Leave it to the imports to do things the direct way, without a bunch of commit-

tees and written reports to muck up the system. When Honda wanted to design the trunk on a new model, a market survey was set up to find out just how Americans use their car trunks.

The survey team, all Honda employees, went to Disneyland to gather its information. There—in the parking lots, not at the park—the team watched what kinds of cars Americans were driving, what they put in the trunks and what they unloaded. That information formed a guideline for designing and marketing the trunk of a new car.

It was as simple as that.

Sonic Blasting

Buick will use high technology to assure the water tightness of the Reatta sporty car it plans to introduce early next year. According to Buick, "amplifiers inside the car (on the assembly line) bombard the vehicle with sonic energy." Measurements of energy taken outside the car indicate where the leaks are, if any exist. Reatta will be built under a new version of an old assembly line idea. Cars will stop at each work station in "hiccup" fashion instead of moving past the worker at a steady pace. That never stopping "black devil chain" that runs at every other U.S. assembly line will not be a problem with Reatta builders, who will not have to work on a moving target. **PM**

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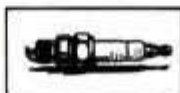
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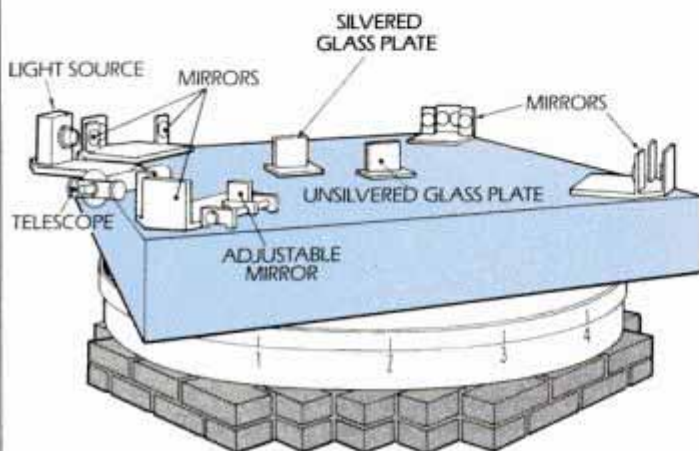


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BY TIM COLE

Physics Centennial



Michelson-Morley experiment used this equipment to split and recombine a beam of light to prove 19th century theories.

Scientists at Case Western Reserve University are arguing that the current era of modern physical science actually began in a Cleveland laboratory 100 years ago. In 1887, the team of Albert A. Michelson and Edward W. Morley set out to prove that the speed of light can be affected by the Earth's passage through space. Instead, the team determined with great precision that light speed is unaffected by the movement of the Earth, debunking 19th century notions of absolute time and paving the way for Einstein's Theory of Relativity. Fittingly, the Michelson-Morley experiment began with the splitting and recombining of beams of light, an exercise that illuminated not just the fundamental laws of nature, but lighted a path for future generations of scientists



around the world.

Academicians at Case Western Reserve, where the Michelson-Morley experiment was conducted, say the work not only led to the development of modern physics—which in turn resulted in such contemporary disciplines as nuclear engineering, solid-state electronics and magnetic resonance imaging—but also resulted in profound changes in philosophy and the arts. By overturning popular theories of the universe, the Michelson-Morley experiment seemed to sanction a spirit of inquiry that transcended science and touched the broad spectrum of cultural and political life.

According to Philip Taylor, professor of physics at CWRU and originator of the

Michelson-Morley Centennial, the experiment was confusing to the scientific community at the time because the results were exactly opposite from what the experiment was designed to prove. Nineteenth century physicists were convinced that light was a wave phenomenon that traveled through a medium known as ether, which filled all of space. It was thought that the speed of light would change with changes in this medium, much the same way a boat's speed is affected by changes in the speed and direction of a river's current. It was assumed that the Earth's orbit around the sun disturbed the omnipresent ether, affecting light in much the same way.

Michelson, a physicist, and Morley, a chemist, set out to prove the theory by building an interferometer—an instrument (see illustration) that makes precise measurements by means of the interference of light-wave patterns. They split a single beam of light into two beams that traveled at right angles to each other. The beams were reflected back and forth through a series of mirrors for a precise distance of 36 ft. and then recombined to be visible through an eyepiece.

It was expected that the light would travel at different speeds and reach an observer at different times. The research team also knew that the recombined beams would produce bright and dark bands called interference fringes; bright bands were areas where light arrived in phase, dark fringes where light arrived out of phase. If the divided beams were traveling at different speeds in different directions—and if the beams were influenced by ether—they expected to see shifts in these interference fringes.

The pair could see no such shifts, even when the interferometer was rotated. The discovery raised sobering questions about the absolute nature of time and led to the Theory of Relativity, which states that all motion must be defined relative to the ob-

server's frame of reference.

Pondering the Michelson-Morley achievement is interesting and valuable as this century ends and another begins. A hundred years from now we may be commemorating scientists who have discovered the essential particle of matter, an event that may be realized soon when the Superconducting Super Collider comes on line.

Super Collider Site Selection

It will be the biggest particle accelerator on Earth, capable of speeding protons close to the speed of light before they collide and release the energy of 40 trillion electron volts. Dubbed the Superconducting Super Collider, this mammoth machine will yield new insight into the fundamental particles of nature. Where to place this huge scientific experiment—estimated cost \$4.5 billion—is currently under study by the Department of Energy. The DOE deadline for site advocates is early August, and states, counties and municipalities are lining up to offer free land—as mandated by the federal government—in exchange for the tremendous economic energy the Super Collider is expected to generate. Watch for updates on America's quest to lead the world in this important area of particle physics research—along with a major look at how the Super Collider may change our lives.

Space Station Will Be Revamped

The final configuration for America's planned Space Station is still up in the air. The cost of the original dual-keel version was expected to approach \$15 billion, up from NASA's original \$8 billion estimate of just 12 months ago. But Reagan Administration officials recently reached an accord that would allow NASA to proceed with the first phase of the Space Station, a scaled-back \$12.2 billion manned orbiting platform consisting of a main truss,

(Please turn to page 58)

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SCIENCE

(Continued from page 56)

four 45-ft.-long pressurized modules, and a solar-array power system. Phase two would include upper- and lower-station booms, a servicing facility and a co-orbiting platform for undisturbed processing of materials in microgravity. The 2-step Space Station design comes amid at least one call from the scientific community for an early lofting of a single, large module with numerous docking ports.

Scientist Peter Banks, chairman of NASA's Task Force on the Scientific Uses of Space Station, cites a critical need for early deployment of a less expensive Space Station that will not sacrifice funding for other scientific work. NASA officials say America will be disserved with an outdated station design that could perform little more than the Soviet Union is achieving now with Mir, their own orbiting platform.

The dissension and foot-dragging is one more unfortunate byproduct from the Challenger catastrophe 18 months ago. To make matters worse, the next shuttle launch will probably be pushed back from February 1988, to August or September 1988.

Indeed, knowledgeable observers now allude to America's "launch crisis," particularly in view of the April loss of a communications satellite aboard an Atlas/Centaur rocket that lifted off in a lightning storm. NASA insists the launch was ordered under proper weather criteria, a notion that has been scoffed at by aerospace professionals.

The McDonnell Douglas Medium Lift Vehicle (based on the venerable Delta expendable launcher) and NASA's forthcoming design for a Heavy Lift Vehicle will go a long way toward re-establishing America as a space power. But the prospect looms of having the U.S. rely on other national space agencies to launch critical navigation, weather and military payloads. Numerous Navstar and Landsat satellites are waiting to be launched, and the military's KH-11 (and supersecret KH-12) reconnaissance satellites need to be augmented as soon as possible.

So, under the unfortunate possibility that the United States must go shopping for launch services, what's available on the open market? Of course, the European Space Agency has enjoyed significant success with the Ariane system, and the Japanese are making real strides with their launch vehicles. But don't discount The People's Republic of China, which will soon market the Chang Zheng 3, Long March 1 and Long March 2 rockets. The Soviet Union is also making overtures to firms seeking launch platforms for satellites.

And you thought the race for space

ended when Neil Armstrong strolled the lunar surface in 1969.

More Embassy Woes

The National Bureau of Standards, the arm of the U.S. Department of Commerce that monitors and measures various types of industrial materials and designs, recently concluded that Soviet eavesdropping devices aren't all we have to worry about with our embassy in Moscow. NBS reports the building has "important structural deficiencies" outside the bugs embedded in the building's beams, including poor joints in reinforced concrete columns and walls that lack sufficient strength because of hollows—they aren't completely filled with concrete.

NBS investigators also found cracks in a rooftop parapet and recommended measures be taken against "progressive collapse," which occurs when the failure of a single supporting structure leads to a wider failure. The NBS team concluded that remedial measures would cost \$1.5 million but would not entail major reconstruction—if the building were located in Washington, D.C. There's no telling how the U.S. State Department intends to handle this threat to the safety of our personnel.

Mapping The Sea Floor

President Reagan established America's Exclusive Economic Zone (EEZ) in 1983, giving the U.S. jurisdiction over seabed resources extending 200 miles offshore. The EEZ encompasses more than 3.4 million square miles and effectively doubles the target area for future retrieval of energy and mineral resources. The Department of Interior's U.S. Geological Survey recently started surveying this huge area using the GLORIA (Geological Long Range Inclined Asdic) side-scanning sonar system, discovering important new features of the sea bottom adjacent to our shores.

Installed aboard the British research vessel Farnella, GLORIA is capable of scanning a swath 60 kilometers wide, covering up to 20,000 square kilometers a day at a speed of 8 knots. Farnella found undersea canyons that cut thousands of feet deep across the ocean floor for more than 100 miles. Researchers also discovered that some canyons are oriented less perpendicular to the coastline than previously thought.

In addition, the Farnella crew discovered tremendous undersea landslides 25 miles across, giving new insight into the incredible dynamics of the ocean floor. Farnella continues to map several segments of the EEZ and is scheduled to map the EEZ off Hawaii and Alaska this summer.

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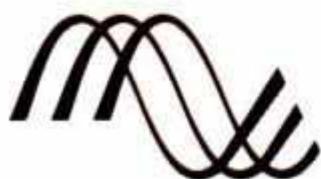
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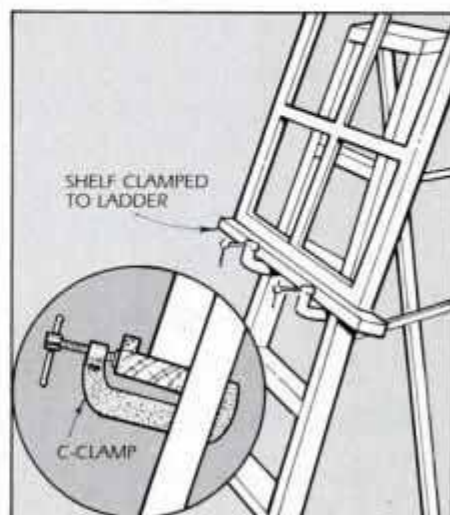
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HINTS FROM READERS

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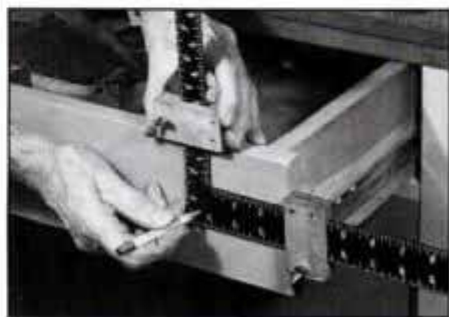


Next time you need an easel for painting windows, shutters or any other large, flat object, you'll probably find it in your garage. All that's needed is your step ladder and two C-clamps. Simply place the clamps at the desired height and rest your work on them. The clamp handle even serves as a paint-can hanger. For more versatility, clamp a board or L-shaped ledge to the ladder as shown. This enables you to handle objects smaller than the leg span.

—L. Small

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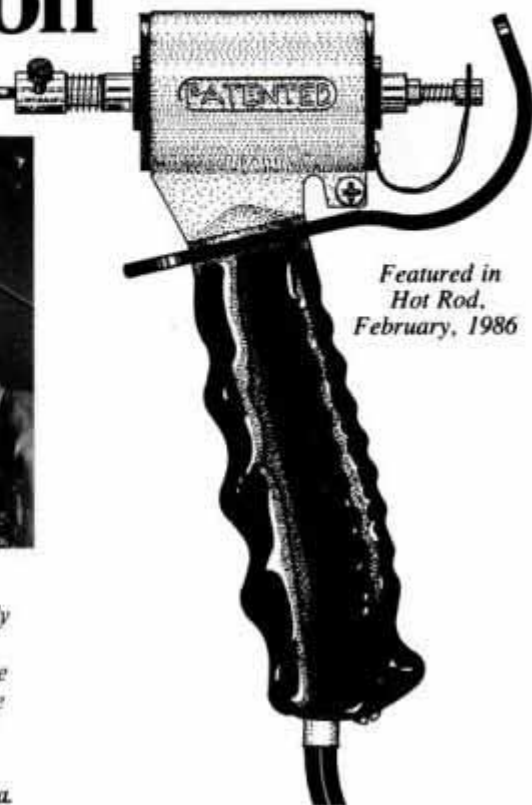
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Keepsafer Plus package comes with a programmable control console, three transmitters/sensors and a handheld remote control.

Keepsafer is an easy-to-install, wireless home security system. Simply screw the transmitters/sensors (T/S) to a window or door and plug the control console into an outlet. When the window or door is opened, the T/S signals the console which, in turn, sounds an alarm. The basic system (\$179) has a control console and two T/S. Additional T/S cost about \$25. Keepsafer Plus (\$349) comes with an expanded control console,

three T/S sets and a remote control. Some options include a smoke alarm, emergency autodialer, medical alarm, glass-break detector and an infrared motion detector. For more information, contact Schlage, 2401 Bayshore Blvd., San Francisco, CA 94134.



Two of the many accessories available include a glass-break detector (left) and an automatic phone dialer (above). In case of a break-in, dialer calls a central dispatch station that, in turn, calls emergency numbers.



Dual-Exhaust Window Fan

Keep cool with this portable 2-speed window fan that converts easily to a free-standing floor model. The unit features two 8-in.-dia. fans that reverse direction to blow in fresh air or exhaust stale room air. The fan is 10¾ in. high and fits windows ranging between 24 in. and 35½ in. wide. Extenders are available for use in wider windows. An adapter permits use in case-

ment and awning windows.

At low speed, the fan operates at 1500 rpm; and air output of 675 cfm. High speed (2000 rpm) circulates 900 cfm of air. The fan (model No. 2000) has a steel frame with a durable plastic grill that guards children's fingers. It's \$50 at hardware and department stores. Contact W.B. Marvin Manufacturing, Box 230, Urbana, OH 43078.

Decked Out

Make an old, wood deck look like new again with Wolman's Deck Brightener. Deck Brightener is formulated to remove dirt, mildew and algae from pressure-treated and untreated wood. Simply mix it with water and apply the solution to the deck with a sprayer, mop, brush or roller.

Allow the solution to stand for about 10 minutes, rinse the deck with water, and then brush it off with a stiff-bristle broom. Wait until the deck has dried thoroughly before applying a water repellent or stain. One 6.4-ounce packet costs about \$8. Contact Becky Guy, Wolman Protection Products—PM, 1050 Koppers Bldg., Pittsburgh, PA 15219.



Easy-to-apply cleaner is formulated to remove dirt, mildew and algae from wood without using harmful acids or chlorine.

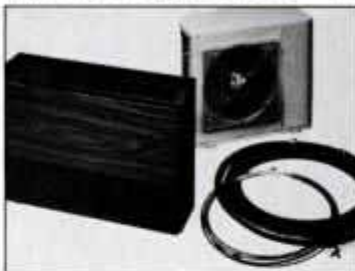


Mix one 6.4-ounce packet in 1 gallon of water. This will provide 150 sq. ft. of coverage.

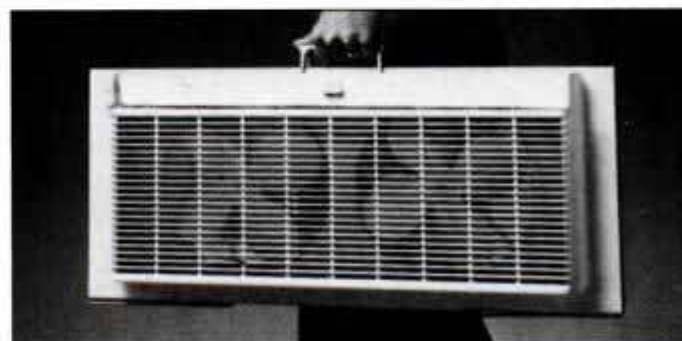
Keeping Cool And Quiet

A new type of room air conditioner developed by United Technologies offers an alternative to conventional cooling units. A split-system air conditioner consists of an indoor unit, that can be mounted to the wall or ceiling, and an outdoor unit that houses the compressor. A 2¾-in.-dia. hole through the wall connects the units. They come in three sizes: 1-ton, 11,600 BTU (\$1250); and 1½-ton,

18,000 BTU (\$1750); and 2-ton, 22,600 BTU (\$2250). It's sold through Bryant, Carrier, Payne, and Day & Night dealers. **PM**



Split-system air conditioner has a wood-grain indoor unit and an outdoor unit that houses compressor.



The 8½-pound window fan has a pop-up carrying handle and swing-out feet that convert the unit to a free-standing floor fan.



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.

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.

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.

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.

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.

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.

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.

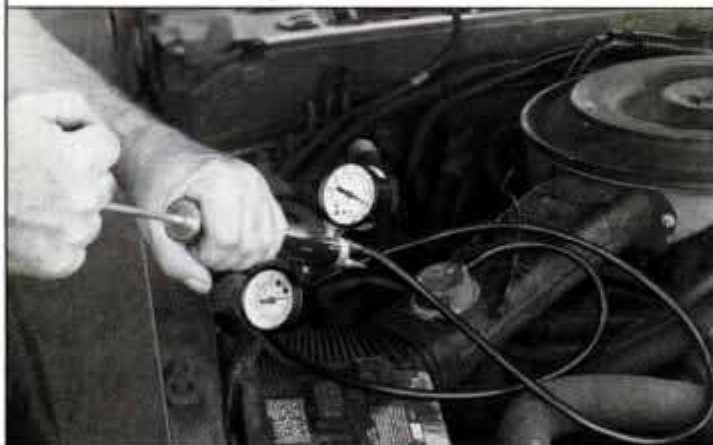
Free trial offer. For a trial package send \$1.00 for postage and handling to Grecian, P.O. Box 9936, Maple Plain, MN 55348. Specify liquid or cream. Limit one per family. Offer ends 9/30/87.



GRECIAN® FORMULA 16®

NEW/AUTO

Two-Way Tester



Our Saturday mechanic is always using this trusty vacuum pump to chase down leaky or failed widgets in that maze of underhood emissions controls. This 2-in-1 gauge allows you to test both vacuum and pressure by just moving the hose from one gauge connector to another. As a vacuum pump, use it to test the EGR valve, the power brake booster, the distributor vacuum advance, and the thermal air cleaner intake valve. This type of pump is essential for diagnosing problems in late model cars. The pump is also great for vacu-

um-controlled A/C controls and door locks. On the pressure side, it will develop 30 psi for checking emissions devices, leaky cooling systems or window washer hoses. This vacuum pump is priced at \$79.95 in auto parts stores, or you can order it (part No. BT 8624) directly from the manufacturer. Write to Borroughs Division, Sealed Power Corp., Kalamazoo, MI 49007; or call toll-free (800)253-0138.

Make My Day—If You Can

CarLock is designed to slip over the center-mounted handbrake handle, and to lock firmly against the gearshift handle, whether your car has an automatic or manual. Easy

to use, it installs or removes in seconds and stores easily in the glovebox or under the seat. This leaves your car in Park, or in gear, with the handbrake firmly applied. Its hardened steel construction, shrouding the lock cylinder, makes it virtually cut- and pick-proof. On cars with gear shifts close to the dashboard, CarLock can block the radio from being removed as well. Bright red in color, it's attention-grabbing enough that it should make thieves move on to the next car before they attempt a break-in. It's \$39.95 plus \$3 shipping from Bluepoint Industries, Chalfont, PA 18914; (800)553-2345.



Bright red color makes CarLock stand out, deter thieves before break-in, not after.

Hydraulic Lifter Removing Tool

Snap-On's hydraulic lifter tool pulls gummed up lifters out of engines by using a sliding hammer and an internally expanding collet. The expanding collet grips the inside of the lifter, and if it won't pull out easily, then a tap with the integral slide hammer will pop it free of the rim of sludge keeping it in. You'll have to find a store that carries the Snap-On line, or order from Snap-On salesman. Ask for Tool No. S-8692; it costs \$47.25.



Twist T-handle to grip lifter with expanding collet, then pull out.

Collet (right) grips lifter.



Rust or pinholes don't have to mean replacing fuel tank.

Save Gas

Eastwood's catalog of tools and supplies for the car restorer includes this elastomeric coating for the inside of leaky or rusty fuel tanks. First, you might need to use Eastwood's \$8.95 etching solution to chemically clean up the rust. Then slosh the sealer around to coat the inside of the tank. It's also claimed to be safe if you use gasohol or octane boosters. It costs \$16.50 for a quart, which should just be enough for most cars, and \$40 for a gallon. For a free catalog, contact the Eastwood Co., Box 296-M, Malvern, PA 19355; (215)644-4412.

Light At The End Of The Tunnel

Tired of working on your car with a flashlight held in your teeth? Or burning your nose on the lamp in your dropcord? This 30-watt lantern's cool, diffuse light is perfect for working in or under your car. Unlike that flashlight's pencil beam, you can see things that aren't right in the beam. Rechargeable batteries provide hours of use, or just plug it into the wall or lighter socket. The lantern is available in hardware and do-it-yourself stores, or send \$82.95 plus \$5.50 for postage to Romar Enterprises, P.O. Box 42340, Las Vegas, NV 89116. **PM**



Fluorescent light recharges from 110- or 12-volt sources.

CAMEL LIGHTS

Share a new adventure.



9 mg. "tar", 0.6 mg. nicotine av. per cigarette by FTC method.

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



**“I’M AN EASY GUY TO SATISFY.
I ONLY WANT THE BEST.”**

INTRODUCING SIERRA: THE ULTIMATE PICKUP FROM GMC TRUCK.

You demand a lot of your possessions.

To fit your life, a vehicle must do more than simply fit in your driveway. Now there’s a truck to meet your highest expectations — and exceed them: Sierra. The ultimate pickup from GMC Truck.

Sierra’s aerodynamics give it a contemporary profile, with a rakish windshield and flush-fitting side glass. With sophisticated styling, it’s designed to be the full-size pickup that can go everywhere. Select a four-wheel-drive model

(with the Insta-Trac system that lets you shift conveniently from two-wheel to four-wheel drive without stopping), and “everywhere” can be almost anywhere!

Full-size and all-new.

Sierra features a new standard rear-wheel anti-lock brake system (operable only in the two-wheel-drive mode on four-wheel-drive models) to help prevent rear-wheel lockup during braking, whether your Sierra is empty or loaded. The fuel tank is mounted between the frame rails. The majority of the exposed metal surfaces on Sierra are galvanized steel, covered by deep-luster basecoat/clearcoat acrylic enamel — the same advanced painting technique that

protects some of the world’s finest automobiles.

Full-size inside . . . and outside.

Sierra is still a full-size truck in the great GMC Truck tradition. Its handsomely appointed interior features room for three adults — and even more shoulder and leg room than previous full-size pickups from GMC Truck. There’s a choice of 6½’ short-bed or 8’ long-bed models. And the spacious long-bed can still accommodate the proverbial 4’ x 8’ sheet of plywood between the wheelhousings.

Full-size power.

The amazing 4.3-liter Vortec V-6 engine is standard (except on 3500 models which feature a standard 5.7-liter V-8), and imbues



Sierra with both power and economy. In fact, with the available five-speed manual overdrive transmission and Vortec engine, a two-wheel-drive Sierra is rated at an impressive EPA estimated MPG city 17 and highway 23. Or you can have your choice of available V-8s, including the powerful 7.4-liter (454 cu in) or the 6.2-liter (379 cu in) diesel. Electronic fuel injection, standard on every gasoline engine, offers instant starting response and outstanding over-the-road performance — all the power you need for full-size jobs, like towing. In fact, when properly equipped, Sierra can move up to 19,000 lbs, including itself, passengers, trailer, equipment and cargo.

You'll find that Sierra is built to be driven, thanks to a new fully independent torsion bar front suspension on 4 X 4 models or a newly improved two-wheel-drive front suspension. When you take the wheel, you'll be driving a full-size pickup with handling as advanced as its looks.



And Sierra has a warranty to match. Every new Sierra has a 6-year/60,000-mile warranty on the powertrain and a 6-year/100,000-mile warranty on outer-body rust-through. See your dealer for the terms and conditions of this

limited warranty.

Built to pass your toughest test.

If you're satisfied with only the best in life, buckle up and visit your GMC Truck dealer for a look at the new Sierra. (You'll find a listing in the Yellow Pages, under "Truck" or "Automobile.")

See the new Sierra for yourself. It's everything you expect from a GMC truck. And like nothing you've ever expected in a full-size pickup.

Unless, of course, you expect only the best.

GMC TRUCK
IT'S NOT JUST A TRUCK
ANYMORE.

Car Clinic



BY MORT SCHULTZ

Divide And Conker

The engine conks out every time I turn the power steering wheel of my 1981 Mercury Cougar to the left or right stop while the car is at a standstill. The drive belt is in good shape, and its adjustment is right on the money. So tell me—why is this happening?

JOE NUZZOLO
VALLEY STREAM, NY

There are two possible reasons: (1) Engine idling speed is too low; therefore, when you turn the steering wheel to one stop, engine speed can't keep up with power-steering pump demand, rpm drops and the engine stalls. (2) The power-steering, high-pressure relief valve is stuck.

The job of the high-pressure relief valve is to let the pump build up to a specific pressure (600 psi, for example) as the steering wheel is turned. When pressure reaches that point, the valve is supposed to open and allow pressure to bleed off. If the valve sticks, pressure will build up beyond the allowable point. The demand by the pump for greater power overloads the engine, and it will stall.

Adjust engine's slow-idle speed to spec; then, test high-pressure relief valve.

Tow Strap Warning

This warning is straight from the U.S. Department of Transportation: If you bought elastic or nylon tow straps, because they were advertised as being helpful

in getting a vehicle out of snow and mud, watch out!

The U.S. Department of Transportation says, "Many manufacturers' directions are either incorrect or unclear. For example, elastic or nylon tow straps should always be attached to the frame of a vehicle—never to the bumper or to a ball hitch."

Directions that say to leave slack in the line so the driver of the pulling vehicle can accelerate rapidly to jerk a stuck vehicle free are dead wrong. The tow strap can act like a sling shot, pulling the bumper or ball hitch free and flinging it at the tow vehicle.

Is DOT overreacting? So far seven accidents involving these straps have resulted in four deaths and three injuries.

Plymouth 'Canary'

Since new, my 1984 Plymouth Reliant had been whistling while it worked—a loud canary-like twitter that seemed to come from the right-front corner. The noise defied all efforts to identify its source, and I took little comfort in hearing the same sound from other 1981-'84 K-cars as I walked the streets.

Then, one day I got lucky. With my car parked pointing into a stiff wind, I heard the noise and traced it to a side-marker light lens. As air passed between the lens and bezel, it made the annoying sound. A bead of silicone sealer stopped the whistle once and for all. Maybe others can use this information.

DR. ELIHU N. SAVAD
WESTFIELD, NJ

Battle Of Wits

I bought a 1986 Pontiac Grand Am from a used-car dealer. Soon after, the paint along the lower part of the body began flaking. The dealer said it's not his responsibility and suggested I see if Pontiac will stand the cost of repair under the terms of the new-car, 3-year, rust-through warranty. The Pontiac dealer says that since I'm the second owner I'm out of luck... besides, flaking paint is not rust-through. Should I give up?

GARY ROSENBERG
WEST PALM BEACH, FL

The paint condition and its repair are subjects of a Pontiac-instituted recall. Refer the Pontiac dealer to Dealer Service Management Bulletin 86-SM-22; then if he has a question, he should get in touch with the Pontiac field or zone office.

On some models built in the Lansing plant, adhesion between the chip-resistant primer and the basecoat/clearcoat surface was less than adequate because of an error in the painting procedure. Pontiac will pay for refinishing cars that have flaked or chipped paint. The offer is in effect for three years from the date a car was placed in service, regardless of mileage—this means three years from the day the first owner drove it from the showroom.

The policy extends to subsequent owners of a vehicle for the full 3-year period. When the dealer does the work, the basecoat/clearcoat surface has to be removed, hopefully without disturbing the chip-resistant primer, so a new basecoat/clearcoat coating can be applied.

Search For Lurch

Can it be true that I must put up with a low-speed lurch just before I brake my 1986 Taurus to a stop? The car is equipped with an automatic overdrive (AXOD) transaxle.

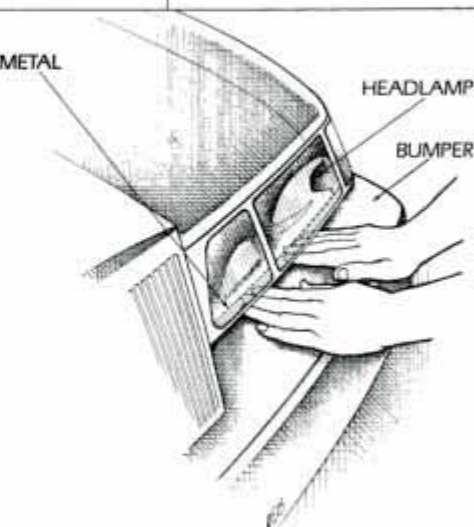
This is what the Ford deal-
(Please turn to page 74)



Rattle Traps

Buzzes and rattles are usually easy to fix, but tough to find. So this tip may help.

If you hear a buzz or rattle from the front of your car, don't overlook the headlights. One or both may be touching the sheetmetal lying just below the lamps. This could be causing that vibration-type noise you're hearing. Slip



your fingers under each headlight and press the strip down until there's a little clearance between the light and strip.



LEARN TO PREPARE THIS DISH IN JUST 30 MINUTES.

You're looking at the dish antenna of one of the most advanced satellite communications systems around. And you can learn to work with it in some of the most spectacular classrooms around—from the highest mountaintops to desert plains. Maybe even more impressive, you'll not only get this system set up and operating in 30 minutes, but you'll do it working side by side with just two other soldiers. Welcome to the Army Signal Corps.

Your team will be responsible for transforming a spot of wilderness into a satellite communications station. One capable of sending and receiving messages anywhere in the world. If you qualify, you'll be trained to work with microprocessors, troposcatter and microwave communications equipment, single-and multi-channel systems, and more. High tech doesn't get much higher than this.

If the challenge of preparing one of our dishes gets you hungry for some exciting high-tech learning, call toll free, 1-800-USA-ARMY, or talk to your local Army Recruiter.

ARMY. BE ALL YOU CAN BE.

WE PUT OUR FINGER ON THE PROBLEM:
SLUDGE FROM CONVENTIONAL MOTOR OILS.





AND CAME UP WITH THE SOLUTION:
NEW QUAKER STATE WITH QSX
KEEPS ENGINES CLEANER TO LAST LONGER.

These photos tell the story. The rocker arm cover on the left comes from an engine that used conventional motor oil. That kind of sludge buildup can be murder on your engine.

The rocker arm cover on the right is from an engine that used New Quaker State with QSX. Our amazing new QSX formula works by keeping deposit-

forming combustion by-products suspended in oil, so they can be filtered and removed without collecting on vital engine parts. Regular oil changes with New Improved Quaker State can actually extend the life of your engine.

So reach for superior engine protection—
 New Quaker State with QSX.



REACHING FOR THE BEST.



Don't miss the Quaker State 500 at Pocono Raceway on August 16, 1987. For information and tickets call 1-800-RACEWAY or (717) 646-2300.

CAR CLINIC

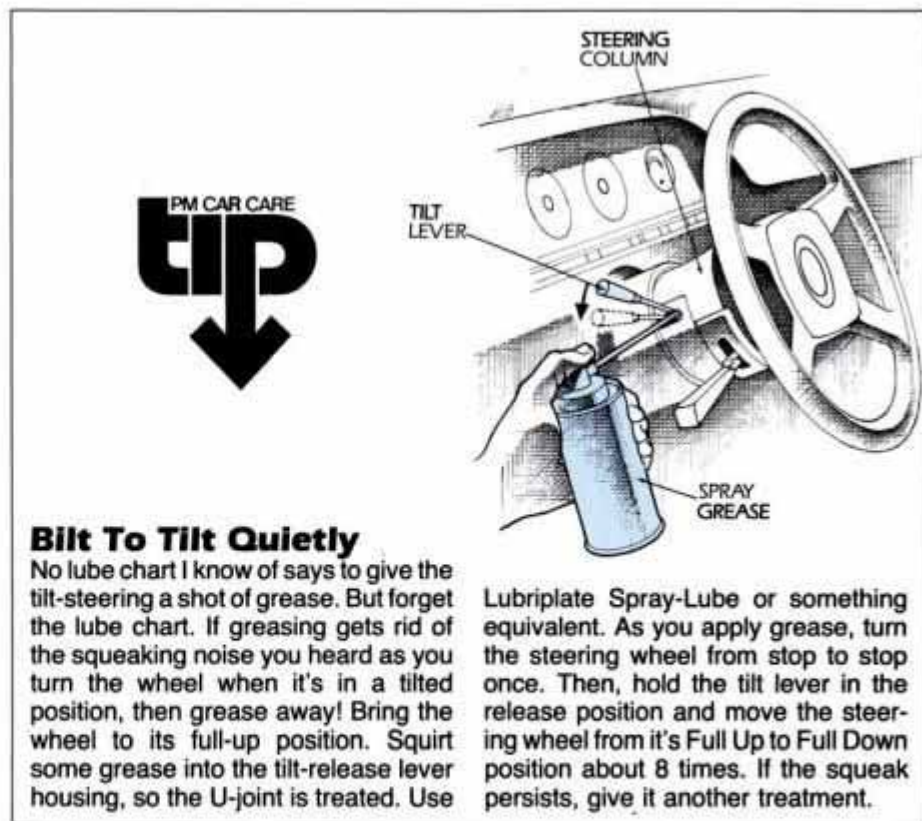
(Continued from page 70)

er told me. He says there's nothing wrong with the brakes, and that I'd better get used to it, because that's the way things are, which is hard to believe.

ART NOBLE
SPRINGFIELD, MO

Believe it. If there's no mechanical malfunction, then this is indeed the case. What you call a lurch, Ford calls a harsh driveline bump or jerk. Some owners of 1986 and 1987 Taurus and Sable models are getting this sensation, like you, just before coming to a complete stop; others are also getting it while alternately coasting and lightly accelerating at speeds under 15 mph. Ford says the condition results from power train lash (movement, that is) because of the way the power train is calibrated. It doesn't appear as if lash has any long-term harmful effect.

On the slim chance that a malfunction in the brake system is causing the lurch, bump or jerk—however you want to describe it—you may want to have another dealer or a Ford factory field representative test the car. But don't let anyone try eliminating lash by resetting engine idle speed or read-



Bilt To Tilt Quietly

No lube chart I know of says to give the tilt-steering a shot of grease. But forget the lube chart. If greasing gets rid of the squeaking noise you heard as you turn the wheel when it's in a tilted position, then grease away! Bring the wheel to its full-up position. Squirt some grease into the tilt-release lever housing, so the U-joint is treated. Use

Lubriplate Spray-Lube or something equivalent. As you apply grease, turn the steering wheel from stop to stop once. Then, hold the tilt lever in the release position and move the steering wheel from it's Full Up to Full Down position about 8 times. If the squeak persists, give it another treatment.

justing the throttle valve (TV) cable. It won't work and may create a problem you don't have now.

Tiring Effort

I have a 1984 Honda Accord. Ever since it passed the 5000-mile mark, it has had

Essential Tools For Your Garage.

You know the value of having the right tools for the job at hand.

Easy-to-use, easy-on-the-pocketbook Berryman products are your blueprint for maximum performance.

Berryman's powerful BRAKE CLEANER removes brake fluid, grease and oil from disc brake pads, linings and other related parts . . . on all brake jobs large or small. Plus it stops brake squeal.

No shop is complete without it. Berryman products are guaranteed. So ask for them wherever you shop for parts.



Guaranteed Quality Since 1918
3800 E. Randol Mill Rd.
Arlington, Texas 76011



Removes grease and oil from pads, linings, stop brake squeal.

a tendency to drift to the left. It isn't bad, like a pull, but I can't take my hands off the steering wheel and have the car track straight. The car has now been driven more than 30,000 miles. To try and resolve the condition, tires have been balanced and rotated; the front end has been checked for worn parts (there are none) and has been aligned; brakes have been inspected (there is no sign of damage or worn parts). Is there a solution?

JOE WALLWORK
NEW YORK, NY

Maybe. Although there will be a slight drift with most vehicles if you don't keep your hands on the steering wheel, let's assume that you're experiencing an abnormal drift. Alignment settings are fussy; be sure they are not only within spec, but symmetrical from side-to-side. Based on your descrip-

tion, I must also assume that nothing mechanically wrong with your Honda is causing the drift. Then, the likely place to look for a reason is with the tires.

A likely cause is a condition I call "ply-steer syndrome" that affects some models. If this condition is present, the tires have a tendency to cause the car to steer in the direction of the plies, resulting in drifting. Had you been aware of this before, you may have gotten a new set of tires from the tire company (as your tire warranty states, tires on a new car are the responsibility of the tire company

—not the car manufacturer).

At this point, the only thing you can do is relate the history of the condition to a dealer of the particular brand of tires. If he's a good guy, he may take the case to the company, which can decide if you're entitled to another set of tires at a reduced rate under the mileage-prorata provisions of the tire warranty. **FM**

DO YOU HAVE A CAR PROBLEM?

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

Service Tips

■ If your 1985-'87 Buick Century's 2.8- or 3.8-liter port or sequential fuel injected engine won't start, consider the circumstances. Is the vehicle stubborn only when it's parked nose-down on a hill? Then the solution, according to technical service bulletin (TSB) 87-6E-12, may be to have a new fuel pump installed—part No. 25115689 if the car is an '85 or '86 model; part No. 25115465 if '87.

■ The information in Honda TSB 87-010 is most important to owners of 1983 Preludes. It says that the camshaft timing belt should be replaced for the first time at 37,500 miles, and that Honda will pay for the work. In fact, owners who have already paid to have belts replaced will be reimbursed if they see their dealers.

■ Chrysler this month answered once and for all the question about the feeding of vehicles built in the U.S. which are taken to countries where only leaded fuel is sold. TSB 14-02-87 says, "Due to metallurgical composition of the piston rings and valves, operation using leaded fuel will result in accelerated wear of these engine components and engine damage will occur." Although the TSB refers to the 3-liter MMC engine, the warning applies to all engines used in vehicles built for sale in the U.S.

■ To try and straighten out a 1985-'87 AMC Eagle with an erratic fast idling speed, clean the fast-idle linkage and install a splash shield (part No. 8993549) to protect the linkage. Instructions are in MR 251 (MR is Renault's designation for TSB) which says that road splash can be contaminating the linkage.

THE ORIGINAL. COPIED BUT UNMATCHED.

We invented this style of plier. Improved it with patented can't-slip adjustment. Improved it again with our patented stress resisting flange. And still again with our new PERMALOCK fastener. All of which is why tongue and groove pliers by any other name can't match CHANNELLOCK. Be sure that name is on the pliers you buy. Send for free catalog. Channellock, Inc., Meadville, Pa. 16335

Tools by

CHAN NEL LOCK

For you who want the best.



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CHANNELLOCK Pliers Are American Made

Guarantee. It's good for as long as you own your Ford car. Ask to see the limited warranty and the service guarantee when you visit your Ford Dealer.

**Ford. Best-built American cars...
six years running.**

For the past six consecutive years, Ford quality has led all other American car companies.

This is based on an average of owner-reported

FORD THUNDERBIRD

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?



Buckle up—Together we can save lives.



King Cab Nissan Hardbody pickup with light bar and off-road tires was a real head-turner.

NISSAN SE PICKUP
A real prize.

FORD TAURUS LX
We hated to see it go.

OLDSMOBILE DELTA 88
The drama continues.

Since our last episode (see page 120, Dec. '86) three cars have gone back to their makers, we've kept one truck and had a brief fling with another. Our Subaru 3-Door Turbo was returned after nearly 8000 trouble-free miles, but Contributing Editor Rich Taylor liked the Mazda B2000 pickup truck so much that he bought it. Rich reports that it's now gone more than 15,000 miles, much of it towing a heavy V8 race car, without a single glitch. But Rich does talk wistfully about Mazda's new 4x4 B2600 truck, with its bigger, more powerful Mitsubishi engine.

of plowing it into big piles and praying for an early Spring. Effortlessly going into 4-wheel drive, the automatic front hubs make it unnecessary to get out of the driver's seat.

The 5-speed transmission is perhaps



When the Delta 88 was good, it was very, very good, but the rest of the time...

the smoothest to shift of any vehicle we've driven in recent years. That's good because the claimed 140-hp engine needs to be shifted a lot to keep up with traffic. For only 18 or so mpg, even in 2-wheel drive, we expected something that had a little more oomph.

Make no mistake about this truck, it's a truck; you'll realize that right away, with stiff springs and rear brakes that lock up early if the bed is empty. As a work truck, or a truck dedicated to semi-serious off-roading, it'll be in its best element.

The interior in our truck was plushly carpeted and generally very nice, putting many cars to shame. However, the

(Please turn to page 160)

Nissan SE 4X4

If nothing else, this SE King Cab "Hardbody" 4x4 pickup certainly had the highest rate of parking-lot admirers of almost anything we've driven in a long time. Almost daily, someone wanted to talk to us about it, admiring its aggressive looks and elegant styling.

While we normally put considerably more mileage on our long-term test vehicles, out of deference to our lucky contest winner (see *We Have A Winner!*, page 99), we restricted ourselves to only about 2300 break-in miles.

We liked the Hardbody's ability to extricate itself from the densest, plowed-in Manhattan snowbank. Yes, there are such things.

Last winter we had a lot of snow and New York City followed its usual plan



Taurus wagon pleased everyone with its combination of traditional practicality, radical styling and excellent manners.

PM TECHNOLOGY UPDATE 7/87



People Who Live In Globe Houses

How do you reconcile the dream of living in detached housing in an increasingly crowded world? That's the dilemma that faced Dutch architect Dries Kreijkamp of Breda, The Netherlands. So Kreijkamp set out to maximize interior living volume and minimize exterior space. The result is the field of 85 globe houses sprouting on the outskirts of Hertogenbosch. "Basically,

the dwellings are meant for a maximum of two persons, plus a baby," Kreijkamp says, "and I emphasize the word 'baby.'" The 4-level globes measure 5½-meters wide and are made of a cement-reinforced plastic of Dutch manufacture called GVC. The walls are 10 centimeters thick and utilize a sandwich construction. The globes are placed on pedestals 2.5 meters high and 3

meters wide, requiring only 6.67 square meters of land. Tenants enter through the pedestal, which also contains a storage room and space for a heating plant. A staircase leads to a bedroom on the next level, and eating/living facilities on the top floor. Windows are 1.2 meters wide (inset) and round out the globular motif. They also contribute to the houses' passive solar characteristics.

Living in the round is one proposal for detached, multi-family housing. Architects say the multi-level design is adequate for a couple and a small child. Foreground, the whimsical touch of this Dutch housing project extends to the park benches—shaped like scrub brushes.

Editor: Tim Cole
Contributors: Theo C. Bensen,
Ed Valigursky, Ted Francis, Carter Hillier

TECHNOLOGY UPDATE 7/87

SPACE

Space Station: Fixing A Leak

In a worst-case scenario, a random strike by space debris or a micrometeoroid could lead to a deadly loss of life-sustaining atmosphere aboard America's orbiting space station. So engineers at Boeing Aerospace have developed a solution to what they term "penetration damage control;" it's reminiscent of the way you might repair a puncture in a bicycle tire.



BOEING PHOTO



ILLUSTRATION BY ED VAUGHN/USKY

More than a simple rubber patch, however, it would consist of aluminum tape backed by a silicon-based, space-qualified adhesive. The proposed space patch would be 7 in. in diameter

and about 8 mils thick, with a special cushion to prevent the damaged space station skin from ripping it. Most repairs would be effected internally. Repair of more serious damage would be per-

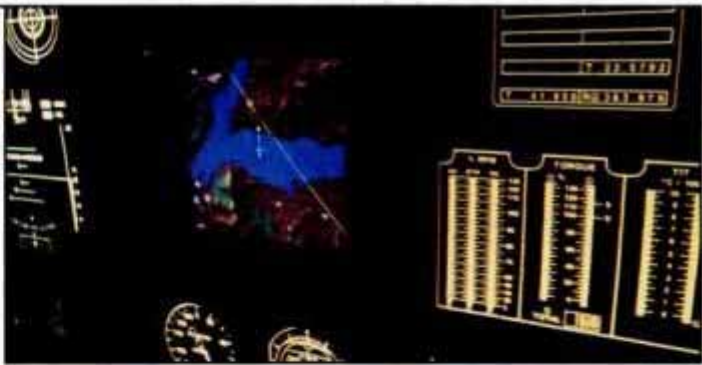
formed during extravehicular activity (EVA) using the specially designed patch handle (inset) that would allow astronauts wearing thick gloves to pick up and handle the patch with ease.

AVIATION

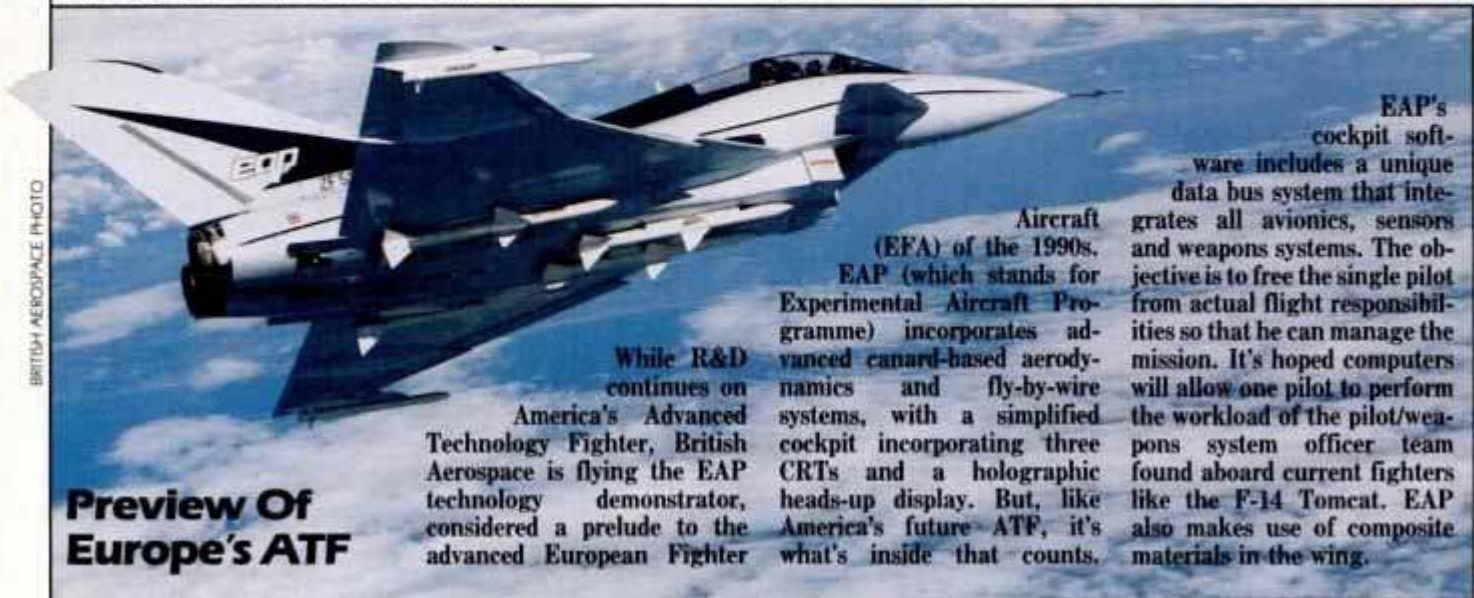
Digital Map For Future Cockpits

This high-density (640 pixels × 480) computer-graphic navigation aid from Harris Corp. can store information on more than 250,000 square kilometers of territory, obtained prior to combat from

aerial reconnaissance. The display can segregate civilian installations from military targets and zoom close for a tree-top preview of the strike zone. Controlled by a simple joystick to reduce pilot workload, the nav/aid also offers critical flight information like altitude above sea level.



HARRIS CORP PHOTO



BRITISH AEROSPACE PHOTO

Preview Of Europe's ATF

While R&D continues on America's Advanced Technology Fighter, British Aerospace is flying the EAP technology demonstrator, considered a prelude to the advanced European Fighter

Aircraft (EFA) of the 1990s. EAP (which stands for Experimental Aircraft Programme) incorporates advanced canard-based aerodynamics and fly-by-wire systems, with a simplified cockpit incorporating three CRTs and a holographic heads-up display. But, like America's future ATF, it's what's inside that counts.

EAP's cockpit software includes a unique data bus system that integrates all avionics, sensors and weapons systems. The objective is to free the single pilot from actual flight responsibilities so that he can manage the mission. It's hoped computers will allow one pilot to perform the workload of the pilot/weapon system officer team found aboard current fighters like the F-14 Tomcat. EAP also makes use of composite materials in the wing.



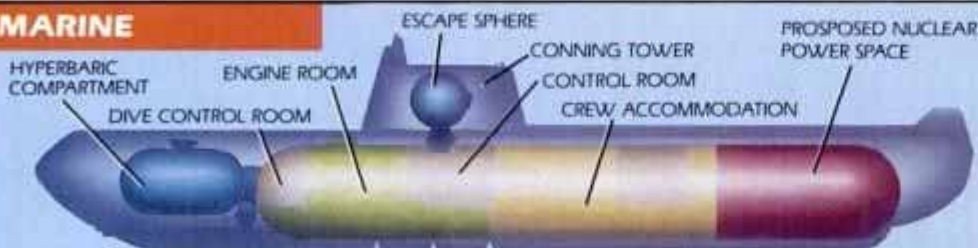
PM ILLUSTRATION BY ED VALIGURSKY

Electronic Firefighter

Air-dropped to the scene of a forest fire, the Handar Remote Automatic Weather Station (RAWS) instantly alerts fire fighters on the ground and in the air to treacherous weather changes. The portable system can transmit temperature, relative humidity, wind direction and speed, rainfall duration and amount, plus forest fuel temperature and moisture. A synthesized voice transmits

the information to ground personnel via 2-way radio. Information can also be transmitted to fire control centers via satellite, and then broadcast to personnel at the fire site. Between fires, the solar-powered RAWS supplements permanent weather towers and develops fire danger ratings. It also assists managers at the Interagency Fire Center in Boise, Idaho, who produce a profile of forest-fire behavior based on weather information, site characteristics and lightning strike data.

MARINE



PM ILLUSTRATION BY GEORGE REISECK

Sub Could Go Nuclear

At more than 28 meters length overall, it's the largest commercial submarine ever launched, a combination mobile underwater habitat and highly autonomous, long-range submersible. Best of all, the Canadian-French joint venture, dubbed Saga I, is expected to be converted into Saga N, the world's first nuclear-powered, privately owned sub, sometime after 1988. In the meantime, designers say Saga I will be powered by dual closed-cycle Stirling engines, modified by the Swedish firm Kochum. The Stirling is based on a 19th century principle involving the expansion and contraction of a working gas (helium in this case), which acts on a piston or pistons. It's anticipated that Saga I will be able to undertake a 150-mile submerged voyage, then support week-long saturation diving and return to base. It has a submerged speed of 6 knots and a diesel-powered surface speed of 7 knots.



Fighting Subsea Erosion

Britain's Seabed Scour Control Systems Co. has solved the problem of fractures to underwater pipelines and footings with nets made of

polypropylene tape. Each tape is fibrillated to give approximately 4.5 million filaments per 30 x 5-meter net section. The filaments catch and hold current-borne sand or soil, forming a permanent barrier under the structure.

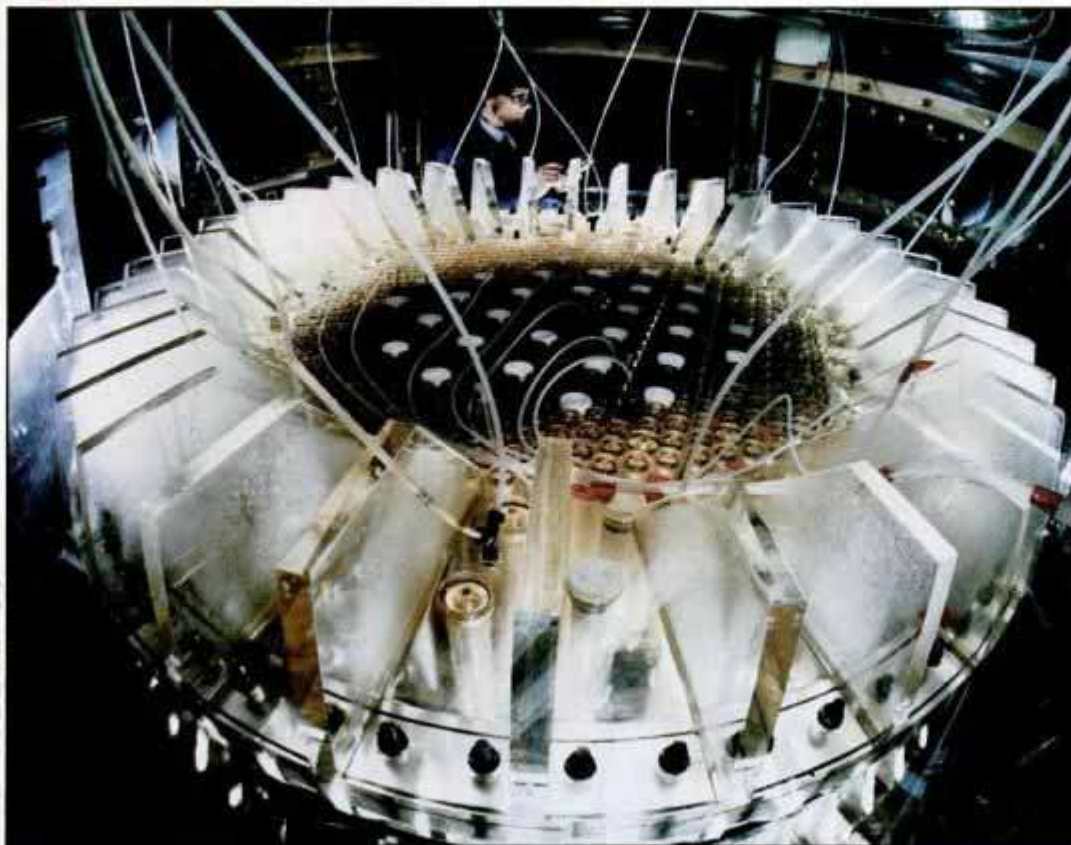


LONDON PICTURES SERVICE PHOTO

ENERGY

Reactor Model Tests Design

The objective of the 1/4-scale, clear-plastic mockup is to see how a fluid behaves as it flows through and around a newly designed high-pressure nuclear reactor plenum. Scientists at Britain's National Nuclear Corp., who designed the model, report the full-scale plenum, when built, will support the nuclear reactor core of the proposed Commercial Fast Reactor and will direct a flow of liquid sodium coolant through the CFR's fuel assemblies. Researchers are also checking the core-plenum model for unnecessary vibration that might be caused by the high velocity of sodium coolant through the plenum inlets. **TU**



LONDON PICTURES SERVICE PHOTO

Is Newman's Car For Real?

The United States Patent Office doesn't think so, and neither do some disbelievers scattered across America. But Joseph Newman of Lucedale, Mississippi, backed by some topflight scientific opinionmakers, may have tapped the fundamental energy of the smallest particles of matter. At recent demonstrations, the "backwoods" inventor powered an 1800-pound fiberglass car at a speed of 8 mph for more than 34 hours. A faulty transmission and a bent rotor shaft foiled a faster speed for the vehicle, which, Newman predicts, will travel 60 mph and cost under \$5000. Newman's vehicle uses a 200-pound battery pack made up of 9-volt transistor batteries connected in series. The pack supplies 17,000 volts, but the energy machine under the cowl draws only 18 milliamps of current. The machine, on the other hand, produces 125 milliamps of current and more than

100,000 volts. How's that? Newman says the power source comes from within the atoms of the machine's 240-pound, 30-gauge copper-wire coil and 200-pound rotating magnet.

The machine consists of a battery pack, commutator, rotating magnet and a long coil of copper wire. Battery current flows into the commutator in three segments: fire, blank and short. In the fire position, current flows into the copper coil causing atoms to align and release a minute portion of their gyroscopic particles, creating a magnetic field. In the blank segment, voltage is broken, and when these gyroscopic particles attempt to return to the wire, they create an electric current. The short segment permits the energy produced by the collapsing magnetic field to complete the circuit. Newman is calling it "Gyro Power," and it may not be just the stuff of dreams.



PHOTOGRAPHS BY JUNE HEWITT

SELF HELP



Doing it yourself is great,
but it's not always easy.
Sometimes you need a little help.

LubriMatic® brand products can give you all
the help you need. We're the world's only manufacturer
of a full line of quality lubricants, lubrication equipment
and accessories. Since all we do is lubrication, we do it
better. And that means better results for you.

So no matter what you work on or with, if it moves,
we'll keep it moving better and longer.

If you'd like a little help around the house, help yourself
to the LubriMatic® brand at leading automotive and
hardware retailers everywhere.

LubriMatic

Division of **White** Corporation

Seat belts save lives.

*Based on R.L. Polk Registration counts as of July 1, 1985. ©SUBARU OF AMERICA, INC. 1987

SUBARU 4 WHEEL DRIVE KEEPS A CAR FROM BECOMING AN OFF ROAD VEHICLE.

Subaru 4 Wheel Drive is designed to keep you on the road regardless of the conditions. In fact, we feel so strongly about the traction it gives, we offer 4 wheel drive on virtually every car we build. So there's no reason to think of it as something found only on trucks.

And over the years, we've offered everything from the "On Demand"™ 4 wheel drive system to a new state-of-the-art Full Time 4 Wheel Drive system.

What's more, a Subaru with 4 wheel drive is reasonable to buy, maintain and operate. Not to mention, Subaru is the number one 4 wheel drive car in America.* Subaru, the car that keeps hazardous road conditions from turning into hazardous driving conditions.



SUBARU.
Inexpensive. And built to stay that way.

Моторная, защищенный автоскопический привод

THE CARS OF MIAMI VICE

Automotive engineering is the real star of this TV megahit.



BY CLIFF GROMER

Actors Don Johnson and Philip Michael Thomas relax on the original 'Vice' car, a Ferrari Daytona Spyder look-alike powered by Chevrolet.

The white Mercedes-Benz coupe rolls up to a curbside berth. It is the Moby Dick of Mercedes-Benzes, outrageous in proportion, sublime in appointments. An underworld type (TV good guys don't ride in MBs) emerges from Moby Dick's white flanks. Draped on his arm is a knockout in high heels—entertainment for the evening. And as the camera pulls back for a wide-angle shot, you see just how radical this Mercedes really is.

The car has all the exterior trappings of a high-performance sports car: monochromatic paint scheme, racing wheels and tires, AMG-style spoilers, ground-effect skirts



and air dams. Inside is the bar, TV, remote-control VCR. The ultimate touch, though, is the badge on the trunklid. The top-of-the-line Mercedes currently available in this country is the 560 series. But this car goes a step beyond. The badge reads 10,000 SEL.

Remember now, all this high-performance stuff is on a limousine, and a limousine stretched by 50 inches at that. It's enough to make a true Mercedes aficionado weep. But it's the kind of car "Miami Vice" fans have come to expect.

As a matter of fact, "Miami Vice" has become a cult program for car lovers. Writers and producers use automobiles to make real statements about the scenes unfolding on your TV screen. Cars set the tone, and establishing the show's style requires the engineering skill and artistic finesse of people like Carl Roberts of Kingsport, Tennessee. The car fabricator helped the show's Ferrari Testa-



Sonny Crockett's first ride on the show was a Ferrari 365GTB Daytona Spyder replica (top). Called the California Daytona, the black roadster was basically a Chevrolet Corvette underneath with a hopped-up, small-block Chevy V8 for power. Above, and left, the sleek fiberglass body panels stood up to stunts and camera mounts for two years before being retired. Automobiles of all makes and eras are an important stylistic device on "Miami Vice."

TOP: PM PHOTO BY BRIAN KING, MIDDLE AND ABOVE: S. GELBERG/GLOBE PHOTOS



The 428 Cobra Jet-powered '69 Mercury Cougar GT (top), and bright red '68 Pontiac GTO hardtop (lower middle), have been seen in several episodes. The "luxury-to-excess" theme is personified in metal through the tongue-in-cheek Mercedes-Benz 10,000SEL limo, complete with a special ground-effects package. Tubbs, Crockett's partner, struggles along with a mint condition '63 Cadillac DeVille convertible (upper middle).



TOP, PHIL KUNZ PHOTO; UPPER CENTER, S. GELBERG/GLOBE PHOTOS; LOWER CENTER, PAUL ZAZARINE; ABOVE, C.R. MOTORING PHOTO
POPULAR MECHANICS • JULY 1987

rossa achieve a status equal to that of Crockett, Tubbs and the rest of the cast.

The car-as-stylistic-device got a start with the car driven by main protagonist Sonny Crockett, played by actor Don Johnson. His original machine was a Daytona Spyder, or rather, a look-alike Ferrari 365 GTB/4 Daytona Spyder. The first significant "Vice" car, it was a prop Sonny needed to infiltrate the high-roller world of drugs, prostitution and other assorted illegalities that support Miami's crime empire. Crockett had to dress the part, and had to go the whole routine. The lifestyles of the Miami vice-lords give fresh meaning to the term ostentatious.

Check out the clothes: Rumpled white linen suits with rolled up pant legs, hot pink scooped-neck T-shirts, \$400 Charles Jourdan loafers. Check out the toys: An Endeavour 42-ft. yacht for living quarters, a 38-ft. Wellcraft Scarab with twin 440 Meres for play.

All the while Crockett drones about town in a Ferrari Daytona Spyder look-alike, picking up groceries the way we would use a Chevy Impala.

The rest of the "Miami Vice" team weren't ignored when the cool cars were handed out.

Crockett's partner and fellow player, Ricardo Tubbs, played by actor Philip Michael Thomas, gets to pilot a pristine '63 Cadillac DeVille convertible. It may not be the wheels of choice for an underworld over-achiever, but it passes as the mark of a hard worker who has managed to cut out some kind of turf. Switek, another "Vice" cop, gets to drive a turquoise '63 Ford Thunderbird.

Forget for a moment the show's obvious flaws. Forget that Crockett was an All-American football hero who once ran a screen pass 95 yards in the Gator Bowl. You figure it out how a guy like this can make it as an undercover cop without being unrecognized. Forget the fact that Crockett and Tubbs regularly investigate



all kinds of murders and go on busts—activities that would certainly blow their rather tenuous cover.

Forget also that "Miami Vice" has skidded in the ratings and regularly gets busted by its time-slot rival "Dallas." And while you're at it, forget the show's boring and tedious plots, flat dialogue and general heaviness to the scripts. The point is, if you consider it a treat to see rare and unusual cars, "Miami Vice" is the show for you.

Not all the cars on the show reek of blatant excess. Some are more subtle, you have to be paying attention to notice them, as many are just roll-ons.

For instance, the producers had access to a mint-condition 1968 Pontiac GTO. An original, red car with black interior, the model was equipped with the hideaway headlight option and Rally II wheels. This was a car that had been recognized in 1968 as Motor Trend's Car of the Year. It was the best-selling GTO model of all time and was a benchmark muscle car of the '60s. Many GTO enthusiasts consider the '68 to be the best looking of the entire GTO series.

So how was the car used on the show? In one episode, a drug dealer drove it to a buy. You see him pulling up to a building, go inside to do business, then come back

out and drive away. Most sitcop shows would have the dope dealer driving something like an '84 Monte Carlo, or even a beat-up van.

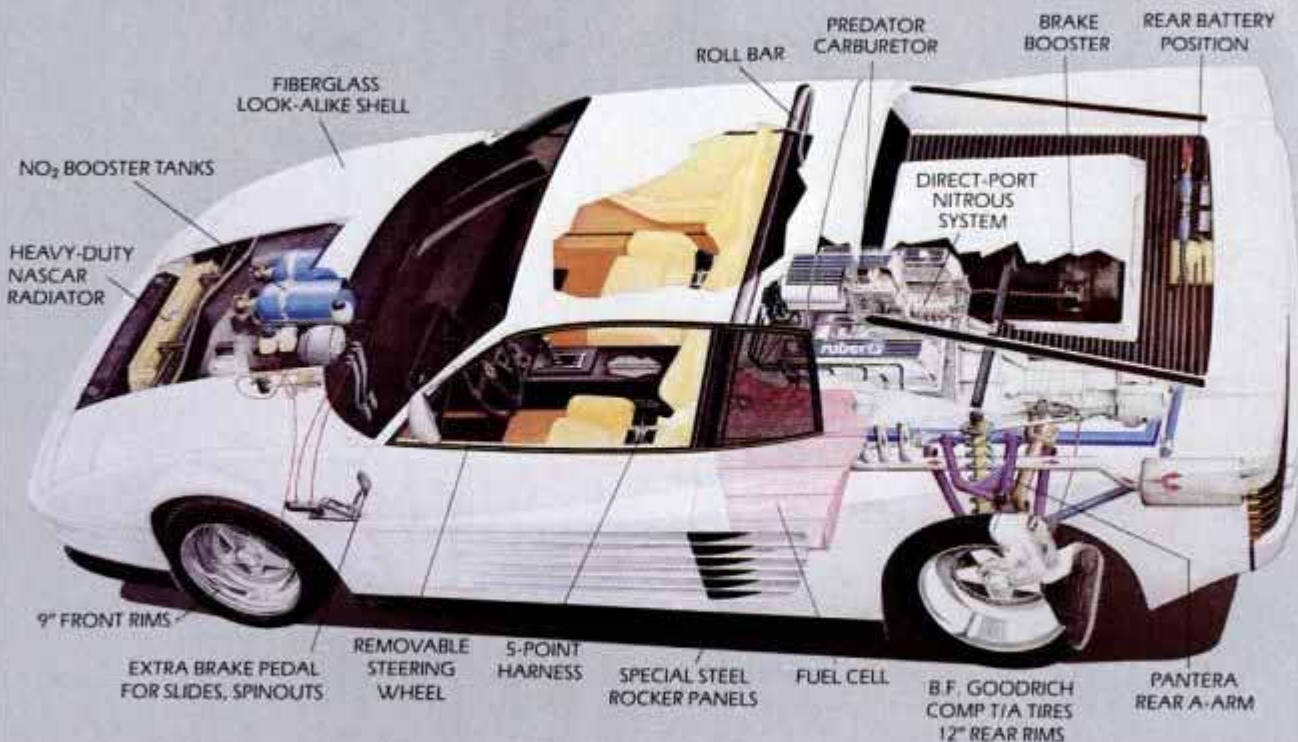
Another muscle car, much rarer than the GTO, also made an appearance as the daily driver of a drug dealer. A limited-production high-performance 1969 Mercury Cougar GT, the car was optioned out with the big 428-cu.-in. Cobra Jet engine, special hood scoop and styled wheels.

Where does "Miami Vice" get all their neat cars? They rent some and build some. Sources include individual collectors, auto specialty shops and car fabricators like Roberts. The original

Ferrari look-alike used by Crockett was spotted on a lot in Newport Beach by the show's producer. He knew the car had the perfect image for his lead character. The car was a custom-built machine using Ferrari-design, fiberglass panels adapted to a 1980 Corvette chassis. And some real Ferrari hardware integrated with the car added to the Ferrari effect.

When the new model Ferrari Testarossa came out, it was decided to update the Ferrari on "Vice" to the trick-looking new machine. Plus, the real Ferrari North American people got a little miffed that these fakos were getting so much attention.

INSIDE CROCKETT'S STUNT "FERRARI"



"Miami Vice" took on a new look this year which included a new car for Sonny Crockett—a black Ferrari Testarossa (right). When the car didn't show up in night scenes it was painted white. A look-alike replica (left) is used for all car chases and stunt work. Underneath the Ferrari body panels, the stunt car is basically a mid-engined DeTomaso Pantera powered by a modified 351 Cleveland Ford engine.



They offered to supply two real Ferrari Testarossas for the show. The Testarossa was Ferrari's latest model and one would be used regularly and one would be kept as a backup. The cars were supplied to the producers painted black, but when they didn't show up well in night scenes, they were later painted white. To create a car that would perform stunts, "Miami Vice" producers turned to the Roberts Motor Co., which had specialized in safety-oriented stunt cars for the movie and TV industries. Carl Roberts' assignment was to build a Testarossa look-alike that would be able to stand up to the rigors of

stunt duty. In effect, Roberts was asked to build an automotive Thespian that would breathe life and action into the show just as much as the human players. Unlike the front-engined Daytonas, the Testarossa was a mid-engined car, so using a Corvette chassis as a starting point wouldn't work. The proportions of the car were wrong. So Roberts took a 1972 DeTomaso Pantera—a perfect car with 12,000 miles on the clock and a collector value of about \$30,000—and chopped it apart.

Roberts designed Testarossa look-alike, fiberglass body panels working from pictures in a magazine, and

parts he salvaged from a wrecked Testarossa. He molded a 1-piece nose for the car that was easily removed for service access to the front end.

Another reason for the fiberglass body sections is that they were easily replaceable in the event a stunt got out of control.

To beef up the Pantera's chassis to handle jumps without the force of impact causing the roof to buckle, an additional subframe made from 2½-in. square tubing was bolted to the chassis. The subframe also works as a skid plate to protect the bottom of the car from impact. The suspension also was upgraded with

stiffer springs to make the car more rigid, plus Koni shocks. To get the additional ground clearance necessary for the jump maneuvers, the body was shimmed up 1½ in. and extra body mounts were added for more support.

Driver protection presented a problem from a visual point of view. A full roll cage would have been the way to go for maximum safety, but the roll bars would have been visible around the windshield posts. A compromise was reached by installing a roll bar just behind the driver's seat in the engine compartment. The bar was attached to reinforced areas of the frame rails and further reinforced with ¼-in. steel plates at about the midpoint of the bar for vertical support. A fuel cell was used to prevent spillage during rollovers or crashes, and a competition safety harness was installed.

The Grant steering wheel is another safety feature. It is easily removable in case of an accident so the driver can be freed in case he's

(Please turn to page 156)

ASIAN



Koreans Kim Woo-Choong and Chung Ju-Yung may soon be as well known in America as Lee Iacocca and Roger Smith. Mr. Chung is the chairman of Hyundai, which in 1986 had the most successful introductory year ever for an import. Hyundai sold an incredible 160,000 Excels, and hopes to raise that to 250,000 in 1987.

Mr. Kim, the chairman of Daewoo, expects to sell 100,000 cars in America this year. Unlike Hyundai, which established a new dealer network from scratch, Daewoo is selling its cars through Pontiac dealers. This gives Daewoo access to GM technology, not to mention a ready-made dealer body.

Daewoo and Hyundai are perfect examples of the most important change in the auto-

mobile industry since Honda, Toyota and Datsun opened up the American market 20 years ago. While it's no longer economically feasible to build low-cost cars in America, the Voluntary Import Restrictions plus weakened dollar have forced Japanese automakers to sell ever-more-expensive models in the U.S.

Small car production is shifting to Third World countries where wages are lower, the work ethic is stronger and governments are more lenient to heavy industry. The low-cost cars these countries produce will still be sold in America and Western Europe, because that's where the money is.

Once their workers have earned enough to trade in their bicycles for automobiles, these same Third World factories will start pro-

At speed (from left) are Dodge Colt (Japan); Hyundai Excel (Korea); Ford Festiva (Korea); Mercury Tracer (Japan, by way

INVASION!

We test 8 captive imports with rock-bottom prices and mixed parentage.



ducing cars for local consumption. The same strategy carried Japan from postwar ruin to impressive prosperity in just a few decades—and it's worked so well, that Japan can no longer compete with Asian or South American workers.

We finally have an International Automobile Industry. For the first time, cars are being built and sold all over the world, not just in "developed" countries. But since Europe, Japan and America have the markets and technology, virtually all of them are cooperative ventures.

Take the Daewoo, for example. It was designed in Germany as an Opel Kadette. It's also called a Vauxhall in England, and sold in nearly every European country. The Daewoo version was restyled in Warren,

Michigan, to fit in with other Pontiacs, and named the LeMans after a French racetrack. But it's built entirely in Korea of parts sourced all over the world.

The Hyundai is even more of an international venture. It's based on Mitsubishi mechanicals engineered in Japan, but with a body styled by Giorgetto Giugiaro in Turin, Italy. It's built in Korea in a Mitsubishi-engineered factory, from parts sourced all over. It's sold in America by Hyundai, but in yet another twist, Mitsubishi is buying cars from Hyundai and selling them as the Mitsubishi Precis. It's now cheaper for Mitsubishi to import cars from Korea than build them in Japan!

We identified eight of these inexpensive cars on the American market. In addition to

of Mexico); Pontiac LeMans (Korea) and Chevy captives from Japan: Sprint, Spectrum and Nova (by way of California).



PONTIAC LEMANS



CHEVROLET SPECTRUM



CHEVROLET NOVA



MERCURY TRACER

the Hyundai Excel/Mitsubishi Precis and Daewoo LeMans, Ford is importing a Mazda-designed Festiva from Korea as well as a restyled Mazda 323 assembled in Mexico and labeled a Mercury Tracer in this country.

Chrysler's Dodge Colt is a Mitsubishi Mirage built in Japan, while Chevrolet's Sprint started life as a Suzuki Cultus in Japan. Chevrolet dealers also import the Isuzu I-Mark from Japan and call it Spectrum. Then there's the Chevrolet Nova, a Toyota Corolla assembled in America of Japanese parts.

We did our track testing at Los Angeles County Raceway in Palmdale, our photography at El Mirage Dry Lake, and our back-to-back driving loops in the high-desert foothills of the San Gabriel Mountains.

The average price of our eight "low-cost" Third World cars—even including the Hyundai—is a heady \$8560, despite \$94-a-month wages in places like Mexico.

Mercury Tracer

Our testers unanimously picked the Mercury Tracer, not Mazda 323, as the best car in this group. Happily, there's more than just a trace of the 323 left in the Tracer, despite its move to Mexico and a facelifting by Ford designers in Dearborn. At first glance, the Tracer seems much more rounded than the 323, but in fact, it's identical except for replacement grille, taillights and bumpers, plus repositioned body side moldings.

The Tracer will soon replace the Lynx in Mercury's lineup. It's available now as a 3- or 5-door hatchback. A Tracer station wagon is on the way. Our group thought our test 5-



HYUNDAI EXCEL

Text by Rich Taylor, Photos by Studio 10

SPECIFICATIONS AND DIMENSIONS

MANUFACTURER/MODEL	BASE PRICE	PRICE AS TESTED	ENGINE	TRANSMISSION	WHEEL-BASE (in.)	LENGTH (in.)	WEIGHT (lb.)
Chevrolet Nova	\$8548	\$11,007	74-hp SOHC 1.6 liter Inline-4	3-speed automatic	95.7	166.3	2250
Chevrolet Spectrum	7709	9287	70-hp SOHC 1.5-liter Inline-4	5-speed manual	94.5	158.8	1900
Chevrolet Sprint	5995	8509	48-hp SOHC 1.0-liter Inline-3	5-speed manual	88.4	141.1	1550
Dodge Colt	5407	7138	68-hp SOHC 1.5-liter Inline-4	5-speed manual	93.7	157.3	1900
Ford Festiva	5765	8000*	58-hp SOHC 1.3-liter Inline-4	5-speed manual	90.4	140.4	1750
Hyundai Excel	5195	5690	68-hp SOHC 1.5-liter Inline-4	4-speed manual	93.7	160.9	2150
Mercury Tracer	8364	9856	71-hp SOHC 1.6-liter Inline-4	5-speed manual	94.7	162.0	2158
Pontiac LeMans	7000*	9000*	74-hp SOHC 1.6-liter Inline-4	5-speed manual	99.21	163.7	2153

* Estimate

1. Best speed while weaving through seven cones placed 100 ft. apart; the higher the speed, the better the transient handling.

2. G-forces generated during steady-state cornering around a 200-ft.-dia. circle; cw = clockwise, ccw = counterclockwise.

3. The number of standard-size grocery bags that will stand upright (1-in. crush space permitted) in trunk with rear seats up.



CHEVROLET SPRINT

Ford Festiva

The Festiva is really in a different class from the Tracer—part of the “micro-mini group.” In crowded Japan, this is a popular market segment, but the Festiva, Sprint, Daihatsu Charade and Subaru Justy are the only shoeboxes of this size to make it to America—so far.

Designed by Mazda, the Festiva is assembled by Ford’s partner in Korea, Kia Motors, though the drivetrain is built by Mazda. Like the Tracer, the Festiva has been given heavy, rubberized bumper/airdams front and rear, with



FORD FESTIVA



DODGE COLT

door was “prettier than the usual 5-door hatch,” and surprisingly roomy for both passengers and cargo. The interior is identical to that in the 323.

Said our testers, “All controls are where they should be. Instrument cluster is excellent, everything can be read at a glance.” The Mercury Tracer’s bucket seats came in for special praise: “Fabric seats are a nice luxury in this price range, and give an excellent seating position with plenty of headroom.”

Mostly though, our testers were impressed by the chassis. “Responsive, quick and more sporty to drive than its appearance would suggest,” as one tester put it. Our testers’ summations were unanimously glowing. The quality of fit and finish is a tribute to the Mexican workers in the new, highly automated Hermosillo factory.

TEST RESULTS

GAS MILEAGE (EPA city/ PM test)	¼-MILE (sec. @ mph)	0-60 mph (sec.)	BRAKING (ft.) (60-0 mph)	SLALOM ¹ (mph)	SKIDPAD ² (cw/ccw)	TRUNK SPACE ³	INTERIOR SPACE INDEX ⁴	TEST TRACK RANKING ⁵	ROAD TEST RANKING ⁶	OVERALL RATING ⁷
29/25.54	19.732 @ 69.38	16.54	126.8	55.41	.70/.74	15	150.78	6	6	6
37/27.47	18.568 @ 71.95	14.19	140.7	52.51	.70/.72	15	138.00	8	5	8
44/37.72	20.469 @ 69.43	15.09	119.4	54.58	.71/.72	8	134.19	5	4	3
37/28.57	18.603 @ 71.90	15.27	125.0	56.05	.69/.73	11	147.56	7	3	4
39/37.20	17.890 @ 75.80	10.39	113.6	55.30	.74/.76	8	137.90	2	2	2
29/30.25	18.953 @ 70.12	14.99	127.0	53.92	.73/.74	11	144.94	4	8	7
28/26.86	17.744 @ 75.76	12.19	135.6	57.80	.73/.76	11	160.69	1	1	1
31/25.64	18.405 @ 73.32	12.97	137.4	54.47	.75/.75	14	157.06	3	7	5

4. Front-seat width x headroom x legroom + rear-seat width x headroom x legroom + 1000.

5. Points are awarded from best (1) to worst (8) in each category. Fewest total points ranks first, and so on.

6. Subjective ranking on the road by a team of testers; cars are graded by “feel,” independent of test track results.

7. Average of Test Track and Road Test ratings. Road Test score breaks ties. Bold numbers show best performance.

ASIAN INVASION

body-side moldings that continue the bumper line. The 1.3-liter 4-cylinder is essentially a smaller version of the Mazda 1.6-liter Four in the Tracer. The Festiva weighs 400 pounds less, so performance of the two siblings is virtually identical.

Even with just 58 hp, the little Festiva zoomed 0 to 60 quicker than any other car in this test. It had the shortest braking distances, too, and was near the top in our handling trials.

The Festiva is a blast to drive—a modern-day Mini Cooper. Our testers praised the “positive” shifter, “responsive” steering and “stable” handling. “I’d have no qualms about driving this car 80-plus all day; lots of fun and surprisingly steady, with great gas mileage,” said one tester.

Even those of us who like the Festiva have a hard time thinking of it as a “real” car. The Festiva is “just a skateboard, a perfect college car, or second or third family car for everyday running around.”

Our testers were unusually enthusiastic about the Festiva. “This car is pure fun, peppy and impish, but also well-mannered and cute.”

Chevrolet Sprint

We liked the Sprint. But with only 48 hp from three cylinders, it's also about the slowest car we've tested since the Volkswagen Beetle: The quarter-mile in more than 20 seconds is *slow*.

Chevrolet has come up with three different versions: There's the normal Sprint we tested, an ER model set up for maximum fuel economy (54 mpg, EPA City, the best in the country) and the Turbo. The Turbo raises horsepower from 48 to 70 and adds the usual sporty steering wheel and such, but

also raises the price to where other Mini GTs are better buys.

Our testers were impressed with the standard Sprint, despite some obvious shortcomings. Everyone called it “cute and fun,” and typical comments were “loud, slow, flimsy and too much fun!; noisy, tinny, full of vibrations. I love it!” As one tester summed it up: “Actual performance is a five; perceived performance is a 10.”

Dodge Colt

Compared to the Festiva and Sprint, the Colt is a full-size car. It feels big and sturdy, and as one perceptive tester put it, “It's hard to believe this is a stripped Japanese economy car. It has the confident road feel of a good German machine.”

The Colt is well on its way to being the universal economy car. It's built in Japan and sold all over the world in everything from stripped econocar to hot-rod Turbo versions. In America, you can buy it at Dodge, Plymouth or Mitsubishi dealers. Soon, Yugo dealers will also be selling the Colt, this time built in Malaysia and called the Proton Saga. Then there's the Hyundai Excel—a restyled Colt—not to mention the identical Precis which Mitsubishi dealers will sell next to the Mirage. That's a total of six nameplates on this same car, all available in America.

Its boxy styling is getting a bit out-of-date but, in our experience, just about every glitch was refined out of the Colt years ago. Colt owners swear by them: 100,000 miles with nothing more than new tires and oil changes seems to be a common experience.

According to our testers, the Colt is also quite a nice car. “This car is friendly,” said one. “The seats are comfortable and easily adjusted. The controls are easily reached. Small touches like

that make a big difference as the miles go by.”

Pontiac LeMans

We were looking forward to driving the LeMans, but instead of the German road car we expected, the Opel-designed, Daewoo-built LeMans is more like Japanese econoboxes from 10 or 15 years ago: mediocre-handling, underpowered, uncomfortable and sprinkled with superficial “American” styling clichés.

The 4-door LeMans looks something like a Ford Tempo while the 3-door we tested seems too stubby and cluttered. The black plastic taillights and rear quarter-window louvers were specifically criticized by our testers. The LeMans reminded one tester of Bill Mitchell's famous line: “Styling a small car is like tailoring a dwarf—it never looks quite right.”

In our testing, the LeMans was an average performer in everything except fuel economy, where it barely beat out the heavier, automatic transmission Nova for last place.

Both at the track and over the road, our testers complained about the LeMans' curious handling. As one tester put it, “This car has a very top-heavy feeling. It swings and sways, and wanders from side to side. It doesn't inspire confidence.”

Other deficiencies noted by our testers are uncomfortable seats, cramped rear leg- and headroom, vague shifting, poor plastic trim, lots of shakes and rattles, and severe axle tramp over rough surfaces.

Chevrolet Nova

The Nova, a rebadged Toyota Corolla assembled in Fremont, California, at the NUMMI joint venture factory, is by far the biggest and most expensive of these captive import/joint venture cars. The Corolla/Nova is, as one tester put it, “perfect for what it is—totally competent family transportation, totally generic, totally dull.”

The Corolla has been around for quite a while, and it's getting pretty long-in-the-tooth. Still, it's a straightforward, dependable, surprisingly comfortable sedan, with no rude surprises.

Our group specifically liked the seats, driving position and overall comfort, and complained only about minor annoyances. The worst feature of this particular car, and the one that kept it from a higher finish in this test, was the power-robbing automatic transmission, constantly hunting up and down for the right gear.

Our advice: In any of these small cars, order the 5-speed. It makes all the difference in the world in driveability, fuel economy and driving pleasure.

(Please turn to page 148)

CAPTIVE IMPORTS FAMILY TREE

Car Name In U.S. Market	Original Name	Country Of Origin	Assembled In	Drivetrain Built In
Chevy Nova	Toyota Corolla	Japan	U.S.A.	Japan
Chevy Spectrum	Isuzu I-Mark	Japan	Japan	Japan
Chevy Sprint	Suzuki Cultus	Japan	Japan	Japan
Dodge Colt	Mitsubishi Mirage	Japan	Japan	Japan
Ford Festiva	Autorama Festiva	Japan	Korea	Japan
Hyundai Excel	Mitsubishi Mirage	Japan	Korea	Korea
Mercury Tracer	Mazda 323	Japan	Mexico	Japan
Pontiac LeMans	Opel Kadette	Germany	Korea	Korea

BOX SCORE: Japan 16, Korea 5, Germany 1, Mexico 1, U.S.A. 1

GOTCHA!

Or does he? We test 10 pocket-size radar detectors against the top-rated full-size Escort.

BY RICH TAYLOR, Contributing Editor
Photos by Brian Kosoff

In our November 1986 issue, we compared 10 full-size radar detectors, plus the pocket-size Passport. Since then, a new generation of miniature detectors has hit the market. We assembled 10 of these for this test, including the Passport.

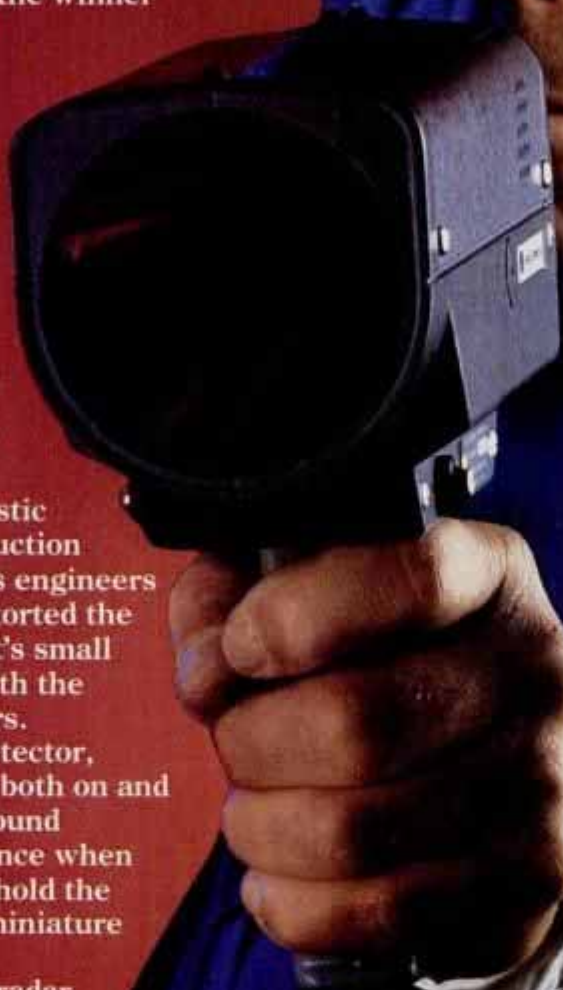
As a control, we also included the winner of our November test, Cincinnati Microwave's industry-standard Escort, plus the mid-sized Autotronics Snooper D-4000, which is billed as pocket-size.

Cincinnati Microwave was very upset with the results of our November test. Specifically, they thought that its Passport should have finished second to the winning Escort. CM blamed the Passport's poor showing on our use of a Radar Ready Mount to hold the units during testing.

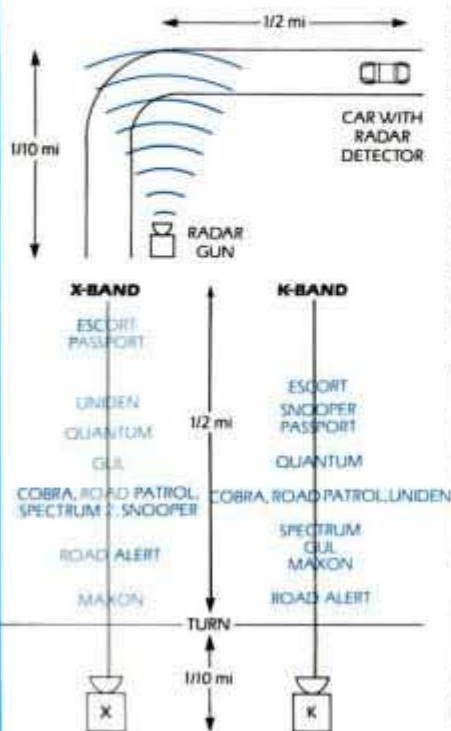
The Radar Ready is a clear plastic shelf held to the windshield by suction cups, and Cincinnati Microwave's engineers claim that these suction cups distorted the microwave signal to the Passport's small antenna, while not interfering with the signal to the larger radar detectors.

For this test, we tried every detector, including the Passport, mounted both on and off the Radar Ready Mount. We found absolutely *no* measurable difference when using the Radar Ready Mount to hold the Passport or any other detector, miniature or full-size.

Clearly, the Escort is the best radar detector around. Its performance is dramatically superior to any other full-size detector, as well as any mini. When it first came out, the Escort was the most expensive detector on the



DETECTOR PERFORMANCE AROUND A CORNER



On the majority of highways, the most convenient way for a police officer to stay out of sight while operating his radar is to aim into a blind corner. We used the same corner as in our November test.

As in our previous test, the Escort was able to find the radar from a half-mile before the corner. Consistent with the results of our previous test, Passport was easily the best of the minis, but not as good as the mid-size Snooper on K-band. The poorest-performing minis, the Maxon and Road Alert, were less than a quarter-mile from the radar before detecting it. No detector in this group had to round the corner before sniffing out Smokey. However, this may have been due to an early morning mist giving better reflectivity to the radar. In clearer weather, they might not have done so well.



X- and K-band radar guns were clamped to tripods and used alternately in tests.

DETECTOR PERFORMANCE OVER A HILL



Detectors were tested atop a microwave-neutral shoebox lid as well as the suction-cup mount used last time.

We used the same hill as in our November test of full-size detectors. Once again, the Escort was best in K-band performance—and in the absence of the full-size Uniden which won this category last time, best in X-band as well. On either X-band or K-band, the Escort can pick up radar from nearly a mile away, which is truly impressive.

Performance of the minis is not as good by comparison. This is a situation where a police officer is not likely to use an instant-on radar gun, so being able to detect the radar before the crest of the hill is of

market. This is no longer true—which makes the Escort not only the best performer, but something of a bargain.

Escort was redesigned in 1980 to reduce interference from other microwave sources, like burglar alarms, door openers and other radar detectors. We tested an older Escort belonging to one of our staff members, and found that at least on K-band, it was inferior not only to a 1987 Escort, but to all the current pocket-size detectors in our test group, as well. If you have an Escort with a serial number lower than 400,000—or any other older radar detector, for that matter—you're in the market for a replacement. Radar detector technology has changed so fast that a 5-year-old unit may not give you adequate warning.

Combining the results of both of our tests, we find that

the best full-size detectors are better than the best mini. But, there are drawbacks to a full-size detector. An Escort, for example, weighs a hefty 19.5 ounces and measures $5\frac{1}{2} \times 4\frac{1}{2} \times 1\frac{3}{4}$ in. By comparison, the Passport measures $4\frac{1}{2} \times 2\frac{3}{4} \times \frac{3}{4}$ in. and it weighs just 6 ounces.

This makes a Passport (or any mini) literally pocket-size, while full-size detectors must travel in your briefcase. Although the Snooper and Maxon claim to be "pocket-size," the only pockets they'd fit are those in an overcoat or army fatigues.

Just about any modern detector, full-or pocket-sized, will warn you in time to avoid police radar. A police radar gun

transmits a beam that's about two lanes wide at 500 ft. from the gun, and four lanes wide at a quarter-mile. Since it's a relatively low-powered transmitter, and depends on a signal reflected off your car in order to judge your speed, the practical limit for police radar is about 1500 ft. for automobiles and 2500 ft. for big trucks. That's also about the practical limit for an officer to swear to visual identification that will stand up in court.

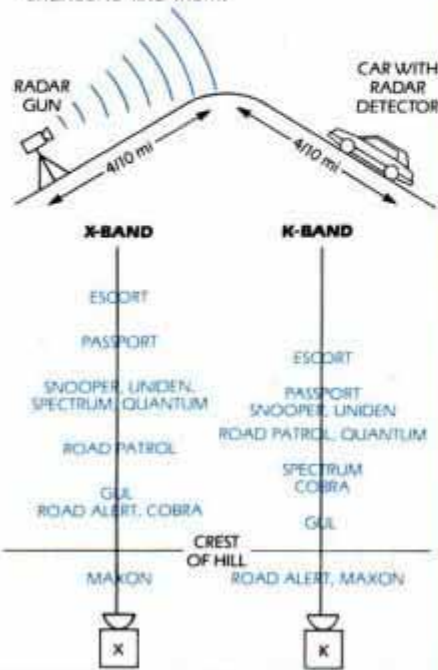
Even the worst radar detector in this test can pick up an X-band signal from 2 miles away in a straight line, and under ideal conditions the best start blatting their warning when the radar is still 3 or more miles ahead. K-band is weaker,

True pocket-sized detectors include: (A) Uniden RD-9; (B) Sparkomatic Road Alert 30; (C) BEL Quantum; (D) Passport; (E) Radio Shack Road Patrol 30; (F) Cobra Trapshooter Micro; (G) Whistler Spectrum 2; and (H) GUL G3005. Bigger pockets are needed for (I) Snooper D-4000 and (K) Maxon RD-1. Winner Escort (J) is full-size.



utmost importance. On some police cars, the radar is wired into the ignition and is always broadcasting.

The best of the minis was the Passport, noticeably better than the mid-size Snooper. The poorest of the minis, the Maxon and Road Alert, didn't find the radar until after they'd crested the hill. Unfortunately, that's also after the radar has gotten it's chance to find them.



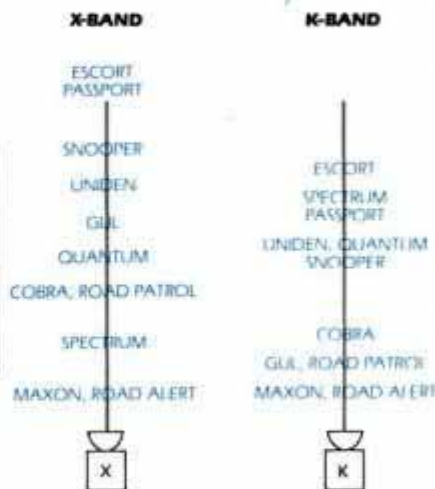
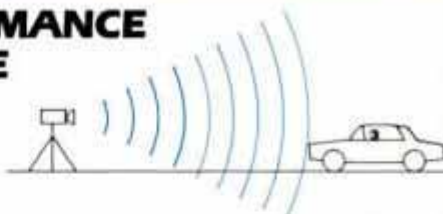
DETECTOR PERFORMANCE IN A STRAIGHT LINE

As in our full-size detector test, the Escort was the the best, with a range in excess of 4 miles. The Passport is virtually identical on X-band, not quite as good on K-band. In fact, Whistler's surprising Spectrum 2 was nearly as good as the Escort on K-band. Good sensitivity also helps pick up instant-on radar as the police trigger their guns to catch motorists ahead



About 52700 in electronic countermeasures litter dash in long-distance test.

of you. Standard operating procedure with instant-on radar is to set the unit on HOLD and then wait for a gap in traffic. When the next group of cars approaches, the officer releases the HOLD button and zaps the group. The radar locks in on the fastest car and—9 times out of 10—the officer writes up the first car in the pack. Advance warning of these blitzes permits you to let



someone else go first. Even the worst pocket-size detectors can find radar from almost 2 miles away in a straight line. If all roads were flat Interstates—and all radar officers aimed their units right down your lane—any one would do. In the real world, they aren't, they don't and it won't.

but in a straight line you might still have a mile of warning.

The tricky situations are around corners and over hills, where the experienced radar officer will aim his gun so that he nabs you just as you turn into his beam.

Good radar detectors are sensitive enough to pick out police radar at the very fringes of this diffuse signal, and selective enough to discriminate between a legitimate X-band or K-band transmission and many (but not all) false alarms triggered by garage door openers, CBs, other radar detectors, airport radar, microwave transmission towers, even high-tension lines.

Accurately measuring false alarms is difficult, because of constantly changing real-world condi-

tions. Several detectors in our test group were fairly immune to falses, but probably because they weren't sensitive enough to be affected by *anything* short of a thermonuclear explosion, including police speed radar.

Our car-to-car interference chart gives some idea of susceptibility to false alarms triggered by other detectors. A casual test performed during the Auto Editor's daily commute indicates that the most resistant detectors to false alarms are the Escort, Snooper, Cobra, Maxon and GUL.

As you can tell from our test charts,

the Escort and Snooper are sensitive units with superior discrimination. The Cobra, Maxon and GUL are, to put it kindly, not among the best performers.

Some of our test detectors are literally clones—the same electronics with slightly different styling sold under a different name. Specifically, the Cobra Trapshooter, Road Patrol XK, Road Alert 30 and Uniden RD-9 are seemingly identical. However, as you can see from our test results, their performance varies significantly. Some of this can be attributed to assembly line variations, or perhaps to differing specs for different marketers.

Our test was done using an X-band MPH Industries K-55 and K-band Kustom Electronics Falcon, among the most popular handheld



police radar guns.

Out on the highway, when you're nudging the national speed limit, what you need is a warning beep that can be heard above the radio and gets you to tap the brakes *now*. One tester's "annoying noise" was often another's "attention-grabbing beep." We suggest you only buy a detector you can return, just in case its audio warning drives you crazy or proves to be inaudible.

Every detector also has an array of lights to provide a visual warning. It's important that you be able to tell the difference between X- and K-band signals instantly, without looking away from the road. While rarely used on the open expressways because of their short range, K-band radar gives little warning to even the best detectors. A K-band signal requires immediate action on the part of a motorist, but the relatively high-powered X-band units will often give a mile or more of notice.

Signal strength indicated by flashing lights and beeping tells you how close you are to Smokey, and helps to sort out false alarms. On many units, one or two warning lights and a lazy "peep" indicate faraway fuzz or some X-band pollution from alarms, and other sources. More lights and faster beeps mean "watch out!" Any full-bore alarm

DETECTOR PERFORMANCE RANKING

X-BAND	K-BAND	OVERALL
1. ESCORT	1. ESCORT	1. ESCORT
2. PASSPORT	2. PASSPORT	2. PASSPORT
3. UNIDEN, SNOOPER, QUANTUM	3. SNOOPER, UNIDEN, QUANTUM, SPECTRUM	3. SNOOPER, UNIDEN, QUANTUM
6. GUL		6. SPECTRUM
7. SPECTRUM, ROAD PATROL	7. COBRA, ROAD PATROL	7. GUL, COBRA, ROAD PATROL
9. COBRA	9. GUL	
10. ROAD ALERT, MAXON	10. ROAD ALERT, MAXON	10. ROAD ALERT, MAXON

with no preliminary buildup means you've just been zapped by the "instant-on" radar. If you hit the brakes immediately, you may escape detection—police radar won't lock onto an accelerating or decelerating object, only one moving at a steady speed. Just remember not to collect the traffic behind you when you cram on the binders. A ticket beats an accident any day.

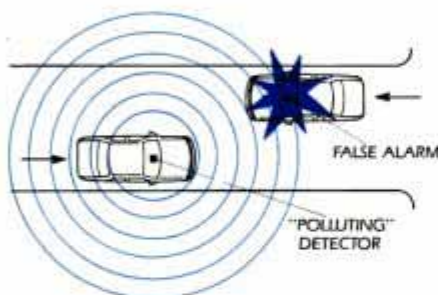
Until recently, all false alarms were on the X-band. Now, Rashid Radar Safety Brakes for heavy trucks also operate on the K-band. Only Escort, Passport and a new GUL model (not the one we tested) have circuitry that claim to screen out Rashid false alarms. Right now, only a relative handful of 18-wheelers are equipped with the Rashid collision warning system. But as more of them hit the road, you'll need a detector that can tell radar and Rashid apart.

That's why we did this test. **FM**

RADAR DETECTOR SOURCES

- **BEL Micro-Eye Quantum** (\$330), BEL-tronics, Ltd., 20 Centre Dr., Orchard Park, NY 14127, (800)341-2288; in New York, (716)662-0522.
- **Cobra Trapsnooter Micro** (\$300), Dynascan Corp., 6500 W. Cortland St., Chicago, IL 60635, (800)262-7222.
- **Escort** (\$245) and **Passport** (\$295), Cincinnati Microwave, Inc., One Microwave Plaza, Cincinnati, OH 45249-9502, (800)543-1608.
- **GUL G300S** (\$260), GUL Industries, 23970 Craftsman Rd., Calabasas, CA 91302, (800)423-3538.
- **Maxon RD-1** (\$100), DAK Industries, Inc., 8200 Remmet Ave., Canoga Park, CA 91304, (800)325-0800.
- **Microna Road Patrol XK** (\$200), Radio Shack, Tandy Corp., 1700 One Tandy Center, Fort Worth, TX 76102, (817)390-3300.
- **Snooper D-4000** (\$180), MSI, 116-32 Chairman Dr., Dallas, TX 75243, (800)442-3574.
- **Sparkomatic Road Alert 30** (\$230), Sparkomatic Corp., Routes 6 and 209, Milford, PA 18337, (800)233-8831.
- **Uniden RD 9** (\$270), Uniden Corp. of America, 6345 Castleway Ct., Indianapolis, IN 46250, (317)842-0280.
- **Whistler Spectrum 2** (\$330), Whistler Co., 5 Lyberty Way, Westford, MA 01886, (617)692-3000.

CAR-TO-CAR INTERFERENCE



"POLLUTING" DETECTOR

...TRIGGERS FALSE ALARMS IN:

	QUANTUM	COBRA	ESCORT	GUL	MAXON	PASSPORT	ROAD PATROL	SNOOPER	ROAD ALERT	UNIDEN	SPECTRUM
QUANTUM						*				*	
COBRA				*			*				
ESCORT	*	*		*	*		*		*	*	
GUL		*			*	*	*			*	
MAXON		*	*			*	*			*	
PASSPORT		*			*		*		*	*	
ROAD PATROL		*		*					*		
SNOOPER			*	*						*	
ROAD ALERT		*					*				
UNIDEN	*		*						*		
SPECTRUM											*

The modern world is filled with microwave radiation. According to the experts, up to 25 percent of all radar tickets are erroneous, mostly because the same airport radar, motion detectors, CB transmitters and garage door openers that set off false alarms in your radar detector can also trigger Smokey's radar.

Superheterodyne radar detectors produce their own low-level microwave radiation, which can trigger false alarms in other detectors. Instead of Smokey, you can be picking up nothing more than your fellow commuter.

We tested for false alarms by bringing every combination of detectors bumper-to-

bumper. As you can see from the chart, compared to last November's, the pocket-size detectors are more prone to false alarms than their full-size counterparts. They also emit more spurious radiation, thus causing more false alarms. The cleanest detectors are Snooper and Spectrum when either giving or receiving radar rumors.



PM PHOTO BY RICH COX

WE HAVE A WINNER!

A California reader drives off with a Nissan Hardbody V6 in our Customize-This-Truck contest.

Drum roll, please. And the winnah is: Larry Wood, who claimed the Nissan Hardbody 4x4 King Cab SE and drove it back to California, the American epicenter of automotive passions. Larry qualifies to design outrageous custom cars by dint of designing Hot Wheels toys for Mattel for the past 18 years.

Larry's entourage of vehicles includes a rear-engined sidewinder Buick V6 '34 Ford street rod, a '32 Nash, a 429-powered '46 Caddy for daily driving, and a 1913 Harley-Davidson which he keeps in the living room. They really do that kind of thing out in California.

Larry does all of the work on these toys himself, (except for the chrome and paint). So he's certainly ready to



Larry Wood accepts Nissan keys from Editor-in-Chief Joe Oldham (right) and PM Publisher Dan Coleman.

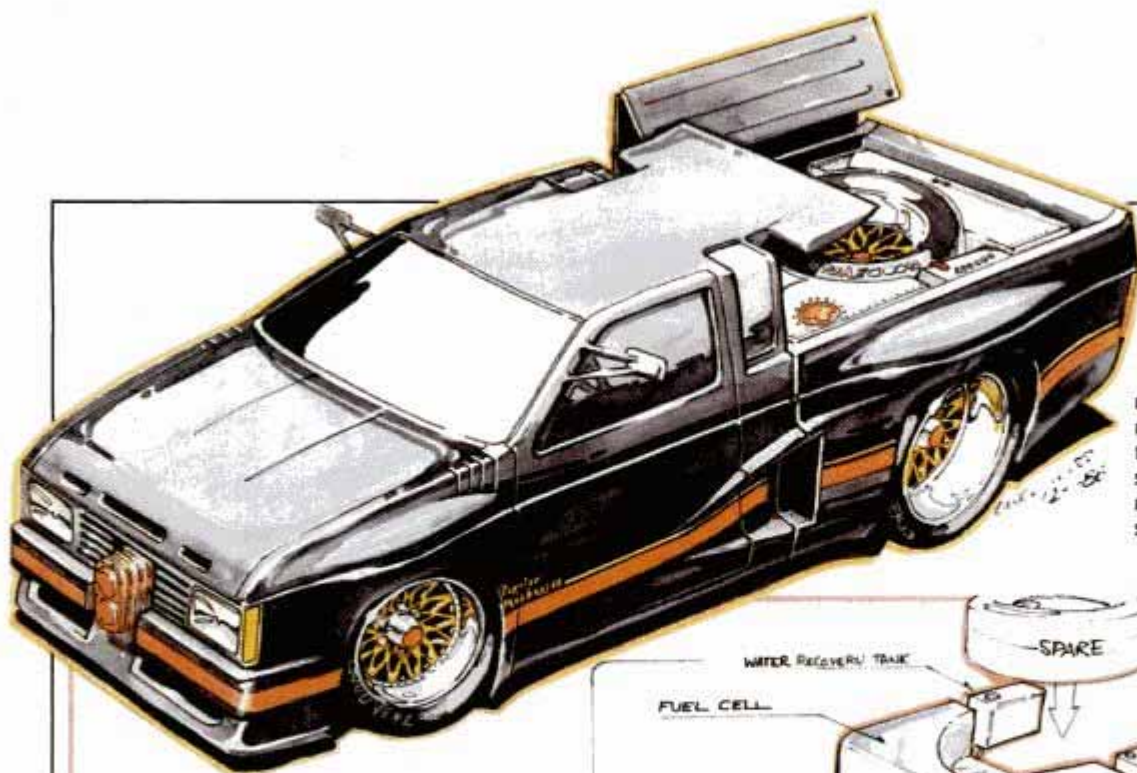
perform the radical customizing he's suggested for his new Nissan. "Living in car-crazy California there are enough big-wheeled, 4wd mini-trucks to jam the freeways," says Larry. "They hardly make heads turn anymore. Everyone seems to be driving them. Seems that the hi-buck, hi-tech sports car is the

rage here now. Everywhere you look there are Porsches, Audi Quattros, Ferraris. So why not a pickup that has the look, power and handling of the sports set?"

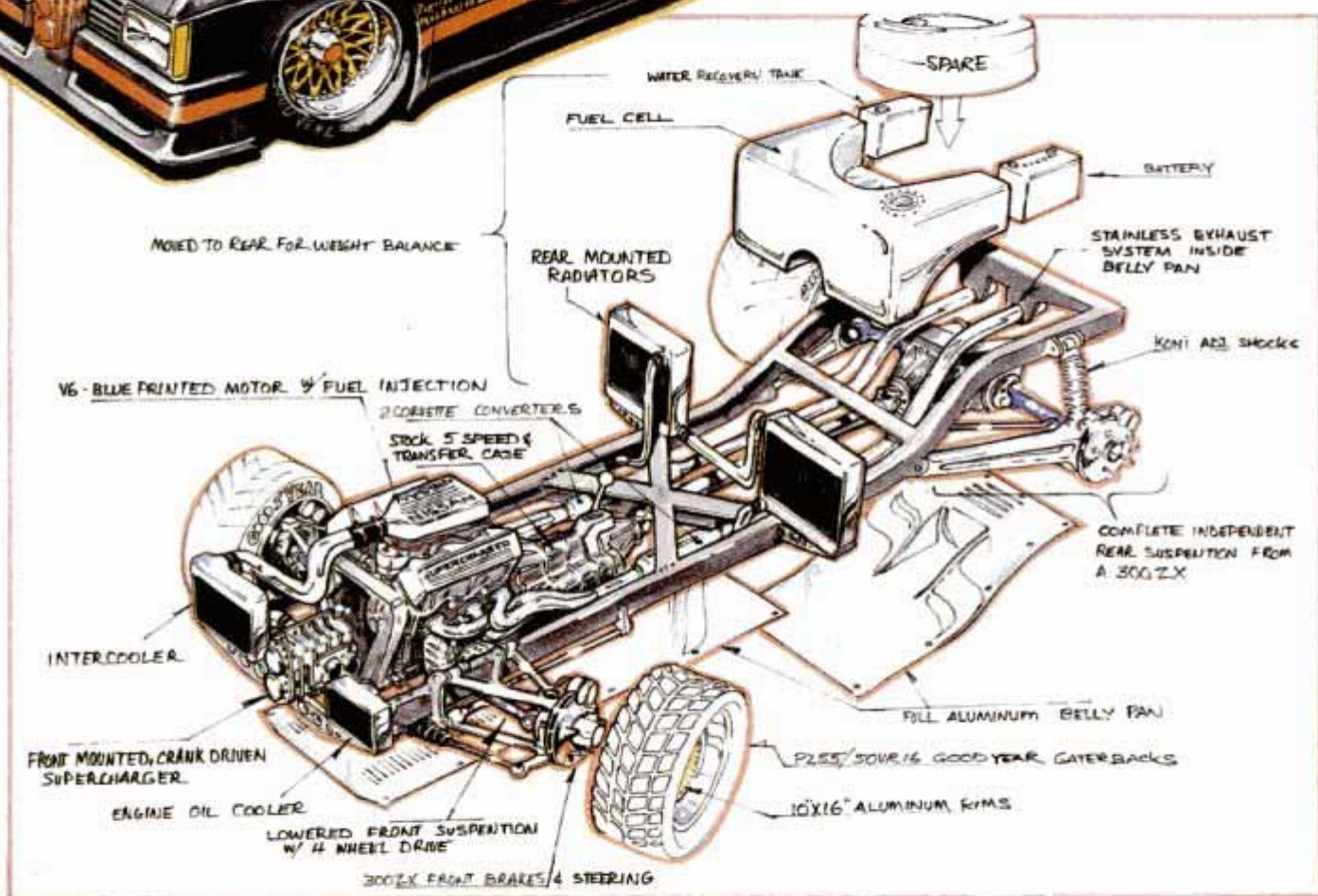
Larry specified a blue-printed Nissan V6 motor, even though a lot of entrants insisted on the last standby of the hot-rodder—a small-block Chevy. Larry wants to supercharge and intercool the 3-liter V6 with the crankshaft-driven blower mount-

ed low and protruding through the grille. Moving the radiators, battery, spare and fuel cell to the rear will help with front-to-rear weight balance, and 300ZX rear suspension and brakes give 4wd independent suspension. A full belly pan should clean up the aerodynamics on the bottom of the truck,

PM PHOTO BY CLIFF GROVER



Winning entry sports supercharger, intercooler, 300ZX rear suspension and plenty of other custom touches. Winner Wood says he could get this truck on the road, modified to his specifications by next summer. It'll be just the thing for chasing parts for his stable of wild vehicles. Not to mention blowing off a lot of sports cars on the boulevards.



complementing the NACA duct, air dam, wind and aluminum bed cover "to help keep traction when we get alongside a Ferrari on Highway 1 through Big Sur."

Larry's well-planned graphics treatment complements the hi-tech ground-effects style built into the bodywork. Note how it accentuates the radiator intakes flanking the bed.

Larry claims, "I could easily build this very trick truck in my own garage and be

looking good by next summer. Wanna go for a ride?" You bet!

We got hundreds of entries that suggested the only thing the Hardbody needed to complement its 140 hp V6, 5-speed transmission, alloy wheels, light bar and trick paint job was a set of personalized license plates belonging to the winner.

While the people from Nissan were impressed with that kind of testimony to the product they sell, that's not

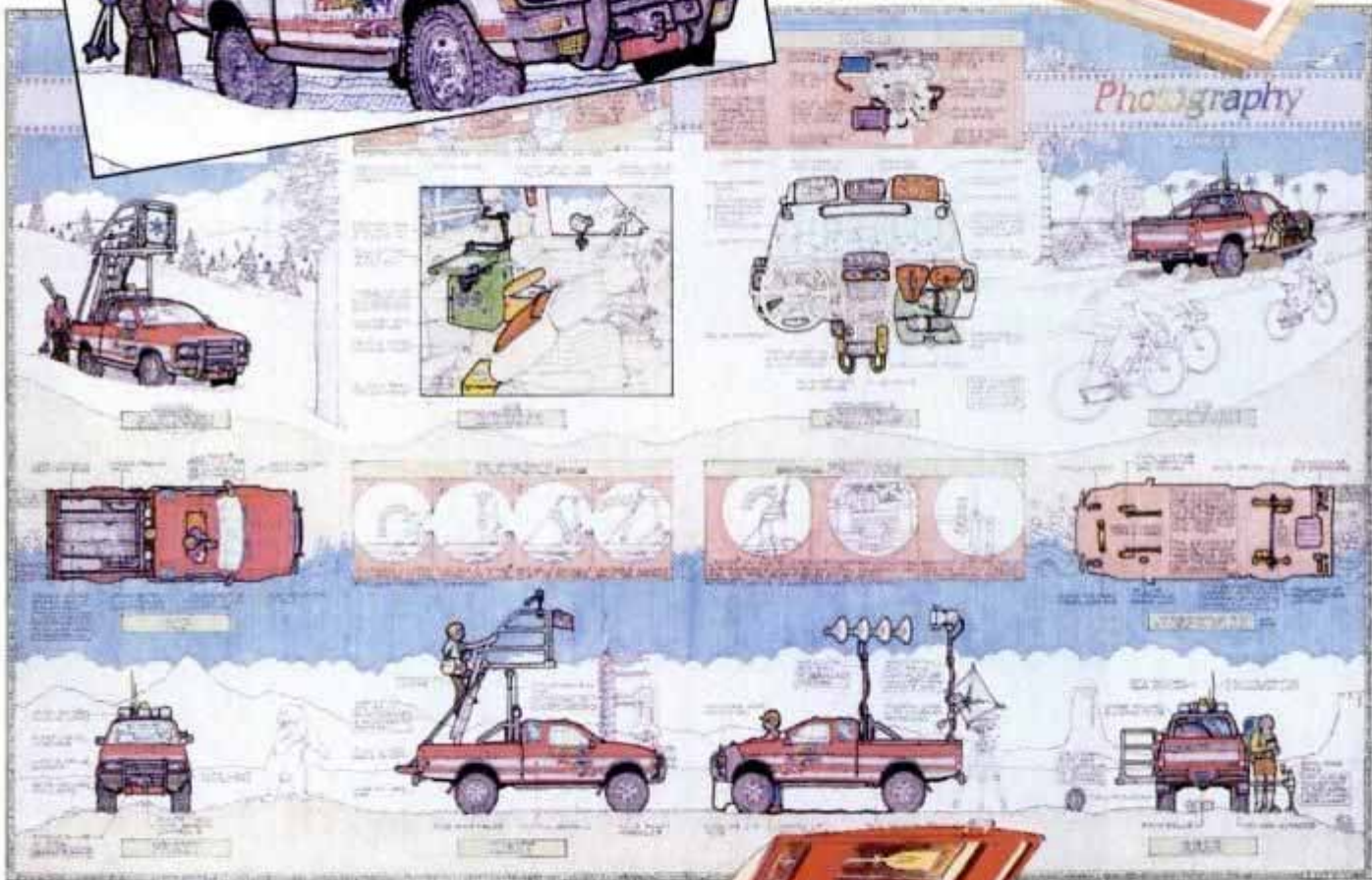
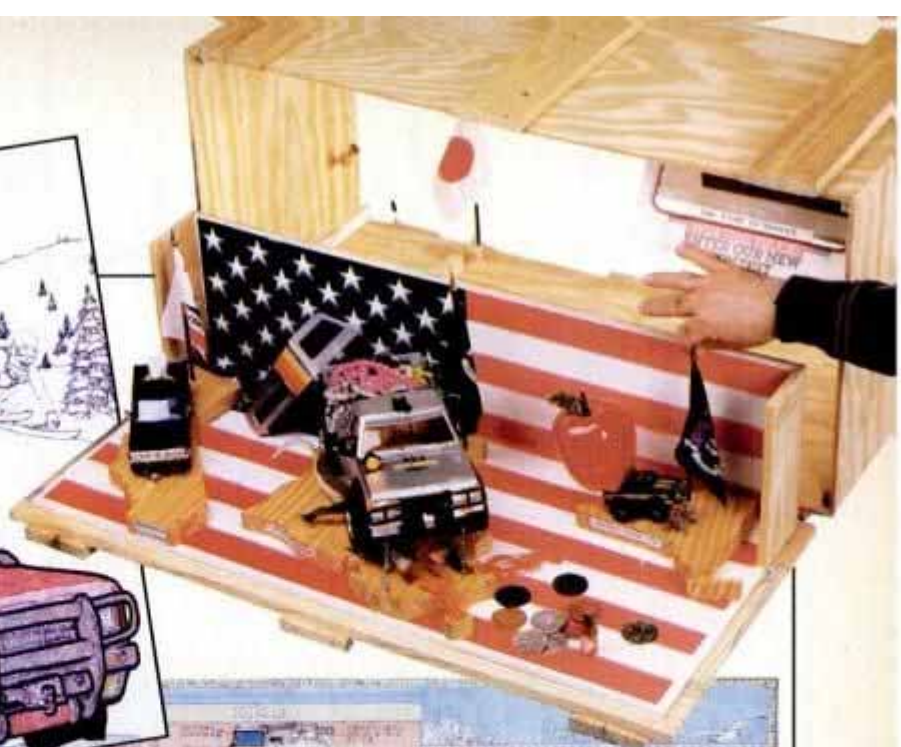
how to win a "Customize-This-Truck" contest. Final determination of the winner was made by Editor-in-Chief Joe Oldham from the finalists that Assistant Auto Editor Mike Allen had selected.

Some other entries, besides the ones shown here, are worthy of mention. If you'll recall, the picture of the Hardbody we used in the original story announcing the contest in the August '86 issue was reversed. Several sharp-eyed readers brought

that to our attention, although some others sent such faithful drawings of the truck that they copied the reversed "SE" letters on the door still reversed.

There were a good number of entries that called for that old standby of the hot-rodder—flames. While certainly attention grabbing, we were looking for something a trifle more contemporary. Ditto for the entry showing the waterbed in the back.

PM



Other entries include working diorama (top right) built by Victor Buccola from Louisiana. Drawings top left and center of page are from Roger Margulies of California. Details of his photographer's do-all support truck include camera tower, side-mount platform, light box, developing chamber. John Reilly of Yonkers, New York, designed a pickup cap that doubles as a fishing dinghy (above). Design (left), submitted by Peter E. Solomon of Glen Ellyn, Illinois, is embellished with streamlined light bar on cab roof.

POPULAR MECHANICS HISSAN KIMB CAR CONTEST

MUSCLE

Five of America's hottest sport boats lock horns in a classic performance battle.

If you want to go fast and look good doing it—but not deplete your bank account—the current fleet of mini-offshore machines, scaled-down imitations of the triple-engined Cigarettes and Magnums, provide eye-popping speeds at less than eye-watering prices.

They're called muscle boats and there's a lot to like in these downsized wave busters besides power, speed and sexy lines. When it comes to rough-water performance, there are few similarly sized boats in

their league. The sharp entry of the deep-vee hull gives an incredibly smooth ride in most models, even when blasting through seas that would hammer you into a mass of Jell-O in other designs.

What's more, you stay dry while navigating the rough stuff. Strakes and hard chines surrounding the wetted surfaces keep water away from the cockpit at all speeds. And despite the fact that you're ripping along at close to a mile a minute, the low seating position and wraparound windshield keeps wind blast



BOATS

BY FRANK SARGEANT; Photos by Skip Gandy

to a minimum. On the downside, these boats don't have a lot of cockpit space. They're all engine compartment and bow, and the cuddy cabin is little more than crawl space on most.

But space is not what these boats are all about. Would you complain that a Ferrari isn't roomy? This is not to say you can't overnight on a muscle boat—you could, if dockside washrooms were close by.

These boats are built for racing, and the PM test team gave them plenty of it, wringing out five of the

sleekest midsize hulls on the market during sessions at Mercury Marine's Mercabo test facility near Placida, Florida. Two additional entries from Four Winns and Chris-Craft (see *Point . . . Counterpoint* on page 154) were included in the performance analysis, but major differences in standard power and amenities placed them out of any valid comparison.

The five boats we eventually charted were supplied by Donzi, Wellcraft, Sea Ray, Chaparral and Formula. Sterndrive power for each was MerCruiser's



Sprinting for the horizon, from center and moving clockwise: Wellcraft Scarab I, Thunderbird Formula F206 LS, Donzi Z-21, Chaparral Villain III, Sea Ray Pachanga 22.



Thunderbird Formula F206 LS: Nicely balanced profile and quick.



Chaparral Villain III: Surprisingly stable rough-water ride and

impressive 350 Magnum, a 270-horse fire-breather that pulls extra power from a big GM block via high-rise intake manifolds. They were tuned to perfection by Merc's Test Center professionals. The drive system for each boat was MerCruiser's beefy Alpha One, one of the toughest stern-drives in the business.

Despite hours of prop tinkering to squeeze the last fraction of speed from each, we found some significant differences in performance among the five essentially similar muscle boats.

Sea Ray Pachanga 22

The Pachanga 22 won the hearts of the test team for several reasons. First, its striking lines and spaceship dash made it look as if it was traveling 100 mph while still tied to the dock. Second, when the lines were untied, it lived up to its looks, with significantly higher top-end speeds than the rest of the fleet. And when it came to the performance course—a saltwater run with a pair of hairpin turns—the Sea Ray also came on strong, with tracking so tight that G-forces threatened to flatten the test crew permanently.

The boat also had more storage than any of the others, partly due to clever use of space. There's a cutout in the

sole, for example, where a hatch fits neatly over an insulated cooler. There are also lockers in the cabin to hold a fair amount of overnight gear.

Seating at the wraparound console was comfortable, but the bucket seats could be deeper to provide better support during high-speed turns. We found the seat hardware a bit light for the job, too.

The windshield is tempered safety glass in an aluminum frame, providing excellent, distortion-free visibility. All gauges are easy to read from the helm position, and the padded sport wheel is ideal for tight maneuvers.

Sea Ray cleverly opened up the cuddy access via a door that stretches across the entire port side of the console—an impressive improvement over the low crawl space provided in most other boats in this class.

TEST PARAMETERS

Each boat was equipped with a 270-hp MerCruiser 350 Magnum feeding power to the prop through an Alpha One stern-drive. Props were chosen for maximum speed on each boat. Top-end and acceleration figures are the result of averaging four test runs for each boat with two adults aboard. A Decatur radar gun was used for speed tests, while timing was accomplished with a St. Charles stop watch.



OVERALL RANKING/MAKE/MODEL	1. SEA RAY PACHANGA 22	2. WELLCRAFT SCARAB I
LOA/Beam/Deadrise/Weight/Fuel Capacity	22'/96"/22°/3135 lb./63 gal.	21'/96"/20°/3100 lb./60 gal.
Cockpit: (sq. ft.)	14.44/Cozy but more than adequate	20.37/Easy movement fore and aft
Sunpad: (sq. ft.)	17.26/Smallest in the fleet	24.44/Spacious but access blocked by radar arch
Cabin: Useable volume (cu. ft.)	8.02/Also on the small side and extremely dark	10.29/Roomy but difficult entry/egress
Sleeping Pad: (sq. ft.)	37.9/Merely average	43.6/Moderate size but comfortable and well lighted
Stowage: (cu. ft.)	55.06/Copious and extremely well laid out	23.5/Adequate but hardly substantial
Seating Space	5 +/-/Plush, secure and comfortable	6/Not uncomfortable; solidly built
Hull Construction: (see key)	HLU RT, Wd/FG SS, Inj. PU	1 LY CR, 3 LY WR, Wd/FG SS
Top-end Speed: (mph)/Ranking	58.23/1/Sets the pace	57.18/2/Solid performer
Acceleration 0-40: (sec.)/Time/Ranking	10.17/3/Moderate but still spritely	9.98/2/One of the quickest
Performance Course: (sec.)/Time/Ranking	51.95/2/Tremendous cornering, tight steering	51.52/1/Excellent tracking; slight porpoise
Fit-and-Finish: Ranking	1/Striking graphics, excellent use of space	2/Top-quality hardware throughout, plush interior
Price as tested	\$29,395	\$29,270
Address	2600 Sea Ray Blvd., Knoxville, TN 37914	1835 Whitfield Ave., Sarasota, FL 34243

Hull Construction Key: HLU=Hand Layout; LY=Layer; M=Mat. CR=Chopped Roving; WR=Woven Roving; FM=Fabmat, comb. mat & roving; CM=Chopped-strand mat; SS=Stringer System; Wd=Wood; FG=Fiberglass Reinforcement; Inj.=Injected; Spr.=Sprayed; PU=Polyurethane Foam Flotation; RT=Ray Tech, comb. of laminates & fiberglass; TXC=Tri-Axial fiberglass & Coremat

Perfect symmetry between wheel, gauges, seat and throttle position. Unhindered sight lines from helm.



Switch access and mounted compass make sense. Wheel doesn't interfere with gauges. Seats secure.





Sea Ray Pachanga 22: Extraordinary speed and spritely handling.

Wellcraft Scarab I

The Scarab, which many consider to be the progenitor of the popular high-performance boat, is still the boat to beat in this class. It ran a very close second in top speed and bested the Sea Ray Pachanga 22 in acceleration and in the performance course.

The Scarab's appearance is exceptional and the fit and finish are top notch. But the entry to the cuddy cabin requires contortions that most of us can't perform comfortably. And the raucy-looking radar arch makes it tough to get to the sunpad on the stern. Further, at higher rpm the test boat displayed a slow but annoying porpoise. And we found a rough ride in choppy waves at speeds more than 30 mph.

The windshield, trimmed low to match the line of the boat, is not high enough to deflect wind—and worse, the frame runs directly across the line of sight of the driver. Also, the seat control at the helm sticks out into the walkway between the two forward chairs just far enough to bark the shins of an unwary skipper.

These points aside, however, the Scarab I is a dynamic speed machine. Every fitting in the boat is high-grade marine quality and battleship tough—Bomar Marine hatch-

(Please turn to page 154)

exceptional stability at top speed; inexpensively packaged.

One shortcoming in the cabin is the lack of hatches to provide ventilation for overnighting. The Sony stereo in the dash has speakers in the cockpit and in the cuddy, both giving exceptional sound quality.

The powerlift engine hatch is foam padded and does a good job of keeping engine noise down, but it seemed a bit flimsy and had a tendency to wobble during raising and lowering. The swim platform contains the muffled exhaust exits, which are smooth looking and reasonably quiet.

Sea Ray has a special fiberglass layup process for its Pachanga hull, which it likes to keep close to the vest. They call it Ray Tech and, roughly, it consists of a combination of laminates and woven roving. No chopped roving is used.

The Pachanga 22 is a standard sport boat in so many ways that we had to make it our number one choice.



3. THUNDERBIRD FORMULA F206 LS	4. DONZI Z-21	5. CHAPARRAL VILLAIN III
20'6"/94"/22"/3190 lb./43 gal.	22'6"/101"/22.5"/3375 lb./56 gal.	22'/96"/22"/3325 lb./65 gal.
17.93/A real tight squeeze	19.18/Tight but still adequate	33.33/Voluminous
18.69/Average but more than adequate	21.45/Larger than most	19.32/Average but adequate
9.53/Solid but unremarkable; lacks vents/hatches	9.63/Average; headroom extremely limited	9.69/Difficult entry/egress
38.13/Comfortable	45.25/Extra beam helps in this category	38.75/Too thin; extremely uncomfortable
27.69/Side pockets highly appreciated	8.07/Totally inadequate	44.47/Exceptional space well used
5+/Deep bucket seats forward adds to security	6/Generally pretty Spartan	6/Uncomfortable; does not feel well built
Combination WR & CM, Wd/FG SS, Inj. PU	HLU TXC, Wd/Tri-Ax SS, Spr. PU	3 LY WR, 1 LY CM, Wd/FG SS, Spr. PU
54.48/5/Slowest, prop suspected	56.08/3/Reasonably quick; loud due to side exhaust	55.2/4/Average
9.63/1/Quickest here; skiers take note	10.39/4/Average	10.57/6/Way off the pace
54.47/5/Sloppy steering; slides on corners	53.59/4/Excellent rough water ride; tracks well tuning	53.14/3/Stable at speed; outstanding in rough water
3/Excellent seating; plush sleeping area	4/Minimalist approach; racing heritage evident	5/Nice upholstery, but detailing decals nick easily
\$31,725	\$36,995	\$27,748
18100 Biscayne Blvd., N. Miami, FL 33160	P.O. Box 987, Tallahassee, FL 34270	P.O. Drawer 928, Nashville, GA 31639

Elbow rest aft of throttle particularly appreciated in rough water. Gauges somewhat condensed on instrument panel.



Offset wheel hard to get used to. Racing controls mean vital trim function is located out of the way.



Wheel severely restricts view of instruments. But switch and throttle are positioned for comfort and access.

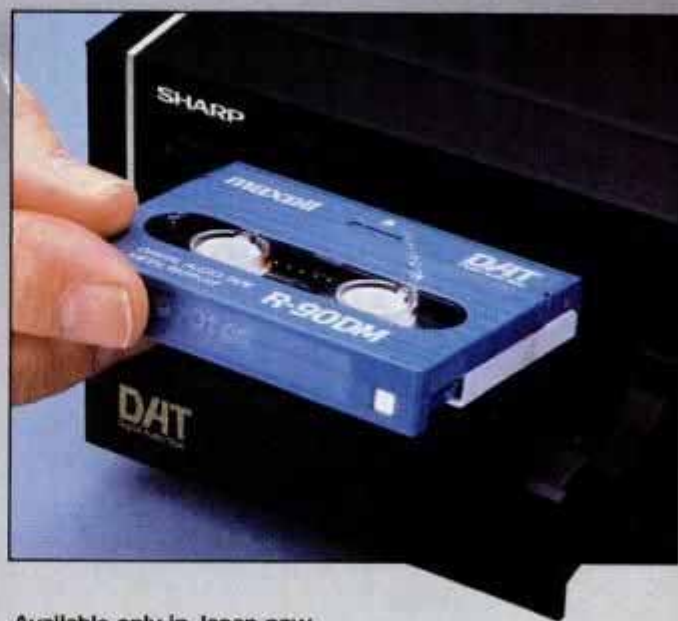




BY STEPHEN A. BOOTH, *Electronics Editor*,
and FRANK VIZARD, *Contributing Editor*
Photos by Brian Kosoff

S muggling isn't the usual way PM goes about getting electronics gear for test stories. But in the case of digital audio tape (DAT) technology, we felt like we were trafficking contraband when we acquired a recorder purchased at retail in Tokyo and carried through U.S. Customs to our lab. Why the intrigue? Because DAT recorders are facing a ban on importation in proposed legislation before Congress.

Digital audio tape (DAT) promises to be the music medium of the future. It renders sound quality on a par with digital compact discs, but in a smaller package. Moreover, DAT provides the opportunity of digital recording to hi-fi enthusiasts—a feature which the playback-only CD lacks. This very asset



Available only in Japan now, Sharp's RX-X100 digital audio tape recorder has controls and displays similar to today's conventional analog decks. But the cassette itself (inset) is half the size of current tapes, and stores 2 hours of music.

EXCLUSIVE TEST REPORT

DIGITAL AUDIO CASSETTES: SMALL TAPE, BIG SOUND

The first digital audio cassette recorders have just hit the street in Japan. Here's how they compare to the compact disc.



might prevent DAT decks from reaching American homes. The proposed embargo is prompted by the music industry's contention that DAT makes mirror-image copies of CDs, and that this ability will precipitate revenue-robbing private copying and criminal piracy.

Our theoretical understanding of DAT, and our instincts, told us this contention is uninformed and unfounded. Indeed, DAT can sound splendid—but it doesn't make bit-for-bit clones of CDs any more than today's conventional analog cassette decks do. Here's the story.

The DAT recorder

The DAT deck we obtained, Sharp's RX-X100, sells for about \$1300 in Japan. So do comparable machines from Aiwa, Hitachi,

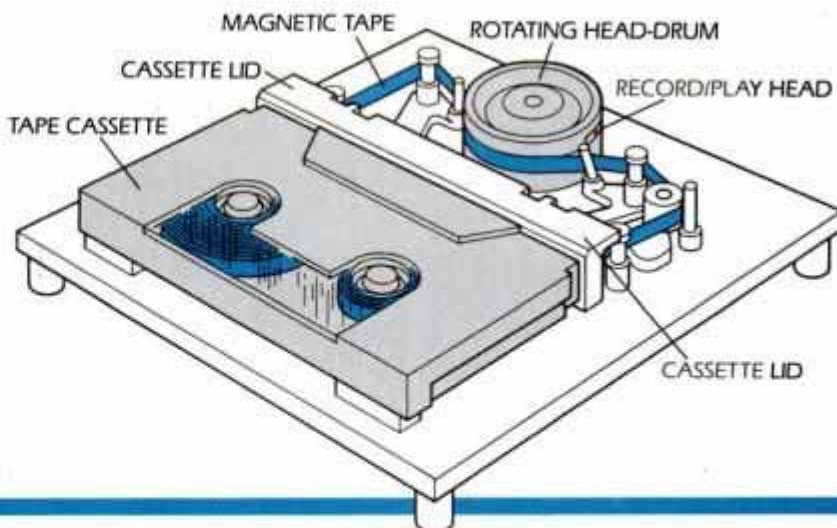
JVC, Mitsubishi, Sony and Toshiba. Tape costs about \$13 for a 2-hour cassette. Both prices should drop dramatically as production increases. The deck measures the same size as most other hi-fi components, but the DAT cassette is half the size of today's analog cassettes.

Sharp's RX-X100 is loaded with controls and features—many of them similar in function to those on analog decks. Operationally, we found the DAT recorder to be both familiar and strange. Though its front panel sports the recording controls of a conventional deck, the tape transport system resembles that of a videocassette recorder.

DAT—HOW IT WORKS

Digital audio tape's transport system (right) works just like that of a videocassette recorder. Once inserted in the deck, the cassette's protective lid opens and the tape is extracted and wrapped 90° around the head-bearing drum. As the tape moves past the drum from left to right at 1/3 in. per second, the drum rotates counterclockwise at 2000 rpm (middle right). This combination yields a recording speed of 123 in. per second—65 times faster than today's analog cassette decks. Because the tape is held at an angle to the drum in a helical pattern, the drum's two magnetic heads write and read information in diagonal tracks across the width of the tape instead of longitudinally along its length, as in analog recording (far right). This space-saving arrangement provides two hours of information on a matchbox-size cassette. Because each of the two heads is mounted at a different azimuth, the information-bearing tracks are laid down in an alternating pattern.

TRANSPORT SYSTEM



And, of course, the machine shares the digital storage format with CDs. In actual recording, this entails different parameters than those we've become accustomed to with analog decks. We'll elaborate on this later.

Like a VCR, the DAT recorder requires a few seconds for the tape to exit the cassette and load into the record/play tape transport system. Also like a VCR, it will disengage the tape and enter the Stop mode if the transport is left in Pause for an extended time.

The functional similarity to a VCR is most apparent when accessing individual tracks on the DAT cassette. Like VCRs that reverse up to 15 units on the tape counter before moving forward in the Play mode, the RX-X100 first overshoots the desired selection by 28 units, swiftly rewinds to the 8-unit mark, then counts down to zero—at which point the music begins.

The tape's fast-advance and rewind speed is awesome—200-times normal playback speed. That's not as fast as the access time between selections on a CD, but it's more than 12 times faster than an analog deck.

Just like CD, the deck gives you direct access to each music track. Simply punch in the selection number (even by remote control) and the tape speeds to the designated point. You can program selections to play in any order you like.

Helical recording

The reason DAT acts like a VCR is because it shares the same helical-scan recording scheme. The type of digital cassette deck available today is called R-DAT, for Rotary. Just like a VCR, the DAT deck's magnetic heads are mounted in a rotating drum that "writes" data in diagonal tracks

across the width of the tape—instead of longitudinally along its length, as in fixed-head analog decks. Though the tape in an R-DAT deck moves at only 0.815 centimeters per second (about 1/3 in. per second), the head-bearing drum rotates at 2000 rpm. This yields a writing speed of 3.133 meters per second, or 123 in. per second.

That's fast compared to analog cassette decks, which record and play tape at 1 1/2 in. per second. Consequently, R-DAT provides two hours of record/play time on a matchbox-size cassette. The tape measures the same 15/100 in. wide as today's analog cassette tape. But the use of a high-density metal formulation permits more information to be stored.

At the standard record-speed stated above (there are two optional schemes), R-DAT decks sample the music at a rate of 48kHz (48,000 times per second)

and assign each sample of 16-digit code comprised of ones and zeros. Though the sampling rate differs from the 44.1kHz used for CDs, theoretically, the results are just as good. DAT yields flat frequency response from 4 Hz to 22kHz (beyond audible range) with an impressive 96 dB (decibels) of signal-to-noise ratio. The best analog cassette decks weigh in around 75 dB. CDs, by the way, are limited to 75 minutes of music storage.

Sampling variance

DAT records at 48kHz and plays back tapes sampled at that rate. But the machines also have a playback sampling rate of 44.1kHz—just like CD's—for prerecorded DAT cassettes that music companies might or might not sell.

What DAT doesn't have is the ability to record at the 44.1kHz sampling rate.

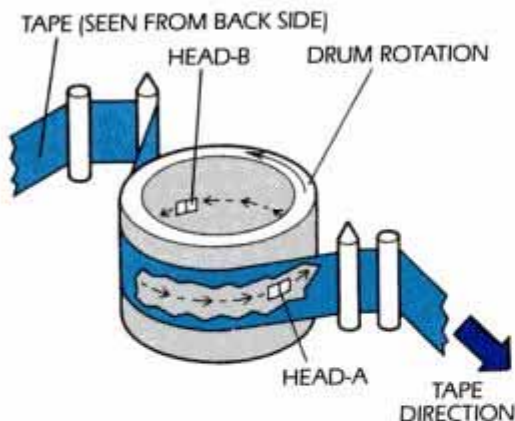
This means a CD can't be copied in direct, digital form, because the machine has no way to convert the incoming 44.1kHz signal for recording at the 48kHz sampling rate. Therefore, the digital signal emanating from a CD must first be converted to an analog signal (within the CD player) which is then re-recorded digitally by the DAT machine.

Even if the CD player has direct digital outputs (some do) and the DAT player has direct digital inputs (some might), the disparity in sampling rates would still prevent direct cloning. Even the improbable insertion of a sampling-rate converter between the two components would not work. That's because most CDs are inscribed with a Copy Prohibit code. This code triggers a mechanism already built into every DAT deck that prevents the machine from recording the encoded material.

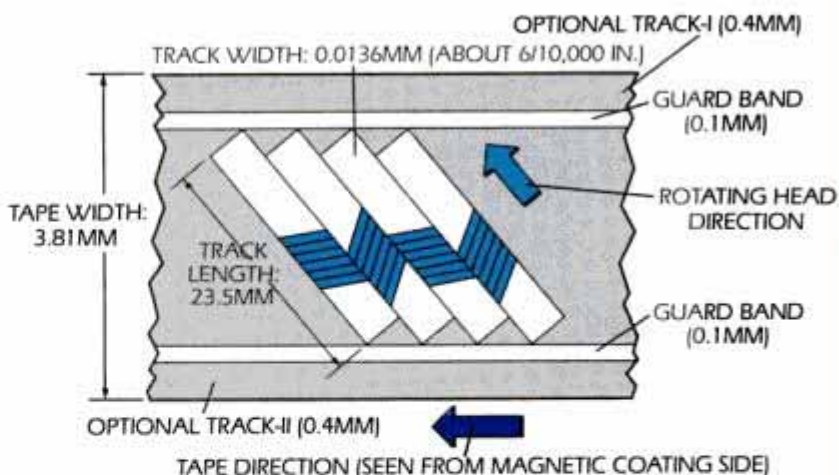


DAT cassette (left) is half the size of today's analog cassette, yet holds two hours of sound. Though tape is same 15/100 in. wide, it uses a high-density metal formula.

ROTATING HEAD



TRACK SCHEME



The DAT deck's inability to make direct digital-to-digital dubs is intentional. It represents an attempt on the part of hi-fi manufacturers to address the music industry's concern that DAT decks will facilitate widespread copying, either for personal use (in car DAT players) or for criminal trafficking in bootleg dubs. The music industry remains apprehensive, and is lobbying for the incorporation of an anticopying device that would prevent the recording of CDs in any manner. (For more on the legal aspects and car stereo applications of DAT, see this month's *Electronics* and *Audio* columns.)

Hands-on!

While politicians debate the propriety of home digital recording—or any home recording at all—our practical experience with DAT indicates it's far from

the clone-maker some think it to be.

Because digital-to-digital recording isn't possible, the input signal must pass through an analog stage. The quality of the analog electronics will determine how good a signal the DAT deck will record, but some deterioration is inevitable, possibly in frequency response and definitely in signal-to-noise ratio. You can think of this like the process used to make a photo print, with the CD's digital signal being the negative. If direct digital recording were possible, the DAT copy would be a print made from the negative. But because the CD's signal must be converted to analog before recording, the DAT dub has the imperfect resolution of a print made from a print.

Besides this signal deterioration that is inherent to the recording chain, our experimentation with the RX-X100 in-

dicates that the recording process itself will introduce the factor of human error to the equation—and thereby further diminish the quality of the dub.

Flying blind

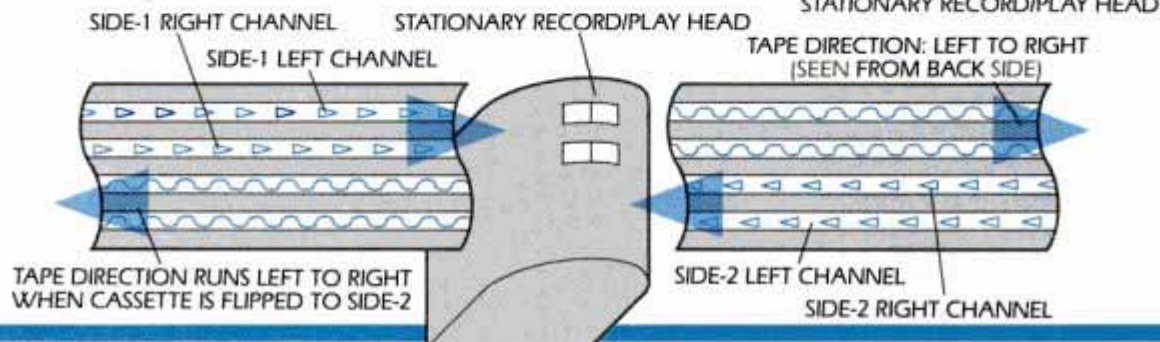
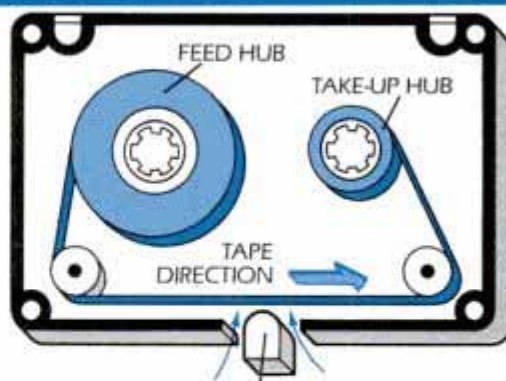
As with analog cassette recordings, the DAT dub's fidelity to the original depends a great deal upon the skill of the person whose hands are on the controls. Though the DAT deck's input-level dials and displays are the same as those on analog decks, it's harder to make a good digital dub. This is partly because of the digital-recording process and partly because of the deck itself.

Unlike analog recording, digital is quite precise and doesn't leave room for error—especially the error of recording at too high an input level.

When you record an analog cassette, *(Please turn to page 155)*

ANALOG CASSETTE—HOW IT WORKS

In analog cassette recording, a nonrotating fixed head enters the housing to press against the tape. The tape passes by the head at 1 7/8 in. per second, and separate tracks for the left and right stereo channels are recorded simultaneously along the length of the tape. When the first side is recorded, the cassette is flipped to record a second set of stereo tracks on the remaining width of the tape. In DAT recording, just like videotape, there's no need to flip the cassette.





'HOW I BOMBED QADDAFI'

There were three terrorist actions that ultimately drew U.S. Air Force F-111Fs to Tripoli, Libyan Arab Republic, on the night of April 15, 1986. The first occurred on December 17, 1985, when Palestinian gunmen attacked innocent travelers at the Rome and Vienna airports. The Libyan leader, Muammar al-Qaddafi, hailed the action, declaring that he "had the right to export terrorism to America."

Further, on March 24, 1986 Libyan armed forces fired several SA-2 and SA-5 surface-to-air missiles at U.S. Naval aircraft flying over international waters above the Gulf of Sidra. Finally, on the night of April 5, 1986, a bomb planted in Berlin's La Belle discoteque exploded, killing a U.S. serviceman. Berlin police failed to connect Libyan agents with the bombing. But U.S. government communications intercepts concluded that Qaddafi was responsible for the atrocity, the same man who had supported terrorists throughout Europe and the Middle East.

The fate of the Libyan leader became intertwined on the night of April 15 with that of a 43-year-old U.S. Air Force colonel—the author of this article. The American flier was piloting the lead F-111F in an 18-plane Air Force strike force assigned to bomb military targets in Tripoli, the Libyan capital. One of three squadron commanders, the colonel delivered four 2000-pound laser-guided bombs to Qaddafi's headquarters at the El-Azziziya barracks, adjacent to the Bedouin tent where Qaddafi often resides.

The Air Force colonel is an intense but amiable southerner who holds a master's degree in laser physics. He agreed to relate his personal experiences during the Tripoli Raid on the condition that he not be identified, an obvious security consideration. The colonel's Navy counterpart on the raid also agreed to an interview under a similar request for anonymity. Their tales of precision aviation in an electronic age bear all the complexity of neurosurgery, with references to night-vision video, forward-looking infrared radar, bomb-run inserts and terrain-following techniques. The discussions produced the following new information about

A personal account of an American blow against terrorism.

BY A U.S. AIR FORCE COMBAT PILOT

the long night mission to Libya. • The Air Force fighter/bombers observed strict radio silence prior to the strike, even during refueling. Hence, the joint Air Force/Navy operation was choreographed completely by careful timing. • The F-111F that was lost, resulting in the deaths of Major Fernando Ribas-Dominicci and Captain Paul Lorence, may have been hit by any number of Libyan defensive systems, or they may have hit the water inbound to the target while trying to outmaneuver a Libyan missile. There is no evidence that any U.S. aircraft were struck by ground fire. • The Libyans employed the most sophisticated air defense ever encountered in the history of U.S. air combat, firing a full array of SA-2, SA-3, SA-6, SA-8 and French CROTALE surface-to-air missiles. • Due to strict rules of engagement, designed to limit damage to nonmilitary targets, at least one F-111F crew fought through the missile batteries to their target, only to discover an electronic malfunction. Because they couldn't guarantee that their bombs would not damage civilian areas, they fought their way back out to sea and dropped their ordnance in the water. • Only two F-111Fs were assigned to strike Qaddafi's barracks/office in the El Azziziya compound in downtown Tripoli. Our author insists that the notion of assassinating the Libyan leader was never discussed by mission planners or strike participants. "Qaddafi personally wasn't the target," he says. "I say that absolutely, categorically, because it was not the mission's objective."

In the aftermath, American aircrews quietly bore the brunt of public opprobrium for "collateral" damage suffered in the Libyan capital (inevitable "in the fog of war," according to the author). But there have been no significant terrorist acts in Europe or America since the night of April 15, 1986. Unfortunately, it's too much to hope that Qaddafi has been silenced.—The Editors

As we came up on the coast, I remember thinking, I'm flying the first airplane across the target. We'd had detailed mission planning involving many, many airplanes. But everything was coordinated off the timing of the launch back in England.

So if the EF-111s didn't get to their

Multiple refuelings of the fleet of F-111Fs was important part of the mission.

station on time, we were going to be sitting ducks. If the Harm and Shrike (antiradar missile) shooters from the Navy weren't firing their missiles on time, I wasn't sure how many planes we would lose. If the air crews weren't flying the ground track they were supposed to be flying, there was a high probability that they would hit each other because our TOT [time on target] was really compressed to saturate the Libyan defenses.

We were completely com-out on our way to the target—no radio communication whatsoever. I had no idea whether the Navy had launched. I had no idea whether anybody was where they were supposed to be.

The first time I ever saw or heard another airplane was 40 seconds prior to my bomb release, when I looked up and saw a Navy A-7 firing a Shrike at a radar emitter. And boy, that gave me a warm, fuzzy, good feeling inside.

'HOW I BOMBED QADDAFI'

Target: El Azziziya Barracks

The adrenalin was up, maybe the heart rate too, but the chatter between me and the weapons system officer (WSO, or "wizzo") was pretty businesslike. I was worried that I wasn't flying fast enough to maintain timing. I was worried about the wind not being in the direction it was supposed to be in. I was worried about the wizzo finding his radar offset point, which would later help him find the main barracks at El Azziziya. It was absolutely paramount that he find it, so there was obviously a lot of pressure on him. And there were only a few seconds to find the target because we were very low to the ground. He moved the Pave Tack pod [forward-looking infrared radar] to the last few feet of refinement and he had to turn the laser on the target to guide the bombs in. He had his hands full while I was maneuvering the airplane. It was on auto pilot—and my hands and feet were completely off the controls—but I had my hand on the throttles the whole time to adjust air speed. When the wizzo got squared away, I pulled the nose up in what we call the Pave Tack Toss, where you loft the bomb, then descend back to low level to egress. In



F-111Fs (top) were chosen because they could deliver heavy ordnance in any weather. Above, ground and air crews from the Statue of Liberty Wing go through preflight checks.

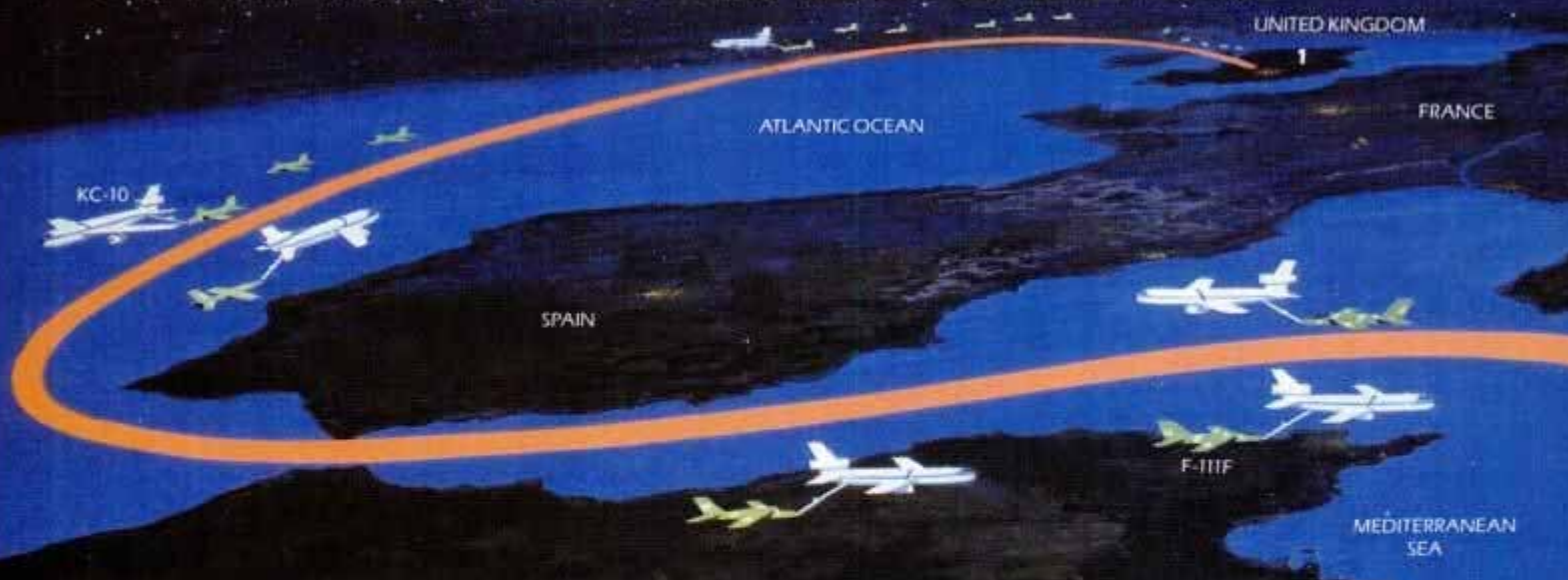
the meantime, the wizzo started guiding the four bombs into the target. They come off the airplane almost simultaneously. He was saying, "I've got it. Come on. Impact. Big Time."

Then all hell broke loose. Just as he was guiding the bombs into the target, a ZSU anti-aircraft weapon opened up. It's a Triple A gun, 23mm, four barrels,

very effective. I could see the tracers coming up at us from about our seven o'clock position.

At that point, the wizzo said our bombs had made impact so I descended to low level to get back over the water. It was then that I made my one and only radio call of the raid on our strike frequency: "Feet wet," meaning we

OPERATION ELDORADO CANYON



[1] Twenty-four F-111Fs of the 48th Tactical Fighter Wing fly the mission from Lakenheath, United Kingdom. Each aircraft is equipped with Pave Tack Forward Looking Infrared Radar and each group of three is accompanied by a KC-10 tanker. Six spare aircraft return to base as planned, and of the remaining 18, five have various technical problems and do not drop ordnance. [2] The remaining aircraft strike the El Azziziya Barracks (headquarters for Libyan leader Muammar al-Qaddafi), Tripoli Military Airport, and the Janzor Naval Barracks at

Sidi Bilal. [3] Aircraft carriers Coral Sea and America launch F/A-18s, A-6Es, EA-6Bs, A-7Es, F-14s and E2-C Hawkeyes. All Navy aircraft return safely after strikes [4] at Benina Airfield, missile aiming sites and Al Jumahlrja Barracks outside Benghazi. The entire mission is flown in strict radio silence at flight levels below 200 ft. Pilots who agreed to exclusive PM interviews said the Libyans offered the toughest anti-aircraft defense in history, including batteries of SA-6, SA-8 and SA-13 surface-to-air missiles.

PM ILLUSTRATION BY DEAN ELLIS

The Navy's Raid On Benghazi

The naval aviator who agreed to an exclusive interview with **POPULAR MECHANICS** flew the new F/A-18 strike fighter off the Libyan coast—the type's first combat mission. His reaction when he saw a Soviet-designed missile headed in his direction?

"It looked like a Saturn 5."

This whimsical allusion to the giant rocket that delivered men to the moon masked the real concern the aircrews had about the inten-

the latest crop of Navy pilots, particularly those who went in "over the beach" after Libyan forces had been alerted.

"There were very few combat experienced pilots on the Benghazi raid. The fact that we hit the targets accurately and got everybody back safely is a testament to the new generation.

"The key was the fact that we'd been in the theater for two to three months and we had looked at various contingencies. During that

craft carriers relied on both high-speed transits and "the complete electronic spectrum" to elude Soviet escort ships.

Launch was a very closely controlled exercise under total radio silence. EA-6B Prowler jamming aircraft and E-2C Hawkeye early-warning aircraft provided support, while the F/A-18s and A-7Es fired Harms and Shrikes for the A-6E attack force. F-14s, assisted by the dual-role F/A-18s, flew fighter cover but no Libyan aircraft got off the ground. KA-6 tankers—A-6s converted for refueling—kept the Navy armada in the air.

A-7Es firing Shrike antiradar missiles flew cover for the F-111Fs during the raid on Tripoli. Every movement of every Navy airplane was precisely timed according to when the F-111Fs released brakes and started their takeoff roll back at Lakenheath.

"There was only one radio transmission as we headed into the Benina Airfield target. We issued an alert as to what missiles would be in the target area. There had been a lot of pre-strike publicity in the press, and the Navy had had a significant presence in the area for several months prior to the raid, so we were surprised that the Libyan defenses weren't more alert. Everything around Benghazi was lit and there was minimal activity.

"For the A-6 drivers and weapons systems officers who had to deliver the bomb loads, it was extremely tough. They were working very hard to, No. 1, not hit the ground, and No. 2, get to the target and get to the right target.

"Obviously, they had a lot of anti-aircraft fire and SAMs to avoid. In that position, you're incredibly busy and it's distracting when people are shooting at you. Time seems compressed, and 15 minutes seem like 15 seconds to the guys in the cockpit."



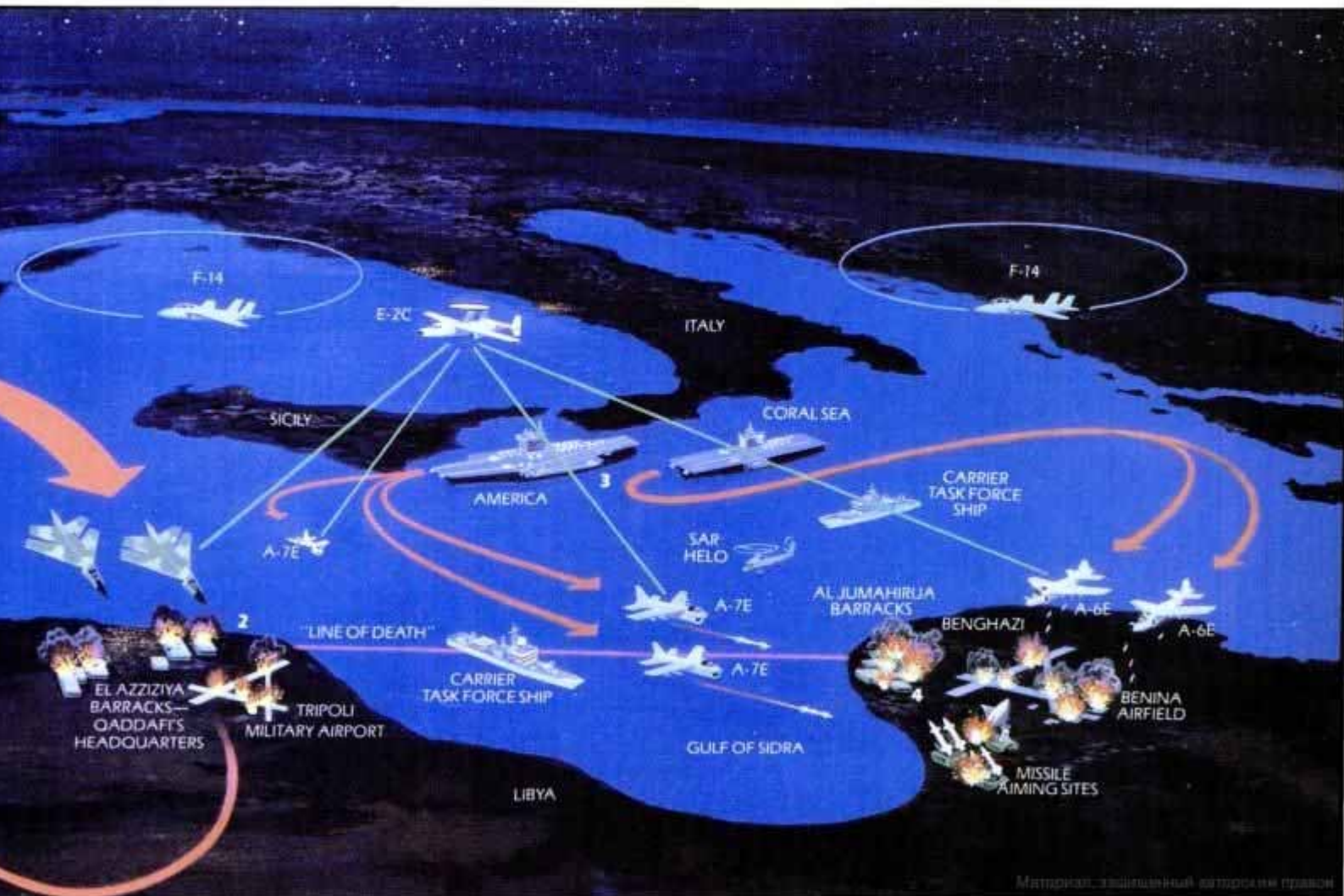
GRUMMAN PHOTO

Swing-wing Navy F-14 Tomcats and E-2C Hawkeye airborne early-warning platform flew cover for both the Air Force Tripoli raid and the Navy strike on Benghazi.

sity of the Libyan ground fire. These were the pilots who demolished the Al Jumahirija Barracks and attacked Benina Airfield with Rockeye cluster bombs, destroying several aircraft on the ground. The Navy pilot personally fired Harm antiradar missiles at Libyan aiming sites, denying ground forces a chance to take a bead on the A-6E all-weather penetrators as they completed their bomb runs.

The F/A-18 jock had nothing but praise for

time, we'd encountered MiG-25s and SU-22s, so we were pretty familiar with the tactical situation. And the A-6 crews were familiar with the area and were highly trained." He said the Navy strike at Benghazi was accomplished primarily with a careful mix of power and tactics: The entire Air Wings of both the Coral Sea and America were involved on a mission that began with a "dash for the launch point" from north of Sicily. The naval aviator said the air-



BENINA AIRFIELD

15 APR 86



DEPARTMENT OF DEFENSE PHOTO

WIDE WORLD PHOTOS



DEPARTMENT OF DEFENSE PHOTOS

Post-strike intelligence showed damage to Soviet aircraft at Benina Airfield, Benghazi (top left). The Navy strike also completely destroyed a military barracks in the Benghazi area (far left). A Mk 82 500-pound bomb from an F-111F failed to deploy near the Tripoli Military Airport (near left) probably when the bomb's parachute retard system failed. Strike videos (above) show destruction of Soviet IL-76 Candid transports at Tripoli Military Airport.

were heading back out to sea.

It was also at this point that I saw an F-111F hit the water at around my nine o'clock position. He was along the attack axis, and he may have seen a missile coming at him. At night, whenever a missile is fired, it always looks like its coming straight at you. So he may have maneuvered abruptly to try to avoid it and hit the water in the process. I don't know. I just know they hit the water, creating a ball of flame that looked like napalm.

And I knew I'd lost some friends.

Preparations

I'd had a tour and a half in Southeast Asia, but I had forgotten what seeing casualties felt like. When you went into a combat zone like Vietnam, you knew months ahead of time and you had a chance to think about it, had a chance to say goodbye to friends and family.

It was a lot different, a lot tougher, in a noncombat environment like Lakenheath. On Sunday everything was fine, and you were with your family. But on Monday, you had to report for work at 2 in the afternoon knowing that that night you were going to launch a combat mission. It was very difficult to deal with. As a squadron commander, I was very close to the families and I had helped pick the crews.

Of course, crew selection was an important element during the planning phase prior to the strike. This was a

classic F-111F mission in that the task required heavy bomb loads and night, all-weather penetration. Early on, during early contingency planning in January of '86, our assumption was that we'd be able to fly across France. But in those early days, we were much more focused on a possible attack at specific targets. We had no idea that we might have to fly all that distance.

Once it became clear that we'd have to fly around the Iberian Peninsula, refueling became a prime consideration. Still, we didn't want one aspect of the mission to be what we call a show-stopper. In other words, we didn't want one thing to cause the entire mission to be in jeopardy. And there's one thing that people have learned over and over again: If there is anything that's going to get messed up, it's going to be a rejoin with a tanker. So I wanted to take off from Lakenheath, join a tanker as soon as possible, and I didn't ever want to have to leave that tanker until the drop-off point near the target. The mother tanker could then be refueled by yet another tanker. Other mission planning included target selection, and what ordnance to carry. We eventually decided on four, 2000-pounders per aircraft for El Azziziya Barracks and the terrorist training camp at Sidi Bilal, and 12 500-pounders for the Tripoli Military Airport. It all came down to the final 72 hours before the strike when we put together last details with

the SAC crews who flew the tankers, then filed into the theater for a briefing by General Westbrook, the wing commander. He said a few things in a motivational kind of way. I gave a last-minute briefing on the weather. Then there was a stir and Gen. Charles Gabriel, chief of staff of the Air Force, came up to the stage for a little chat with the guys. He told us how important the mission was. And I thought, Jesus, we're really going.

Gen. Gabriel also asked if anybody had any questions. It's ironic, but Fernando asked the last question. He wanted to know when we were going to go back to Libya for a second strike. Fact is, Fernando never left Libya.

Regrouping for home

But I had no idea who had gone down as we flew back out through the Navy shield and started to gain altitude. I had to find that damn tanker. The F-111F has an absolutely outstanding ground radar, but it doesn't have a very sophisticated air-to-air radar. So we were concerned about that.

We had a pre-designated orbit point, or rendezvous point, so we had no problem when we went back to using our navigation system. Still, there was one airplane in our group that was having difficulty finding the tanker for the rejoin. I heard him telling the tanker that he couldn't find us and we made

(Please turn to page 153)

SHOPWORK

Guide



In This Section:

- Torsion-Box Workbench
- Portable Power Tool Table
- Roll-Around Small-Parts Storage Cabinet

We've all seen photos of great shops with fine tools hanging on the walls and a floor plan crowded with high-end stationary equipment. These workshops are beautiful to be-

hold and the source of many a wonderful dream. But they are usually very expensive and, therefore, out of reach for most of us.

In hopes of redefining the concept of a *dream shop*—into something more practical and affordable—we brought together the considerable talents of Associate Editor Thomas Klenck and Contributing Editor Rosario Capotosto. The result is a 3-piece ensemble that includes a torsion-box workbench, a portable power tool table and a roll-around small-parts storage cabinet. Not only are these

pieces innovative and affordable, they also store very compactly when not in use, occupying less than 23 sq. ft. of floor space.

The individual merits of each are discussed in the following pages, but as the centerpiece, the tool table demands a special word here. Because it can accommodate a full range of portable power tools, thus providing many of the benefits of stationary equipment, it represents a real breakthrough. We will publish a second story showing the astounding capabilities of this piece in our September issue.—S.W.

Benchmark

How to build a flat, stable workbench for your shop.

BY ROSARIO CAPOTOSTO, Contributing Editor

In the old days, the construction of a workbench was a project that demanded all the skills of the accomplished cabinetmaker. Well-dried hardwood stock for the top had to be carefully joined and surfaced to be flat and true. Because a good workbench top acts as a guide and reference for all the objects to be built in the shop, the supporting framework would be braced against racking and strong enough for the heaviest work. And, to give the bench the weight it needs to stay put, heavily dimensioned stock would be used throughout.

For most home craftspeople, the expense of the wood alone would be enough to deter them from making a quality workbench. Add to this the time and effort necessary for preparing and joining the heavy stock without expensive machinery, and it's no wonder that most workshops make do with a sometimes rickety, and often inadequate, work surface. Our workbench was designed to overcome all these problems—with a few add-

ed attractions to boot.

Designed around a torsion-box top, this bench is economical to make and, with a little care, will rival the best traditional benches for flatness and strength. Further, because it's not solid wood, it will stay flat. It can be built using portable power tools and con-

structed of commonly available materials. The hefty legs are designed to eliminate the need for a complicated framework while





Packed into a less than 23-sq.-ft. floor area, our workshop ensemble includes power-tool table, small-parts cabinet and a workbench that sets the standards for quality woodworking. The bench features a heavy-duty vise, bench dogs and replaceable work surface. The power table and cabinet roll out on locking casters and all three are trimmed with hard-wearing maple.

Workbench design: Thomas Kenick
Color photo: J.R. Rost
Black-and-white photos: Rosario Capotosto
Technical art: Eugene Thompson

Benchmark

adding great rigidity. This means the space underneath is completely open for roll-away storage—a feature impossible to find on conventional benches. Heavy-duty levelers allow you to adjust the bench to any floor. And, on top, there's a replaceable, hardboard work surface. This bench also features the Record 52½D quick-action vise, bench dogs and long-stock support pin in the front leg opposite the vise.

The most interesting feature, however, is the torsion-box top which, simply, is a structure designed to resist twisting and bending loads. It's constructed by sandwiching a square-grid structure, or eggcrate, between two sur-

faces much the same way that hollow-core doors are made. You end up getting maximum strength with minimum materials. Of course, the flatness of a torsion-box depends entirely on the flatness of the surface that it's assembled on. So, you'll have to begin by preparing an absolutely flat surface on your basement or garage floor. This step is time consuming, but the results make it all worthwhile. First, you'll need to lay down a series of softwood cleats which can be trued up for accurate assembly.

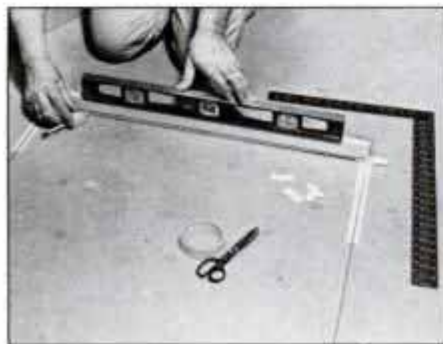
Preparing for assembly

Unless you have a wood floor that you can screw the cleats to, fasten them down with double-faced tape. Make sure you get tape with sufficient holding power. Scotch Mounting Squares will do the job. They come in packets of

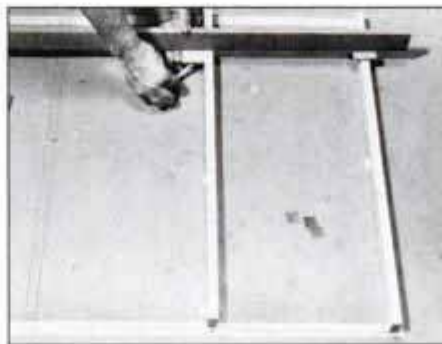
16 1-in. squares and are available at most stationery and hardware stores.

Start by drawing an outline of the benchtop on the floor. Use a large framing square and an accurate 7-ft. straightedge. You'll need seven cleats to support the top assembly. Cut each cleat to 30% in. Mark seven equally spaced cleat locations along the benchtop outline. It's a good idea to lay masking tape around the outline to make your pencil marks easier to see. Number the cleats and cleat locations. Each cleat will be tailored to fit one specific location and you don't want to mix them up.

Most workshop floors are not flat enough to fasten the cleats to without first scribing them to the contour of the floor. Place the first cleat in position at one end of the benchtop outline. Place a level on top and shim the cleat until the



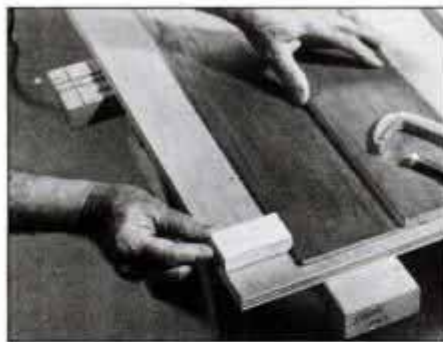
1 Prepare a flat assembly surface by securing leveled cleats to the floor. Scribe each cleat to fit surface irregularities.



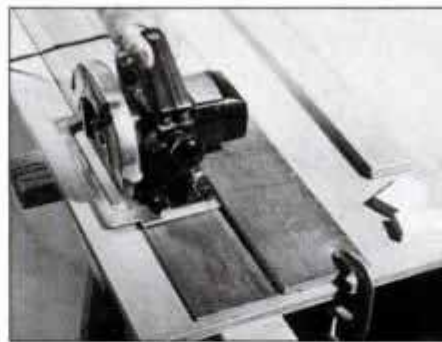
2 The inner cleats are trued by spanning the end cleats with a straightedge. Mark the correct height on each inner cleat.



3 Check the assembly surface to be sure it's absolutely flat. If necessary, fine tune the cleat upper edges with a plane.



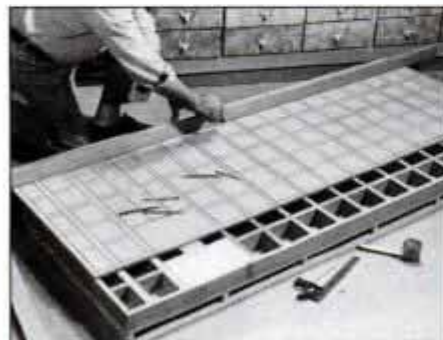
4 Use a spacer block and straightedge ripping guide to accurately rip the plywood for the webs and inner aprons.



5 Rip enough stock for all the webs to identical width. Then crosscut to length, making sure that the cuts are square.



6 Hold benchtop components in place with pipe clamps and drive one staple at each web joint. No glue is needed.



7 Using a long straightedge, transfer the eggcrate pattern to the panel top to be used as a guide when driving the nails.



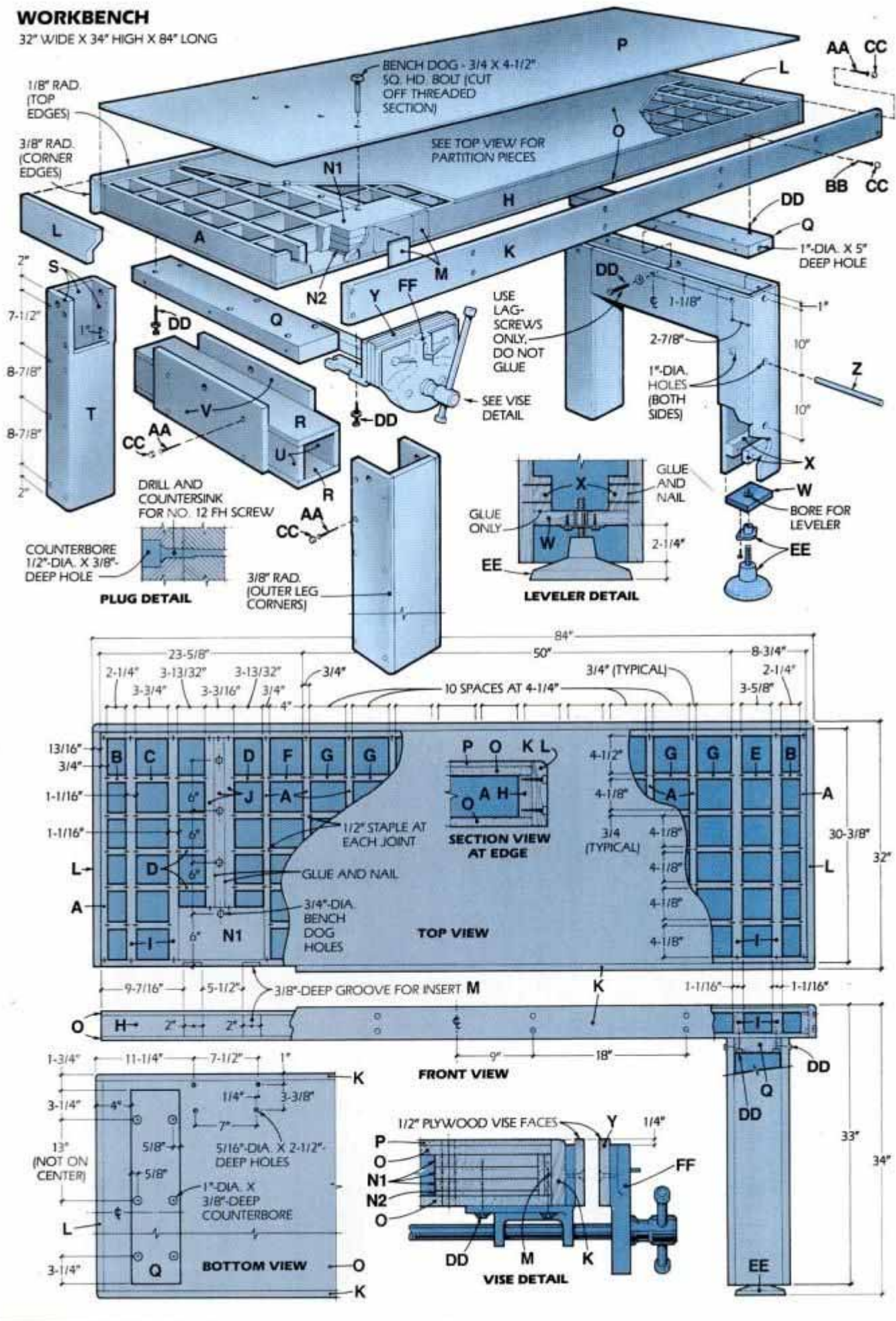
8 After one side of the eggcrate is stapled together, check for square, and apply slow-setting hide glue on all edges.



9 Instead of using clamps to hold the panel in place while the glue sets, drive finishing nails between each intersection.

WORKBENCH

32" WIDE X 34" HIGH X 84" LONG



Benchmark

bubble centers. Scribe the contour of the floor on the lower edge of the cleat and cut to the line. When placed back in position, this cleat should now be level. Now cut the cleat for the opposite end (No. 7) in the same way and fasten both down with three adhesive tabs each.

Next, scribe and trim the remaining cleats to fit the floor at their correct positions. Don't worry about leveling these at this point. Place cleat No. 2 in position and temporarily secure it with the tabs. Cut three spacers (about 1/4 in.) and place one of them on the end of the first cleat and one on the end of cleat No. 7. Lay your long straightedge on these spacers and use the third spacer

to scribe the correct height of cleat No. 2. Repeat this on the other side of the benchtop outline. Then remove cleat No. 2, connect the marks with a straight line, and trim to this line. Repeat this procedure for the remaining cleats and then, lay them all in position and check them with the straightedge. When you're satisfied that the top edges of all the cleats are true and flat, fasten them down with adhesive tabs.

Building the benchtop

Start construction of the benchtop by cutting the plywood webs. Use a straightedge ripping jig to cut the webs straight and to the same width. Then cut the maple webs to size and prepare the vise support block as shown in the drawing. Cut the long inner aprons to size and rout the recesses for the maple

inserts. These inserts accept the front lagscrews that hold the vise. Finally, cut the top and bottom particle board panels about 1/4 in. oversize.

Lay one of the panels on the cleats and temporarily fasten it in place with four 4d finishing nails. Position the inner aprons and the end web pieces and use pipe clamps to hold them together. Now begin assembling the eggcrate pieces fastening each to the next with a staple driven across the joint. No glue is necessary. The staples only serve to hold the pieces in place until the box is completed.

Next, mark the remaining panel with the grid pattern as reference for nailing. Run a bead of slow-setting hide glue on the top edges of the eggcrate and lay the panel in place. Drive 4d finishing nails between each intersection to clamp the panel in place. Allow

Key			MATERIALS LIST—WORKBENCH					
No.	Size and description (use)		N1	3 1/4 x 6 x 10" plywood (vise block)	X	8 1 3/16 x 2 x 5 1/2" maple (support cleat)		
A	13 1/4 x 2 1/2 x 28 1/2" lauan plywood (long web)		N2	1 1/4 x 6 x 10" plywood (vise block)	Y	2 1/2 x 3 1/4 x 9 1/4" plywood (vise pad)		
B	10 1/4 x 2 1/2 x 2 1/2" lauan plywood (web)		O	2 1/2 x 30 3/4 x 82 3/4" particle board (top)	Z	1 1" dia. x 12" dowel (stock support)		
C	5 1/4 x 2 1/2 x 3 1/2" lauan plywood (web)		P	1 1/4 x 30 1/4 x 82 1/4" hardboard (top)	AA	80 2" No. 12 fh screws		
D	8 1/4 x 2 1/2 x 3 3/8" lauan plywood (web)		Q	2 1 3/4 x 5 1/2 x 28 1/2" maple (cleat)	BB	28 1 1/2" No. 12 fh screws		
E	5 1/4 x 2 1/2 x 3 3/8" lauan plywood (web)		R	4 1 3/16 x 5 1/2 x 28 3/4" maple (crossmember slab)	CC	108 1/2" dia. plugs		
F	5 1/4 x 2 1/2 x 4" lauan plywood (web)		S	12 1 3/16 x 5 1/2 x 29 1/4" maple (outer leg piece)	DD	28 3/4 x 3" lagscrews and washers		
G	50 1/4 x 2 1/2 x 4 1/4" lauan plywood (web)		T	4 1 3/16 x 5 1/2 x 21 1/2" maple (inner leg piece)	EE*	4 6" leveling jacks		
H	2 1/4 x 2 1/2 x 82 3/8" lauan plywood (apron)		U	4 1 3/16 x 4 x 28 3/4" maple (crossmember inner rail)	FF**	1 vise Record No. 52 1/2 D		
I	4 1 1/16 x 2 1/2 x 28 3/8" maple (web)		V	4 1 3/16 x 7 1/4 x 19 1/2" maple (crossmember outer rail)	Misc*	Leveling jacks (No. 91007) available from Armor Products, Box 445, E. Northport, NY 11731 (\$25 postpaid). **Vise (No. 10G04.02) available from Garrett Wade, 161 Avenue of the Americas, New York, NY 10013 (\$102 postpaid).		
J	3 1 1/16 x 2 1/2 x 22 3/8" maple (bench dog web)		W	4 1 3/16 x 3 1/16 x 5 1/2" maple (leveler support)				
K	2 1 3/16 x 3 1/4 x 84" maple (apron)							
L	2 1 3/16 x 3 3/4 x 30 3/8" maple (apron)							
M	2 1/4 x 2 x 2 1/2" maple (insert)							

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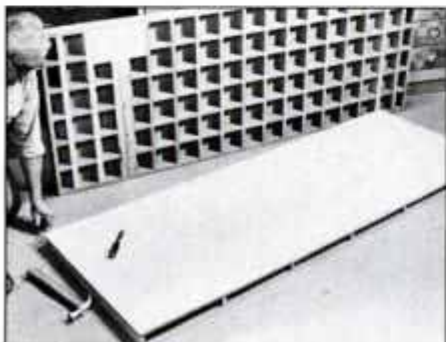
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Benchmark

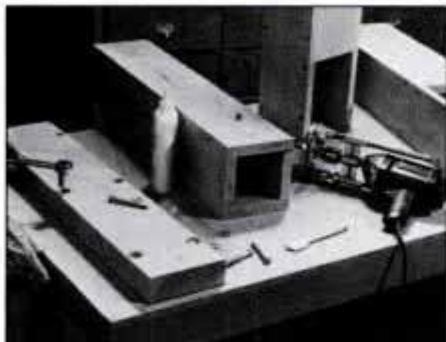
the glue to set overnight. When the glue is dry, lift off the partially completed torsion box and carefully pry the base panel away from the cleats. Lay the glued-up section face down on the cleats and drive staples at all the joints. Spread the glue and attach the remaining panel. After the glue has dried, use a router with a flush-trimming bit to trim the excess from panel edges.

The support system

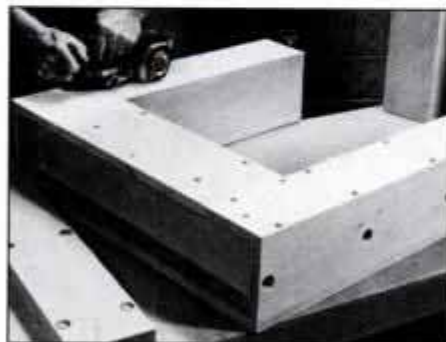
Cut the maple ledgers to size and fasten them in place with $\frac{3}{4}$ x 3-in. lagscrews. Be sure they're positioned so the lagscrews enter the maple webs in the benchtop. Next, cut the stock to the



10 When the glue has dried, remove the benchtop and pry up the base panel. Then lay the top, face down, on the cleats.



12 Maple ledgers connect the leg assemblies to the top. Secure these with lagscrews that extend into the maple webs.



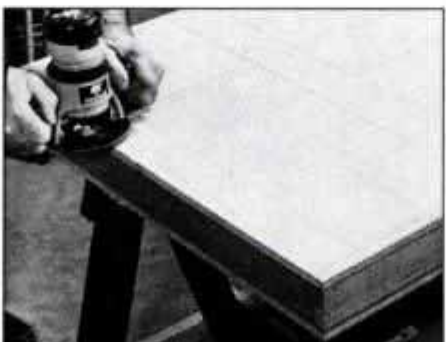
14 Glue plugs in the counterbored holes and dress with a belt sander. Then rout a $\frac{3}{8}$ -in. round on the outer leg corners.

correct length and width for the legs. Bore the 1-in. holes for the stock support pin as shown in the drawing.

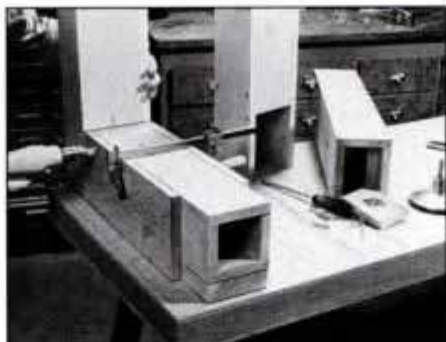
Fasten the short cleats which hold the leveler support blocks in place before assembling the legs. Clamp the leg pieces together and bore the screw pilot holes and the counterbores for the plugs. Apply glue and assemble the legs as shown in the drawing. Bore a hole in each leveler support block and screw the levelers in place. Then glue the blocks to the support cleats mounted in the legs. Glue the plugs in place and, when dry, dress them down with a belt sander. Then rout the $\frac{3}{8}$ -in. round on the outer leg corners.

Adding the final touches

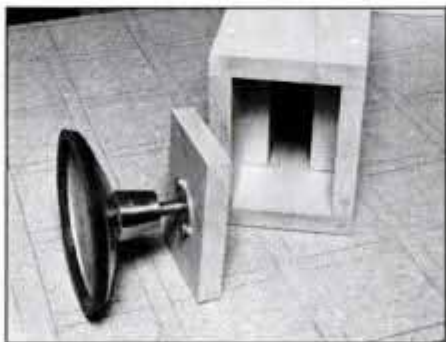
Position the hardboard top leaving $\frac{1}{16}$ in. all around and fasten it down with $\frac{3}{4}$ -in. brads on roughly 8-in. centers.



11 Glue and nail the second panel in place and use a router with a flush-trimming bit to trim the panel excess.



13 Clamp the leg pieces together and counterbore pilot holes for the screws and plugs. Glue and screw together.



15 Screw the adjustable levelers to the mounting blocks and glue the mounting blocks to the support cleats in the legs.

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Next, cut the maple outer aprons about 1/4 in. oversize in width and glue and screw in place. Trim the edges with a router and flush-trimming bit. Use a 3/8-in.-rad. rounding over bit to soften each corner of the bench.

Next, turn the bench upside down and place the vise in position to mark the holes for the lagscrews. After the vise is secured, lagscrew the legs to the ledgers. Be sure to check that the legs are square with the bench.

To make use of the retractable dog in the vise, bore 3/4-in.-dia. holes across the bench on the vise centerline to accept a 3/4-in. bolt bench dog. Bore the holes completely through the bench on 6-in. centers. We finished up with three coats of satin polyurethane. Thin the first coat one part thinner to six parts varnish, and use full-strength varnish for the last two coats.

FM



16 After nailing the hardboard top in place, glue and screw the maple outer aprons. Use a router to trim the excess.



17 Place the vise in position to mark the lagscrew holes. These holes extend into the vise support block and inserts.



18 A drill guide helps in boring the 3/4-in. holes for the bench dog. Use a 3/4-in. bolt—threaded end cut off—for the dog.

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SHOPWORK *Guide*



One For All

This power-tool table gives you stationary-tool performance from your portable power tools.

BY ROSARIO CAPOTOSTO, Contributing Editor

Making your own tools—there's nothing more satisfying to a woodworker. You can customize the tool to your specific needs and save a lot of money. Building stationary equipment, however, is way beyond most of our talents. But we took stock of what is commonly available to home craftspeople—added a little ingenuity of our own—and came up with a versatile stationary power-tool center that can be built easily. Furthermore, our table was designed to be built with portable power tools, the same tools you'll use later to achieve stationary-tool performance. (Note: In our September issue, we will feature an entire story on how to use this innovative table.)

The heart of our table consists of two, octagonal, tool-mounting plates. These self-aligning plates are easily removed for tool adjustment or change. Although we're showing the power table with the circular saw and router, virtually any portable power tool from a sabre saw to a belt sander can be mounted. A sturdy miter gauge allows you to cut angles and the table's ripping capacity, with the

fence, is over 24 in. Best of all, you can have two tools mounted at once to speed multiple machining operations. And when you are done working, you can roll the unit on the heavy-duty locking casters under the workbench for storage.

Construction details

Start construction by cutting the maple stock to width and length for the legs. Bore $\frac{1}{8}$ -in. pilot holes, counterbored for plugs, and glue and nail the leg pieces together. Then prepare the apron pieces for assembly. As shown in the drawing, cut two notches in the center partition to allow for clamp access when securing the rip fence. Bore a $\frac{3}{4}$ -in. hole for the wiring and cut the switch-box cutouts in the front apron. Then fasten the ledgers to the short-end aprons. Temporarily clamp the apron pieces together and counter-bore screw pilot holes for 2-in. No. 12 f.s. screws. Then install the blocking at the end aprons.

The legs are secured to the frame with dowels. Transfer the dowel locations from the legs to the frame with metal dowel centers. Clamp two blocks of wood at the corner to guide the leg into position and tap with a mallet to mark the centers on the aprons. Bore the dowel holes in the frame corners and glue and clamp the legs.

Tool table design: Thomas Klencik, associate editor
Color photo: J.R. Rost
Black-and-white photos: Rosario Capotosto
Technical art: Eugene Thompson

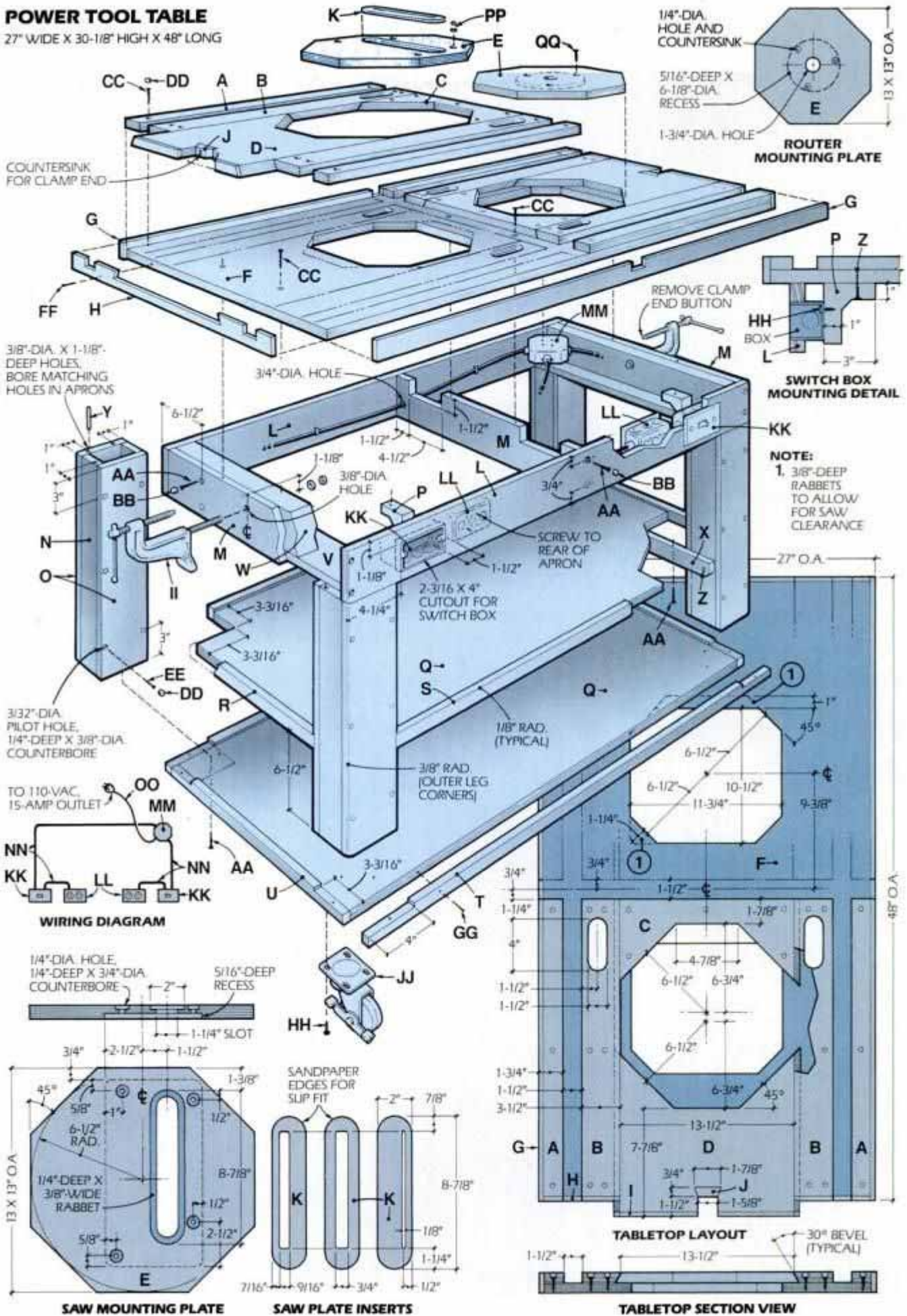


Equipped with the miter gauge (left) or rip fence (above), our power-tool table is capable of a host of woodworking operations. Portable power tools are mounted in self-aligning removable plates for quick tool changes and adjustments.



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SHOPWORK *Guide*

One For All

inner guide. Be careful to make these cuts straight and parallel. Then cross-cut the guides to length.

Lay out the fixed and sliding plates and cut with a sabre saw. Then, using a 1½-in. spacer between them, center the two fixed plates on the base to be square to the base centerline and screw in place. Next, temporarily clamp the two sliding plates in position so that their centerlines, and those of the fixed plates, are all on the same line. Lay the inner guides on both sides of the plates and clamp. Check that the long edges of the inner guides are square with the gap between the fixed plates and the sliding plates move freely, but are not

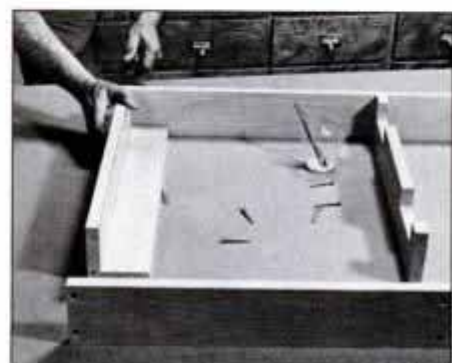
too loose. Then screw guides in place.

Four slotted holes are cut in the inner guides to facilitate clamping the fence in position. Cut each hole by first boring two 1½-in.-dia. holes and then cutting away the waste with a sabre saw. Screw the base to the aprons. Then, use 1½-in. spacers in the long track and cross track to position the outer guides.

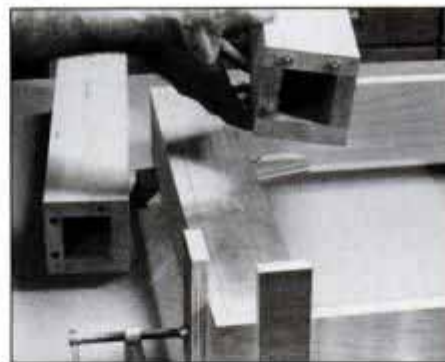
To cut the mounting plates, lay out a 13 × 13-in. square. Draw the diagonals and inscribe a circle. Where the circle intersects the diagonals draw a 45° line. Saw-mounting plate must be recessed to accept the base of your circular saw. Because each brand of saw is slightly different, you must adapt our dimensions to your saw. Drill holes for the mounting bolts in the saw base and corresponding ¼-in. holes and ⅝-in. counterbores in the mounting plate.



1 Assemble the legs with nails and glue. Bore ⅝-in. pilot holes and counterbore for plugs. Finish driving with a drift punch.



2 Screw the aprons together to make the frame. Cut two 1½ × 4½-in. notches in the partition for fence-clamp access.



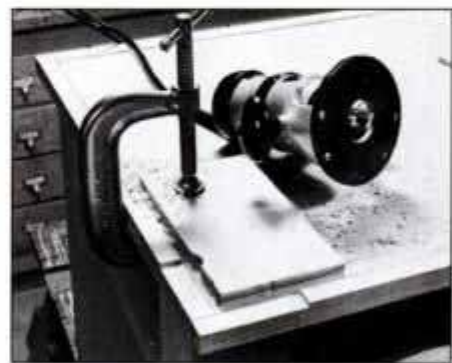
3 Use dowel centers to transfer hole locations from the legs to the frame. Clamp two blocks at the corners to align the legs.



4 A drill guide ensures straight dowel holes. Bore 1½-in.-deep holes for 2-in. dowels to allow for excess glue.



5 Slide in the top shelf before attaching the support cleats. Screw and glue the cleats and screw the shelf in from below.



6 Trim the maple edge band flush on the lower shelf where the legs join. Screw the shelf in place with 2-in. No. 12 fh screws.

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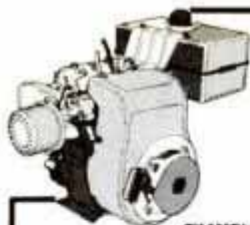
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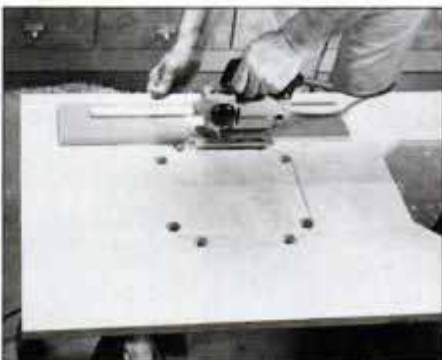
One For All

You'll need to make a few throat plates to accommodate the most commonly used blade angles. Use 1/4-in. hardboard for these inserts and recess the mounting plates to accept them. The router plate also should be recessed. Although we routed a circular recess, a square one will work just as well. Make sure that the router is centered in the mounting plate.

Cut the miter-gauge parts to the dimensions given. The miter guide rail must be trimmed to 1/4 in. in thickness so it lies flush with the table surface when in use. Assemble the slotted adjustable beam by laminating three layers as shown in the drawing. Cut the carriage bolt head recess by drilling successive blind holes with a 1-in. bit. Clean away the excess with a sharp

chisel. Then rout the slot in the guide rail with a 3/8-in. straight bit. Take care to position the guide rail at 90° to the plate and clamp it in place before drilling the pilot holes.

The bridge fence is designed to be used in a closed position—when the tools are mounted in the table—or open position which allows stock to be passed underneath and a tool to be hand operated from above. When assembling the fence, first place the two guide rails—complete with sides and braces attached—in the tracks of the table. Then place a straight piece of stock in the cross track of the table and align the fence guide rails against this. Next, secure the fence top with 1 1/2-in. No. 10 fn screws. Position the pivoting fence sections and insert the end pins. The pivoting fence is held in the upright position by two roller catches. When



7 The cutouts in the base are started with 1-in.-dia. holes bored at the corners. Use a guide to make the cuts.



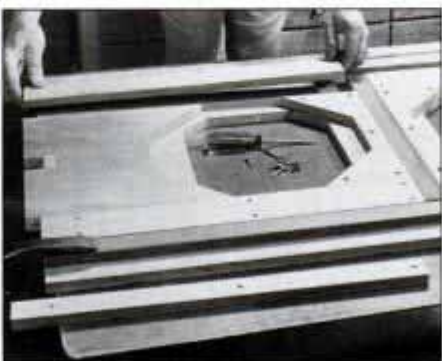
10 Bore pilot holes and counterbores for the guide mounting screws and plugs. Align outer guides with a 1 1/2-in. spacer.



8 Rip the inner guides and the fixed and sliding plates. Be sure that the cuts are absolutely straight and parallel.



11 Cut the clamp access holes in the inner guides by first boring 1 1/2-in. holes and cutting the waste with a sabre saw.



9 Install the fixed plates on, and square with, the centerline. Place sliding plates on centerline and install inner guides.



12 Mount the switch and outlet boxes on the long apron. An octagon junction box splits the circuit to the two tools.



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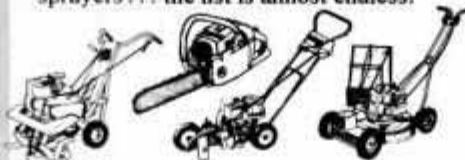
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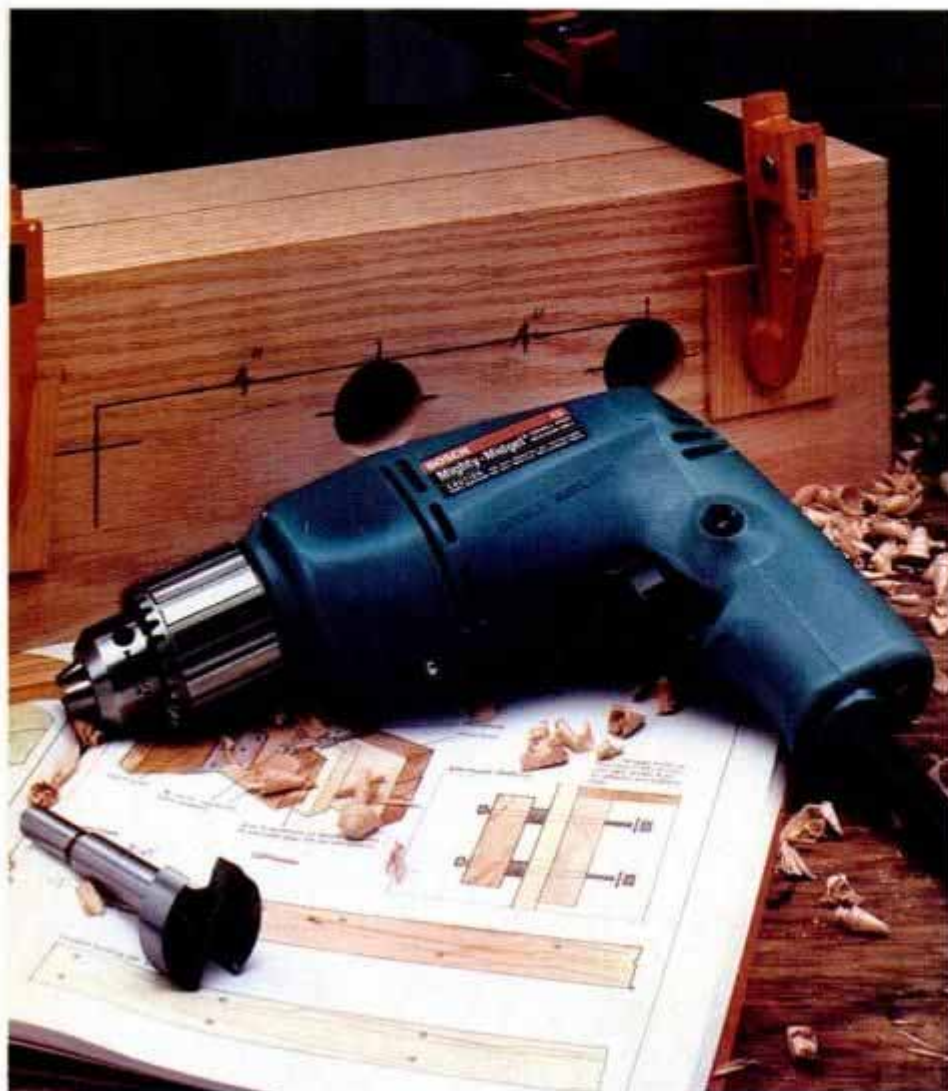
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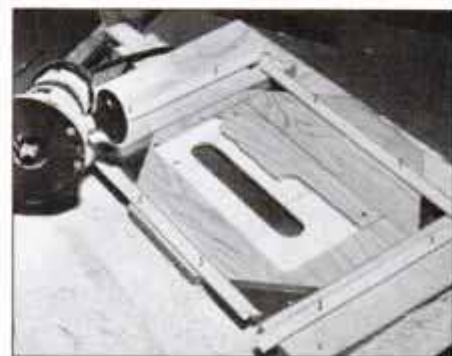
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One For All

installing these, check to be sure that the fence is square with the tabletop.

Two hold-down clamps are used to tighten the sliding plates on the mounting plates. Remove the button ends of the clamps by holding the buttons in a vise while backing off the screws. Bore clamp mounting holes through the short aprons and blocking. Countersink the maple inserts on the sliding plates to receive the ball ends and install clamps.

Trim the power table edges $\frac{3}{16}$ -in.-thick maple and apply three coats of urethane varnish, thinning the first for good penetration. Apply a first coat only to the insides of the tracks to seal the wood and permit easy sliding. **PM**



13 Rout a $\frac{5}{16}$ -in. recess in the saw-mounting plate to accept the circular saw base. Tailor the size and position to your saw.

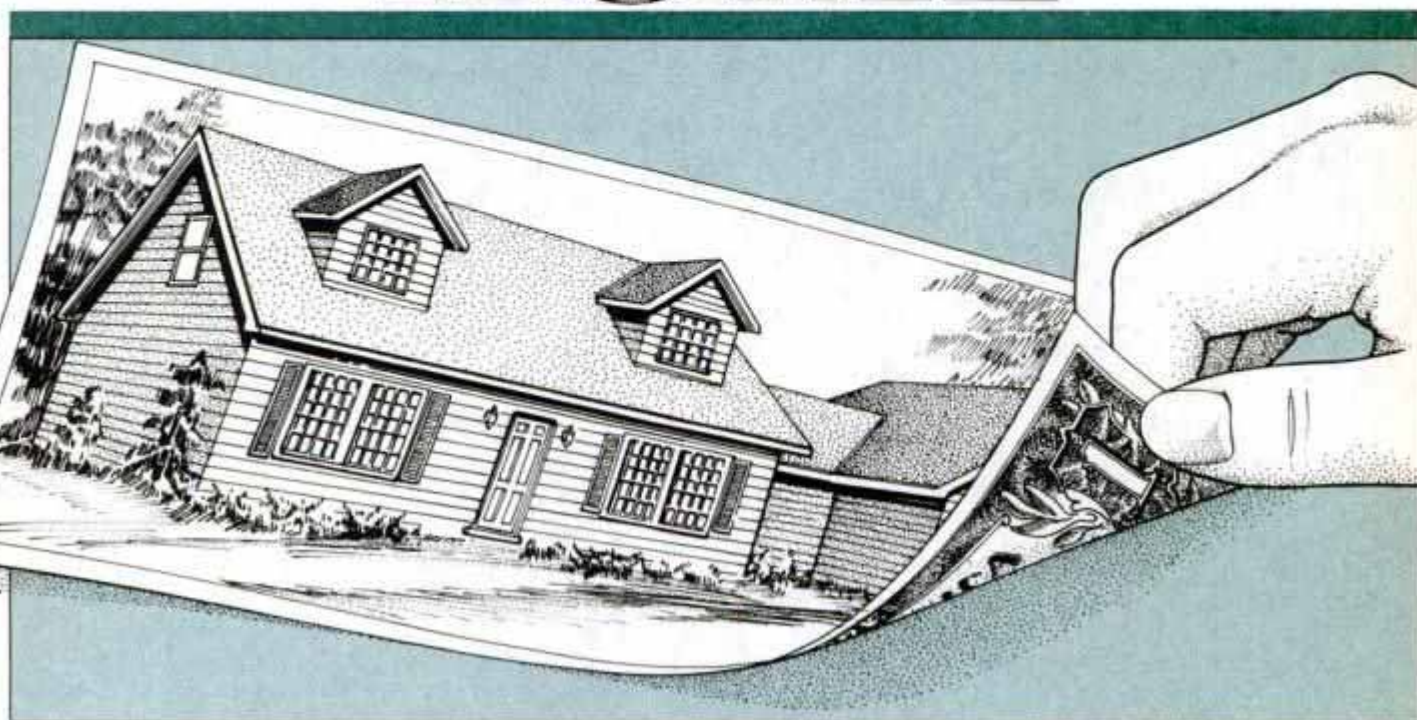


14 The miter-gauge rail is recessed underneath for the carriage bolt head. Laminate maple stock for the adjustable beam.



15 Assemble the fence with the rails in the tracks. Use a piece of straight stock in the cross track to insure square.

THE BETTER HOME



The Pros And Cons Of HOME EQUITY LOANS

It's virtually impossible these days to escape lenders' sales pitches for a new type of second mortgage, the home equity line of credit. Switch on the radio and you're assaulted by annoying jingles—"Call 800-USA-Loan, call 800-USA-Loan." Full-page newspaper ads tout tantalizingly low loan rates. Many lenders have also begun exhorting potential borrowers through the mail. The Loan Depot, a mortgage broker that arranges home equity lines nationwide, plans to send out 15,000 letters a day to entice homeowners to borrow against their homes. And just in case the advertising blitz isn't enough to woo you into the bank, some lenders have used a tactic formerly reserved for getting you to put money into the bank: giving away cameras, pocket TVs, coffeemakers and any number of other gadgets to borrow-

BY WALTER UPDEGRAVE
Illustrations by George Retseck

ers who will sign up for a home equity loan.

So far, this mass merchandising effort has been wildly successful—at least from the lenders' point of view. Borrowings under home equity lines have zoomed from less than \$1 billion in 1980 to \$35 billion in 1986. And with everyone from banks to credit unions to finance companies to major brokerage firms like Merrill Lynch hawking these loans, market research firm SMR Corp. predicts borrowings against home equity lines will more than double again, topping \$75 billion in loans outstanding, by the end of this year.

Why now?

Why the sudden craze for this new form of credit? "Home equity lines are one of the most flexible and low-cost methods of borrowing available to consumers," says Charles Humm, vice president of brokerage firm Merrill Lynch, which makes home equity loans in 38 states. "It's a hassle-free way to borrow." Once you've qualified for a line of credit, there's no need to go down to the bank every time you want to draw against the loan. Instead, you borrow by simply writing a check against a special account set up by the lender. About 100 banks across the country even allow you to use your credit card to draw against a home equity line. In short, all participating lenders are making it as easy as possible for you to get at the money.

The new tax bill has also boosted the

popularity of these loans. A treasured tax loophole—deductibility of interest on such consumer borrowings as credit cards and car loans—is being phased out by tax reform. This year, you can only deduct 65 percent of the interest on such borrowings.

Next year, that percentage drops to 40 percent, then falls to 20 percent in 1989, 10 percent in 1990, and disappears completely in 1991. But borrowings under a home equity line remain deductible, within limits.

If the proceeds of your loan are used for medical or educational purposes, the interest is fully tax deductible. Otherwise, deductions are limited to interest on borrowings up to the original purchase price of the house plus the cost of all the improvements you've made.

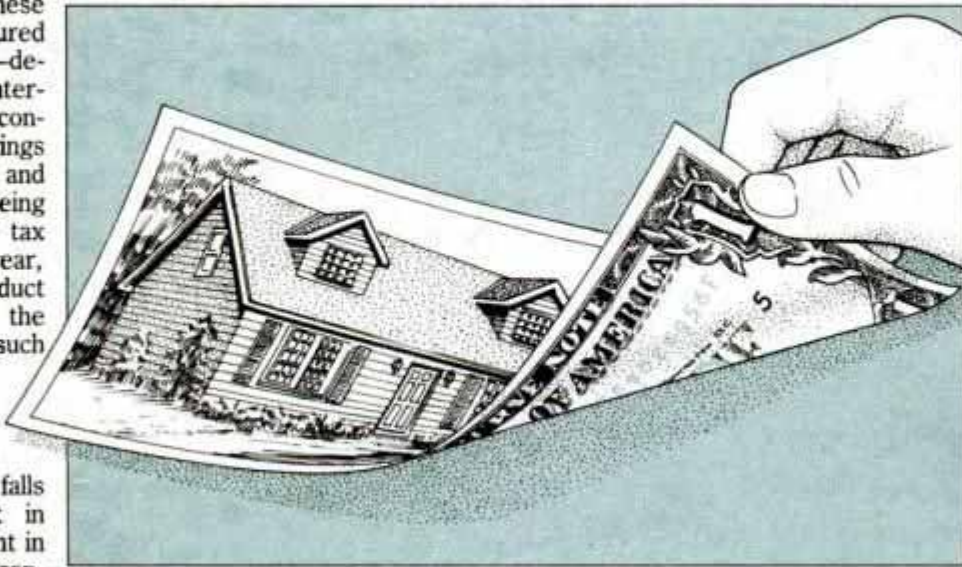
How they work

But before you join the parade of homeowners who've already signed up for home equity lines of credit, you should understand how these loans work and weigh their advantages against some possible pitfalls.

The flip side to the convenience of these loans is overindulgence: You may be tempted to borrow more than you actually need. The average line of credit on home equity loans is about \$40,000—giving reckless borrowers far more leeway to wreak financial havoc on themselves than with credit cards which generally have \$3000 to \$5000 limits. Also, most home equity lines carry variable rates. If the general level of interest rates rises, so will the monthly payment on your home equity loan.

But the most frightening aspect of these loans is one that the lender is least likely to dwell on. "What people may not realize but should know when they take out an equity loan, is that they are putting their house in jeopardy," says Donald Badders, president of the National Foundation for Consumer Credit. "If you default on the loan, you lose your home."

To drum up loan volume, many lenders tout home equity lines as an all-



purpose form of consumer borrowing—an easy way to buy a new car, finance a vacation or even a way to pay down your credit card balances.

But, given the high stakes involved, most financial planners and credit experts suggest these lines of credit be reserved for such necessities as medical or educational expenses or for home improvements that significantly add to the resale value of your home. "It's very easy for the equity in your home which might have taken years to build up to be quickly chiseled away by borrowing for vacations or other frivolous or casual expenses," says John Pollock, president of New World Decisions, a market research firm that tracks consumers' use of debt.

Terms

The terms of a home equity line will vary somewhat from lender to lender, but most work on the same principle: The lender extends you a line of credit that allows you to draw on the equity in your house. Generally, the lender lets you borrow up to 80 percent of the un-mortgaged value of your house. If your home's market value is \$150,000 and your mortgage balance is \$50,000, you might qualify for an \$80,000 line of credit. You can draw down the entire amount of the line or just a portion.

Most home equity lines are set up as revolving lines of credit much the same as credit cards, so you can continue to borrow against the line as you repay principal. Lenders also examine your credit history and gauge your ability to repay borrowings based on your income. Thus, even though you have enough equity in your house to merit a

\$50,000 line of credit, the bank might grant you a smaller one—or none at all—if you've got a lousy credit record or your income simply isn't big enough to handle payments on a \$50,000 loan. The way individual lenders judge your credit worthiness varies widely. Some aggressive lenders may have more flexible standards.

Since your home serves as collateral for these loans,

lenders consider them less risky and, therefore, charge a lower rate than for other types of loans. Although a few lenders may offer fixed-rate home equity lines, the interest rate on these loans is usually pegged one to two percentage points over an index such as the prime lending rate, the rate banks charge to their best business customers.

With prime at 7.5 percent, as it was at the beginning of this year, the going rate for most home equity loans runs between 8.5 percent and 9.5 percent. Keep in mind, though, that with a variable rate loan, you run the risk that the interest rate—and your monthly payment—can rise.

"If inflation takes off," says Lewis Altfest, a New York City financial planner, "people may find themselves at double-digit interest rates and in financial difficulty." For example, for a \$50,000 loan at 9 percent with a 15-year repayment schedule (two percentage points above prime) monthly payments are \$522. But if prime rises two percentage points, the rate on the loan goes to 11.5 percent and the monthly payment increases to \$585. Were prime to move upward yet another two percentage points, the loan rate would jump to 13.5 percent and the monthly payment climb to \$650—\$128 a month more than the initial payment negotiated during a period of low inflation.

The interest rate isn't the only cost for these loans. Most lenders also impose an origination fee, sometimes called points, equal to 1 percent to 2 percent of the amount of the line. Thus, if you sign up for a \$50,000 line of credit, you pay a \$500 to \$1000 fee, regardless of how much you borrow against that

line. "Sometimes the lower rate of a home equity line can be eaten up by these costs," says Altfest.

Since a home equity line is another mortgage on your house, you may also have to pay some of the same closing costs you paid when you bought your home. Fees for a new appraisal, title search, title insurance and attorneys' services can add another \$400 to

\$700 to the cost of the loan, although some lenders include these costs in the origination fee.

Generally, as long as you plan to have the loan outstanding more than a few years, the lower rate will more than compensate for the upfront origination fees and closing costs. In their zeal to make these loans, many lenders are waiving closing costs and origination fees. This is a good deal for borrowers, provided the loan's interest rate is still competitive.

Repayment

Repayment terms vary widely. Some banks spread principal and interest payments on borrowings over 10 years, while others give you 15 or as many as 25 years to repay. Other lenders allow you to make interest payments only, if you wish. In that case, the full amount of the loan is due when its term expires.

While this arrangement—known as a balloon loan—lowers your monthly payments, it leaves you with the problem of coming up with a huge payment at the end of the loan something that is often impossible. "Balloon loans have gotten a lot of people in trouble," says Badders. "No matter how much people try to plan for it, that day comes around when the balance is due and people just aren't ready for it."

Badders and Altfest both suggest that, even if the lender doesn't require regular principal payments, you should insist on setting up a repayment schedule and stick to it. This will prevent you from being pinned down by a huge load of debt that could easily crush you if interest rates rise. Under these circumstances, even some relatively modest



additional expenses, for instance a medical emergency or the sudden need for a new car, could result in losing your home.

Shop around

Since the terms and rates can vary so widely, it's important to shop around before taking out a home equity line. For example, while Society for Savings, a Hartford, Connecticut, savings bank, recently charged 8.5 percent (prime plus 1 percent) for its home equity line, brokerage firm Merrill Lynch got 9.5 percent (prime plus 2 percent), and Beneficial Corp., a consumer finance company that makes home equity lines nationwide, hit up borrowers for prime plus 4 percent—an 11.5 percent interest rate. For a \$30,000 loan, paying 11.5 percent instead of 8.5 percent could cost you an extra \$900 a year. With premiums like this involved, doing some careful research could pay off handsomely in interest savings.

Beware, though, of teaser rates. Some lenders push home equity lines that have introductory rates as low as 5 percent. But the bargain-basement rate lasts only a year—sometimes less—and then goes up. "Don't just look at the rate for the first year," says Altfest. "You want to choose a line that has a competitive rate over its entire term."

You can also save on borrowing costs by comparing origination fees and closing costs. These elements are generally considered to be the "fine print" in these loans. A 2 percent origination fee on a \$60,000 line costs you \$1200. You can cut that in half by finding a lender who charges 1 percent and eliminate it entirely if you go to a bank that's waiving

the fee to lure new customers.

Verifiable index

Make sure the lender is using an independent, verifiable index for pricing the loan. Most lenders tie their rate to the prime rate which is published in most daily newspapers. A quick check can tell you what your rate should be. A few banks, however, peg the rates on their loans to their own cost of funds, a

measure that at best is difficult to verify and at worst subject to manipulation by the bank. You're usually better off going with a lender who uses an independent, easy-to-follow index such as the prime rate.

Get what you need

Just because your banker or broker is willing to give you a fat line of credit, say \$90,000, that doesn't mean you should necessarily apply for the maximum. Instead, you should realistically gauge the amount of credit you need, add a bit of a cushion for an emergency, and take out a line for that amount.

The reason is that you'll pay an origination fee of up to 2 percent on the entire amount of the line you are granted whether you actually borrow against it or not. So if you take a \$90,000 line but the most you ever draw on it is \$20,000, you've paid an origination fee of \$1800 for a \$20,000 loan—effectively a 9 percent fee. Better to plan carefully and take a \$20,000 to \$30,000 line and pay a \$400 to \$600 fee.

The bottom line

Used properly, home equity lines provide you with a flexible, efficient and relatively inexpensive method of financing a variety of needs. But before you write a check against your house, do some aggressive comparison shopping and remind yourself again of the inherent risks in going this route. "It's wise to exercise a little extra caution and discipline with these loans," says Ross Levin, a Minneapolis financial planner. "After all, the collateral you're putting up is the most important asset you own—your home."

FM

How To Install A DEADBOLT LOCK

It seems that all of us are more security conscious than we used to be. New high-end electronic security systems seem to be springing up everywhere these days. And while many of these boast truly remarkable capabilities, it's important to remember that any good security system should start out with the installation of deadbolt locks on all your exterior doors. With a little care and the right tools you can install them yourself and save a substantial amount of money in the process.

Deadbolts come in two basic styles. One requires a key to lock and unlock the door from both sides. The other requires a key on the outside, but is easily operated with a turn unit knob from the inside. The type you choose will depend on the type of doors you have and on fire-safety factors.

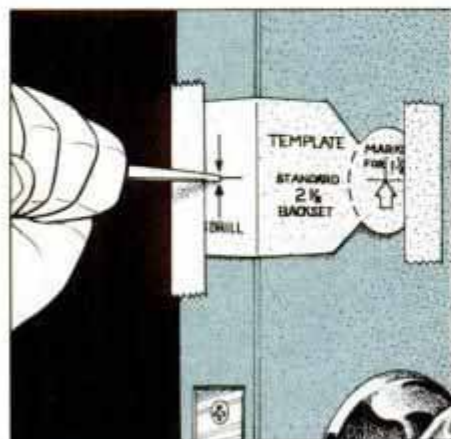
If you have a door with a glass panel in it, then an inside key lock offers more protection from an intruder who might be able to reach the turn units by breaking the glass. If your doors have no glass, then locks with inside turn units will work fine. The added advantage of a lock that has a turn unit on the inside is that you don't need a key to get out in the event of a fire.

The choice is yours. The installation is virtually the same.

Start by deciding where you want the lock to be. If you have a hollow-core



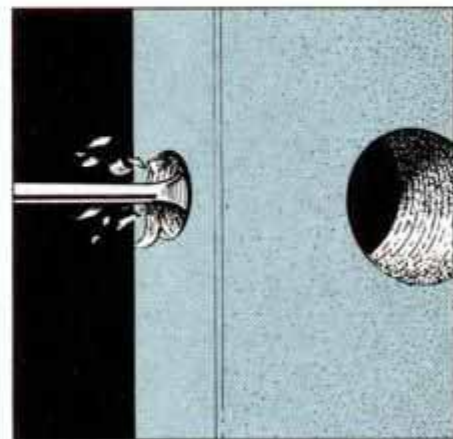
Installing deadbolt locks on your exterior doors is the first step in improving the security of your home. The job requires just a few tools and a couple of hours.



1 Begin by positioning the template supplied with your lock on the edge of your door. Use an awl to mark hole locations.



2 Bore lockset hole first using hole saw. Bore until pilot bit breaks through other side, then complete hole from other side.



3 Bore bolt hole next, making sure to keep bit aligned vertically and horizontally. Accuracy is crucial on this job.

door, stay just above the lockset that is already on your door. Hollow-core doors are reinforced near this lockset and, therefore, are strongest at door-knob level. Even if you have solid-core doors, stay near the lockset for the greatest strength.

When you buy your deadbolt, you will find directions that include the exact drill bit sizes you will need. Make sure you have bits to meet those requirements. Inexpensive, adjustable holesaws work fine. You will also find a paper template to help you mark the exact hole locations.

Getting down to work

The hole for the lock cylinder should be bored first. While you bore the hole, pay close attention to the angle of your drill and make sure that you bore straight in. Don't drift to the left or right. If you are working alone, block the door so that it remains steady and concentrate on a straight hole through the door. When

the larger hole for the lock cylinder is finished, bore the smaller bolt hole. Use the same procedure.

When the holes are bored, press the bolt in place and mark around the plate with a knife. Then, chisel out the plate area to the manufacturer's recommended depth. Next, press the lock cylinder into its opening from the outside and make sure that it catches the bolt. Installing a strike plate for a deadbolt is a little more involved than for a regular lockset.

Many deadbolts come with a reinforcing box to give the doorframe added strength. Measuring for this box is critical. Because doors often warp when in place, simply measuring from the bolt to the edge of the door and transferring those measurements to the doorjamb does not always work. A better way is to paint the edge of the bolt with lipstick and then, after closing the door, turn the bolt against the door frame. The lipstick will mark the exact spot where the bolt

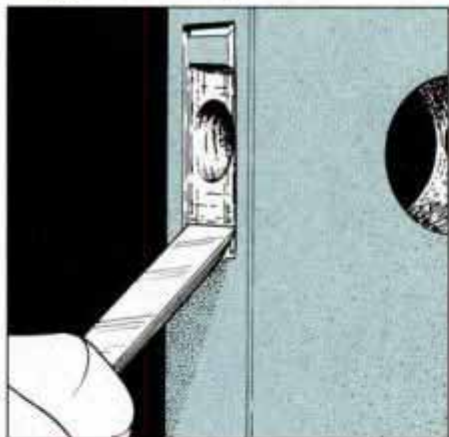
will strike the frame. There's no going wrong with this tip.

Determine the exact center of the lipstick mark and take all measurements off of this point. When installing a reinforcing box, you will need to bore two holes and then trim them into a square hole for the box.

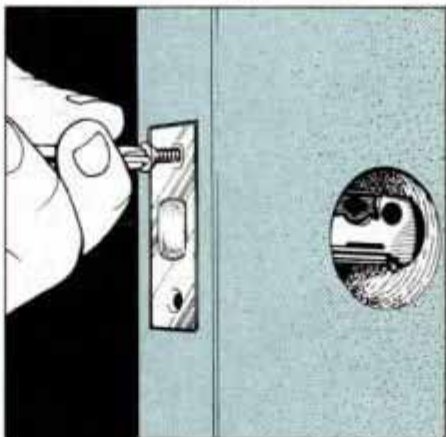
Chisel must be sharp

Even if no reinforcing box is included, you will have to chisel out a recessed area to accept the strike plate and a heavier, brass reinforcing plate. The total depth of these two plates will be near 1/4 in.

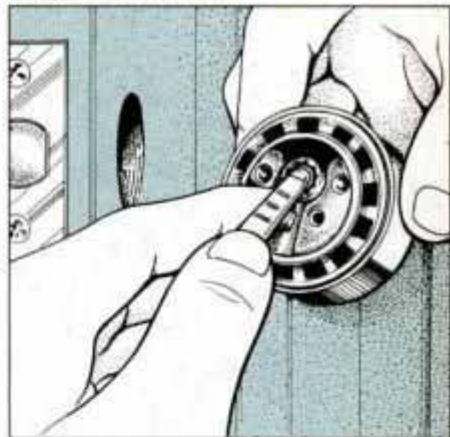
When doorframe is ready for the strike plate, reinforcing plate and/or reinforcing box, bore the screw holes. The reinforcing plate will come with heavy screws at least 3 in. long that will extend through the door frame and into the exterior wall studs. Install these and the screws for the strike plate and the job is complete. **PM**



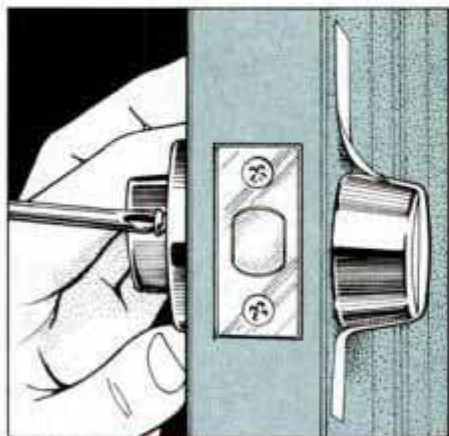
4 Trace bolt plate on edge of door, then mortise out door edge so plate will sit flush. Be sure to use a very sharp chisel.



5 Slide bolt into hole and make sure it fits flush on door edge. Prebore screw clearance holes, then attach with screws.



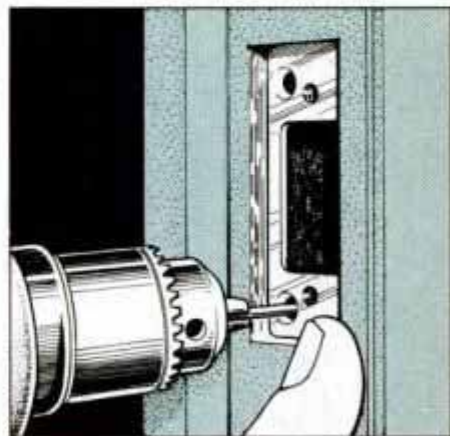
6 Deadbolt is activated by flat pin that joins both sides of lockset. Pin length can be adjusted to match door thickness.



7 Slide lockset and pin through deadbolt mechanism, then tape to door. Slide other half of lockset into place and attach.



8 Test bolt for proper operation, then when satisfied, coat end of bolt with lipstick, close door and slide bolt onto jamb.



9 Using lipstick mark as guide, mortise jamb to receive deadbolt hardware. When hole is complete, attach plates with screws.

How To Repair A BATHTUB DRAIN

Repairing a poorly working tub drain is one of those intimidating tasks for most people. All the important parts seem to be hidden under the tub or inside an adjacent partition wall. In practice, however, nothing could be further from the truth, because the working parts can all be removed, cleaned, adjusted and reinstalled from the outside. All you need to know is what type of drain you have.

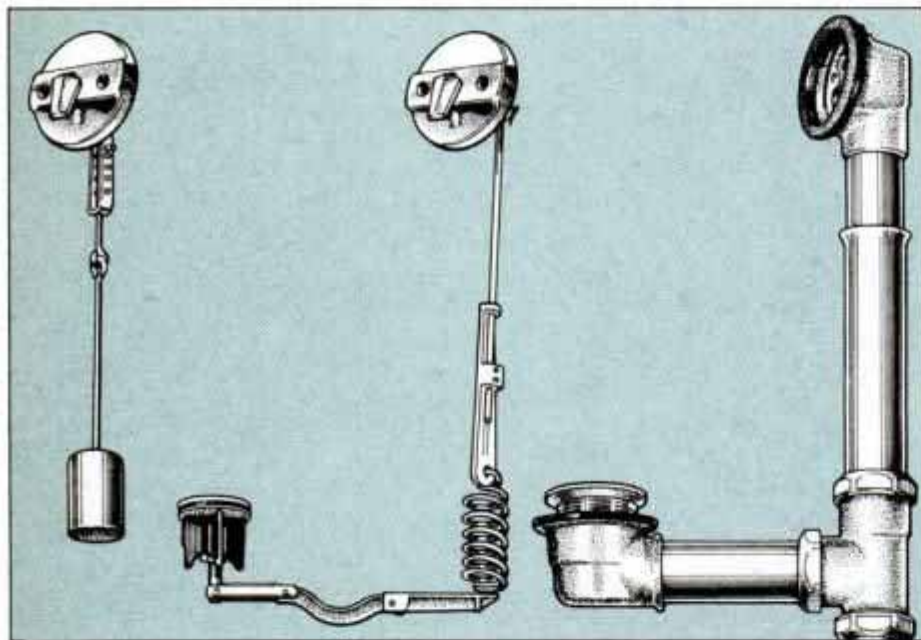
Tub drains, usually called tripwastes by plumbers, come in two basic styles with the same purpose, namely to close off the tub opening so the water does not drain until you want it to. The one on the left is called an internal plunger. When you flip the trip lever below the faucets, the plunger slides past a drain baffle in the overflow tube and prevents the water from passing into the drain system. This type of tripwaste calls for a

simple screen that covers the drain opening at the bottom of the tub.

The second type (below right) is called a pop-up tripwaste. When you operate its trip lever, it allows a drain stopper—positioned in the drain opening—to fall into the opening, closing it off and preventing water drainage.

In most cases, the tripwaste just needs to be cleaned and sometimes adjusted as shown below. Accumulations of hair and soap are the usual culprits. The hair becomes caught and the soap tends to bind it in place. If you force the trip lever when it's stuck, you can distort the mechanism's adjustment which will have to be repaired as well.

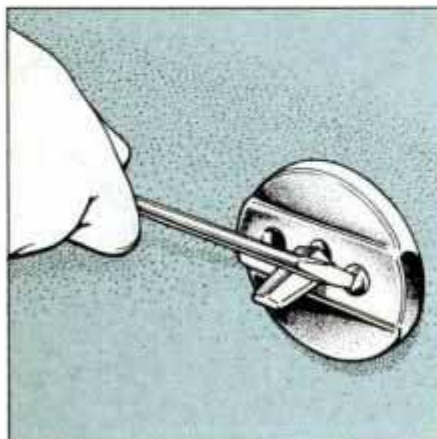
—Merle Henkenius



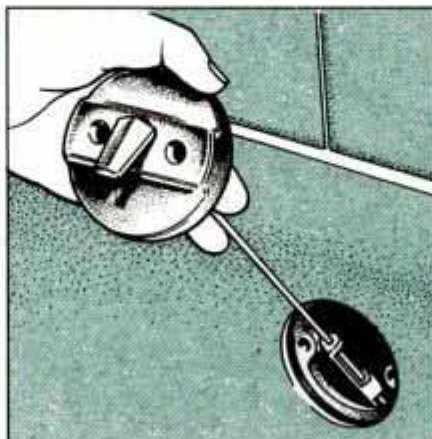
1 Two basic tripwastes are internal plunger (left) and pop-up model (middle). Both fit standard drain system (right) with vertical overflow and horizontal drain-opening tubes.



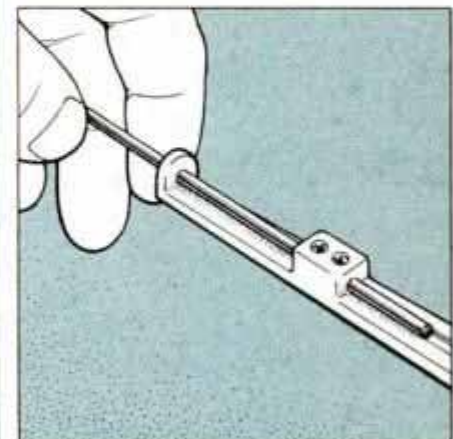
2 To clean plunger type, just remove screen. For pop-up (shown above) just pull mechanism from drain opening.



3 To remove plunger tripwaste—or vertical section of pop-up—unscrew overflow cover plate. It's attached to overflow tube.



4 Pull mechanism from overflow tube and clean thoroughly. Apply heat-proof grease, then reinstall and check operation.



5 If plunger or spring arm needs adjustment, move connecting rod on fitting and retighten. Reinstall and check.

Homeowners' Clinic

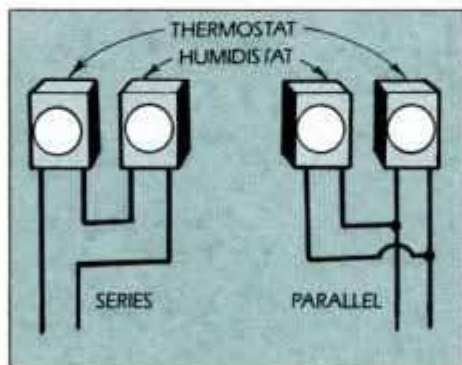
BY NORMAN BECKER, P.E.

Air-Conditioning Humidistat

What is your opinion on installing a humidistat in series with my air conditioner thermostat? Will this save on operating costs?

LEON MARKS
PLANTATION, FL

The amount of electricity saved will vary considerably with the user. A humidistat with dehumidification control (the contacts close when the humidity rises), such as the Honeywell model No. H46C1000 will do the job. It operates in the range of 20- to 80-percent relative humidity and sells for about \$45. There is a disadvantage in connecting the controls in series. In this case, both the humidistat and the thermostat contacts must be closed for the air conditioner to operate. If the relative humidity is low, the air conditioner will not run even though the room may be uncomfortably hot. When



Humidistats can be wired in parallel or series with the thermostat to allow your air conditioner to engage on high humidity.

the two controls are connected in parallel, the air conditioner will operate if the contacts on the humidistat or thermostat are closed. The condition that is met first, temperature or humidity, triggers the air conditioner. Here, you can use the air conditioner to control humidity by setting the thermostat to engage at a high temperature.

Severe Humidity

I have a severe humidity problem in my house which is 2 years old. The indoor relative humidity levels run 70 to 80 percent during the winter months. My double-glazed windows are constantly covered with moisture and the varnish is beginning to peel. The attic is vented by six roof vents and six eave vents. The walls contain 6 in. of Fiberglas insulation with plastic vapor barrier and there's 12 in. of cellulose insulation in the attic. To take care of moisture in the bathroom, I have a power vent to the outside. The range hood is not vented but there is only minimal cooking done on the range.

MIKE TRUAX
IRON, MN

It sounds as if you have a tight, energy efficient house. While this helps keep your heating costs in line, it inhibits fresh-air infiltration that would otherwise help to control humidity. Condensation problems often appear in the fall after the house has been exposed to the warmer moist air of the summer months. The moisture from this summer air is absorbed by every-

thing in the house including wood framing, walls, floors, clothes, furniture and so on.

When the drier, cool weather arrives, the house tends to dry out and thereby increases the relative humidity of the interior air. If the temperature at the windows is below the dew point, this moisture will condense.

If this is the cause for the moisture buildup in your house, it can be corrected by ventilating the rooms. Open the windows in each room for about an hour during the warmest part of the day. The dry outside air can then mix with moisture-laden household air and reduce the overall humidity.

There are other possible causes for moisture buildup in your house. If your basement takes on water after a rain, make sure it's pumped out as soon as possible. The water vapor will migrate up to the habitable portions of the house. The dirt floors in crawl spaces should be covered with 4- to 6-mil polyethylene sheets even if the soil feels dry. According to the Small Homes Council at the University of Illinois, a 1000-sq.-ft. house can re-

lease as much as 18 gallons of water per day through evaporation in the crawl space. Try to avoid storing firewood in your basement. As it dries, the moisture it loses will contribute to the relative humidity of the household air.

Another possible source for excessive moisture buildup in the house is a clogged heating-system chimney. One of the products of combustion in a gas-fired heating system is water vapor. If the chimney is clogged, the water vapor will pour into the house. This must be checked not only because of the moisture-level buildup, but because poisonous carbon monoxide could be leaking into the house as well.

Screening Sun's Rays

We live in a house out in the country in central Michigan. In the afternoon, the sun comes through the upper windows and casts across some rather good prints and paintings.

I would be very grateful for your advice on some form of window covering that would largely eliminate or screen the sun's harmful rays that have a fading effect on the pictures. Many thanks for whatever information you can supply.

ALBERT L. CATALLO
GRAND LEDGE, MI

The 3M Company has exactly what you want. They have a product line called Scotchtint Sun Control Films that will cut out about 99 percent of the ultraviolet rays which cause fading and drying of pictures, furniture and carpeting. The film also reduces summertime heat gain and wintertime heat loss. Scotchtint films are available in do-it-yourself kits or can be installed by authorized 3M trained service representatives. For information on your local Scotchtint Film distributor, write to Energy Control Products/3M, 220-8E 3M Center, St. Paul, MN 55101. **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.

Appliance Clinic

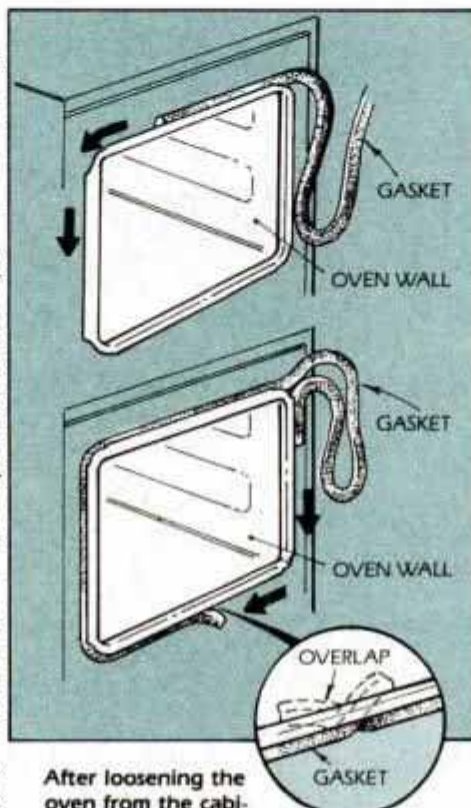
BY STEVE TOTH

Door Seal Burnout

I have a Gaffers & Sattler self-cleaning electric range model No. A38X2CW94, serial No. 03X009305206. The door seal is burned out. How do I replace it?

VICTOR LUCIANO
SAN LEANDRO, CA

You can purchase the door gasket (part No. 1313-279) from any Magic Chef parts distributor for about \$30. To install the new gasket, first remove the oven door. Notice that the gasket fits between the oven wall and the cabinet frame. Loosen the six screws located around the inside of the oven that fasten it to the frame. Hit the side of the oven gently with your fist to loosen it from the frame. Then pull the old gasket out. Starting at an upper corner, feed the new gasket across the top, down one side and then across to the center of the bottom of the oven. Now feed the other end of the gasket around the other side of the oven in the same way. Where the ends meet at the bottom, overlap the gasket and tuck the ends behind the oven cavity. Replace the six screws that hold the oven to the outside frame and install the door.



After loosening the oven from the cabinet, thread the gasket around oven wall. Tuck in ends behind oven cavity.

solenoid-operated valves—one for the ice maker and the other for the cold-water dispenser. It's easy to confuse the two. The ice-maker valve (Sears part No. 482531), is a slow-closing valve. The cold-water valve is quick closing (Sears part No. 839936).

Check the part number on the valve you installed against the above numbers. If it's the correct valve, try checking the water flow from the reservoir storage tank to the spigot. Make sure it's open and free from anything that could cause your after-flow condition. If you need to replace the tubing, order Sears part No. 807200.

Popping Fridge

I have a Gibson refrigerator model No. RT4C1DEDG, serial No. C92844605. It makes a loud popping noise 10 or 12 times a day. I'm worried that the copper tubing might rupture and leak.

FELIX FLORES
SOMES BAR, CA

Your noise is probably related to expansion and contraction of metal parts during the automatic defrost cycle. The refrigerator is equipped with an electric heater that comes on after 8 hours of compressor operation. This heats the aluminum cooling coil to about 50° F and melts off any ice. During this cycle, the parts will expand. When the compressor comes back on, the coils cool and contract.

There's a sound-level kit (Gibson No. G-166510) available that will muffle the noise. The kit consists of insulation which is added between the cooling coils and the back of the refrigerator. It costs about \$3 at Gibson service centers. To install this kit, first unplug the refrigerator and remove the evaporator cover. Then, disconnect the evaporator fan motor and position the insulation behind the evaporator. If you feel unsure of this operation, call your local Gibson service company for professional help. **PM**

Still Ticking

The problem is a knocking noise in the gears of our Maytag wringer washer. We paid a serviceman just to tell us to run it until it stops. I understand Maytag has stopped making wringer washers. Do you think we could still get parts?

THOMAS W. CAMPBELL JR.
PHILADELPHIA, PA

Maytag discontinued manufacturing wringer washers in November 1983. However, all functional (noncosmetic) parts for these units are still stocked. It's difficult to know what's causing the knocking. I suspect it's coming from the transmission. The gears may be worn, or may need lubrication.

I suggest you call Maytag at 1-215-568-5910 to get the name and address of the Maytag service company nearest you. If you feel like taking on the job yourself, pick up a wringer washer service manual (part No. 56-127) from any Maytag parts dealer for

about \$3. It explains how to remove the transmission. You can then send it to the Maytag Co., Newton, IA 50208, Attn: Customer Service. Include a letter explaining the problem.

Water Torture

I have a Sears Coldspot automatic refrigerator with an ice maker and cold water dispenser, model No. 106.7618440, serial No. E13409860. Three years ago the dispenser spigot started to leak when turned off. I replaced the solenoid and valve unit and the leak stopped. Recently, the leak reappeared and I replaced the same parts once again. However, I found the water continued to run for 2 or 3 seconds when I released the dispenser switch. I tried replacing the solenoid valve again with the same results.

JOHN BANNON
KANSAS CITY, MO

Your refrigerator uses two separate

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.

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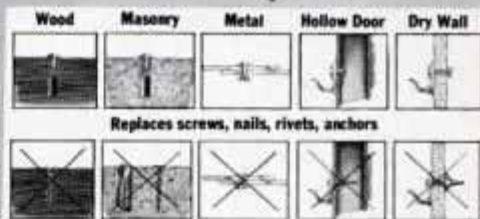


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Piece-Keeper

An easy-to-build small-parts cabinet.

BY ROSARIO CAPOTOSTO, Contributing Editor

How many times have you spent about 20 minutes searching for a specific box of screws or the brass escutcheon pins you bought last summer—you know they're in the shop somewhere—only to discover that the box is nearly empty and the hardware store is, of course, closed. Well, take heart, because for most shopworkers, keeping organized is an ongoing struggle. This is true especially when it comes to organizing the hundreds of small parts required for all types of shopwork.

In an effort to end some of the chaotic clutter, we present this simple 6-drawer, roll-around storage cabinet. The easy-to-build cabinet provides storage for 120 items such as screws, nails, nuts, bolts, wood dowel pins, plugs and other hard-to-find parts. Each drawer holds 20 9-ounce clear plastic cups. The inexpensive cups are available at supermarkets and convenience stores. Unlike most small-parts cabinets, this system allows you to remove a cup and bring it right to the workbench or job site. And, since the cups are clear, it's

easy to identify the contents and determine when to refill.

The cabinet also features a built-in, adjustable-height steel roller housed behind the drawers. Use the roller to support workpieces on the outfeed side of our portable power-tool table

the drawer panels that hold the cups. Use solid maple for the drawer guides, drawer faces, cabinet trim and as edge band to conceal the plywood laminations. Note that the 2¼-in.-thick post (part L in Materials List) that supports the roller is made by gluing three pieces of ¾-in. maple plywood.

Begin by cutting the cabinet's plywood panels, to the dimensions given in the Materials List, using a portable circular saw. This includes the sides, back, partition and top and bottom. Next, glue ⅛-in.-thick × ¾-in.-wide maple edge band to the edges of the plywood panels, as indicated by the drawing. Only the partition (D) does not receive edge banding. An easy way to "clamp" the edge band in place until the glue dries, is with masking tape (see

photo 1). Before assembling the cabinet, bore a 1-in.-dia. access hole in the partition so that you can take out the carriage bolt and remove the roller assembly, if necessary. Also, glue and nail two post guide strips (K) to the partition. Then, cut a ½-in.-wide × 12½-in.-long slot in the back panel to accommodate the carriage bolt. To do this, first bore two ½-in.-dia. holes to establish the top and bottom of the slot. Then, make two parallel plunge cuts with a circular saw to establish the slot width. Cut through the last bit of wood with a sabre saw (photo 2).



Cabinet features an adjustable-height outfeed roller that stores behind the drawers. Use roller to support long boards when working on the torsion-box workbench or power-tool table.

or a standard table saw, planer and jointer. The roller can be adjusted to hold oversize stock when you're working on the torsion-box workbench, too. Note that the compact, portable cabinet requires less than 4 sq. ft. of floor space and stores neatly against the workbench.

Cabinet construction

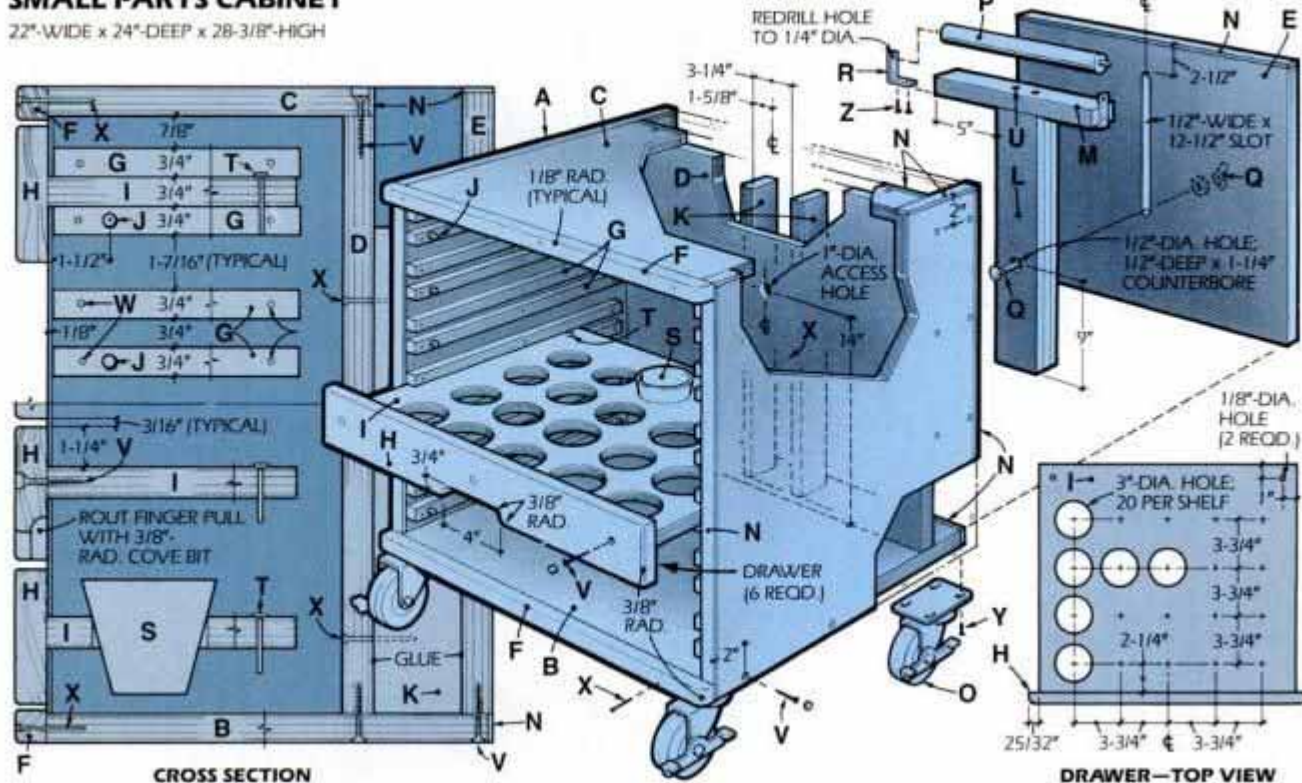
As with the other projects in the Shopwork Guide, this cabinet can be constructed using portable power tools. Build the cabinet from ¾-in. maple-veneer plywood. Use less expensive lauan mahogany-veneer plywood for

Compact and portable, this small-parts cabinet (left) utilizes clear plastic cups for storing nails, screws, nuts and other hard-to-find items. Cabinet houses 120 cups.

Cabinet design: Rosario Capotosto
Color photo: J.R. Rost
Black-and-white photos: Rosario Capotosto
Technical artist: Eugene Thompson

SMALL PARTS CABINET

22"-WIDE x 24"-DEEP x 28-3/8"-HIGH



MATERIALS LIST—SMALL PARTS CABINET

Key	No.	Size and description (use)	(drawer stop)	W	3d finishing nail			
A	2	3/4 x 22 13/16 x 23 1/8" maple plywood (cabinet side)	K	2	3/4 x 2 5/8 x 20 1/2" maple plywood (post guide)			
B	1	3/4 x 20 1/2 x 23 1/8" maple plywood (cabinet bottom)	L*	1	2 1/4 x 3 x 20 3/8" maple plywood (post)			
C	1	3/4 x 19 15/16 x 20 1/2" maple plywood (top)	M	1	1 1/4 x 2 1/4 x 13" maple (roller support)			
D	1	3/4 x 20 1/2 x 22 1/2" maple plywood (partition)	N	1/2 x 3/4-wide maple (edge band)	O***	4	caster with brake	
E	1	3/4 x 20 1/2 x 23 1/8" maple plywood (back)	P***	1	1 1/2"-dia. x 13" steel roller	Q	1	1/2"-dia. x 3 1/2" bolt, washer and wingnut
F	2	1 1/16 x 3/8 x 22" maple (trim)	R	2	2 1/2" corner brace	S	120	9-oz. clear plastic cup
G	24	3/4 x 3/4 x 18" maple (drawer guide)	T	12	6d common nail cut to 1 1/2" long (stop)	U	2	2" No. 12 fh screw; 1/2"-dia. maple plug
H	6	1 1/16 x 3 1/2 x 22" maple (drawer face)	V	1 1/2	No. 8 fh screw; 3/8"-dia. maple plug	Y	16	1" No. 12 panhead self-tapping screw
I	6	3/4 x 18 x 20 1/16" luan plywood (drawer)				Z	4	1" No. 8 fh screw
J	12	3/8"-dia. x 1 1/2" hardwood dowel				Misc:		Carpenter's glue, 100-, 120- and 220-grit sandpaper, satin-finish polyurethane varnish.

Assembly procedures

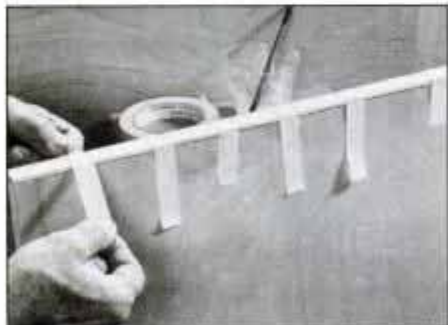
Bore screw-shank clearance holes and 3/8-in.-dia. x 3/8-in.-deep wood-plug holes at each screw location. Glue and screw together the cabinet with 1 1/2-in. No. 8 screws. Conceal each screwhead with a 3/8-in.-dia. maple plug. Next, make the T-shaped post that supports the outfeed roller. Attach the roller to the cross support with two corner braces (R). Cut 3/4 x 3/4 x 18-in. drawer

guides (G) from maple stock. Each drawer panel slides between two pairs of guides.

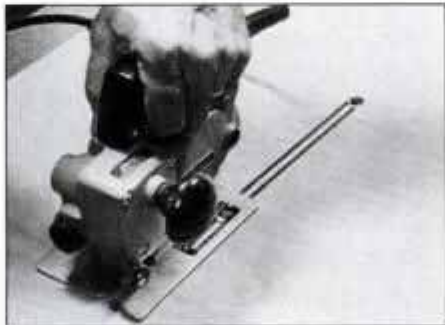
Bore three pilot holes in each guide to accept 3d finishing nails. Also, bore a 3/8-in.-dia. x 3/4-in. hole 1 1/2 in. from the end in 12 of the guides.

The holes accept 1 1/2-in.-long dowel rod sections that act as drawer stops (K). Be sure to use these 12 parts as lower drawer guides.

When installing the guides, use spacer blocks to maintain uniform spacing. Use a 1 1/16-in.-wide spacer block to separate one pair of drawer guides from the next. Use a 3/4-in.-wide spacer between the upper guides and the lower guides. Wrap three thicknesses of masking tape around the 3/4-in. spacer to create clearance for the panels to slide (photo 6). Glue and nail the guides to the cabinet sides. Note that the



1 Use 1/2-in.-thick maple edge band to conceal the exposed plywood edges. Tape the edge band in place until the glue dries.



2 To form the bolt slot in cabinet back, first bore two holes, then saw out the waste using a portable circular saw and sabre saw.



3 Before attaching the partition to the cabinet, bore a 1-in.-dia. bolt access hole and attach two plywood post guide strips.

WORTH WRITING FOR

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uppermost guide on each side is 3/4 in. from the underside of the cabinet top. Finally, glue the dowel-rod stops into the holes bored in the lower guides.

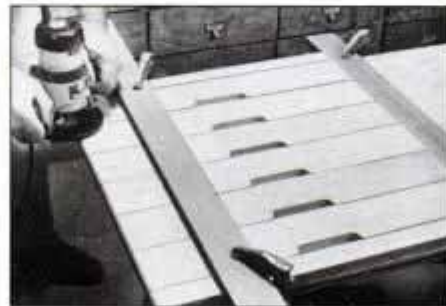
Next, cut six drawer panels (I). There's no quick, easy way to cut out the 120 3-in.-dia. cup holes—20 per panel—but here's the method I used. First, bore 1/4-in.-dia. holes at each hole center. Then, use a 3-in.-dia. holesaw in an electric drill and bore halfway through the panel. Turn over the panel and complete the cut. Sawing from both sides makes it easier to remove the waste plug from the holesaw. Bore holes in the back corners of each panel to receive pins (T) made from 6d common nails. The pins, when inserted in the holes, will hit against the protruding dowel-rod stops when the drawer is opened fully. Lift the pins to remove



4 After the partition is in place, install the cabinet top. Assemble the cabinet parts with glue and 1 1/2 in. No. 8 wood screws.



6 Wrap spacer block (arrow) with three thicknesses of tape to provide clearance for the drawer panels to operate smoothly.



8 Clamp together all the drawer faces and use a 3/8-in. rounding-over bit to rout a radius on both ends of each drawer face.

the drawer from the cabinet.

Now cut six drawer faces (H) from maple stock. Use a sabre saw to cut a 3/4 x 4-in. handgrip in each face. Then, rout a recessed finger pull—on the backside of each face—around the handgrip, with a 3/8-in. cove bit. Rout a radius on both ends of each drawer face with a 3/8-in. rounding-over bit. Clamp the faces together and rout them all at once (photo 8). Glue and screw the faces to the drawer panels. Attach four locking casters to the cabinet's bottom. The overall height of the casters is 4 3/4 in.

Next, finish-sand the cabinet and apply one coat of polyurethane varnish thinned one part thinner to six parts varnish. Then, apply two full-strength varnish coats. Sand lightly between coats with 220-grit sandpaper. Install the steel-roller assembly and secure it with a carriage bolt and extra-large wingnut. Finally, install the drawers and drop in the cups.



5 This shows outfeed roller assembly ready for installation. Note that carriage bolt is in place before the cabinet back is attached.



7 Cut cup holes with a drill and holesaw. Saw halfway through, turn over panel and continue sawing to remove the waste.



9 The roll-around cabinet has four swiveling, locking casters and six drawers. Each drawer houses 20 clear plastic storage cups.

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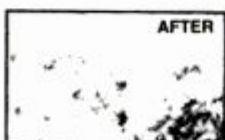
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ASIAN INVASION

(Continued from page 94)

Hyundai Excel

The success story of 1986 was Hyundai, and we looked forward to our first drive in this tremendously successful car. But our testers unanimously felt that the Hyundai was inferior to the mechanically identical Colt.

They complained about the interior's poor fit and finish, "no-feel shifter," "lackluster" engine and "twitchy" handling. Interestingly, the Colt and Excel were almost perfectly matched at the track, as they should have been. Our testers' negative impressions were totally subjective.

Chevrolet Spectrum

Our testers preferred the Spectrum to the Hyundai—and the Nova and LeMans, for that matter. But the Spectrum's poor track performance, when averaged with our road-test ranking, put it in last place. Realistically, if you were going to buy one of these cars, we'd certainly recommend the Spectrum over the Excel, and put it about on a par with the Nova and LeMans.

Our testers thought the Spectrum looked "smart and traditional." It comes across as "larger than it looks, honest passenger space makes it one of the better choices for a family car."

Unlike the Hyundai and LeMans, which elicited considerable negative comments from our testers, the Spectrum was judged to be relatively innocuous. As one tester summed up, "Yet another Japanese economy car that I can't get excited about."

Conclusion

In many ways, the current automobile market is like that in the '50s when independent importers were bringing in all sorts of small European cars, hoping to make a buck. Companies like Volkswagen, BMW, Saab and Volvo evolved into major importers, but cars like DKW, Skoda, Rover, Borgward and Austin never made it.

We've never put much faith in captive imports. It's all too easy for an American manufacturer to pull the plug on an unsuccessful marque, leaving you with an orphan strapped for parts and service, like owners of a Vauxhall, Opel, Fiesta, Capri, Simca, and LUV have found out.

However, there's a difference in this group of captives. Even if Chrysler walks away from the Colt, you could still get parts from a Hyundai or Mitsubishi dealer. Ditto for Tracer parts at a Mazda agency or Nova parts at a Toyota store. Sprint and Spectrum depend on the futures of Suzuki and Isuzu in America, while LeMans is the "if-fiest" in this regard.

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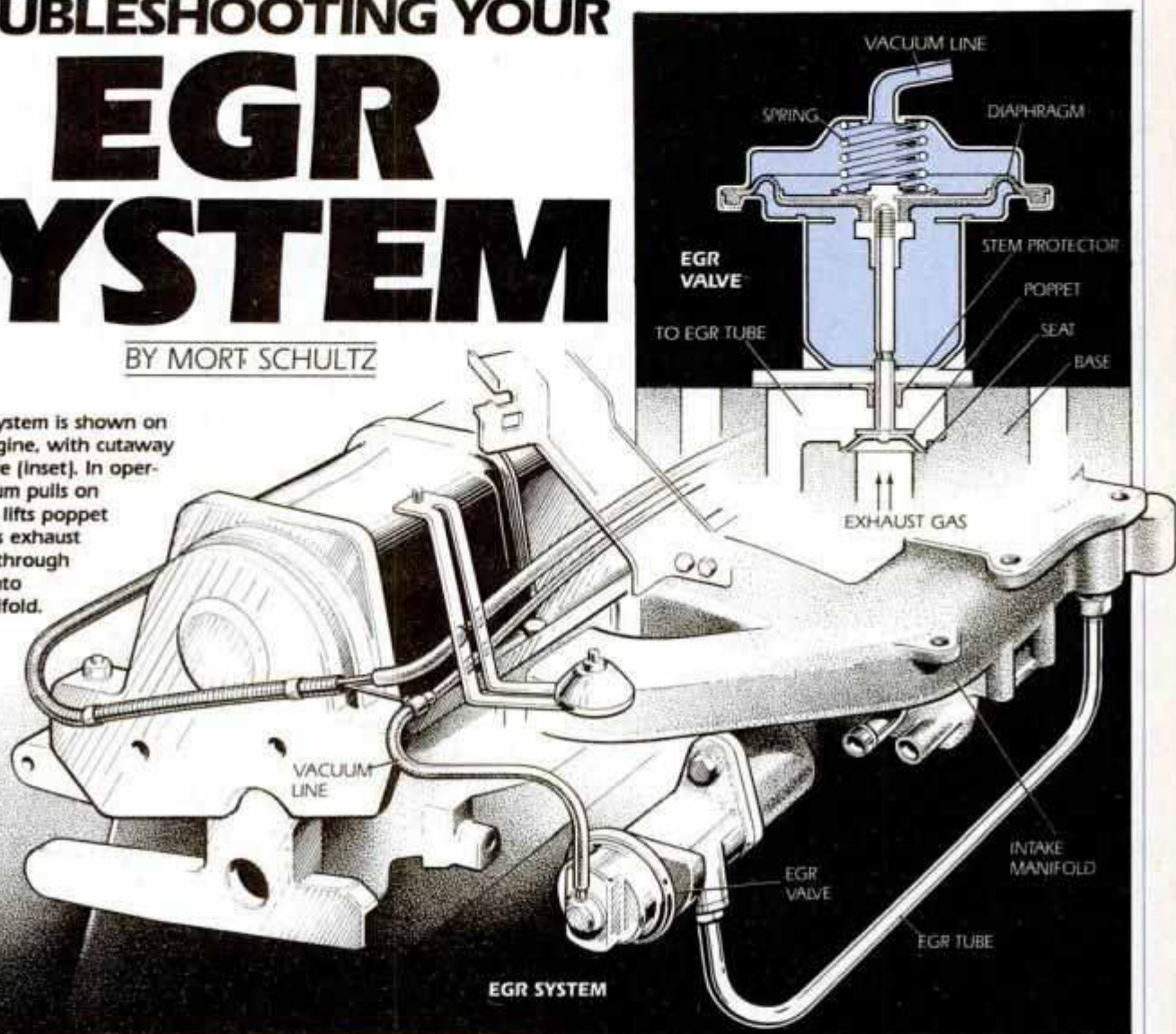
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BY MORT SCHULTZ

Basic EGR system is shown on Chrysler engine, with cutaway of EGR valve (inset). In operation, vacuum pulls on diaphragm, lifts poppet off seat, lets exhaust gases flow through EGR tube into intake manifold.

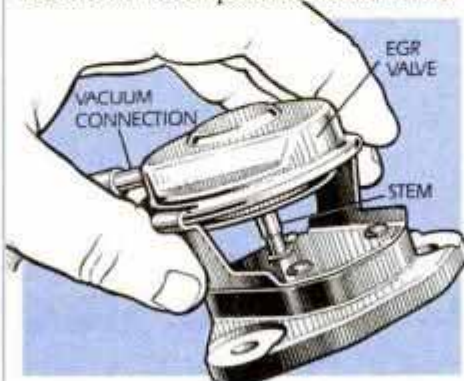


What automotive part has gotten the most bad press in the past 15 years? Taking blame for multitudes of engine problems—including hard starting, stalling, hesitation, surging, spark knock, missing, rough idle, lack of power and backfiring—is the EGR valve. Its purpose is to limit the quantity of oxides of nitrogen (NOx) engines spew into the atmosphere. To keep down NOx levels, it's necessary to keep combustion chamber temperatures below 2500° F by injecting exhaust gas into the intake system. This dilutes the fuel/air mixture, lowering temperatures dramatically. The tricky part is knowing when to inject, because EGR is unnecessary at idle or full throttle. Modern carburetors and fuel injection systems are calibrated with EGR in mind, so a malfunctioning

EGR system (or a missing one) can lead to serious spark knock.

Facts about blame

EGR control components include time-



1 Watch stem of EGR valve for movement when diagnosing EGR system problems.

delay valves, coolant or ambient temperature vacuum switches, back-pressure transducers, vacuum-amplifiers, timers, electric-pulse solenoids.

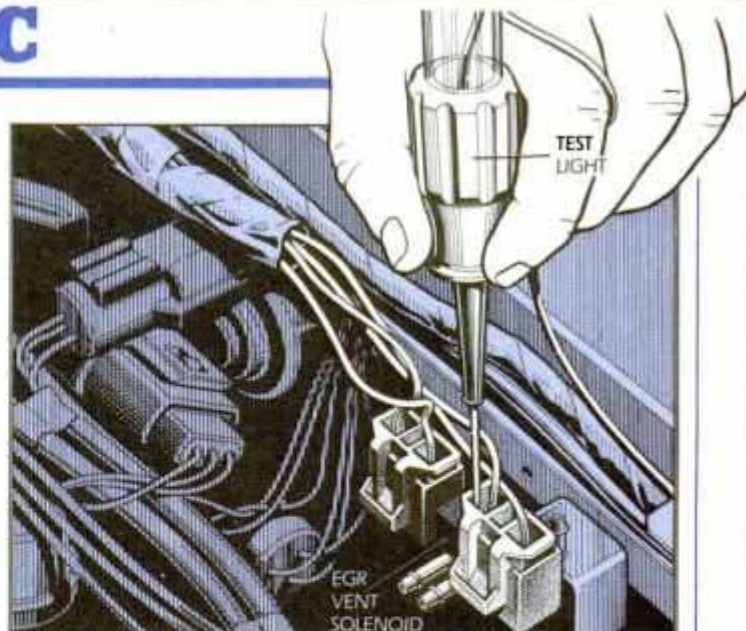
EGR systems rank high on the list of automotive systems misdiagnosed by both Saturday and professional automotive mechanics.

Many believe a system has failed if they feel no movement from the EGR valve diaphragm as engine speed is increased. Under some conditions, feeling no change is normal.

Accurately troubleshooting the EGR system in your vehicle hinges on your knowing how it is supposed to work and which components control the valve. The following is a description of some of the main EGR systems used by Chrysler, Ford and General Motors over the past 10 years.



2 Damaged vacuum lines can disable an EGR system; be on the lookout constantly for kinked or cracked hoses.



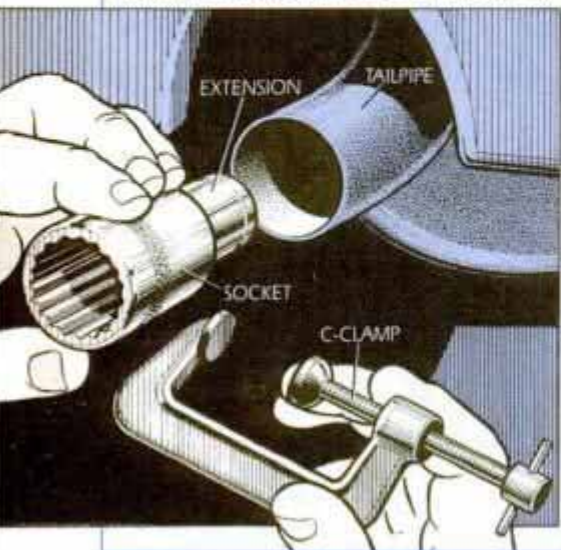
3 Use test light to ground EGR vent solenoid; it should click if solenoid has power, is electrically okay.

Chrysler systems

Most Chrysler Corp. cars and light trucks built in the U.S. use one of two types of EGR systems: venturi-vacuum or ported-vacuum. With the venturi-vacuum system, vacuum is drawn from a port tapped into the venturi of the carburetor or throttle body. Because the pull of venturi vacuum by itself is not strong enough to raise the EGR valve diaphragm off its seat, Chrysler uses a vacuum amplifier.

In addition, there's a coolant-controlled temperature valve or timer to prevent the EGR valve from opening when the engine is cold or started, which would cause hesitation or stalling. A charge temperature sensor (CTS) may keep the delay timer from beginning its countdown until the fuel mixture in the intake manifold is above

4 Clamp close-fitting socket with extension into tailpipe to build back-pressure.



60° F. The delay timer, controlled by a solenoid, delays the vacuum signal from 35 to 90 seconds.

Troubleshooting Chrysler EGR

Start a *cold* engine and let it run between 2000 and 3000 rpm. Watch the stem of the EGR valve (Fig. 1). It should not move.

Let the engine warm up for 2 or 3 minutes. Increase engine speed to between 2000 and 3000 rpm as you watch the valve stem. It should now move.

If the stem acts this way, the EGR system is working properly. But if the stem doesn't move when it's supposed to, either the EGR valve is bad or vacuum is not reaching the valve.

To test the valve, disconnect the hose from the valve hose connector and attach a hand vacuum pump securely to the connector. Pump up vacuum; then, hold it at a steady reading. If the EGR valve stem still doesn't move, replace the valve. Even if the stem moves, there still may be a slow loss of vacuum because of a pinhole in the diaphragm, so apply vacuum and squeeze the hand vacuum pump hose closed. The valve stem should stay open as long as the hose is clamped. If the stem falls, replace the valve.

If hand-vacuum-pump testing confirms that the EGR valve is in good shape, check the rest of the system. First, examine the entire length of vacuum hose from the EGR valve to wherever the hose ends. Replace or straighten cracked or kinked hoses.

If the vacuum hose ends at a part that screws into the radiator, cylinder head, intake manifold or water pump hous-

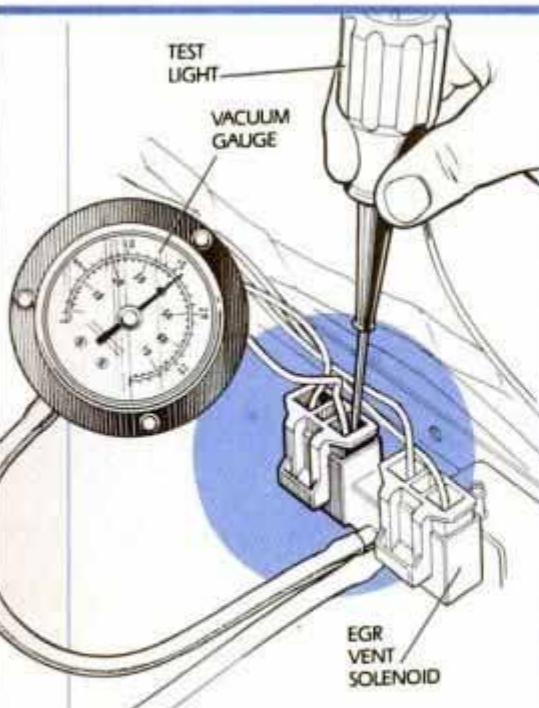
ing, you're dealing with a coolant-controlled EGR temperature valve (CCEGR). When the engine is cold the CCEGR vacuum switch should shut off the flow of vacuum to the EGR valve. To test, make sure the engine is fully cold (shut off for at least 12 hours), and the ambient temp in the shop is below 80° F or so. Then connect a hand vacuum pump to the connector nearest the threads and pump up vacuum. There shouldn't be more than a 1-in. drop in vacuum in 1 minute. If it's too warm in the shop, you'll have to remove the switch and immerse it in ice water or put it into the refrigerator.

Replace a bad CCEGR with one the same color (and temperature value) as the one your car was originally equipped with.

The EGR valve hose may go to a vacuum amplifier. Coming off this circular component are one or two other hoses. If there is one hose, it goes to a solenoid that controls a delay timer. Two hoses go to the timer solenoid and a charge temperature sensor, respectively. The CTS senses the temperature in the intake manifold. Here's how to test these components:

■ **Vacuum Amplifier**—Trace and disconnect the hose going to the CCEGR from the amplifier, or if there's no CCEGR, from the carb or throttle body. Attach a vacuum pump to the hose, and start and warm up the engine. Apply 2 in. of vacuum with the pump. The valve stem should move and the engine should idle roughly. If not, replace the vacuum amplifier.

■ **CTS**—With the engine cold, disconnect the two wires and connect the ohmmeter across the terminals. If the



tach it at once. Start the engine and rev it up between 2000 and 3000 rpm. Watch the EGR valve stem as you keep time using a watch with a sweep hand. If the timer is black, the stem shouldn't move for 35 seconds; orange, 60 seconds; red, 90 seconds.

Chrysler port-vacuum EGR

A small coolant-temperature-operated switch, called a coolant vacuum switch (CVS), won't admit ported vacuum from a fitting just above the throttle plates to the EGR valve until the engine has warmed up. Troubleshoot these components with a hand vacuum pump the way we've just described for a venturi vacuum system.

Ford systems

Most FoMoCo engines in 1974 and later, U.S.A.-built vehicles without microprocessors have one of three types of EGR systems: ported vacuum, remote back-pressure transducer or integral back-pressure transducer. Trace the vacuum hose from the EGR valve. If it connects to a part having several hoses attached to it, that part is a vacuum switch and you have a remote back-pressure transducer system. Otherwise, you're dealing with a ported vacuum system (3-in. vacuum motor), or an integral back-pressure transducer system (4-in. vacuum motor).

Begin testing a back-pressure transducer system by disconnecting the vacuum hose at the EGR valve. Start the engine and press your thumb over the hose. If the engine is a 2.3 liter, run it at 3000 rpm. If it's a 1.6 liter, run it at 4000. With all other engines, press the

accelerator pedal down once and release it. You should feel vacuum at the hose end. If not, and the hoses are okay, replace the back-pressure transducer, which lies between the EGR valve and the intake manifold.

You still have to test the EGR valve. Reattach vacuum hose and build up exhaust system back-pressure by inserting socket into tailpipe (Fig. 4).

Remove the vacuum hose at the EGR valve and attach a vacuum pump to the valve. With the engine idling, apply 6 in. of vacuum. The EGR valve diaphragm should move, and the engine should start to run roughly. If so, clamp the vacuum line to the pump and hold it for 30 seconds. Not more than 1 in. of vacuum should be lost. If any of these tests fail, replace the EGR valve.

Microprocessor system

Ford-built vehicles with microprocessor control systems have electronically controlled EGR systems. A sensor called the EGR valve position sensor, which is mounted on top of the EGR valve, receives signals from the microprocessor through two solenoids to control the opening and closing of the valve. Let's call one the control solenoid and one the vent solenoid.

To check this system, first test the EGR valve by disconnecting the vacuum hose connected to the valve and attaching a hand vacuum pump. Apply vacuum and hold it for 30 seconds. If vacuum drops more than 1 in. in that time, replace the valve.

If the valve tests okay, but spark knock persists on the road, test the electrical part of the system. Begin at

5 Vacuum gauge readings should not drop more than an inch during testing.

resistance is 10 ohms or more, replace the CTS.

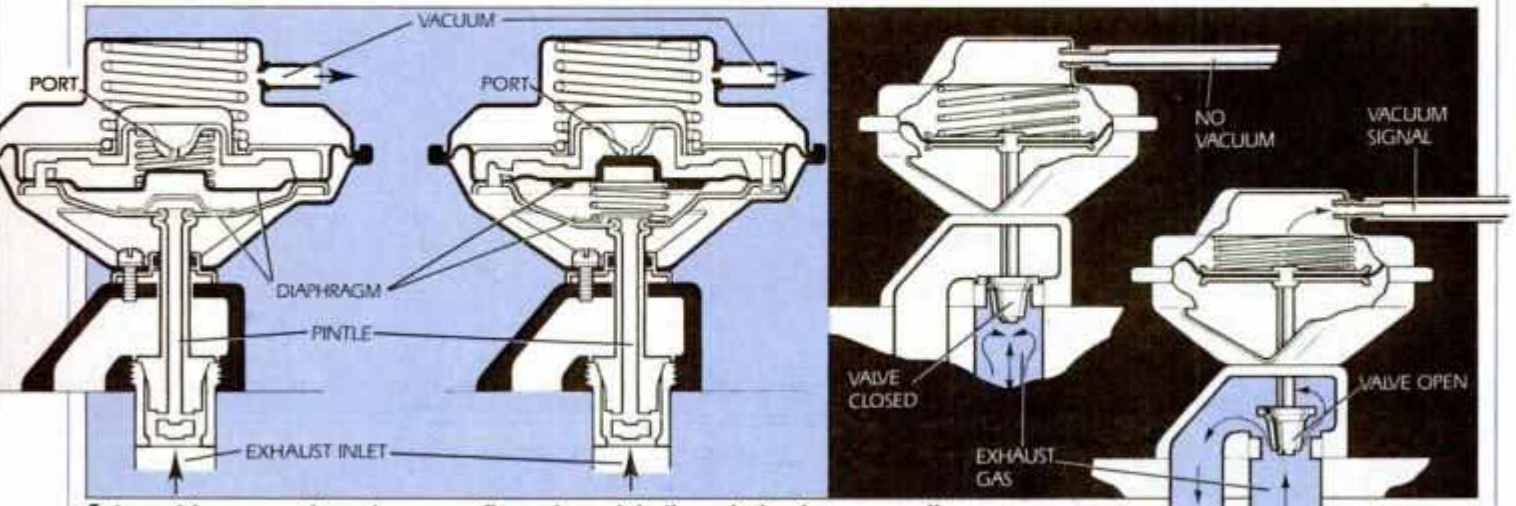
■ **Delay timer solenoid**—Disconnect the wire going to the timer at the solenoid to uncover a 2-prong connector. Attach a jumper wire from one prong to ground. Attach a jumper wire from the battery and touch it to the other prong. If the solenoid doesn't click, replace it.

■ **Delay timer**—For stalling or rough idle in the first minute of operation, suspect a faulty timer. With the engine cold and turned off, disconnect the vacuum hose at the EGR valve and reat-

GM POSITIVE BACK-PRESSURE EGR VALVE

GM NEGATIVE BACK-PRESSURE EGR VALVE

GM SINGLE-DIAPHRAGM EGR VALVE



6 In positive-type valve exhaust, gas flows through hollow pintle, closes port, allows vacuum to open pintle. In negative, vacuum pulls diaphragm port open, keeps pintle closed unless exhaust pressure keeps it shut. In single-diaphragm type, vacuum opens valve.

the EGR vent solenoid (Fig. 3), which is the solenoid having the small vent. Connect the pigtail end of a test 12-volt light to a convenient ground and turn on the vehicle ignition switch, but don't start the engine.

Probe the electrical connectors at the solenoid with the tip of the test light. If probing both wires with the test light doesn't make the light glow and the solenoid click, replace the solenoid. Test the control solenoid the same way. Now, make sure solenoids hold vacuum.

To test the vacuum-holding ability of the control solenoid, disconnect the vacuum hose from the solenoid and attach a hand vacuum pump. Seal the vent of the vent solenoid with tape or a finger to keep vacuum from escaping.

Pump up vacuum and energize the control solenoid with the test light. If vacuum drops, the control solenoid is bad. Replace it.

Test the vent solenoid by continuing to hold the vent closed and maintaining vacuum on the control solenoid. Energize the vent solenoid with the test light. As you do, unblock the vent. Vacuum should not drop, meaning that the vent solenoid has closed and vacuum is being retained (Fig. 5).

GM systems

Most GM engines with and without Computer Command Control (CCC) have one of three types of EGR valves: single diaphragm (or port), positive back-pressure, or negative back-pressure (see Fig. 6).

Warm up the engine. With a 6- or 8-cylinder engine running at 2000 rpm or a 4-cylinder engine running at 3000 rpm, pull the vacuum hose off the EGR valve and place your finger tightly over the end of the hose.

If you don't feel vacuum, there's a bad hose or a defective vacuum component. If vacuum is present, reconnect the hose, reach beneath the valve and put your finger on the diaphragm. It will be either rubber or metal.

If rubber, you're dealing with a single-diaphragm EGR valve which opens and closes in response to ported vacuum. Test this valve by alternately opening and closing the throttle. If the diaphragm moves up and down (if it doesn't, replace it), attach a hand vacuum pump and apply vacuum (Fig. 7). If vacuum doesn't hold, replace the valve.

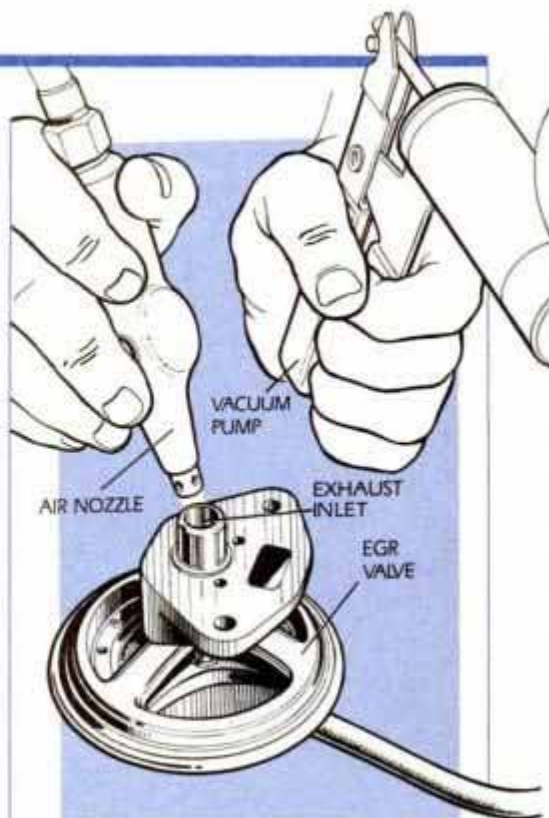
Positive back-pressure EGR valves are controlled by both vacuum and exhaust back-pressure. Test it with the engine warmed up and running at a fast idle. Disconnect the vacuum hose from the valve, insert a golf tee in the end of the hose and place a finger on the valve diaphragm. The diaphragm should stay down and engine speed should increase. Reconnect the vacuum hose and feel if the diaphragm rises. Engine speed should decrease.

Note: You may feel a slight vibration from the diaphragm plates of both positive and negative back-pressure EGR valves. This is normal. Take the valve off the engine. Apply 10 in. or more of vacuum to the valve with a hand vacuum pump. The diaphragm should not rise off its seat.

Maintaining vacuum, aim a stream of low-pressure air into the valve's exhaust outlet (Fig. 8). If the diaphragm doesn't open completely, clean the exhaust passage if it's heavily coked, or replace the valve.

A negative back-pressure EGR valve is controlled by a combination of manifold vacuum, ported vacuum and negative exhaust back-pressure. Test it with the engine off.

Disconnect the vacuum hose from the EGR valve and push up on the diaphragm plate as you place a finger tightly against the EGR valve hose connection. If the diaphragm drops in less than 20 seconds, replace the valve. Repeat the procedure as some-



■ Back-pressure EGR should open when compressed air is blown in exhaust inlet.

one cranks the engine. If the diaphragm doesn't drop, replace the valve.

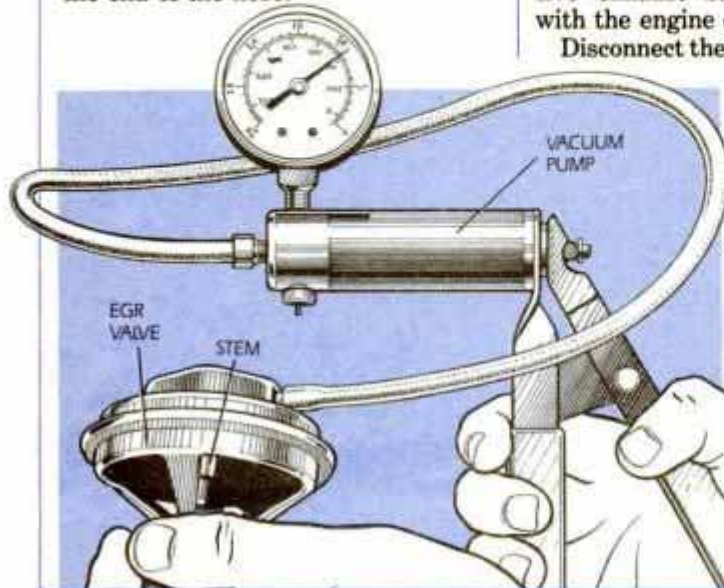
GM EGR control units

Most GM engines use a thermal device that controls vacuum to the EGR valve. Engines without CCC employ a coolant-temperature-sensing switch, an engine-heat-sensing or a combination coolant and engine switch.

If the EGR valve responds positively to tests, make sure the rest of the system is not causing your engine problem by checking hoses; then, by replacing the control switch.

The EGR control system of GM engines with CCC on pre-1983 and many post-1983 vehicles consists of a solenoid and a thermal sensor. To test them, connect a vacuum gauge to the end of the hose at the EGR valve and start the engine. Open and close the throttle a few times. There should not be a vacuum reading until the engine gets warm.

If there is a reading, remove the wire at the solenoid. If this makes vacuum disappear, replace the thermal sensor. If the vacuum reading persists, suspect a bad solenoid. Beginning in 1983, GM started using a Pulse-Width-Modulated EGR System that pulsates up to 32 times per second on 2.8-, 3.0-, 3.8-, 5.0- and 5.7-liter engines. If you find that an engine-driveability problem is not due to a bad EGR valve, get help to determine if it's one of the control units. **PM**



7 Apply vacuum to EGR valve, watch stem move up. Diaphragm should then hold vacuum steady, not leak down.

'HOW I BOMBED QADDAFI'

(Continued from page 114)

three or four orbits to let him try to catch up. At that point, I decided to do a little torching. The F-111F fuel dump is located between the two engine outlets. What you do is dump a little fuel and, at the same time, light the afterburner. It's like igniting the contents of an aerosol can with a lighter. But with an F-111F, the results are spectacular! Our tardy F-111F saw the flame and made the rejoin with no problem.

All the way down there, the anticipation of finding the targets, executing the attack, the risks, the uncertainties, kept the adrenalin up to where I was pretty alert. But when I came back and rejoined with the tanker, I noticed that when I refueled, I didn't do as good a job as I should have. The flight surgeon had given us all a couple of go pills, or amphetamines, if we started to get tired. So I took one with a swig of water and felt bulletproof again.

Heading for Lakenheath

On the long flight back, I knew we'd lost an airplane because he hadn't made his "feet wet" call and was nowhere around. So I sat there in my airplane, flying back, listening to the high-frequency radio. We were able to tune in the press conference back in Washington announcing the strike. We heard Secretary Weinberger describe the mission and say that we had an overdue airplane. The press asked if the plane had been shot down and the secretary said: "It's unknown at this time. He could be having a radio problem, or could have been diverted to another airfield." And that was all true, because, really, at that point he didn't know for sure.

But, as we flew back up the Atlantic toward Lakenheath, I knew.

I guess the only noteworthy thing that happened on the long flight back was making the decision to send one malfunctioning F-111F into Spain. A bleed duct in one engine's compressor system failed—a relatively minor problem—but we decided to risk the political considerations in sending the plane to Spain rather than risk losing an airplane 10 miles out of Lakenheath.

Emotions were mixed but I was feeling pretty low as we headed home. I figured we'd hit the target pretty good, but you always hate to lose an airplane. Our mother tankers refueled us enough to get back with a reserve and we pulled in just as the sun was coming up.

It was funny. We had left when the sun was setting the night before and now it was sunrise. Another day.

But it had been a night that will last a long, long time for those of us who had been a part of it. **PM**

How many undeserved radar tickets were issued last year?

- a) 1,012,317
- b) 649,119
- c) 0
- d) No one knows

Unfortunately, the correct answer is d) No one knows. Over 10,000,000 tickets were issued last year. By some estimates, up to 30 percent of them were incorrect.

Traffic authorities like to say that radar is as accurate as a yardstick. And that's the problem. You know how two people can get different answers using the same yardstick. Even if only 1 percent of the tickets issued last year were the result of radar errors, that's still 100,000 undeserved tickets.

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MUSCLE BOATS

(Continued from page 105)

es in the cuddy are a prime example. The powerlift motor hatch, with inside viewing mirror, is also well-built.

Maxima Stereo pipes high-energy sound throughout the boat. The tilt wheel adjusts to fit all drivers, and the cockpit floor has a rough-sand finish fiberglass to prevent slipping. Naugahyde upholstery is well sculpted throughout the cockpit, while the cuddy cabin is finished in a soft velour.

Thunderbird Formula F206 LS

The F206 LS was the quickest of the fleet out of the hole, which should make it a favorite with skiers. It didn't match up on top-end speed or on the performance course, so, despite good marks in other areas, we ranked it No. 3.

One of the best features on the boat is

the "Silent Thunder" exhaust system, which routes noise and fumes through the swim platform. This silences the roar of the big V8 to a distant grumble. Seating is comfortable, and the upholstery is exceptionally well executed. Deep buckets hold securely in turns.

Gauge visibility is excellent and the small, padded wheel is just right for the performance driver. However, we found a bit too much play in the steering. Visibility through curved windshield is excellent.

The cabin entry is eased via a cutaway in the dash, allowing a bit of headroom. The sleeping pads are exceptionally thick and comfortable, and the Blaupunkt stereo is awesome.

Donzi Z-21

The Donzi scored high in hull construction and rough-water performance, and finished a close third in top end. But fourth place finishes in acceleration and

in the performance course, combined with an interior that wasn't quite on par with others in the test fleet, led to a fourth-place ranking.

Donzi reveals its offshore heritage when you take a look at the massive engine mounts and stringer system, a solid structure that made it one of the heavier boats and probably accounted for somewhat slower acceleration.

This extra weight is a plus when running offshore, however. Combined with its sharp, 22.5° vee hull, the Donzi cut waves like a giant sword, with no tendency to hammer even at 40 mph.

Steering wheel placement was disappointing, though, set so low that an average-height driver will have to crouch to grip it—an impossible position for long runs.

In a distinctive design feature, the exhausts exit on the sides of the boat, just ahead of the transom. If you like noise, you'll love this system. If you don't, you'll hate it. Another unusual aspect of the boat is the nearly complete absence of storage space.

Like Sea Ray, Donzi will not give out complete details of its hull construction. The boat builder admits to using a combination of Tri-Axial fiberglass fabrics with lightweight Coremat between layers to smooth out the surface. The result is an exceptionally sleek appearance, which ultimately becomes the Z-21's primary strong suit.

Chaparral Villain III

The Villain awed the test crew with its wave-hopping capability, slamming through a tough inlet just as smoothly as it ran the flat waters of a protected waterway. However, it was not the fleetest of the fleet and corners cut to keep costs down (it is several thousand dollars below the other boats tested) were evident enough for us to rate the Chaparral No. 5.

We liked the exceptional stability at top speed—almost like driving a car. Upholstery was plush and well coordinated with boat trim. But when we managed to slip into the cuddy through the tiny entryway under the dash, we found no ventilation and the mattress pad too thin for comfort.

The sweptback windshield looks good, but the grab rail above it cuts across the line of sight for most drivers. The oversized, padded wheel is ideal for sporty driving, but obstructs the tach and speedometer. Also, the seats seemed rather rickety in their mounts for performance boating.

Unlike some of the other PM comparison tests, our clutch of speed machines were remarkably close in style and temperament. That's easy to understand when you consider what they have in common—speed and sex appeal. What else is there? **PM**

POINT . . . COUNTERPOINT



The Four Winns Liberator offers comfort at speed.

The Four Winns Liberator and Chris-Craft Stinger 222 are two superb specimens in the muscle boat family. But, as sometimes happens in a strict comparison test, they didn't quite fit our predetermined mold.

The 350 Magnum-equipped Liberator turned in respectable but distinctly lackluster top-end and acceleration times. And she was definitely off the pace during the hard twists and turns of our performance course evaluation. This was because she's a little beamier, has a little more padding in critical areas, and, as a result, travels a little slower than her muscle boat contemporaries. But, these mild performance deficiencies only serve to point up her strong side, a counterbalancing priority placed on superior appointments—like a huge, well-ventilated cuddy cabin forward,

accessed via one of the few reasonable companionway hatches in our 7-boat fleet. The Liberator also makes liberal use of teak trim and fairly oozes stowage space.

More than any other muscle boat tested, the Stinger 222 is directly devolved from the racing fraternity. Its adjustable bolster bench and skimpy cockpit are definitely competition features. Sunpads and other topside amenities are an afterthought here (although the cabin volume and ventilation are superb), and the boat comes with only two engine options—the 260 or the 454. We invited Chris-Craft to send along a 222 with the larger powerplant and enjoyed the vicarious race-boat thrill it offered from the centerline command station. If you want to make a statement, here's a boat that will give it a little sting.—*Tim Cole*



A racing heritage dominates the Stinger 222—a megamuscle boat from Murray Chris-Craft.

DIGITAL AUDIO CASSETTES

(Continued from page 109)

it's okay for the input signal to reach the 0-dB level—and even beyond for brief periods. The red-colored zone beyond 0-dB indicates that you're saturating the tape and warns of distortion.

When the input level meters of a DAT deck flash red, it's not a warning: It's a fact.

Analog distortion results when the tape simply can't absorb any more signal. A saturated tape will sound muddy. The high, treble frequencies disappear and the bass becomes boomy rather than punchy.

This distortion, however, is created by music. The natural balance of frequencies present in the original has been altered, but the distorted balance remains music (some rock musicians intentionally saturate their recordings to achieve a warm, buzzy sound).

Digital distortion is another thing entirely. Created by the machine, it sounds terrifyingly otherworldly.

Mixed-up bits

Tape saturation from too high an input level plays no part in digital distortion—which sets in when the input level meter hits 0-dB.

Instead, distortion is caused by the inability of the 16-bit digital quantization system to assign a 16-digit code to the too-high input signal. The system has simply run out of bits, and it frantically attempts to assign some code to the overload signal. The scrambled-up bits it assembles, when played back, produce a noise that's horrid and distinctly unmusical. If you can imagine the edgy, broken-up sound of a phonograph needle dragged across a record, that's pretty close to mayhem digital distortion engenders.

To make good DAT recordings—and we did—you must find the optimum input level below the 0-dB "brick wall." That takes trial and error and is made difficult by the wide dynamic range of CDs. Just when you think you've found the correct input level, a powerful passage of music jumps out, hits the brick wall, and crashes your recording.

It helps a bit to know the musical selection you're dubbing. This way, you can test-record the hot spots to find the input-level limits. If you don't know the music, today's DAT decks don't make your job very easy. Unlike 3-head analog cassette decks, there is no way to audibly monitor the recording as you make it. All you can do is watch the input-level meters in order to catch a mistake, correct your levels and re-record immediately. If you don't set the levels correctly and don't watch the meters, you won't be aware of any distortion until you play it back.

Sound quality

For our listening tests we made the best-possible DAT copies from a variety of compact discs, then compared the two side-by-side. After multiple listenings spread over several days, CD emerged as our preference.

The best DAT dubs were very good and, note for note, dead accurate. But they were not sonically authentic. Missing was the transparent or airy quality associated with CD. Humpty-Dumpty had been put together again digitally by DAT, but with a different glue.

The DAT copies did sound better than analog copies of the same material—and would be very satisfying if not compared directly to the original CDs.

But for that matter, so would the analog dubs!

It is for this reason that we feel DAT should not be treated as a special threat to the music industry.

Unfortunately, no record company has released any prerecorded DAT music cassettes, so we can't report on their quality. Theoretically, they should sound equally as good as the CD version. One other thing we couldn't test was compatibility among DAT decks of different brands. Theoretically, a tape made in one deck should play fine in any other. We did test record LP records. Their limited dynamic range (compared to CDs) made them easier to record and the dubs sounded great—though no better than the originals.

For the record, our test system was balanced so that no source would sound louder (and trick the ear into hearing better) than another.

Conclusion

Despite some limitations in these first machines, DAT holds great promise for the future. In an optional recording mode, it can offer four hours of recording time with quality equal to FM stereo. In yet two other optional modes, it can yield either two hours of 4-channel surround sound or two hours of satellite-transmitted digital audio, respectively. Some engineers believe the R-DAT format can even accommodate full-motion video with soundtrack.

We find it sad that the R-DAT format has already been hobbled by the inability to accept or transmit a direct digital signal. The reason? All-digital preamplifiers already exist, and digital amplifiers are in the works. This means an audio signal could be transmitted in pristine digital form all the way from the source unit to the loudspeaker leads without any loss of fidelity. DAT, because it requires analog input and output, now stands to be the stumbling block in this system. Unless future DAT decks sprout digital inputs and outputs, we have in a sense been robbed of the future. **PM**

SALE



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Miami Vice: Where Cool Becomes Hot

Historians, social scientists and media mavens like to label time and space, give it a tag that focuses on the way we think or the way we act during a given era. The swing generation of the '40s gave way to '50s beatniks and '60s hippies, who espoused peace and poetry. From the me-oriented '70s emerged yuppies and dinks (dual income, no kids), who drank Perrier and breezily discussed commodities futures and the flat tax. Now that we've progressed beyond 1984 and a new century looms, the culture of cool has possessed America, displacing, but not quite eliminating, the self-interest of the previous decade. No other event has done more to shape the trends and attitudes of our time than a TV phenom called "Miami Vice." So let's get cosmic. Whatever way you slice it, producer Michael Mann and actors Don Johnson and Philip Michael Thomas have actually helped define us as a nation.

A sense of social responsibility and high ideals permeates the "Miami Vice" plot lines—regardless of how you perceive the show's dramatic qualities. Sonny Crockett and Rico Tubbs are definitely not in it for themselves as they march on the point against the single most divisive evil of our age—illegal drugs—and other assorted threats to society. They are protagonists with a conscience, making sacrifices and exposing themselves to danger in the sordid, sinister environment of petty and organized crime. They each have overriding sensitivities to minorities, to women. Highly principled, they take very little guff. But they reserve enormous respect for authority, for their colleagues ("call for backup!") and for each other. Gone are the Eastwoodesque forays into the unknown by the lone stalwart. On "Vice," you're in it together—something to consider for self-indulgent baby boomers. Off the screen, both Don Johnson and Philip Michael Thomas are devoted to their privacy and their children—positive attributes indeed at a point in our history when energies devoted to working and socializing have eroded family time.

But—and this is the interesting part—actors Don Johnson and Philip Michael Thomas show us how to conduct a crusade with style. Hence the flashy automobiles and laid-back clothing, the winsome visage behind the stubble beard, the flashing don't-miss-a-trick eyes behind the horn-rim



Don Johnson and Philip Michael Thomas—wearing the white hats.

shades. Cool used to mean duck tails and jalopies, Nehru jackets and neck medallions. Now, nothing less than a Ferrari Testarossa will do, with a bold yet supremely understated tactile look that fairly screams cool. We used to get cool in bursts, in oddly random snatches. But now, cool has got to ooze and envelop. Or it isn't cool.

Combine the dramatic tension of a war against the depravities of crime with the visual statements wrought by automobiles, yachts, an occasional fixed-wing aircraft or helo. You're left with an entertainment experience that speaks volumes, even though the actual dialogue is Spartan and restrained. The essence of acting is nonverbal—actions, glances, movements that convey messages. And saying a lot when you're actually speaking very little makes for the best performances. Intimacy between the actor and the viewer is the objective, and whatever you have to say about the writing on "Miami Vice," it is a testament to the acting abilities of Johnson and Thomas that they can communicate by simply standing in one spot and being, well, cool.

And so, from the show that brought us cool, we have a whole new style of dress. It's now okay for men to have some stubble on their chin, and sales of sunglasses have certainly increased since the show went on the air. More importantly, we have a heightened awareness of the harm of illegal drugs. All of this, of course, is pretty cool. And we could argue that it began with the creative forces who brought you a new kind of television show on Friday nights.—Tim Cole

MIAMI VICE CARS

(Continued from page 89)

pinned inside the cockpit. The wheel is a popular item among the street-rodding set, who remove the wheel to prevent their cars from being stolen.

Since the car would be used interchangeably with the real Testarossa during filming, they had to be as identical as possible. One discrepancy that caught Roberts' eye was that the Ferrari sat lower to the ground. The seats in the Pantera were up too high. The situation was easily rectified by cutting out the Pantera's floor pans and dropping the seats. The Ferrari was also wider than the Pantera. While the Pantera's body panels could be blown out to the required width, the rear tires didn't sit out far enough inside the wheel wells. The solution here came in the form of a set of custom Sbarbaro wheels. The rear wheels were offset 6 in. and were built with a 12-in. width. The Pantera rim is only 8 in. across.

Power for the stunt car comes from a 351-cu.-in. Ford Cleveland engine that runs a Predator carburetor from PCI, Inc., to minimize fuel lag and poor throttle response when the car comes out of a slide.

Foam was added to the carburetor float bowl to keep the fuel from sloshing around during stunt maneuvers and high-speed chase scenes.

While the stock engine is good for about 300 hp, Roberts wanted more power for that extra margin during stunts. He decided against going the supercharger or turbocharger route because of the expense and the room the system would have taken up in the engine compartment. Since power-boost requirements were needed for 10- to 15-second bursts, a nitrous oxide system was installed. A shot of the gas gives an instant 100-plus hp, enough to handle any situation.

But just in case it's not enough to handle any situation, Roberts is getting set to install a 420-cu.-in. Ford Cleveland engine that's available through Ford's motorsports program. The mill is good for 450 hp at 5000 rpm with 350 ft.-lbs. of torque at 2000 rpm. A nitrous system should add an additional 100 to 150 hp in the tight spots.

Backing up the Ford powerplant is a ZF 5-speed transmission. A special braking system uses a second brake pedal to activate the rear brakes only. Locking the rear brakes helps the car spin out or spin around in the classic bootleg U-turn.

It all promises to be an exciting season this fall for the cars of "Miami Vice." Now all it takes is for the producer and writers to bring the rest of the show up to the interest level generated by the machinery. **PM**

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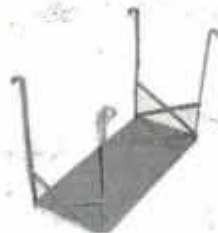
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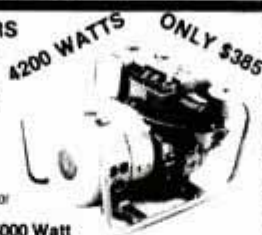
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two side-saddle rear jump seats are so small as to be suitable only for small children or someone you don't want asking for another ride. Even a pair of 12-year-olds complained they felt cramped. But it's nice to have someplace to put things out of the rain, and for that use the space is plenty big, especially with the seats folded away.

The macho styling may lure some buyers who want to use it for commuting and shopping. They'll have to put up, though, with the noisy off-road tires, buckboard ride, wide turn radius and tepid engine. The tires are so large that the spare fits nowhere except into the bed, obscuring part of the vision in the rearview mirror. But somehow that doesn't matter when everyone is watching as you cruise through the hamburger stand.—M.A.

Ford Taurus LX

After less than three months and 5500 miles of pleasant driving, Ford asked for its marvelous Taurus wagon back. It seems the accountants had to get this '86 model off the books ASAP, and we reluctantly returned it—after several increasingly pointed reminders—with 7763 on the clock (it had been delivered to us with 2265 break-in miles on it).

We hated to see it go. Although it had finished behind some \$20,000 imports in our "Wonder Wagons" test (page 58, Dec. '86), when judged all by itself the Taurus was pretty wonderful, too. Not perfect—a few minor rattles and "tinkles" had developed—but close enough for a popular-priced domestic wagon.

Two less minor problems were caused by some of our more abusive track-test procedures and are not likely to affect the average Taurus in everyday use. We warped a front disc brake in repeated panic stops, and this was felt as a slight shimmy in the steering wheel when the brakes were applied lightly. The car also suffered minor rear-body damage, which eventually sprung the fuel-filler door so it would not stay closed. Discounting this, we think the Taurus LX is by far the best station wagon now built in America.

Overall fuel economy was 22.2 mpg, which is outstanding for a relatively large wagon with automatic transmission and the big engine—in this case the 140-hp 3-liter V6. Performance felt like that of a European sports sedan, not the traditional wallowing one expects from a wagon. All in all, the Taurus has been a revelation, and I now know why you see so many of them on the road.—W.H.

Oldsmobile Delta 88

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with our star-crossed Delta 88 Royale Brougham 2-door coupe. You may remember that, in our last installment, the car had suffered a severe case of "the hiccups," which included a blown engine, a fried computer and a number of bumbled repair attempts at two dealerships and a private garage. All this conspired to keep the car off the road for more than three months, making it a prime Lemon Law candidate.

The car had been back on the road for less than a month when the window on the driver's side fell off its track and slid, cock-eyed, down into the door. A small plastic part that holds the glass in its track had broken, and it took three weeks for the dealer to get a replacement. We can see why. The Buick LeSabre we borrowed in the meanwhile had the same thing happen, and Buick's spokesman said it was the second time. Those little plastic parts must be back-ordered by GM dealers from coast to coast!

The Olds rep told us that the dealer had also found and replaced a cracked front brake pad. That may explain why the car had been locking its rear brakes and slewing sideways in panic stops (like when the radar detector started to beep!). Rear-wheel lockup on wet hills had been a problem with our Cutlass Ciera long-term wagon a few years ago, too, so it appears that GM still has not fully exorcised this evil spirit from the infamous X-cars.

Back on the road again, we found the air conditioner inoperative at 7500 miles, but since it was September by then, we decided to grin and bear it. We'd had the car for six months, and over half that time had been spent in various repair shops!

At 8000 miles we noticed intermittent low-voltage readings, and by 9000 miles there was an occasional grating noise from under the hood. A couple of weeks later, at 9400 miles, the inevitable happened and the alternator ground to a halt, leaving the car to limp along on battery power.

At that point, we threw in the towel and asked Oldsmobile to tow the car away. It was November, and the passenger-side armrest had nearly pulled free of the door panel.

We wish GM lots of luck with its new 6-year/60,000-mile warranties. With many cars like this Olds, it's going to cost them a pretty penny. We'd had this example only eight months, and it had proven so unreliable that no staff member trusted it for a long trip. Which was a pity; when it was working, the Delta 88 was a pleasant car with strong performance and good looks. The trouble was that hardly a week went by when *something* wasn't broken or going bad.—W.H.

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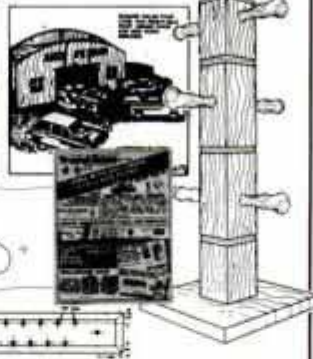
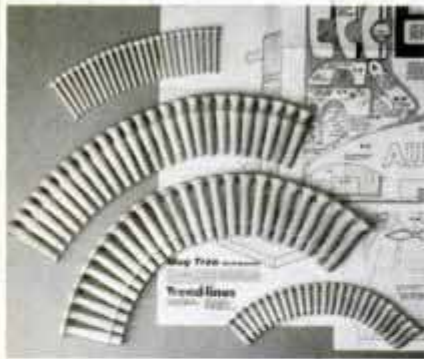
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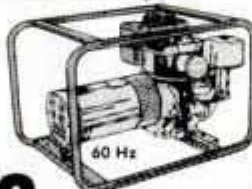
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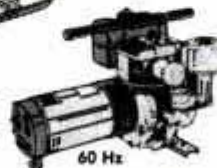
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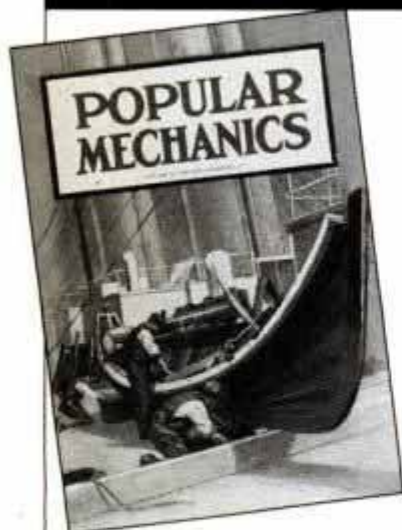
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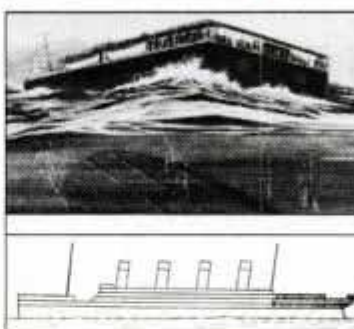
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Stowing folding lifeboats.

After The Titanic

The shocking loss of the White Star Line's *Titanic* sparked some interesting innovations to avert future tragedies at sea. PM's cover subject was the collapsible lifeboat, a lightweight, easily stowed alternative to no lifeboat at all. Completely enclosed lifeboats were also being planned to protect survivors from exposure. But perhaps the most ambitious suggestion involved a watertight detachable ship's compartment, right. As envisioned, the entire upper works of a doomed ship's af-



Sinking solution: a breakaway stern section.

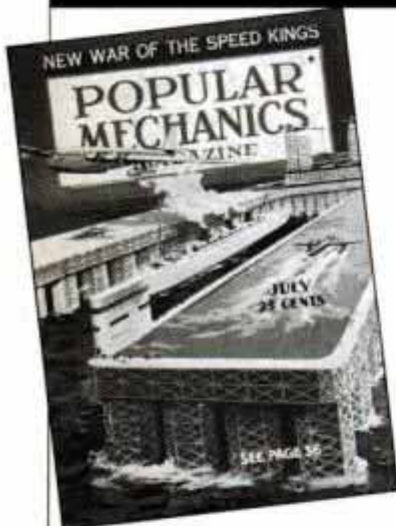
ter section would break away when disaster struck. Passengers would crowd into the fantail and the crew

would release the escape pod from the sinking hull.

All-Wheel Steering

The recently revived concept first appeared in 1912 on an 8-wheel motor truck. Each wheel had an independent electric motor, powered by an internal-combustion generator fueled by gasoline. In theory, these drive motors were to be attached to each wheel, eliminating drivetrain components like universal joint and differential. The rear wheels turned out automatically when the front wheels turned in.

50 YEARS AGO: July 1937



A flexible transportation hub.

Mid-Oceanic Port

Nonstop, transatlantic flight was still a distant dream in 1937, so PM proposed a mid-ocean port for airliners, amphibians and passenger ships. The Heiser Seadrome, as envisioned, was a U-shaped floating transportation facility that included a 2000-ft. tank for seaplanes, a 2000-ft. strip for land-based aircraft, and docking facilities for Queen Mary-class liners. Pontoons submerged 150 ft. below the surface would supply the necessary buoyancy to support the scheme, and wind-driven electric genera-



The steam iron gets a start.

tors would power subsea propeller systems so Seadrome faced the wind.

Way Back When

A half-century ago, PM reported on the invention of an iron that steam-dampened clothes at the press of a button. Like the radio and TV, this simple device found its way into practically every American home.

Telemetry Based

Scientists at the Bartol Research Foundation had perfected a radio transmitter that, when carried aloft by four small balloons, sent back to ground personnel a short-wave radio signal indicating altitude.

25 YEARS AGO: July 1962



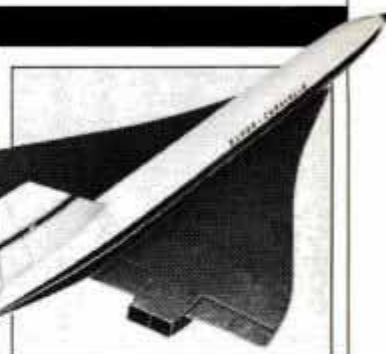
Our underwater frontier.

Beneath The Sea

Scuba equipment, was well-established in underwater exploration 25 years ago. But innovators didn't stop trying to develop new ways to exploit our underwater resources or discover treasure. PM presented several tools for underwater explorers, including the first television cameras, electric propulsion units, towed diving planes and hydrostatic dredging units. Perhaps most intriguing was a handheld, underwater sonar with earphones that spotted objects over 120 yards away.

An SST Is Born

Meanwhile, aerodynamicists in France, not content with subsonic passenger flight, were beginning initial development of what eventually became the Concorde. Originally conceived by the French government as the Super Caravelle, the aircraft would fly at Mach 2.2 close to 50,000 ft. high, giving 100 passengers a 2800-mile range. The PM vision became a reality, and now the Concorde boasts daily transatlantic service by British Airways and Air France.

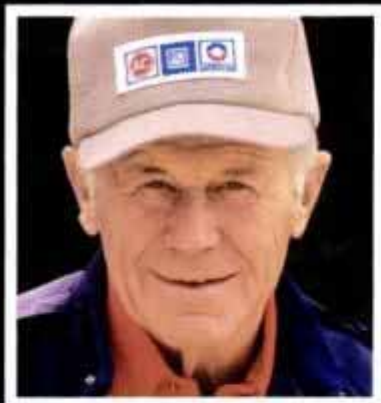


Genesis of the Concorde.

ATV Forerunner

A 4-wheel, balloon-tire utility vehicle, Desert Rat, with a 1-lunger engine, carried people and equipment 20 mph on rough terrain. **PM**

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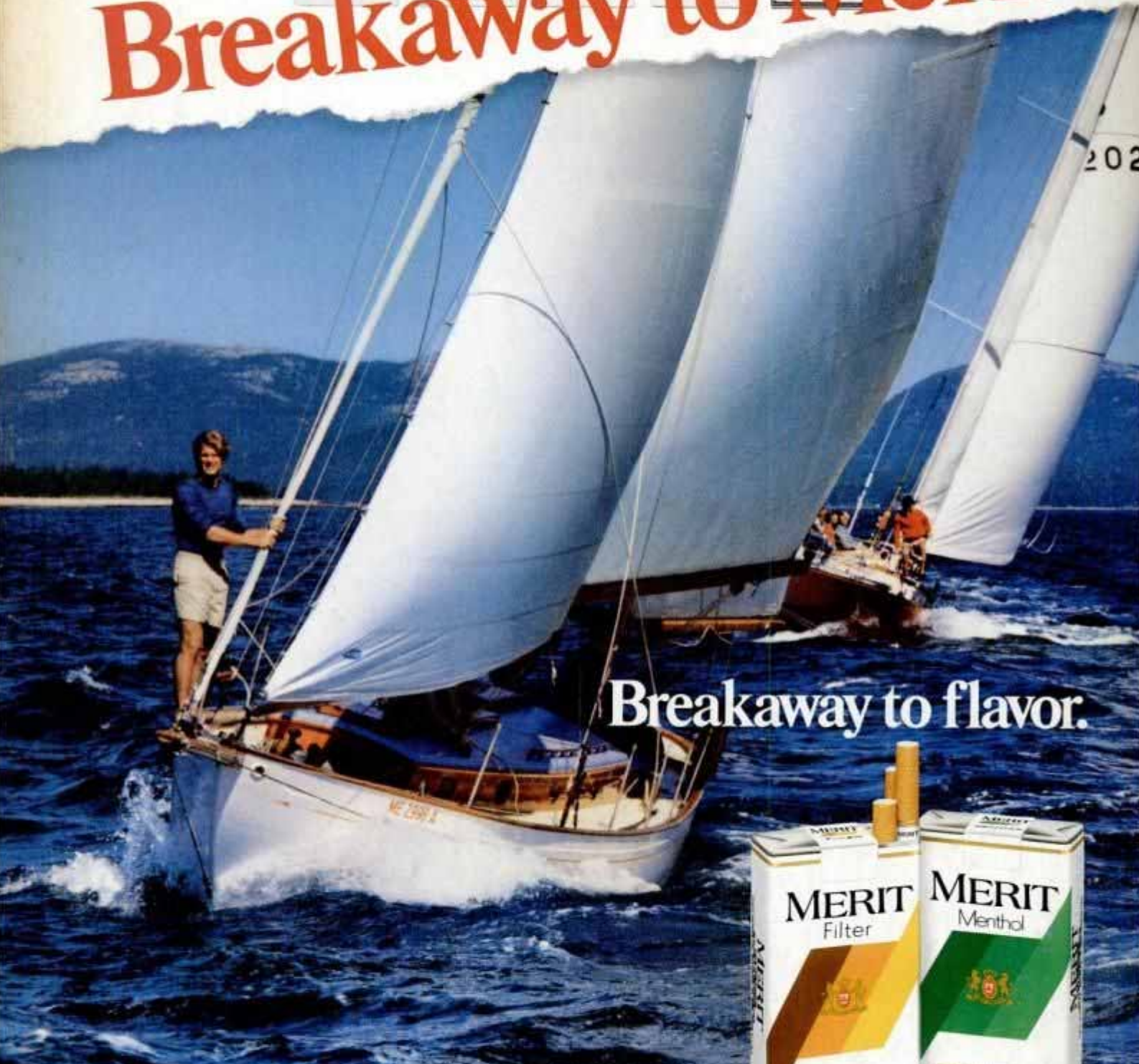
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