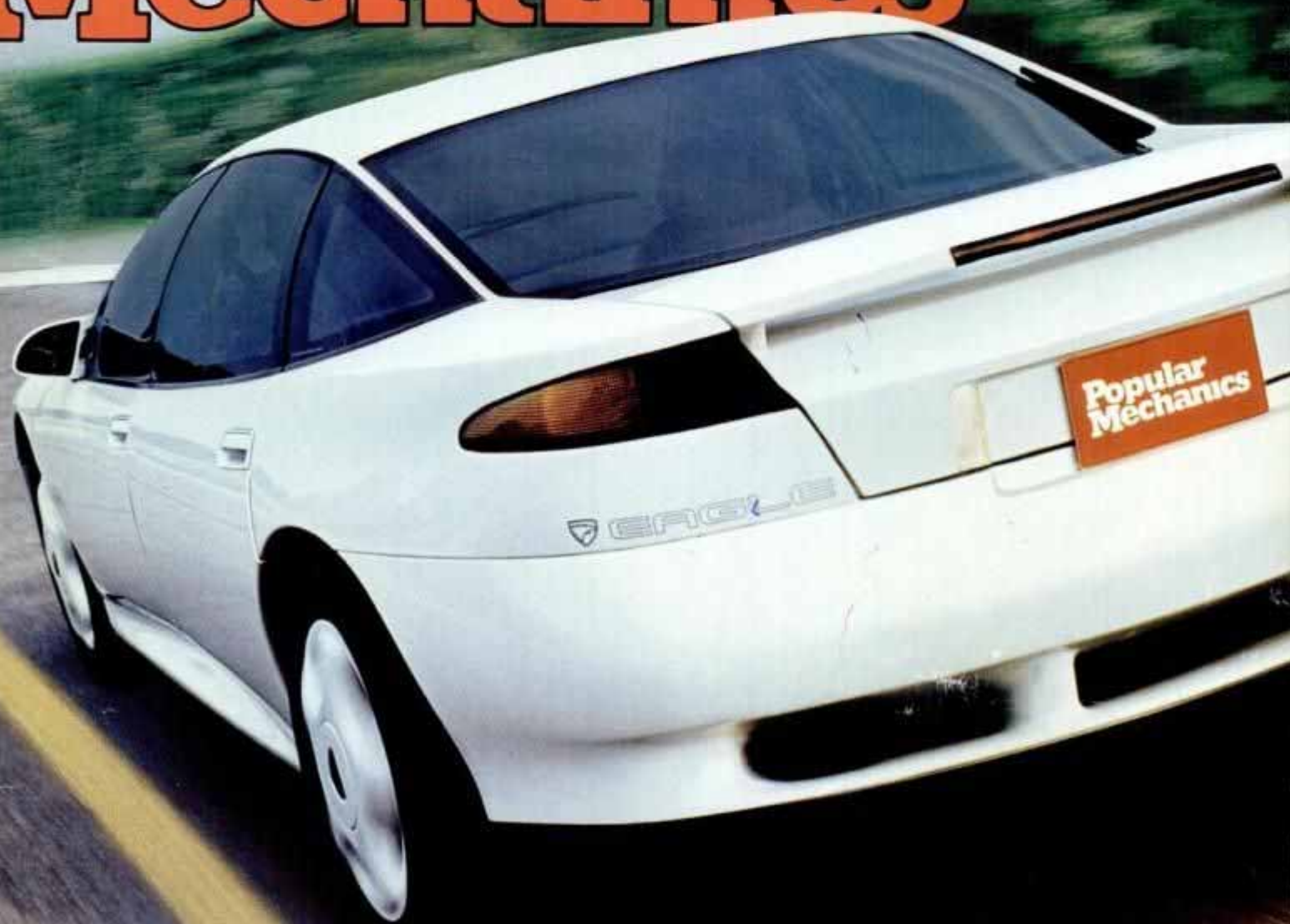


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President Bush's
Incredible 747

Popular Mechanics



SPECIAL

NEW CAR ISSUE

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Most Advanced '92s
Plus Spy Previews Of
The '93s And Beyond

**TAKE DOWN
THAT TREE**

Here's How The
Pros Do It

**BATTLE OF THE
MOUNTAIN BIKES**

Torture-Testing 6 Tough
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PROMOTION?

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DRIVEN
A FORD
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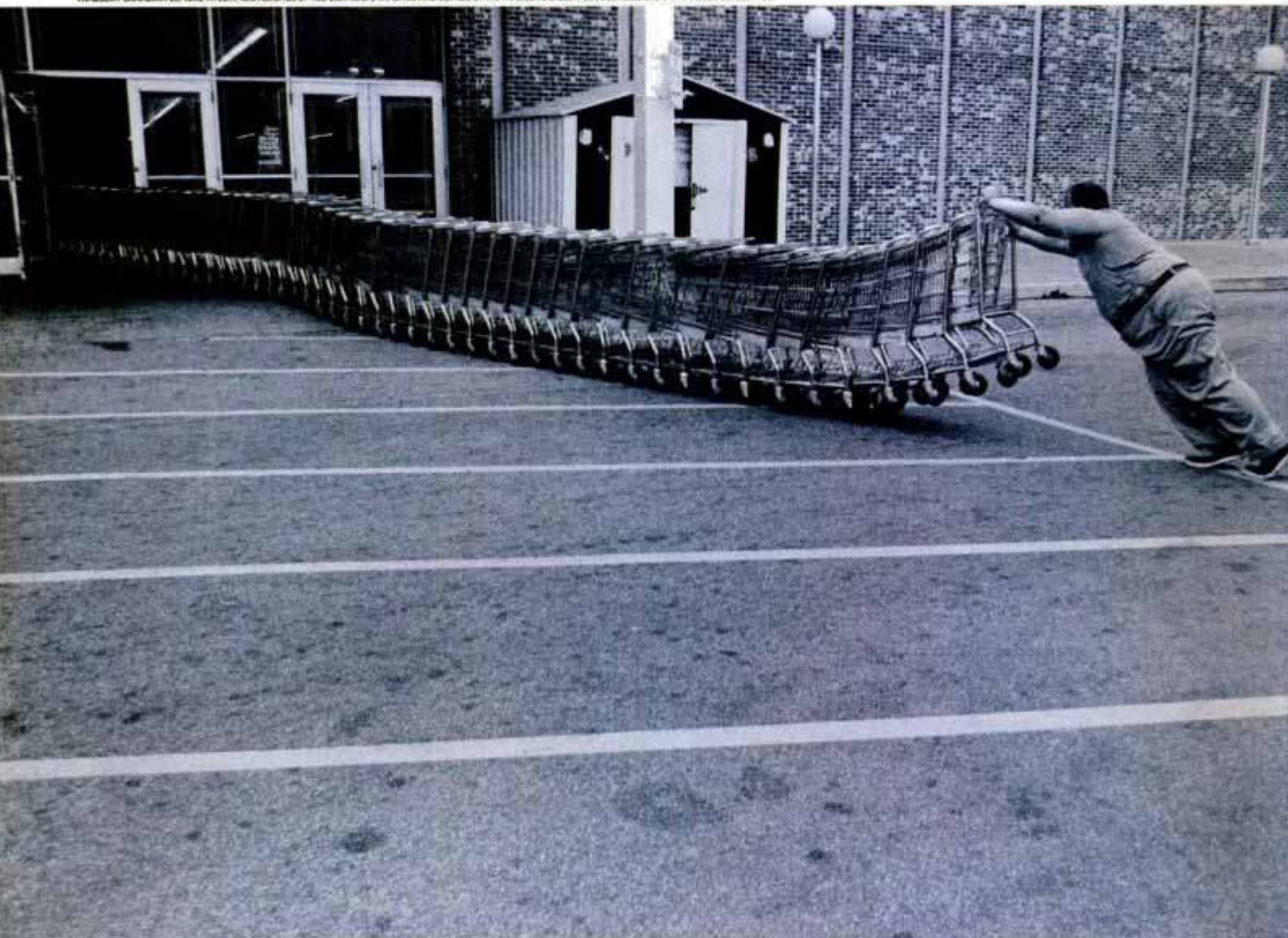


This One



G5FE-SLL-K9K5

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Popular Mechanics

OCTOBER 1991
VOLUME 168
NO. 10



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71 SPECIAL SECTION

—PM cover photo by Rich Cox

AUTOMOBILES

71 SPECIAL SECTION: DETROIT '92

It's the year of rebirth for all-American automotive styling. Plus:

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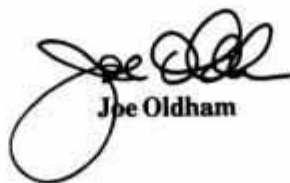
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EDITOR'S NOTES

● There was a time when concept cars, or "dream cars," as they used to be called, were just that. You saw them in a car show and you dreamed about owning one some day. You saw the cars of the future and you drooled. That still goes on to a certain extent. You can still go to a car show and drool over the cars of the future. But the difference is that, recently, many a concept car you see in car shows and magazines turn out to be the way the actual production cars look—or at least they're so close that you can hardly tell the difference. So you have to look at concept cars in a whole different light nowadays. You'll probably be driving one in the not-too-distant future. A perfect example is our cover car, Chrysler's Eagle Optima. Now take a look at the spy photo on page 90 of this issue. Look at Chrysler's yet-unnamed '93 LH sedan. Close? You bet. Buy one of these and you'll just about be driving the Optima concept car. This is a round-about way of calling your attention to the fact that you're holding in your hands our annual new-car issue (domestics, with imports to come in the December issue). But this is not just your usual new-car magazine article. As is our usual practice, we've gone the extra mile for you. We bring you not only a complete report on all the hot new '92s but also spy photos of the '93s and '94s, and a closer look at the latest concept cars that surely point the way to what you'll be driving in '95 and '96. Our new-car coverage was compiled by the automotive department's editorial team led by Automotive Editor Tony Swan with much assistance from Detroit Editor Jim Dunne, Associate Automotive Editor Mike Allen, West Coast Editor Rick Titus, Contributor Don Chaikin and even me. Coverage begins on page 71. . . . **Have you seen President Bush's new Air Force One on TV yet?** It's an incredible aircraft, a huge 747 that has been converted into a flying White House. Get a detailed look in this issue on page 45. . . . **Biking is big.** And mountain bikes are the most popular type of bike these days. These fat-tired flyers have been on our pages before, but our article on page 30 is the first-ever wheel-to-wheel comparison test of the latest models. If you're thinking of going biking, don't miss it. . . . **It's fall,** and you're probably already starting to button up for the winter. Before you do, you'll want to clean up the yard, dispose of all the fallen leaves and trim back any bushes and trees that need it. And what better time to consider that big project that you've been putting off. Yes, the tree. It's been dormant for several years, or it has become more of a nuisance than a thing of beauty. Why not take it down? While we don't really recommend that you do it yourself, our article in this issue will give you some real insight into how the pros do it and what you should expect from a tree surgeon. Till next time.



So there I was, forced to drive a plethora of '92 Corvettes over the twisty mountain roads of the Laurentian Mountains in Quebec. Hey, it's my job.


Joe Oldham

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SMOOTH RICH TASTE

Winston

Идентификационный авторский знак

THE WRAP

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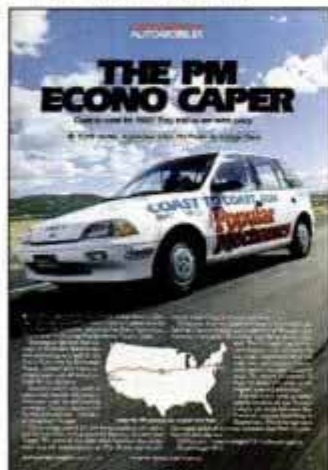
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SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, And May Complicate Pregnancy.

LETTERS

Econo Run



"The PM Econo Caper" caused me to do some calculating. You were on the road for 84.5 hours and used \$63.84 worth of gasoline. When Dan Gurney drove the Ferrari Daytona 365 GTB4, he was on the road 35.9 hours. He got 12.5 mpg. Assuming a 15% premium on the cost of gasoline for the Daytona, today they would have to spend \$312.55. Thus, you saved \$248.71 for 48.6 hours more time on the road. This works out to about \$2.56 per hour for each of you.

There are a lot of safety, environmental and legal questions ignored by the above. However, on a strictly time-versus-fuel-cost basis, faster is the better value. If we wish to motivate people to pursue better gas mileage from an economic basis, then the price of fuel will need to increase dramatically.

JAMES E. GRABER
LOS ALTOS, CA

It is possible to drive the same route across the continent for less than \$50. I selected the car with the second highest gas mileage, the Honda Civic CRX HF,

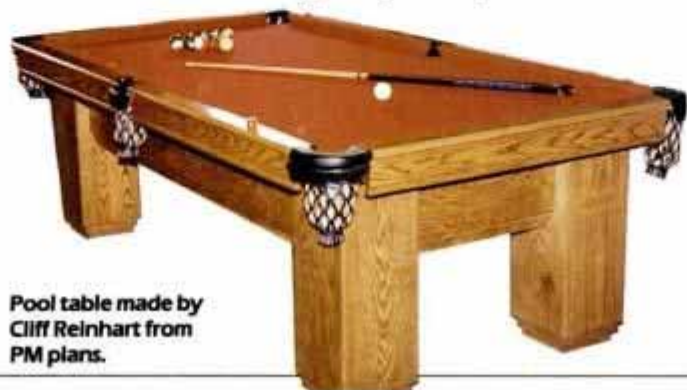
Letters are subject to editing for length, style and format.

a 2-seater known not only for fuel economy but also for its estimated low-depreciation rate (half as fast as the Geo) and occupant collision protection. Although the CRX was rated at *only* 58 mpg/hwy, I usually exceeded that, and not just on the freeways. The CRX also does not seem to have the rough edges ascribed to the Geo. Although it has no back seat, two of us traveled for two weeks, camping out with full luggage, sleeping bags and two 3-person tents, and did not feel crowded.

It may have cost you only \$65 worth of gas to drive across country, but how much did you spend on that paint job on the side of the car?

ROBERT BLAKE
FLAGSTAFF, AZ

I haven't had the opportunity to drive from coast to coast like Tony Swan and Mike Allen did, but I do have a similar story to tell. I drove my 1986 Ford Tempo diesel 5-speed from Kane, Pennsylvania, to Moosehead Lake, Maine, and back. Included in my trip was a lot of backwoods driving. The total miles I put on my car was 2833, just under Swan and Allen's 2993 miles. My miles-per-gallon average was 51.4 compared to the high 56.2 of Swan and Allen. Someday, I hope to travel across the country.



Pool table made by Cliff Reinhart from PM plans.

But for now I'll have to keep reading about the travels of others.

VINNIE MAROLD
KANE, PA

Since the boys were out for a mileage and economy test, and they averaged 56.2 mpg when they filled up with ethanol, why didn't they use it for the rest of the run? Since it's the cleanest burning fuel so far, I think more people should use it. There seems to be a lot of talk against ethanol on the

with regular unleaded. I realize we don't have enough ethanol to run all cars on 85%. But if most were run on the 10% ethanol now available, we'd sure cut down on air pollution.

OMAR A. STROMME
BINFORD, ND

Saving Lives

Your articles on the long-term test cars were timely for me, as I had just purchased the Chevrolet Blazer S-10 4-door 4x4. As you can see by the photograph,



Reader Paul Allsop's Chevy Blazer S-10 saved his life.

part of oil and car companies. Yet ethanol doesn't harm any part of the fuel system. In North Dakota, there is a car with a small attachment on the carburetor that runs on 85% ethanol. It gets the same mileage and performance as

my Blazer went through an unscheduled test in the form of a front-end collision. Through the fault of another driver, my son and I were almost killed. Though the Blazer sustained considerable damage, it protected its passengers. The vehicle was entirely replaced by insurance, and because of my confidence in North American cars, I replaced it with an exact copy.

PAUL J. ALLSOP
WINDSOR, ONTARIO

Pool Project

Here is the result of a school year's worth of work by one
(Please turn to page 12)

THE ULTIMATE LIQUOR CABINET

SCALE $\frac{1"}{8} = 1'-0"$ DATE 2/18/91 DRAWN BY *Pat Chiller*

DETAIL B-B



THE ULTIMATE FINISHING TOUCH.

MIRROR SMOKE-GLASS
SEE SPECIFICATION LIST

$\frac{1"}{28}$ CHERRY VENEER
GRAIN ORIENTATION AS SHOWN

SEE DETAIL A-R

FLOOR SURFACE

BASE WITH KICK SPACE
CONSTRUCTED SEPARATELY
SEE DETAIL H-H



Canadian Club

A PREMIUM WHISKY, UNRIVALED IN QUALITY AND SMOOTHNESS SINCE 1858.

of my students, Cliff Reinhart, a junior at Lakota High School, Kansas, Ohio. The plans for the pool table were followed from your December '89 issue ("Rack 'Em Up," page 74). I thought your readers might enjoy seeing a top-quality project built from one of your great plans.

ROBERT GASTEIER
INDUSTRIAL TECH TEACHER
KANSAS, OH

Bursting The Blimp?

Whoever briefed you on your cover story "Rebirth Of The Blimp" must have surely inhaled too much helium. It appears there is always another

generation of military and civilian "experts" who have to learn for themselves the limitations of large blimps. Ask the WWII fleet airship pilots, who are not financially involved in today's blimp promotions, how effective these large blimps were in severe storms, ice or snow. Then ask them how much lift the blimp has at 10,000 ft. Storms are fights for survival, even at 500 ft. The large blimp's Achilles' heel is weather, and that situation is not likely to change. The larger the blimp, the greater the problem. Some see the blimp as a phoenix, rising from the ashes.

But its future is really only with the California condor.

PHILIP W. NICHOLAS
LAKE SAN MARCOS, CA

I must take exception to the headline that says the Navy is building a nuclear-powered blimp. It wasn't until the last three paragraphs of the article that I discovered this was preliminary work, or should I say wishful thinking on the part of Westinghouse.

This type of misinformation is better left to the professionals of the supermarket tabloids.

FRANK ROBINSON
PIERMONT, NY

If we want a less-polluted world with less wars, the United States must start making modern dirigibles.

These air carriers could get their 500-ton cargoes of passengers and goods anywhere in the world. The dirigible would be a safe, quiet replacement for the terrorist-prone, unsafe, noisy, uncomfortable and aging airplane. A study by the Air Force indicated that it would take four days for an 800-ft.-long blimp to deflate after it was bombed or attacked. These dirigibles could also replace the collapse of America's former sea-going shipping industry.

It's about time we manufacture

magazine if this trend continues.

JOHN TAKACS, D.O.
PORTLAND, OR

If you expect to protect the sensibilities of your patients, the covers of our magazine are small potatoes. You better look into blocking out the entire world for them. That's where the real assaults on their sensibilities are coming from.

—Ed.

The Must-Know Man

Thanks so much for considering my entry to the Must-Know Man Contest worthy of recognition. It inflates one's ego a bit to feel that someone

else thinks a person's ideas have some real merit. Keep the contests coming!

RICHARD P.
BLINK
KERNERSVILLE,
NC

Wind Power

I was elated to finally read a report on the wind-power industry. I was recently graduated from the University of Cincinnati's College of Applied Sciences, where my senior thesis involved the design, fabrication and testing of a wind turbine. "Blowing In The Wind" provided an excellent overview of the pros and cons of wind power. There can be no doubt that the time to actively

pursue alternative energy is now.

I hope through recent world events and articles such as yours that the United States can start to realize the need for clean, natural energy sources before it's too late.

BILL MEYER
CINCINNATI, OH

Dinosaur Debate

"Why The Dinosaurs Died" showed a gross lack of objectivity in selecting such a title, for it was totally misleading and one-sided.

By presenting the cosmic-zap theory as the only viable explanation for the cretaceous extinction event, you

P.B. DON'T MEAN:



POLYNESIAN BOBSLED

modern low-fuel-cost dirigibles.

CHARLES LEE KEETON
NEW ORLEANS, LA

Sensibilities

I have enjoyed your magazine for many years and keep it in the waiting room of my office. Over the past six months, however, dramatic cover pictures have presented too much of a violent and militaristic theme to be considered acceptable.

I have had to refrain from keeping these magazines in the waiting room to protect the sensibilities of some of my patients and will probably not be able to continue subscribing to your

mislead readers. There is another less-spectacular theory that is much more plausible and supported by a preponderance of evidence from the fossil record.

Today, we are witness to a great extinction on the same scale as the dinosaurs. It has been caused by loss of habitat and increased competition with transcontinental migrators (*Homo sapiens*). No meteor is necessary to explain this particular mass extinction, and I'm sure one will not be necessary to finish the job. It may be appealing to imagine the great dinosaurs going out with a cosmic bang. But it is much more likely that they simply faded away with a whimper.

DONALD PIER
LA MESA, CA

No proposed extinction mechanism, asteroid or volcanism, can account for the extinctions of dinosaurs unless it can be coupled physiologically to the organisms that became extinct. For the impact "casting the entire planet into darkness," I have searched for evidences of a global blackout and refrigeration at the time of the dinosaurian extinctions since 1980, and have not found any. Your one-sided coverage of the asteroid/volcano debate can only mislead a public that is growing distrustful of science and journalism.

DEWEY MCLEAN
PROFESSOR
VIRGINIA POLYTECH

I am disappointed that you didn't mention the names of the two hikers who discovered *Seismosaurus*. One was my son, Jan Cummings, of Albuquerque, and the other was Arthur Loy, also of Albuquerque.

LUCILLE CUMMINGS
SALEM, OR

Japanese-Americans

Jack Hartley is proud of his 135,200-mile '87 Olds 98, is tired of how people

knock U.S. car manufacturers, and thinks imports such as the Honda Accord are faulty. He just got very lucky.

The fact is, the 1985-'87 Olds 98s, overall, have a reliability record much worse than average, while the Honda Accords, as well as most other Japanese cars, have a much-better-than-average reliability record overall.

It is always possible to come across a Japanese car that is a lemon, but the chances are far greater in the typical American car—at least the ones built without Japanese help.

Another reader, John T. Hart, thinks that owners of Japanese cars

competition, American cars would be even worse than they already are.

In the meantime, I'm sold on Honda and Toyota.

RICHARD ZIMMER
BREMERTON, WA

I can't let John T. Hart's letter go unchallenged. He seems to say that otherwise-loyal Americans lie to rating organizations to justify contributing to the degradation of American industry by buying Japanese automobiles.

Just who is doing the rationalizing here?

Isn't Hart trying to justify buying lower-quality cars from American

manufacturers, hence reinforcing and prolonging the stagnant, uncompetitive state of the auto industry in this country and also penalizing himself in the process? Given the strong anti-Japanese sentiments in the United States, doesn't it seem more likely that Americans would give their own products more benefit of the doubt? Certainly, John Hart seems to.

DAVID L. FLORO
WINSTON-
SALEM, NC

This is in response to the letter stating that American-made cars are junk. As the proud owner of 1985 and 1988 American-made cars, I will tell

you that neither are junk. The quality of American cars improves every model year. In many cases, the quality equals or exceeds that of the Japanese. American cars will only continue to improve and once again be considered world-class vehicles if Americans buy cars that are made by Americans.

KEVIN J. BEGLEY
SALEM, MA

Let's not forget that Hondas are made by Americans in Ohio, Toyotas and Nissans are made by Americans in Kentucky, and Kawasakis are made by Americans in Nebraska. —Ed.

P.B. DOES MEAN:



LOTS OF REAL PEANUT BUTTER

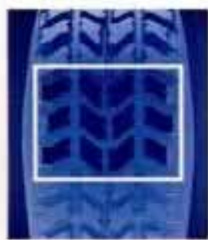
lie or exaggerate the good points on surveys about their cars, and that people who buy Japanese cars have contributed to the degradation of American industry.

What makes him think that American car owners don't do the same thing because they are ashamed to admit that their American car is riddled with faults?

As far as contributing to the degradation of American industry, he couldn't be further from the truth. As long as American car manufacturers face superior foreign competition, those companies will continue to strive for better cars. If it wasn't for



GOODYEAR WRANGLER RADIALS. BUILT FOR GETTING YOU AROUND THE BIG CITIES.



The "contact patch" of a Goodyear Wrangler. It gives you the traction to keep moving.

Just a few words in favor of Goodyear Wrangler radials:

Sunsets, sand, hills, rocks, national parks and TGIF.

Or, putting it another way, Wranglers can make your fun times even more so.

For one thing, Wranglers are race proven. The same tough, steel-belted design that con-

quered Baja and Barstow is in every Wrangler radial.

For another thing, each Wrangler tread pattern is built for exactly the kind of action you're into.

There's the Wrangler MT for the off-roader who'd be

happy if he never saw pavement again.

You'll also find Wranglers that combine on- and off-highway capabilities. Plus Wranglers for towing. And quiet Wranglers for in town or on the highway.

And remember, Wranglers have been consistently chosen as original equipment by top 4-wheel-drive manufacturers like Chevrolet, Ford, Range Rover and Jeep.

Goodyear Wrangler radials. There's nothing like them for getting you around—or through—the big cities.



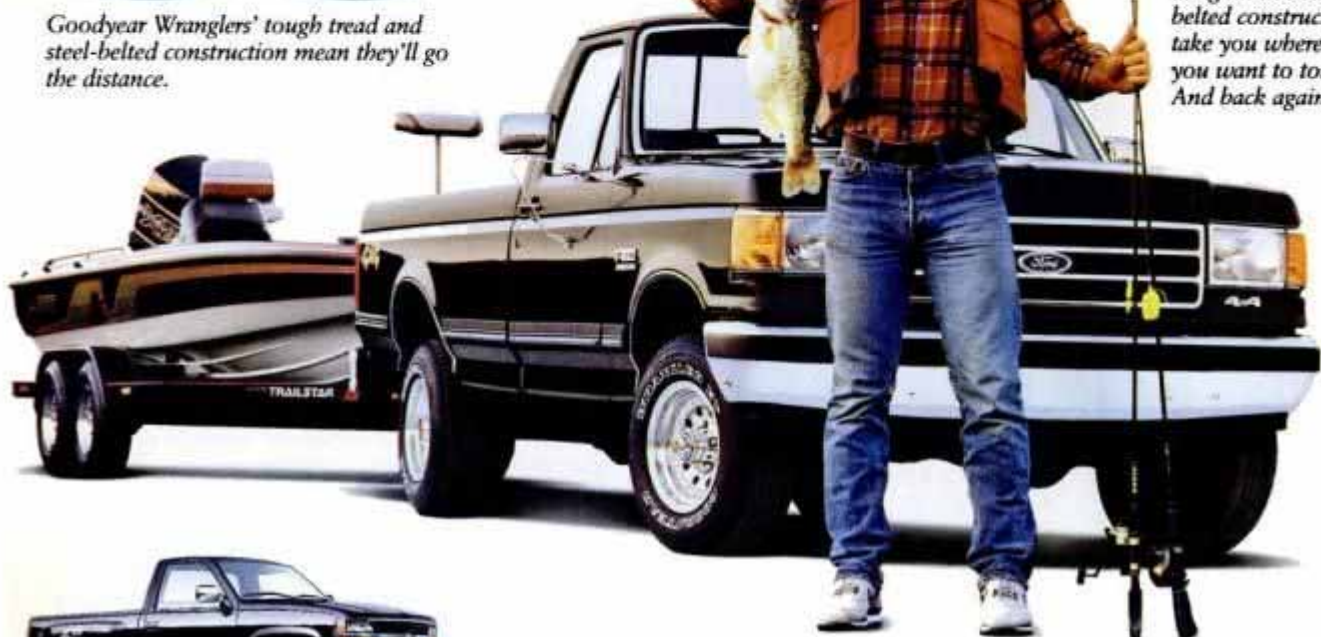
Goodyear Wrangler radials are the choice of ten-time off-road champion Walker Evans.

TREAD LIGHTLY!
ON PUBLIC AND PRIVATE LAND

Use existing paths. Don't forge new ones. Let's keep America beautiful.



Goodyear Wranglers' tough tread and steel-belted construction mean they'll go the distance.



Wrangler tread designs and steel-belted construction take you where you want to tow. And back again.



Chevy Z71 StepSide



Toyota SR5 4x4



Jeep Wrangler Renegade

They all use Goodyear Wranglers as original equipment. Good reasons you should consider Wranglers for your vehicle.



Goodyear wins the most important tests of all.



GOODYEAR

THE BEST TIRES IN THE WORLD HAVE GOODYEAR WRITTEN ALL OVER THEM.

TIME MACHINE

75 YEARS AGO: OCTOBER 1916



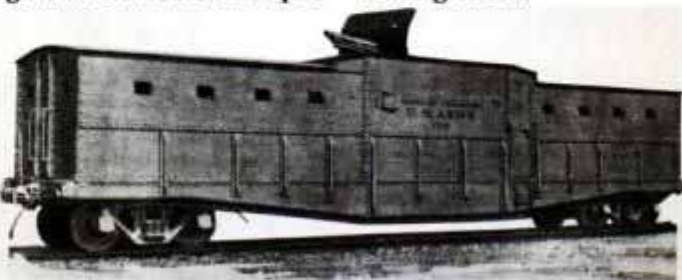
Piggyback Plane

Since Allied biplanes were zeroing in on Zeppelins, rumors flew that Germany was preparing an aerial battleship, a monster triplane with a 146-ft. wingspan. Wild reports held that a small monoplane would hop from the big plane's back to deliver bombs, while the parent aircraft warded off fighters. Although the Germans had test-flown the triplane, the story went, they couldn't figure out how to reunite the small plane with the mother-ship.

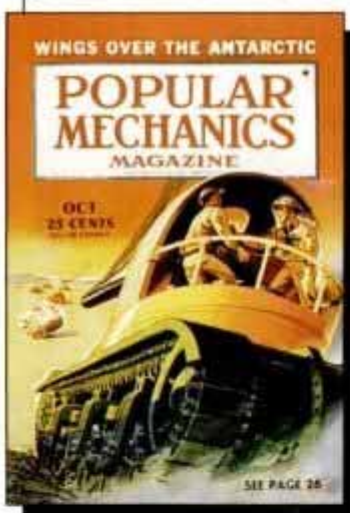
Battle Train

The arteries of armies, railroads saw some of the earliest uses of mobile armor. The Corps of Engineers built an armored car pocked with machine-gun ports and a 3-in. gun that reared from a super-

structure. Designed to patrol rail lines and guard bridges, the car came with a crew of a dozen and could also hold a company of infantry. The corps used it to shuttle construction gangs ahead of advancing forces.



50 YEARS AGO: OCTOBER 1941



Rolling Thunder

Although Pearl Harbor lurked two months in the future, American defense production was already gearing up. The first towed 155mm field guns rolled out of Chicago, and 300 Bofors anti-aircraft guns flew out of Detroit every month. Meanwhile, half-track scout cars with 75mm cannons joined the Army's mobile anti-tank forces. On our cover, we conceptualized a self-propelled howitzer, planting a 105mm gun on an armored turntable that bolted to a tank body.



Rock Heads

Dynamite and jackhammers had been rattling the Black Hills for 14 years, but now Mount Rushmore was all but finished. Workers carved

while hanging on slings invented by the monument's designer, Gutzon Borglum. Despite several falls, no lives were lost during the monument's carving.

25 YEARS AGO: OCTOBER 1966



Sign Of The Cat

Ford prowled into uncharted territory with the new Mercury Cougar, a blend of Mustang flash and Thunderbird plush. From the side, the Cougar looked like an overfed Pony car, but its real trademarks lay fore and aft. Night drivers could spot the big cat a mile away, with its sequentially flashing taillights and its headlights retracted behind a full-beam waterfall grille. Only a V8 could power the heavy coupe. Options ranged up to 390 cu. in.

Touchdown Tech

Super Bowl I was set to kick pro football's popularity sky-high, but the sport had already acquired big-money techno-trappings. For example, the Redskins hired a defense contractor to run statistical analyses of opponents' offenses. The Jets put loudspeakers in Joe Namath's helmet so the wide receivers could hear

his audibles. And the Giants rigged tackling dummies with accelerometers. **PM**



To a truck world
hungry for
any small jump
in horsepower...

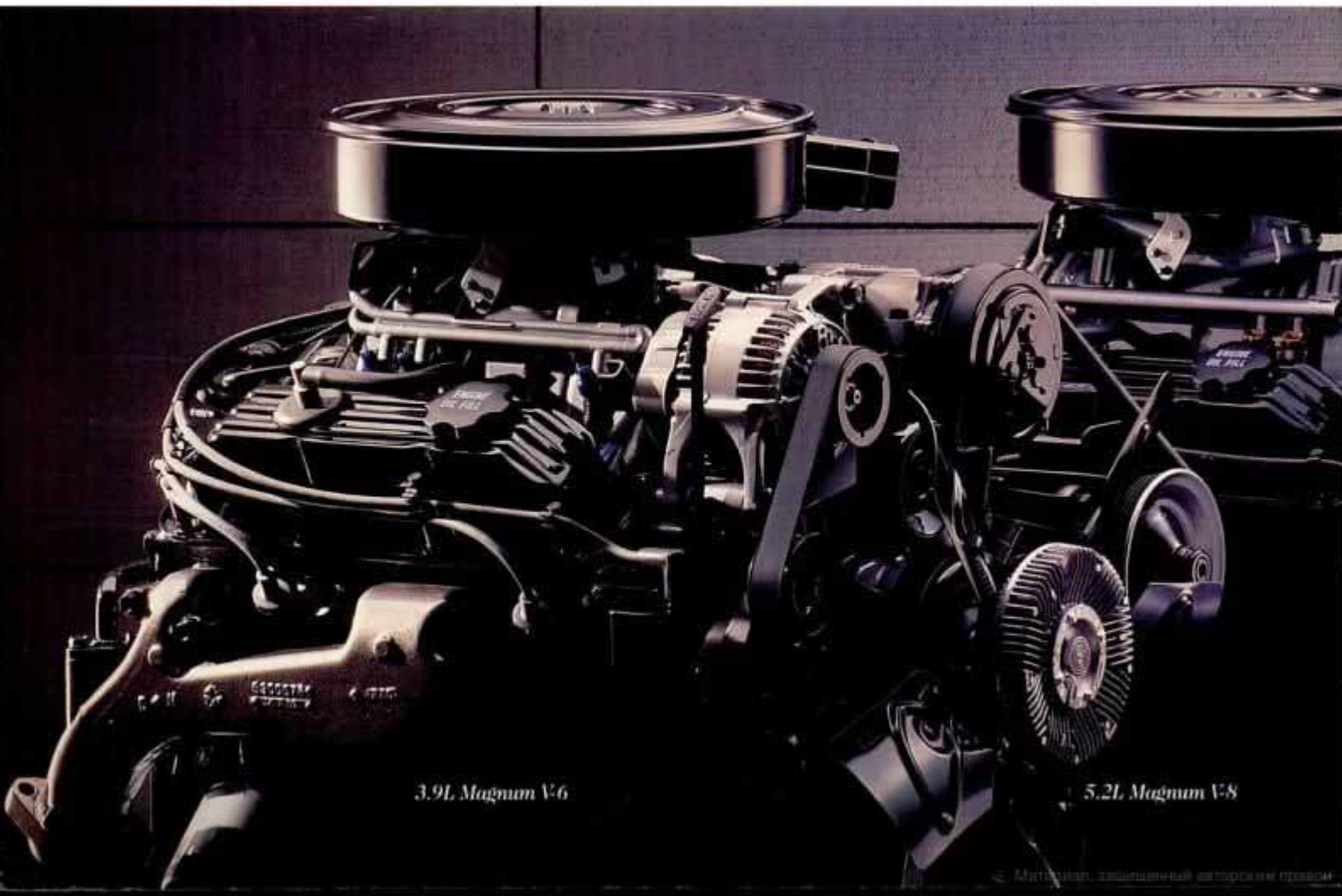
Dodge and a quant

Introducing the new Magnum Series Engines.

Truck owners are a power hungry bunch. But while most truck makers are content to throw them an occasional morsel, Dodge offers up a veritable feast. Presenting the Magnum Series Engines. V-6 and V-8 gasoline-powered engines with new sequential multipoint fuel injection for more power and torque. Plus the mighty Cummins Turbo Diesel with new charge-air cooling.

The new Magnum V-6.
44% more horsepower.

Now with 180 horsepower, our 3.9L V-6 has become a real powerhouse. When practically applied through the wheels of a Dodge truck, that means more power to help you haul important cargo. Like dirt bikes, camping gear or a load of lumber. So you get more out of any Dodge truck it goes into. If you're looking for real power and torque, this V-6 gives you a full helping of both.



3.9L Magnum V-6

5.2L Magnum V-8

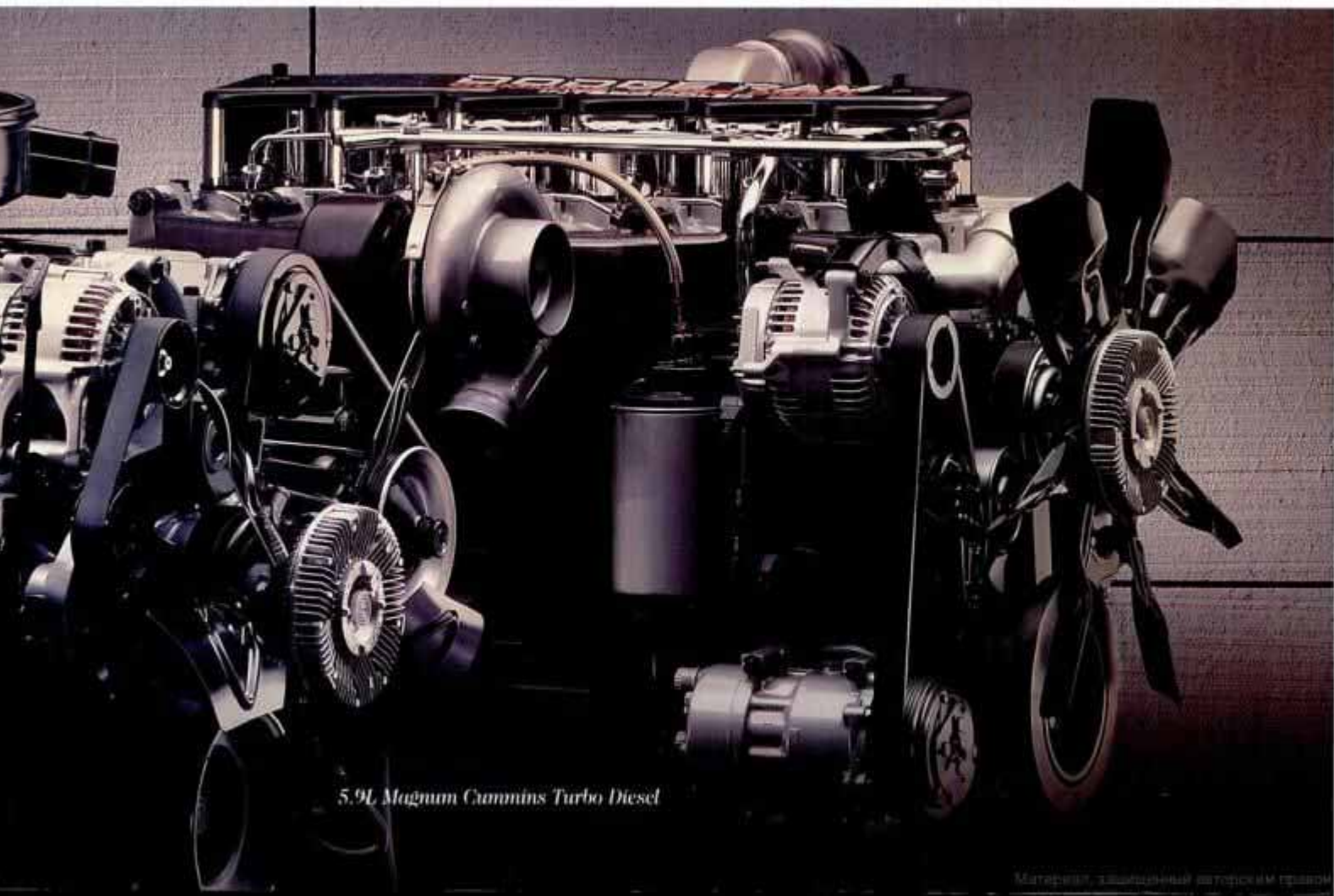
nounces um leap.

**The new Magnum V-8.
35% more horsepower.**

This is big news if you need the power of a V-8. Because this new Magnum delivers an impressive 230 horsepower. And, with increased torque, it brings 280 lbs-ft to bear against whatever you want moved from one place to another. Whether your cargo goes in your truck or follows behind on a hitch, this is the power plant for heavy loads.

**The new Magnum Cummins Turbo Diesel.
More torque than any
other diesel pickup engine.**

A huge 5.9 liters of pure pulling power. That's what the Magnum Cummins Turbo Diesel is all about. Its incredible 400 lbs-ft of torque translates into full-size pickups with massive towing capacity. And now it comes with a new charge-air cooling system designed to deliver excellent fuel economy and a cleaner burn.



5.9L Magnum Cummins Turbo Diesel

A Simple Promise:

Overall, today's Dodge trucks, gas and diesel, can deliver more payload, towing and horsepower than Ford, Chevy or any import.* Period.

It's the simple truth. Today's Dodge pickups, Ramchargers, Ram Vans and Ram Wagons are a force to be reckoned with. And that's no idle boast.

Put the mid-size Dakota with an available Magnum V-6 up against any compact pickup from Ford, Chevy or Japan. In terms of horsepower, there's just no contest. And with 2,550 lbs of payload capacity available, those compacts can't possibly compete.

Or choose a Dakota with a Magnum V-8 under the hood and you've got a mid-size with more power than standard half-ton Ford or Chevy pickups. And with 6,900 lbs of available towing capacity, it even pulls more, too.** Quite simply, it's the best all-around pickup you can buy.

But for the most available towing power, no full-size diesel pickup can pull off more than the Dodge Cummins Turbo Diesel. It offers you up to 11,900 pounds of pull. So if you want some-

thing moved, just tie it up to this brute. It plain out-torques and out-tows Ford and Chevy diesel pickups.** And it can out-carry them too, with up to 4,869 lbs of available payload capacity. No wonder the Dodge Cummins Turbo Diesel is the hardest working diesel pickup you can buy.

Every one of these Dodge trucks gets powerful protection, too. Our unbeatable **770** powertrain warranty is standard. While diesel models get a 7 year/100,000 mile engine warranty as well.†

So it's clear. Only one truck line offers you all these powerful advantages plus new Magnum engines. Which means choosing a Dodge truck is simply the best decision you can make. Period.

For free information about Dodge trucks and Magnum Series Engines, call 1-800-4-A-DODGE.



Advantage: Dodge

Dodge Dakota Club Cab V-8

Dodge Dakota Sport V-6

Dodge Ram Club Cab Cummins Diesel



BUY OR LEASE AT YOUR DODGE DEALER. Buckle up for safety. Correct at time of printing, see dealer for latest information. *Total scores of combined model segment comparisons. Competitive claims based on '91 data ('92 competitive data incomplete at time of printing). **4x2 model comparisons. †See these limited warranties & their restrictions at your dealer.



TECH UPDATE

News Of Tomorrow's Technology Today



WESTINGHOUSE AIRSHIPS PHOTO

World's Largest Blimp Lifts Off

WEEKSVILLE, NC— Boosted skyward by its twin vectorable thrusters, the Westinghouse Sentinel 1000 has flown for the first time. The 220-ft.-long blimp will test technologies for enormous radar surveillance craft such as the Sentinel 5000 depicted on the cover of our August 1991 issue.

The 1000's maiden flight began at 7:07 am on June 26. It flew for 2 hours and 5 minutes, reaching a speed of 30 knots and an altitude of 1000 ft. Test pilots used their side-stick controllers to move the tail control surfaces to full deflection, and reported no problems with the fiberoptic fly-by-light control system. They also gave the ducted

fan thrusters a workout, rotating them through their full 210° range of motion.

The airship's flight test program will include development of new devices aimed at reducing the ground crew required to land and launch the dirigible. Among these is a truck equipped with a telescoping mooring mast. Leading the blimp along by the nose, the mast truck works in conjunction with two smaller vehicles called Unimogs. These Mercedes-built utility trucks are equipped with automatically tensioned electric winches that hold the blimp's side tie lines to stabi-

Editor: Abe Dane
Assistant Editor: Greg Pope
Contributors: Mike Fillon, Oliver Fultz

lize it during ground transit.

Westinghouse hopes to have the Sentinel 1000 FAA certified by next spring. The

follow-on Sentinel 5000, which will be 10-times larger in volume, is expected to make its first flight in 1997.

Highlights This Month

- **Hot News For Firefighters**—Plane maps forest blazes.
- **Airlifter**—Hover barge sets new standard for mega-payloads.
- **Wet Concrete**—Huge vehicle paves canal underwater.
- **Hit To Kill**—Latest SDI developments advance sensor and rocket technologies.
- **Supersonic Style**—Inside Boeing's future Mach-2 airliner.
- **Power Of The Press**—Record-breaking machine bends steel with oil.

Mapping Fire

PASADENA, CA—Forest firefighters may soon get hot updates on their progress from airborne scouts using NASA technology.

In the mountains north of Los Angeles, the U.S. Forest Service is testing a system called Firefly, created at NASA's Jet Propulsion Laboratory.

A twin-engine turboprop, cruising at 3000 to 15,000 ft., trains an infrared line scanner on the inferno. The instrument, which measures heat intensity, routes its data to an on-board computer. There, the information is georeferenced with coordinates from GPS satellites and overlaid onto a digital map. The computer then radios the fire map to a fire co-



PM ILLUSTRATION BY ED VALIGURSKY

ordination camp on the ground.

In previous systems, fire-

fighters had to wait for hours for photographic film, then interpret the images visually

to gauge flame intensity.

Meanwhile, NASA's Ames Research Center, along with private company Terra-Mar Resource Information Services, is developing a similar system designed for altitudes up to 25,000 and 30,000 ft. The sensor at the heart of the Ames system could eventually look down from a high-flying ER-2 reconnaissance aircraft for wide-area coverage.

Firefly turboprop (above) maps blaze in real time. Ames' scanner (left) penetrates smoke to highlight hot spots.



TERRA-MAR PHOTOS

Heavy-Duty Hover Barge

FORT STORY, VA—A modular vehicle has floated off with a U.S. military air-cushion payload record, totting a 130-ton crane over land and water to a waiting ship. The Army platform lifted the record from a Navy Jeff-A amphibious assault craft, which hauled 105 tons in 1984.

Towed by an LCU-2000 landing craft, the vehicle offered a demonstration of the Army's new Pontoon Air-Cushion Kit. PACK consists of a pair of lift fans,

two diesel engines, a lightweight air-trapping skirt system and hardware for mooring and towing. With

the PACK kit, a crew of four can convert an Army pontoon barge into an air-cushion platform in 8 hours. Vehicles that can pull a PACK barge over land and water

range from an LCAV-30 hovercraft to bulldozers to CH-47 helicopters.

The Army's Troop Support Command developed the system to move cargo from ships to roads if combat closes down port facilities. A PACK vehicle can negotiate 5-ft. seas, coral reefs, swamps, raw beaches and other severe conditions.

Engineers plan to modify the PACK skirt system to boost payload above 140 tons.

Pulled by LCU-2000, PACK barge carried record 130-ton crane for 5 hours.



U.S. ARMY PHOTO



A fistful of flavor
for small change.



Filters: 14 mg. "tar", 1.1 mg. nicotine
av. per cigarette by FTC method.

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

One-Step Canal Liner

YUMA, AZ—How do you lay concrete along a desert irrigation canal without cutting the flow of water to crops? The Bureau of Reclamation faced this problem at the Coachella Canal in Southern California, and solved it with a unique vehicle built by Gomaco Corp.

The self-propelled paving



GOMACO CORP. PHOTO



PM ILLUSTRATION BY ADOLPHE E. BROTMANN

machine spanned the 103-ft. canal and planted a 3-in. layer of concrete over a sheet of PVC plastic. The machine used the slipforming technique, by which concrete flows continuously into a mold that's dragged slowly along a surface. A gel-like additive prevented the concrete from washing out underwater.

Mounted on canal-spanning truss, underwater slipformer lays plastic liner and concrete.

additive prevented the concrete from washing out underwater.

After a dredger smoothed the canal bottom, the paver slipformed half the canal's width in each pass.

Having succeeded with a 1.4-mile stretch of canal, Bureau of Reclamation officials are considering underwater slipforming on a wider scale.

Super Solar Boiler

ALBUQUERQUE, NM—Engineers at Sandia National Labs now appear to have tamed the most efficient solar thermal device yet built.

Called a reflux pool-boiler receiver, the device lies at the focus of a huge mirror. Concentrated sunlight boils sodium inside the pool boiler. So-

dium vapor bubbles out and transfers the heat to a Stirling-cycle electrical generator.

Operated at more than 1400° F, the system is so sensitive that if the Sun slips in and out of clouds its temperature can swing by 400° F, fatiguing the stainless-steel dome that contains the liquid sodium. And what's more, the sodium often boils explosively, exacerbating the varying temperature fluctuations.

Sandia solved the problems by adding xenon to the boiler and pitting the inside of the dome with microcavities. These modifications encourage vapor bubbles to form evenly.

The total boiler system, including Stirling engine, should be cranking by next spring.



Parabolic mirror focuses sunlight onto pool of liquid sodium for 90% efficiency.

SANDIA PHOTO

Robot Fuels Up Jets

WRIGHT-PATTERSON AFB, OH—To quicken turnaround time for combat aircraft, the Air Force has launched a drive to replace refueling crews with robots.

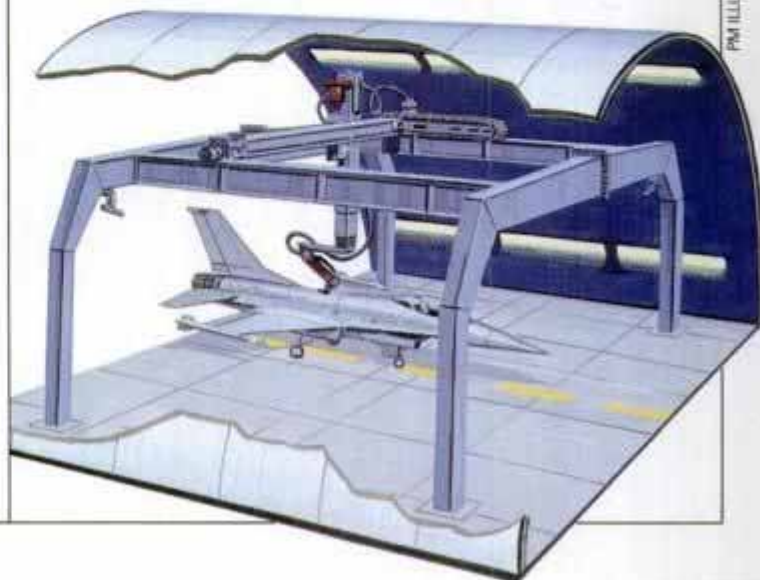
An Autonomous Robotic Refueling System, or ARRS, should cut jet-servicing time by about 50%, the Air Force estimates.

International Submarine Engineering, a Vancouver robotics firm, will build a prototype gantry shaped to fit into a standard flow-

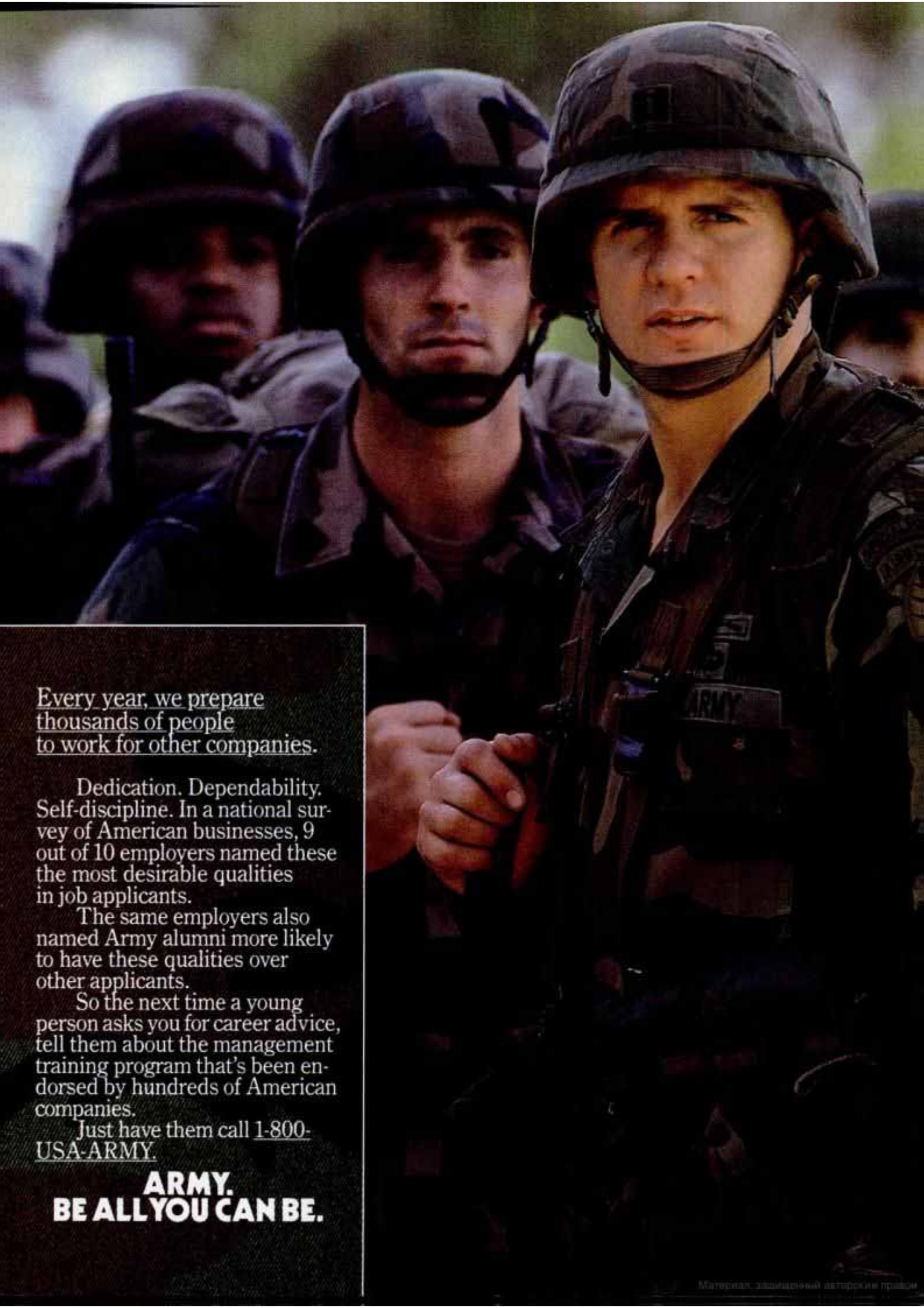
through aircraft shelter. A refueling manipulator will use computer vision and proximity sensors to identify the aircraft type and guide itself automatically to the fueling port on the plane's back.

If ARRS proves worthwhile, engineers plan to modify the gantry to perform other tasks, such as damage inspection and munitions re-loading.

Autonomous refueling robot in flow-through shelter readies F-16 for its next sortie.



PM ILLUSTRATION BY ED VAIGURSKY



Every year, we prepare
thousands of people
to work for other companies.

Dedication. Dependability. Self-discipline. In a national survey of American businesses, 9 out of 10 employers named these the most desirable qualities in job applicants.

The same employers also named Army alumni more likely to have these qualities over other applicants.

So the next time a young person asks you for career advice, tell them about the management training program that's been endorsed by hundreds of American companies.

Just have them call 1-800-USA-ARMY.

**ARMY.
BE ALL YOU CAN BE.**

SDI Evolves From Hype To Hardware

WASHINGTON, D.C.— Whether the Strategic Defense Initiative will spawn a missile-defense system remains uncertain. But there's no question that seven years of SDI spending have bought real advances in rocket miniaturization, remote sensing, adaptive optics and related technologies.

This fall, for example, the SDI Office plans to launch its most compact kinetic-kill vehicle yet. The test article, called Lightweight ExoAtmospheric Projectile, or LEAP, weighs only 22 pounds and is the size of a



Compact LEAP test projectile will pave the way for future kinetic-kill vehicles even smaller.

BOEING ILLUSTRATION



Tests of Israel's Arrow missiles provide data for GBI.

U.S. ARMY PHOTO

bulldog. While LEAP is designed with the possibility of space launch in mind, less exotic, ground-launched projectiles are gaining favor among SDI planners.

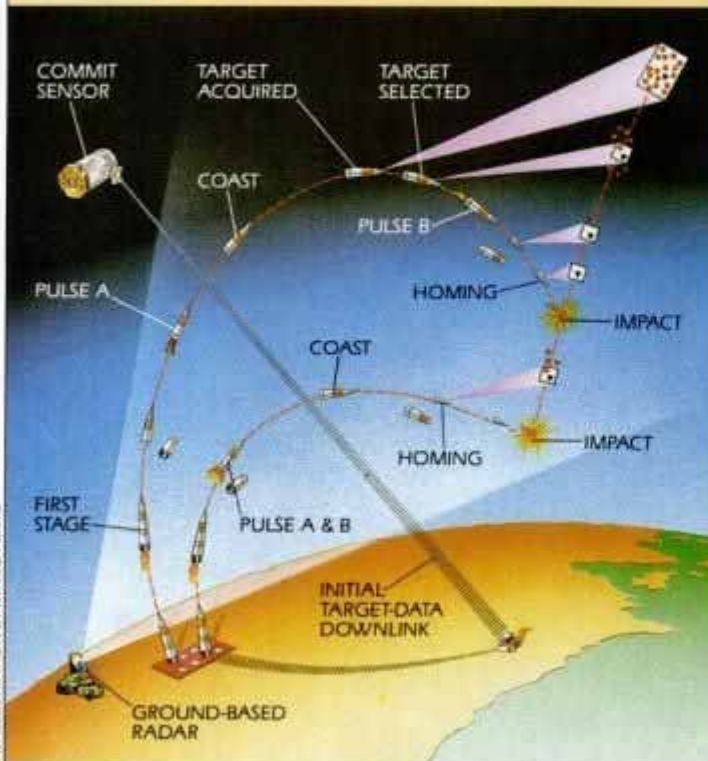
The Army is now managing two such efforts. One, the Ground-Based Interceptor (GBI) program, would field rockets that pick off reentry vehicles in midtrajectory.



LACE satellite modeled ultraviolet plume (above) and tested laser (right).



NAVAL RESEARCH LABORATORY PHOTOS



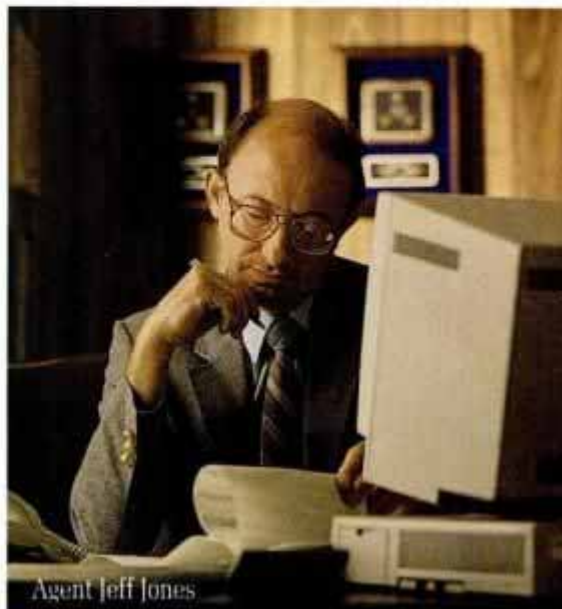
FM ILLUSTRATION BY MARIO FERRO

The other, more ambitious, project is the Endoatmospheric/Exoatmospheric Interceptor (E²I), which targets a warhead as it plunges through the atmosphere. An E²I can take two paths to the warhead: It can either arc out of the atmosphere to acquire its target and reenter as it homes in, or it can blaze straight at its target for a last-ditch intercept. Either way, the nose-mounted infrared homing sensor must perform flawlessly as the missile scorches through the air at speeds above Mach 5. A ni-

trogen-cooled window and on-board electronics will correct for aero-optic distortion. Meanwhile, in directed-energy weapons work, researchers are stemming the atmospheric distortion of laser beams shot into space. Bouncing beams off of a sensor on the Low-Power Atmospheric Compensation (LACE) satellite, Naval Research Laboratory scientists found that computer-adjusted lenses and mirrors kept the beam concentrated. The satellite also has used an ultraviolet sensor to image rocket plumes, which could lead to a new method of spotting missile launches.

Paoli, Indiana since 1972:
3,650 people,
1,260 babies,
2 floods,
2,647 auto claims

...and 1 State Farm agent.



Agent Jeff Jones

Paoli's not a big city by any stretch. But even in a small town like this, things keep changing. They put up a new church not far from the courthouse last year. Families are building houses. Babies are being born. And every time something changes, someone's insurance coverage needs reviewing. That's where Jeff Jones, Paoli's State Farm agent for the last 18 years, comes in.

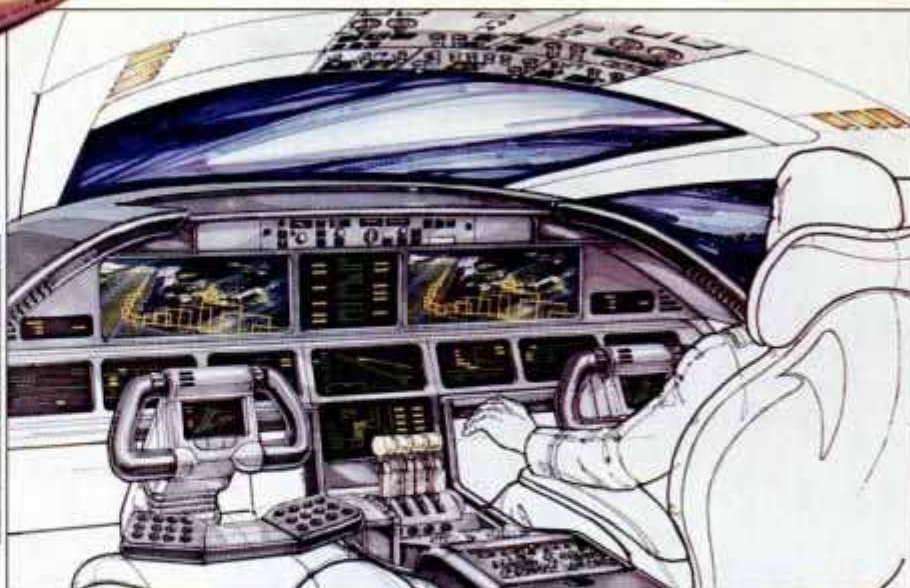
Like State Farm agents across the country, Jeff offers all his policyholders a free State Farm Family Insurance Checkup. That helps them make sure that no matter what's changed, their insurance coverage won't be out-of-date. Whether it's auto, home, life or health insurance.

In 18 years, about the only thing in Paoli that hasn't changed is Jeff. And that's the way folks in Paoli like it.



Like a good neighbor,
State Farm is there.

State Farm Insurance Companies
Home Offices: Bloomington, Illinois



Future SST's High-Tech Interior

SEATTLE, WA—Boeing's design of a High-Speed Civil Transport has progressed to feature an interior festooned with electronics.

Most noteworthy is the inclusion of synthetic vision in the flight deck, obviating a Concorde-style droop nose.

Cameras, infrared sensors and radar would feed cockpit displays to replace the forward view blocked by the jet's straightahead nose. Superimposed on the display, a sequence of squares outlines the flightpath during takeoff and landing.

Back in the cabin, 292 passengers would sit in three classes. Because the fuselage is slightly hourglass shaped, seating arrangements range from three to six abreast. Seatback flat-screen video displays would provide entertainment.

Interior of Boeing's HSCT includes synthetic vision in cockpit and seatback entertainment in cabin.

World's Mightiest Press

SINDELINGEN, GERMANY—Using pressurized oil to stamp sheetmetal, the world's most powerful press is now in operation at a Mercedes-Benz plant. Built by ABB Industrial Systems, the flexforming machine delivers a force of 150,000 tons.

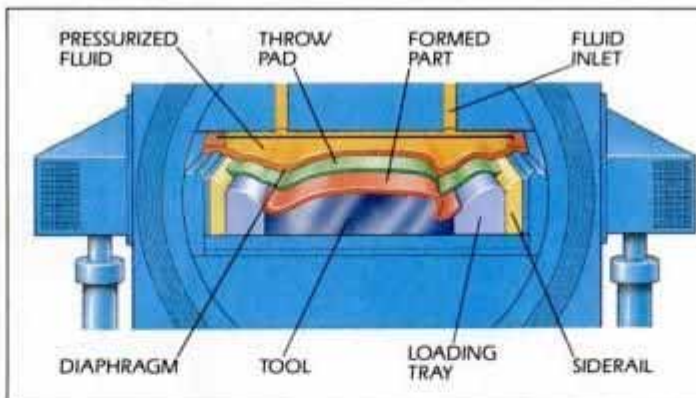
Flexforming is a technology developed in the late 1960s to manufacture precision aircraft components.

Automakers in Europe and Japan have now adopted it for quick prototyping and small production runs.

During operation, workers load a blank sheet of metal over a single tool half and roll it on a tray into the press. There, the other tool half, a rubber diaphragm, covers the blank. Pumps then force fluid over the diaphragm at pressures exceeding 20,000 pounds per sq. in. The oil distributes the pressure evenly, ensuring close tolerances.

Several American automotive companies are currently considering the technology, ABB says.

Monster flexforming press uses fluid to mold metal into complex automotive parts at Mercedes-Benz plant.

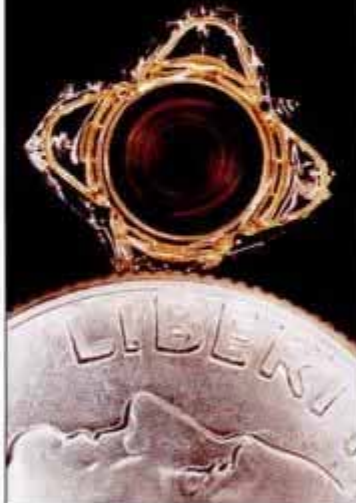


Ultrathin Lens

LIVERMORE, CA—A plastic lens $\frac{1}{10}$ the width of a human hair can focus light as sharply as the eye. Lawrence Livermore National Laboratory developed the prototype device, which could replace a cataract-clouded natural lens.

Livermore physicists used ion beams to etch tiny circular grooves in the lens. Rather than bending light refractively, the grooves' edges diffract light to a focus on the retina.

The lens's extreme thinness will allow surgeons to roll it up and insert it in the eye through a pinhole-size incision. It could also be used as a permanent corrective contact lens.



Microthin lens uses diffraction optics to bring light to a focus.

PM ILLUSTRATION BY HANK ISEN

ABB PHOTO

BOEING ILLUSTRATIONS

LAWRENCE LIVERMORE PHOTO





UNDERSTANDABLY, THE IMPORTS ARE GETTING NERVOUS.

Let the four-door Regal show you why. Only its competitors will experience some discomfort. The Regal Sedan is built to further enhance Buick's reputation for quality—a reputation that is growing by leaps and bounds. It is stylish and sophisticated. And it comes with an impressive list of standard features like air conditioning, four-wheel power disc brakes and four-wheel independent DynaRide

suspension. Plus an even more impressive list of available features, including: ● Dual ComfortTemp climate control ● Compact disc player with Concert Sound ● Super Soft leather seating areas. Also available is a powerful 3800 V-6 engine with tuned-port injection. The 1991 Regal Sedan is in a class by itself. See it at your Buick dealer now. Or you can call 1-800-423-6787 for more information.

The New Symbol For Quality In America.



BUICK



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COMPARISON TEST

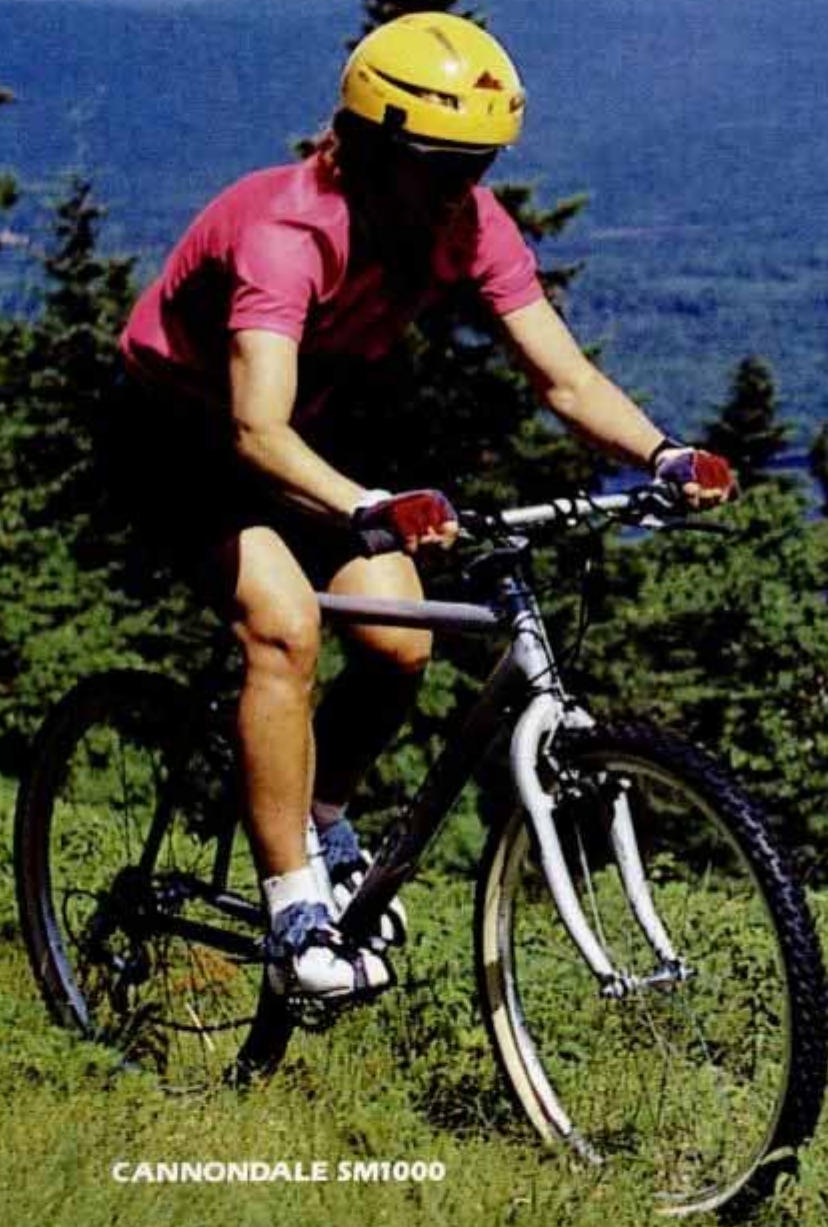
KINGS OF THE HILL

An all-terrain assault on six fat-tired mountain bikes.

BY JOE SKORUPA, Boating/Outdoors Editor
PM Photos by Humphrey Sutton

● As Yogi Berra once said, it's like *déjà vu* all over again. Biking, the sport of the 1890s, is now the sport of the 1990s. Following the introduction of the first 2-wheelers in the late 1800s, biking became a national craze. Today, it's booming again. Last year, nearly 11 million were sold.

The biggest difference between the two booms is that the current rally is focused on mountain bikes—2-wheeled equivalents of 4x4 vehicles. Two-thirds of all bikes sold today, incredibly, are mountain bikes.



CANNONDALE SM1000

PM decided it was time to take a look at these mechanized mountain goats. Although high technology and high pricing have lately taken hold—current models sport front and rear suspensions, one-piece composite frames, 3-spoke wheels and \$4000 stickers—we set a realistic limit of \$1000, and brought six bikes to the leading mountain bike center in the Northeast, Mt. Snow, Vermont. After three days of ideal pavement, dirt and single-track testing, here's what we found.

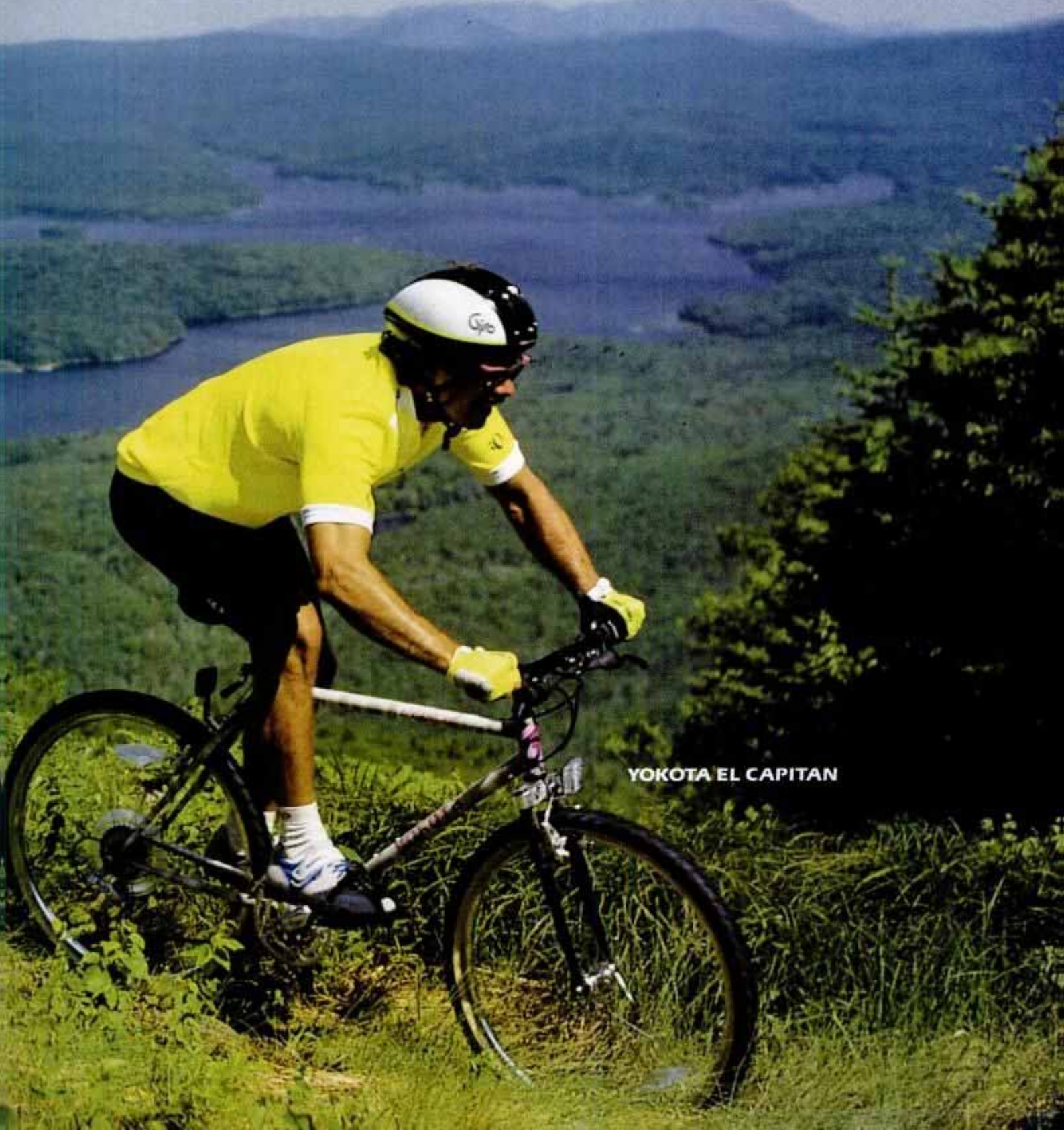
Trek 8000 Aluminum

It's easy to see why Trek has muscled into the upper echelon of biking in a short period of time. With an aluminum frame and top-shelf Shimano componentry, the Trek 8000 proved to be as stable as a mountain goat in steep climbs and rugged descents.

The 8000 is a pro-level bike with narrow handlebars and a lightweight, epoxy-bonded frame that features aggressive geometry. Cornering and power delivery are so immediate that novices may actually need some time

to get used to the feel of it.

The 8000 features the latest dual-lever, push/push shifters. This under-bar, indexed system is located at thumb level and is extremely easy to use. Round grips with radiused ends and a soft gel seat are two of the outstanding features. Of special note are Trek's tires with specific front and rear tread patterns, and a beautifully detailed frame that hides the lug joints with a superb finish. On- and off-road, the Trek 8000 rides like a champ.



YOKOTA EL CAPITAN

KINGS OF THE HILL

Specialized StumpJumper Comp

In terms of innovation, market leadership and racing dominance, Specialized leads the pack in pro-level mountain biking. The StumpJumper Comp, with its top-shelf Shimano componentry and superbly laid-out frame, continues this heritage.

Exceptional cornering and hill climbing make the StumpJumper a raceworthy contender. On-road and off-road feel are equally smooth.

The chromoly frame, which is aggressively angled for steep hills, features lugless construction and unobtrusive welding. Manipulation of frame tubing—squaring, ovaling and tapering—shows a craftsman's touch.

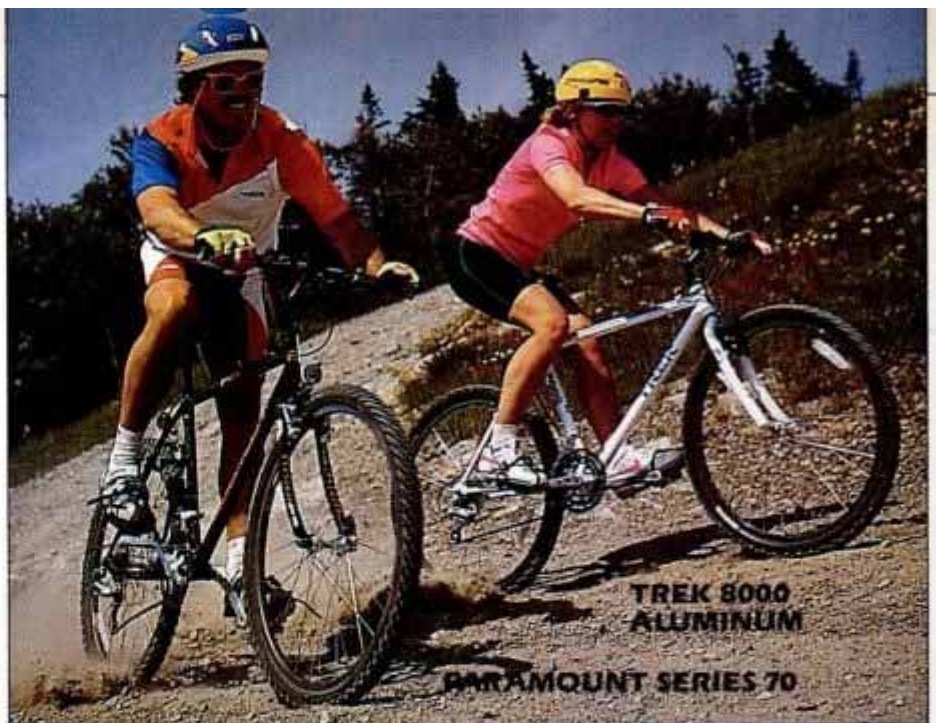
The Shimano Deore XT shifters, which can work in both indexed and friction modes, show that abovebar, push/pull shifting is still popular with hardcore bikers.

Noteworthy features on the StumpJumper include comfortable, rounded grips and a unique front-brake cable setup that runs through the handlebar stem.

Cannondale SM1000

Cannondale is a limited-production builder of pro-level bikes with wide-diameter aluminum tubing, which appears to be on steroids compared to other frames. The care taken in design is also carried through to workmanship, and the SM1000 has a gorgeous finish that hides all traces of the lugless, welded construction.

The SM1000 is an outstanding performer with componentry from Shimano's main competitors, SunTour



and Ritchey. The crew especially liked the rounded grips, soft saddle, curved aluminum fork and Kevlar-beaded tires.

The unique Grip Shift system, which requires a roll of the wrist to change gears, is well suited for non-technical riding, but takes some getting used to in rugged terrain.

If the incredible lightness of riding describes your idea of mountain biking, the SM1000 is for you.

Paramount Series 70

That the Series 70 rounds out our top tier of test bikes isn't surprising. Paramount has been building pro-level racing bikes for years. What's surprising is that the former custom road-bike builder is now aligned with Schwinn and turning out mass-pro-

duction mountain bikes. Turning them out quite well, too.

The chromoly, lug-welded frame, which features an impressive amount of tapering and ovaling for strength, comes with high-priced Shimano Deore XT componentry. Like the StumpJumper, the push/pull shifters are top mounted. Handling was superb on all terrains, and power was delivered with outstanding efficiency, especially up steep hills.

The only nits to pick are with the saddle—it's hard and requires an Allen wrench to adjust—and the price, which is a bit on the high side.

Raleigh Technium Instinct

Giant Raleigh is one of the grand-old names in biking, but it hasn't let the times pass it by. Recently, it hired



CANNONDALE SM1000



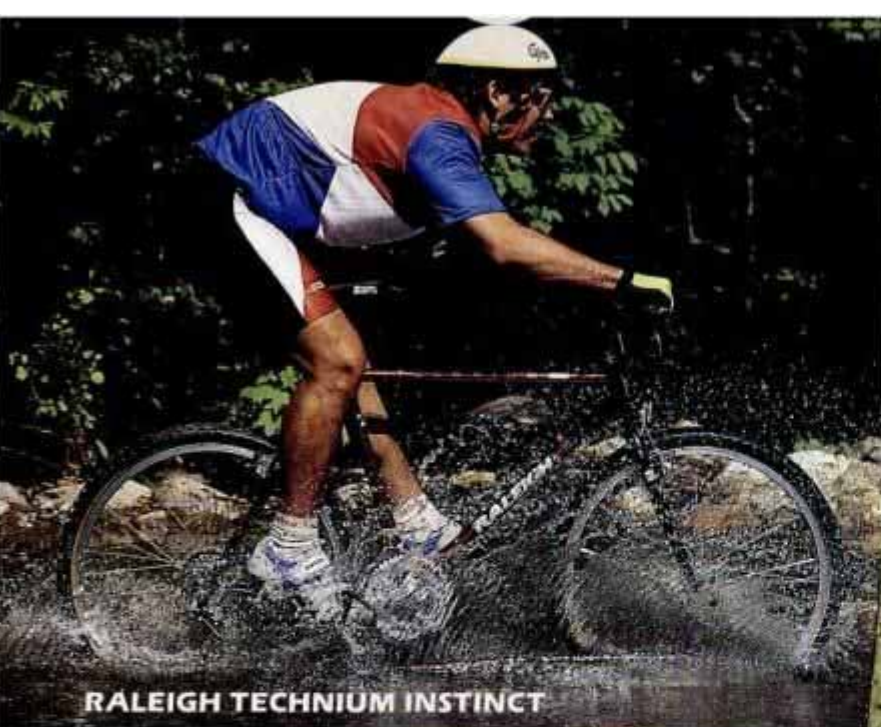
PARAMOUNT SERIES 70



RALEIGH TECHNIUM INSTINCT

SPECIFICATIONS AND DIMENSIONS

MANUFACTURER/ MODEL	PRICE AS TESTED	FRAME SIZE TESTED/WEIGHT/ BRAKES	DERAILLEURS/ SHIFTERS	CRANKSET/ FREEWHEEL	SADDLE/ PEDALS	WHEELBASE/ TOP TUBE LENGTH/ CHAINSTAY LENGTH
Cannondale SM1000 9 Brookside Pl., Georgetown, CT 06829	\$900	20 in./24.5 lb./ SunTour XC Pro	SunTour XC Comp/ Grip Shift	SunTour XC-LTD/ SunTour Cassette	Cannondale Comp/ SR Low Fat	42.5 in./23 in. (L)/ 16.9 in.
Paramount Series 70 P.O. Box 260, W. Chicago, IL 60185	\$1000	20 in./26.8 lb./ Shimano Deore XT	Shimano Deore XT/ Shimano Deore XT (T)	Shimano Deore XT/ Shimano Deore XT	Vetta Turbo/ Shimano Deore XT	41.3 in./22.2 in. (A)/ 16.6 in.
Raleigh Technium Instinct 22710 72nd Ave. S., Kent, WA 98032	\$850	20 in./26.5 lb./ Shimano Deore LX	Shimano Deore LX/ Shimano Deore LX (T)	Shimano Deore XT/ Shimano Deore LX	Brooks Gel Lite/ Shimano Deore LX	42.2 in./22.8 in. (L)/ 16.6 in.
Specialized StumpJumper Comp 15130 Concord Cir., Morgan Hill, CA 95037	\$950	18 in./27.9 lb./ Shimano Deore XT	Shimano Deore XT/ Shimano Deore XT (T)	Shimano Deore XT/ Shimano Deore XT	Selle Italia Turbo/ Shimano Deore XT	41.8 in./22.8 in. (A)/ 16.9 in.
Trek 8000 Aluminum 801 W. Madison St., Waterloo, WI 53594	\$850	18 in./26 lb./ Shimano Deore XT	Shimano Deore DX/ Shimano Deore XT (U)	Shimano Deore DX/ Shimano Deore DX	Vetta Racing Gel/ Sr Low Fat	41.3 in./22.4 in. (A)/ 16.7 in.
Yokota El Capitan 2016 Martin Ave., Santa Clara, CA 95050	\$750	20 in./27.5 lb./ Shimano Deore XT	Shimano Deore DX/ Shimano Deore XT (T)	Shimano Deore DX/ Shimano Deore DX	Gel Tech/ Wellgo	41.3 in./22.4 in. (A)/ 16.3 in.



RALEIGH TECHNIUM INSTINCT

John Tomac, a top racer and designer, to revamp its line, and began pioneering a new kind of frame construction called Technium, which combines the best of lightweight aluminum and rugged chromoly.

The chromoly lugs on the Instinct's frame join the aluminum main tubes to a chromo fork and rear triangle. Bonding of the dissimilar materials is done by using a unique thermal epoxy method that's been proven over time.

Midline Shimano componentry is used with Ritchey tires and a Brooks gel saddle. While power delivery and hill climbing were not as aggressive as the top bikes, overall handling and feel were good. There were no weaknesses to report. Combine this with the test's lowest sticker, and the Instinct comes out as a value winner.

Yokota El Capitan

Newcomer Yokota has been making bikes for years in Japan and, as expected, the El Capitan is strong in all fundamentals. It compares quite well with the Specialized StumpJumper in weight and componentry—a top-shelf Shimano Deore grouping with XT top-mounted shifters. Ride is similar, too, although a slight edge goes to the StumpJumper in overall feel and handling, especially in rough terrain.

Lugless construction of the chromoly frame leaves only the smallest traces of welding. Features of special note include a multipiece fork made with twin chromo tubes and an aluminum crown, a soft gel saddle and a



SPECIALIZED STUMPJUMPER COMP

short competition handlebar. With the second lowest price tag, and good value to go with it, Yokota is sure to make a name for itself in coming years.

All six mountain bikes were worthy of their rugged name. There were differences in design, but the effects weren't dramatic. Prices, on the other hand, ran through a wide range. Top value doesn't necessarily command a top price in the new boom in bikes. **FM**



SPECIALIZED STUMPJUMPER COMP



TREK 8000 ALUMINUM



YOKOTA EL CAPITAN

TEST DATA

FRAME MATERIALS/ CONSTRUCTION	FORK MATERIALS/ CONSTRUCTION	CORNERING & HANDLING	ACCELERATION & HILL CLIMBING	OVERALL FEEL & COMFORT	FIT & FINISH
Aluminum/ Lugless TIG welded	Aluminum/ TIG-welded crown	2. (tied) Agile, but Grip Shift not for everyone	1. (tied) Superb response in all situations	1. (tied) Incredible lightness of biking	1. (tied) Immaculate finish, best dressed
Chromoly/ Lugless TIG welded	Chromoly/ TIG-welded crown	2. (tied) Responsive with no misbehavior	1. (tied) Immediate power delivery	2. (tied) Among best overall, hard seat	2. (tied) Minimal weld marks, good overall
Aluminum and chromoly/ Epoxy bonded with lugs	Chromoly/ TIG-welded crown	3. Performs ably, better on pavement than off	2. (tied) Great road speed, adequate climber	2. (tied) Light weight, great seat, good overall	3. Prominent lugs may not be for everyone
Chromoly/ Lugless TIG welded	Chromoly/ TIG-welded crown	1. (tied) Super stable, surefooted control	2. (tied) Tops, but lighter bikes have slight edge	1. (tied) Rides like it can do it all and does	2. (tied) Battleship gray, minimal weld marks
Aluminum/ Epoxy bonded with lugs	Chromoly/ TIG-welded crown	1. (tied) Instant response, go anywhere, do anything	1. (tied) Best in power delivery, nothing too steep	1. (tied) Mountain goat of test, great grips and seat	1. (tied) Seamless finish, scratch-hiding splatter look
Chromoly/ Lugless TIG welded	Chromoly/ Clamped in an aluminum crown	2. (tied) Efficiently does what's asked of it	3. Adequate in all phases, no weaknesses	2. (tied) Solid and rugged with a soft saddle	2. (tied) Smokey finish not for everyone, slight weld marks

TIG stands for Tungsten Inert Gas welding. Bold numbers in Test Data indicate ranking. All bikes have 21 gears.

ELECTRONICS

LONG ON T

A new camcorder with interchangeable lenses lets you bring home the buffalo and just about anything else.

BY GEORGE SCHAUB

● In still photography you can use either point-and-shoot cameras or full-featured SLRs. One's easy to use, but the other offers lots of creative options and the bonus of interchangeable lenses. You choose one or the other depending on what you're shooting, and how fancy you want to get with your technique.

Now the same choice is available with camcorders. There are plenty of point-and-shoot camcorders avail-

able, but there's now a new breed of advanced amateur video cameras that offer a host of in-camera creative touches, with the capability of accepting interchangeable lenses to boot.

The first of this type is the Canon L1. Part camcorder, part special-effects generator and all video-making machine, the L1 looks and feels like a pro-style camcorder. But it weighs in, with battery and lens attached, at a touch over 5 pounds.

Along with all its features, the L1 sports the Hi8 pedigree, which combined with the camera's 410,000 pixel image-gathering chip, can deliver about 400 lines of



The Canon L1 camcorder can use a complete range of video and 35mm photographic lenses. This capability is most impressive for long-range shooting. The L1 comes with a 15X

zoom, but by substituting the appropriate 35mm lens, you get even greater zooming power. You can, for example, get a closeup of a buffalo without causing a stampede.

BACKGROUND PHOTO: DON LANDWEHRLE/THE IMAGE BANK
ABOVE: LYNN H. STONE/THE IMAGE BANK, RIGHT: ROY ATTAWAY

THE RANGE

horizontal resolution—a crisp, vivid picture. To get the most from the system, you need a TV equipped with an S-video input terminal. If you don't have one, you can use regular 8mm tape as well, albeit with some sacrifice in resolution.

The L1 is a camcorder that thinks it's an SLR, at least when it comes to lens interchangeability. The L1 uses a now-standardized "VL" mount system, one jointly developed with other major video players such as Hitachi, Matsushita and Sony. Any lens by any maker bearing

these initials can be used on this new breed of camera. But Canon has the added advantage of having its own 35mm lens line, the EF lenses for its EOS SLR cameras. Attach the EOS Adapter VL to the camcorder, then the EOS lens to the adapter and, voilà, you've just expanded the number of lenses for your camcorder to include any EF lens ranging from 15mm to 600mm, and the full line of EOS zooms in the bargain. You don't



LONG ON THE RANGE



PM PHOTO BY ROY ATTAWAY

Adding a 75-to-300mm or 80-to-200mm lens will help you capture wildlife on video.

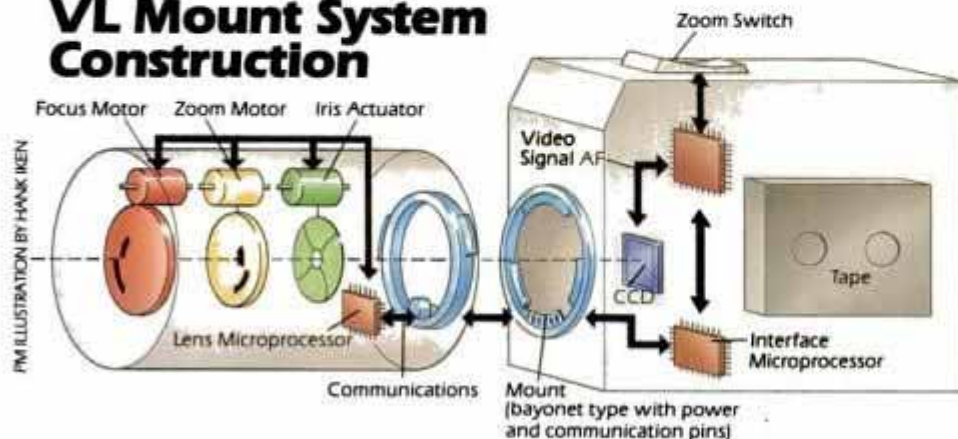
lose any of the automatic features (autofocus, autoexposure, power zoom) when you do so because contacts in the mounts constantly feed information back and forth between camera and lens. That's a lot of optical muscle from Canon. List price is \$3000, and that includes a 15X zoom lens. The VL Adapter lists for \$350.

Keep in mind that when using a lens made for a 35mm camera on a camcorder you are changing the frame-filling capability of the optical system. For example, mount a 20mm lens made for a 35mm SLR on a camcorder and you fill the camcorder viewfinder to the equivalent of using a 108mm lens on an SLR. To make the conversion, multiply the focal length by a factor of 5.4. This occurs because the image sensor in the camcorder is small-

er than a frame of 35mm film—it's like cropping to the center of a picture. The capabilities of this system become very dramatic when you start working with 35mm SLR telephoto lenses—a 600mm EF EOS lens on the L1 camcorder delivers the frame-filling capability of a 3240mm lens.

Canon CL (VL compatible) lenses include an impressive 8-to-120mm (15X) zoom, a more compact 8X (8.7-to-69.6mm) zoom listing for \$400, and a recently added CL 5-to-15mm wide-angle to moderate telephoto 3X zoom (\$700). If all of the above isn't enough, you can also double the focal length of any VL mount lens with a 2X extender (\$350), or digitally double the size of the center of the viewfinder frame with the touch of a button. But we'll get to the special effects later.

VL Mount System Construction



PM ILLUSTRATION BY HANK IREN

Both the lens and the camcorder body contain microprocessors that combine to make videomaking as easy as pushing the RECORD button.

Sound zooming

Though lens interchangeability is the L1's major calling card, there are a host of features that make this more than your average camcorder. Let's start with its sound-recording features. Being an 8mm system, it delivers stereo sound, but with a number of user-controlled options. You can select automatic or manual recording levels via the MIC LEVEL A/M on the top plate of the camcorder body. Select auto for most situations, and manual when you want to change left and right balance yourself (a headphone terminal on the right side of the body allows you to attach a set for monitoring). If you happen to be shooting at race tracks, arenas, airports or even loud waterfalls, activate the ATT (attenuator) switch, setting it to 20 dB to eliminate distortion.

The external microphone can also be adjusted to cover a certain angle of coverage, or to zoom to a near or far-away subject and eliminate noise that has nothing to do with what's being recorded. You do this by activating the STEREO/ZOOM switch. When STEREO is selected, you adjust to record from the center or the entire screen. When ZOOM is selected you work with tele or wide sound. You can also work with a detachable microphone or add sound from a CD or cassette player.

Light control is an essential part of the creative picture-making process, and the L1 gives you almost as much individual control as a 35mm SLR. First off, there are two metering modes on the L1—conventional and peak. Conventional metering is for normally lit scenes, such as a field of flowers on a brightly lit mountain slope. Peak mode is for recording under bright spotlights, such as a stage performance, or when lighting conditions are very bright, such as when taping a day of skiing on the slopes or when lounging under the Miami sun. In a way, peak metering is akin to using a spot meter in an SLR and "laying the spot," or taking a reading from the brightest part of the scene. Photographers who shoot 35mm slides might well envy this feature for their still cameras.

You can also perform a bit of light "bracketing" with the L1. Let's say you're taping your family walking down the beach at sunset, and want to shift from a normally exposed scene to one where the figures become silhouettes against the brilliant sky. As you tape, you can move the exposure control (a knurled ring on the lower-left side of the body) toward the minus side—this makes the image darker. On the other hand, let's say your child

(Please turn to page 132)

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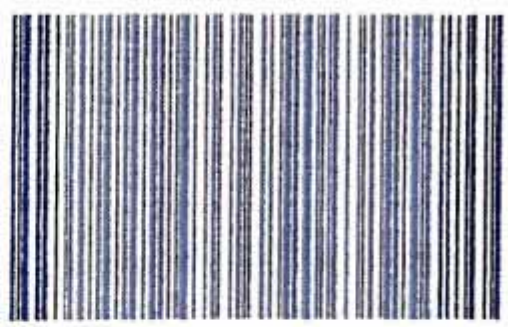
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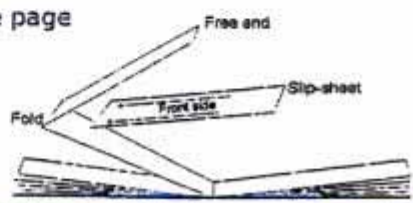
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ARE BUILT FORD TOUGH.**



Enough Alone?



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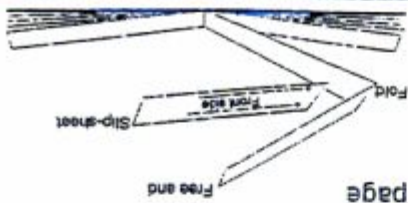
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Inverted Foldout slip-sheet



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Foldout slip-sheet

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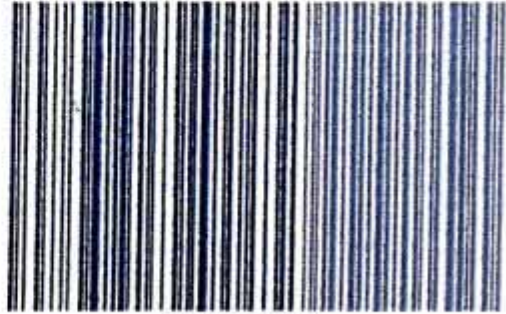
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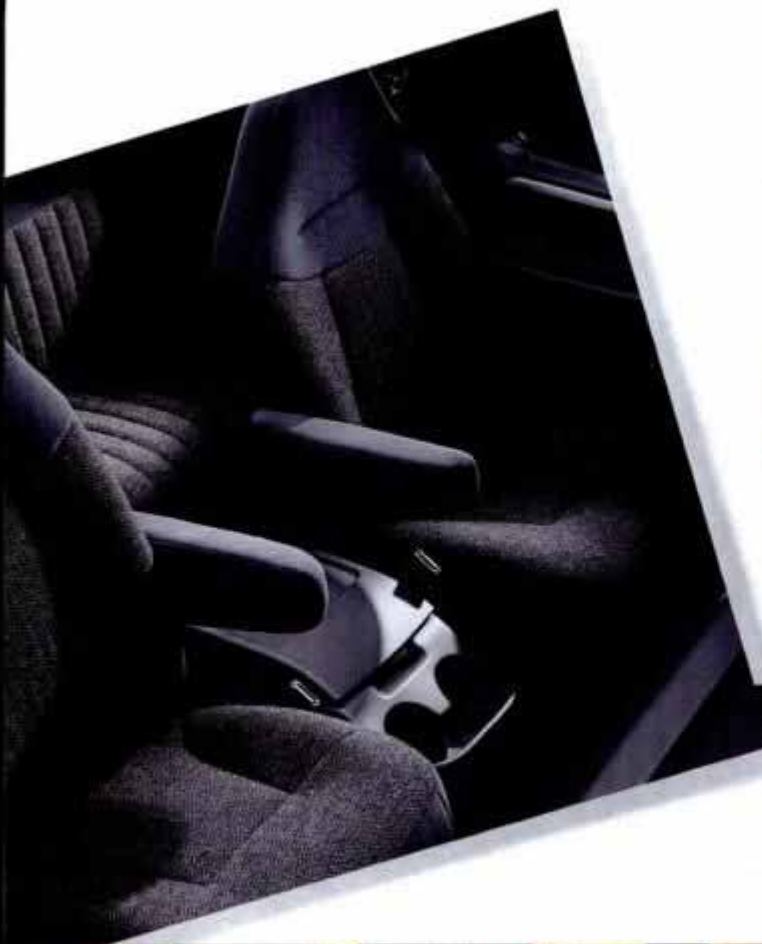
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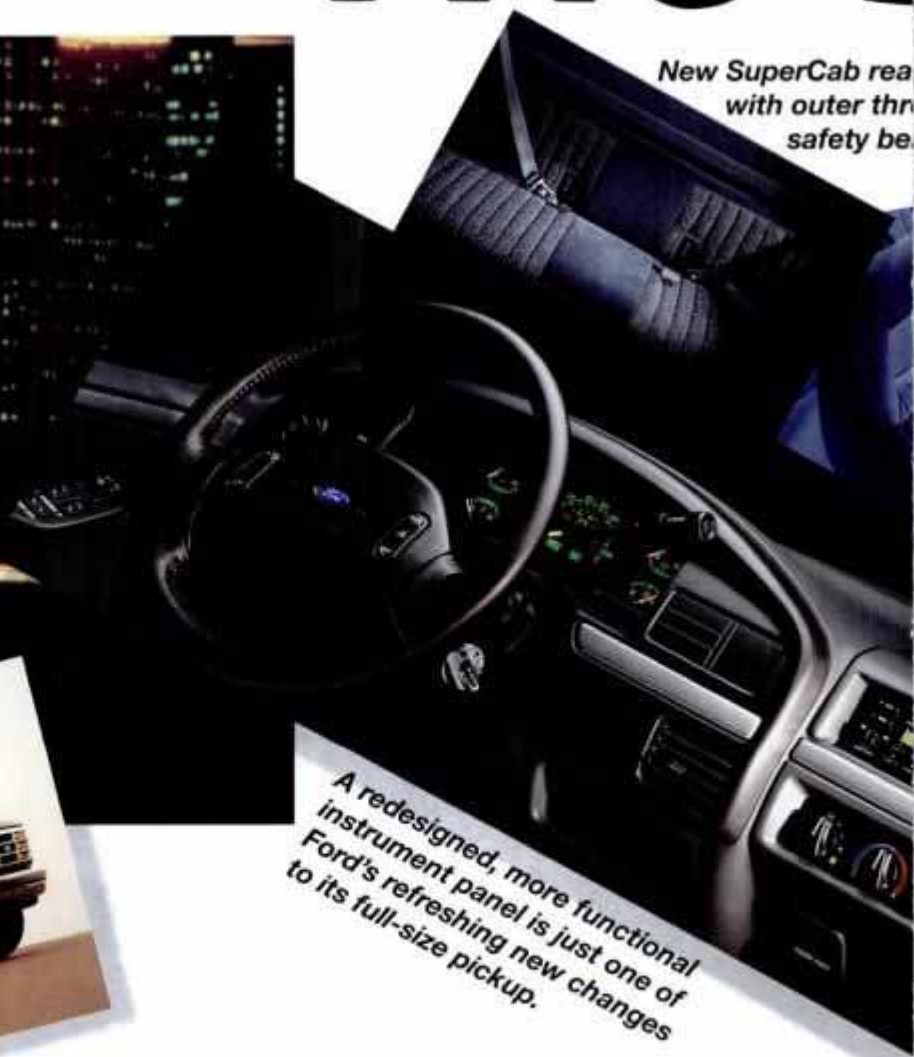


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WIDE WORLD PHOTO

THE PRESIDENT'S NEW PLANE

Upgrading to a brace of brand-new Boeing 747-200s with state-of-the-art facilities, President Bush and his staff can now respond to any contingency on the fly.

BY WALTER SORRELLS

● It's been a long day.

You're tired, and you've got an all-night flight in front of you. But tomorrow is going to be even longer: You're participating in a round of critical arms-reduction talks with the Soviets. A lot is at stake—not just for you, but for your country and for the world.

Outside your cabin the big GE 80-series engines wind up to takeoff power, shoving you deep into your leather seat. Once airborne, you pick up the beige phone next to your desk and ask the operator to get the secretary of state on the line. There's still work to be done. It's a heavy burden. But it comes with the job.

You're the president of the United States of America.

Big One

The plane in this scenario, the new Air Force One, is a Boeing 747-200 heavily modified to take care of every presidential need when the White House hits the road.

Actually, the designation Air Force One may refer to either of two aircraft. Boeing delivered identical behemoths bearing the tail numbers 28000 and 29000 to Andrews Air Force Base in the past year. Whichever plane carries the president bears the radio call sign Air Force One. Under command of presidential pilot Col.

Danny Barr of the 89th Military Airlift Wing, tail number 28000 has already carried the president more than 108,000 miles since last September.

Although the aging 707s—a series of which had served since the Kennedy administration—were clearly ripe for replacement, the size and cost of these new planes have made them an easy mark for critics of government excess. To learn more about them, POPULAR MECHANICS paid a visit to Andrews, where we spoke to Col. Barr and gained admittance to a specially built high-security hangar for a tour of the new aircraft.

The scale of the 6-story-high, 231-ft.-long plane is eminently presiden-

PRESIDENT'S NEW PLANE



tial. It carries a crew of about 25 with 70 comfortably spaced passengers.

Welcome aboard

Space. That's the first thing you notice aboard Air Force One. There's 4000 sq. ft. of it. Space to walk, to sleep, to stretch out, to eat. And especially to work.

Let's start in the forward area, where—appropriately—the president's quarters are located. He and the first lady have a sitting room with couches that make down into a bed. Nice digs. Wood veneer cabinetry, leather seats, deep-pile carpet and electric window shades.

Need to freshen up? Just pop into the bathroom. There's a vanity mir-

ror, a sink, a spare electric razor with, yes, the presidential seal on it and a toilet. There's even a shower. If this seems a trifle luxurious, consider the point made by Air Force One copilot Maj. Gary Nelson: "These people are making decisions that affect the entire country. So you want them to be rested, alert and totally sharp."

Next door is the presidential office, complete with a wood desk and comfortable leather chairs. The blue digital clock on the wall—like the clocks in all compartments—gives local, Washington and destination time.

One use made of the surfeit of space is a medical center. The room manages to fit three first-class seats, two bunk beds, a sink, a refrigerator for

blood and medicines, and a closet full of medical equipment into a space smaller than a kitchen in a New York City apartment. There's also a fold-out operating table, complete with high-intensity lights.

Another working space comes in the form of a generously proportioned conference room replete with VCR, projection screens, map hangers and other power-conferencing essentials. There's also a glistening boardroom table with a wood structure that hides wiring and jacks for both secure and clear telephones.

The plane boasts two galleys, both containing microwaves, stoves and ovens. Since the FAA was understandably distressed about all those



Beautifully veneered desk is centerpiece of presidential office.



Audiovisual aids and secure phones are built into conference room.



BOEING PHOTOS

open burners, the stoves were specially modified for air flight.

Office in the sky

The first thing you'd notice if you stripped off the aluminum skin of Air Force One is that there's an awful lot of wire crammed into the frame. There's 1.2 million ft., in fact—more than twice as much cable as in an off-the-shelf 747-200.

And at the far end of most every piece of wire, there's some kind of office or communications equipment. Air Force One bristles with electronics: 85 telephones, 10 computers, a copier big enough for a law practice, a fax machine and 57 antennas. Many seats have two phones. The white one is a normal line and the beige one is for encrypted voice communication.

The folks who keep this maze of wire operating smoothly sit in a cabin on the upper deck. Here, three Air Force specialists man the Mission Communication System (MCS), a wall of electronic components that drive the plane's complex communications network. Pick up the phone next to your seat and an MCS operator answers. He can then patch you through to pretty much anyone—Mikhail,

Norman, Dan, whomever.

"Anything that the president or the White House staff can do on the ground, we can do in the air," says Air Force One Communications Chief Joe Jaworski.

The plane sprouts television screens everywhere. Literally. Every cabin in the plane has one. Should you get a yen to review that videotape of the president's last speech, no problem. Pick up the white phone next to your seat, and give the third MCS operator a call. He can pop a tape into one of the eight VCRs at his right elbow and send the show down to you remotely.

As for military exigencies, Air Force One has been hardened to protect the communications systems from electromagnetic pulse (EMP) radiation. EMP, that's the kind produced by a nuclear blast. All cable has been shielded. In addition, fine, near-invisible grounded metal screens cover many of the windows, while other windows are covered entirely by grounded metal plates.

Going it alone

In most respects, the planes themselves are relatively standard Boeing

747-200s. Befitting their key role in the national drama, however, several airframe changes have been made. Despite their 7000-plus mile range, the big jets have been given aerial refueling capabilities, allowing them to remain airborne almost indefinitely.

Additionally, two sets of specially designed stairs unfurl from the belly of the plane. They are intended to allow the president to dismount in out-of-the-way places that don't have stairs big enough for a 747.

There's also a built-in conveyor belt that telescopes out of the rear cargo bay, allowing the crew to unload the aircraft without assistance. "On the spur of the moment, we can take the president to any place he'd like to go and have everything we need to operate," Col. Barr says.

With the new 747s and the crack maintenance staff of the 89th MAW, the Air Force now has a plane that will serve the president well into the next century. Reliability so far has been 100%. Says Boeing's Air Force One Project Manager Lee Gant, "We wanted something that was highly reliable and with dependable performance. And that's exactly what we have here." **FM**



AIR FORCE PHOTO



WIDE WORLD PHOTO

Phones, secure and clear, are plentiful in quarters for junior staff.

President's room has fold-out beds, electric shades and more phones.

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JOURNAL



CUTTING EDGE

No matter how you cut it, this butcher block stands up.

BY ROSARIO CAPOTOSTO, Contributing Editor

● At our house, we're partial to hardy stews, canning and the type of cooking that requires a rugged work surface. That's why we built this butcher block table. It's been in our kitchen only a short while, and it's already the

room's focal point, visually and for preparing food.

Generations of good cooks have relied on tables like this, and ours is built along traditional lines. Its charm, however, didn't come at the

expense of its durability.

We wanted a butcher block table with hefty dimensions and an unflinching use of materials. Its top, therefore, is a 5-in.-thick lamination of rock maple, and the poplar legs are likewise beefy. The legs are enameled to stay good looking, even if you slop into them with a mushy floor mop.

Color photo: J.R. Rost
Black-and-white photos: Rosario Capotosto
Technical art: Eugene Thompson
Photo stylist: Gabe Henrick

Making The Top

Make the top by gluing up 14 pieces of 8/4 maple face to face (as opposed to edge to edge). Buy lumber that is S2S (surfaced two sides), and select it carefully, culling out warped, cracked, cupped or bowed pieces.

Crosscut the boards slightly over length, cutting off any sniped ends (Photo 1). A snipe is a crescent-shaped cut in the board's face from when it was planed to finished thickness. A snipe interferes with face gluing the boards.

Joint an edge on each piece. Make a shallow test cut to determine which direction the grain runs. If the jointer tears out the grain, joint the board from the opposite direction. Mark each jointed edge with an arrow pointing the way the grain runs (Photos 2 and 3). Rip each piece to 5 in. wide on the table saw (Photo 4). Joint the sawn edge, and mark it for planing direction.

Next, cut the stock to finished length. Stack the pieces on the table saw with the edge arrows facing the same direction. If possible, shift the boards so they are paired with the annual rings opposing each other, but keep the arrows pointing the same way. Number the pieces 1 to 14.

We used a pair of 3/8-in.-dia. x 2-in.-long dowel pins between each board to align the boards during glue-up. Offset the dowels on both sides of each board so the holes don't meet.

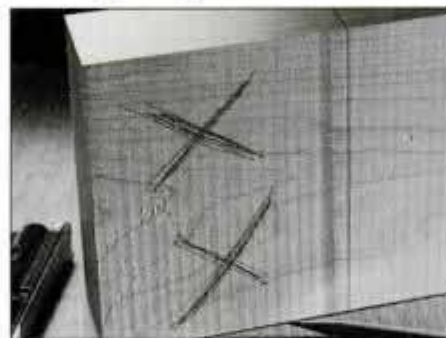
Bore a pair of dowel holes on one face of each board on the drill press, but not in the last board (No. 14). Place a batch of boards, in sequence, on the table saw. Insert dowel center plugs in the paired holes, butt the boards against the rip fence, and, using the miter gauge to keep the pieces square to the fence, press together to transfer the dowel center marks (Photo 5). Bore holes on the marks.

We used water-resistant plastic resin glue, which is nontoxic when cured, to join the boards. The glue dries quickly, so glue the pieces together in stages. We glued together two batches of seven boards, but three batches (5-4-5) work too.

Before gluing the boards together, set up six bar or pipe clamps to prevent fumbling once the glue is applied. Use protective wood pads behind the clamp heads. Apply the glue to both surfaces using a short-bristled 2-in.-wide brush (Photo 6). Allow the glue to dry overnight before joining the subassemblies (Photo 7).

Use a paint scraper to remove hardened glue, and use a very sharp plane

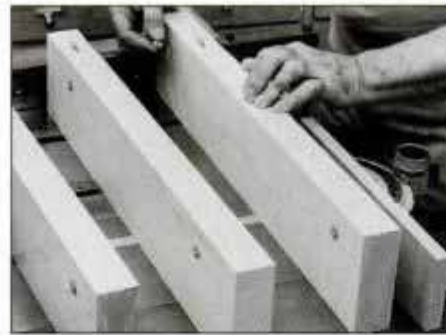
to level and smooth the top and bottom surfaces (Photo 8). Smooth the end grain with a belt sander and progressively finer belts in an 80-, 100- and 120-grit sequence.



1 Beware of sniped areas on board ends. These will interfere with face gluing the top, so mark them and cut them off.



3 Edges become top and bottom surfaces after glue-up. To make surfaces easier to plane, mark and align grain direction.



5 To mark dowel centers, align grain on boards, butt them to table saw fence and push them together using miter gauge.



7 Once the glue is dry, glue and clamp the two groups of boards. Keep clamps off top by using thin strips of wood.

Round the sharp corners with a router and a 1/4-in.-rad. rounding bit. Work the vertical corners first, then round the top and bottom ends, and finish by cutting with the grain.



2 Prepare the stock for ripping by jointing one edge. If jointer tears out edge grain, reverse the board end for end.



4 Rip boards to slightly wider than finished width using a kerf splitter to reduce pinching. Then joint to remove saw marks.



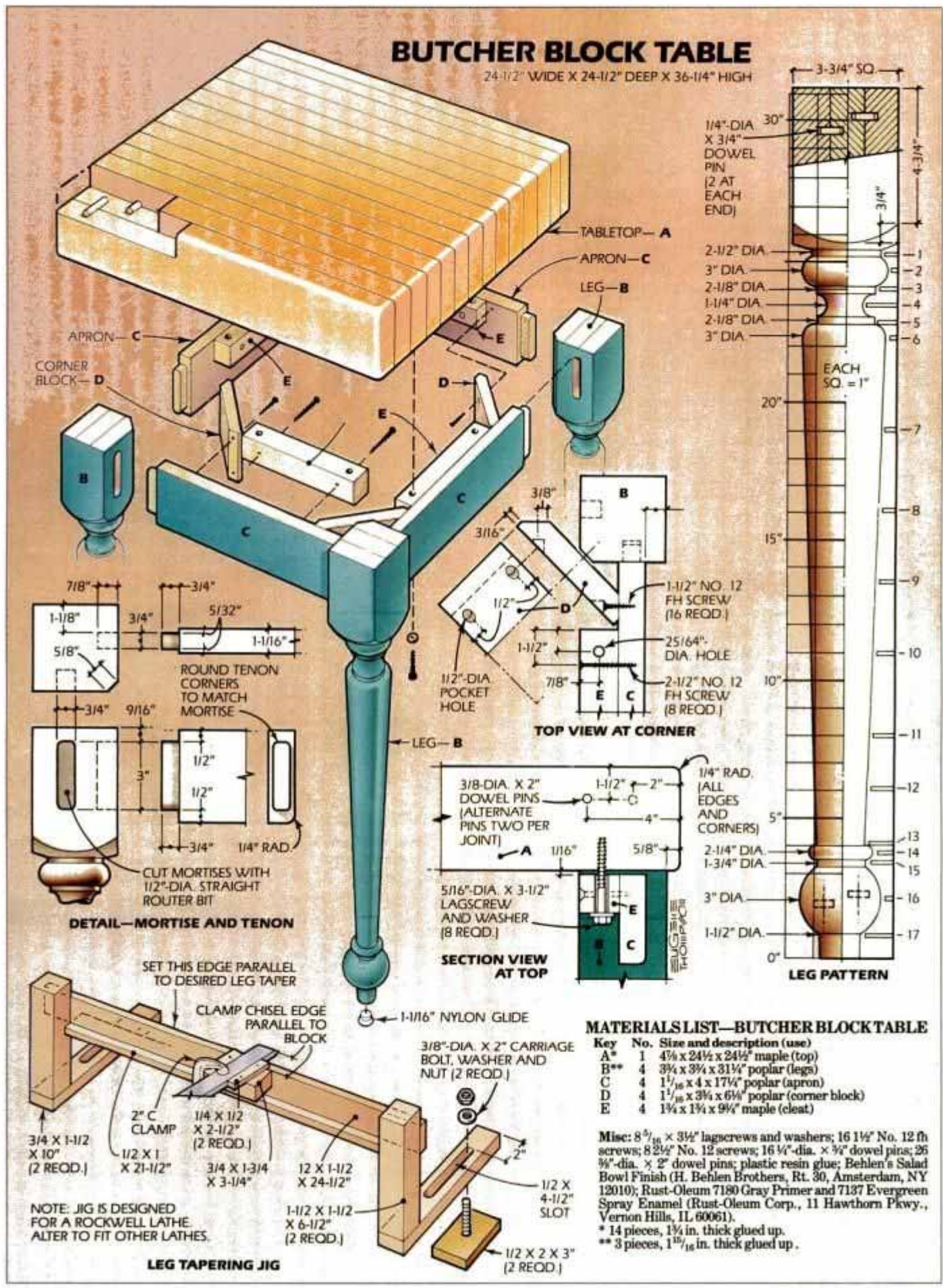
6 Quickly spread plastic resin glue with a short-bristle brush. Glue and clamp together top in at least two groups.



8 Aligning edge grain pays off during surface planing. Scrape off hardened glue, and surface top with a sharp smooth plane.

BUTCHER BLOCK TABLE

24-1/2" WIDE X 24-1/2" DEEP X 36-1/4" HIGH



MATERIALS LIST—BUTCHER BLOCK TABLE

Key	No.	Size and description (use)
A*	1	4 3/4 x 24 1/2 x 24 1/2" maple (top)
B**	4	3 3/4 x 3 3/4 x 31 1/4" poplar (legs)
C	4	1 1/16 x 4 x 17 1/4" poplar (apron)
D	4	1 1/16 x 3 3/4 x 6 1/4" poplar (corner block)
E	4	1 3/4 x 1 3/4 x 9 3/4" maple (cleat)

Misc: 8 5/16 x 3 1/2" lagscrews and washers; 16 1/2" No. 12 fh screws; 8 2 1/2" No. 12 screws; 16 1/4"-dia. x 3/4" dowel pins; 25 3/8"-dia. x 2" dowel pins; plastic resin glue; Behlen's Salad Bowl Finish (H. Behlen Brothers, Rt. 30, Amsterdam, NY 12010); Rust-Oleum 7180 Gray Primer and 7137 Evergreen Spray Enamel (Rust-Oleum Corp., 11 Hawthorn Pkwy., Vernon Hills, IL 60061).
 * 14 pieces, 1 3/4 in. thick glued up.
 ** 3 pieces, 1 10/16 in. thick glued up.

The Legs

Make the leg blanks by gluing together three pieces of 6/4 stock \times 37/8-in.-wide (like the top, position the edge grain facing the same way on the leg blanks). This results in a blank $3^{15}/16$ in. thick. Trim the blanks to $3\frac{3}{4}$ in. square on the jointer.

Cut the mortises in the blanks before turning the legs. Mark the mortises with a square and sharp pencil or a marking gauge. We cut them with a plunge router equipped with a template guide bushing and a 1/2-in.-dia. straight bit (Photo 9). The template is made from lauan plywood and a couple of scrap blocks. Make the template to suit your router setup. Clamp it to the leg tops, and flip it end for end to cut the off-center mortises.

Next, mark the center on both ends of the blanks, and set the table saw blade at 45°. Make stopped cuts at each corner, to within 10 in. of leg top (Photo 10). Cut off the waste with a handsaw. Cut the small bevel on the inside of the legs, where the corner brace butts against it.

Tape a full-size pattern of the leg on a piece of cardboard. Mark the pattern as shown in the drawing, with depth grooves corresponding to the leg profile. Tack the pattern to the wall behind the lathe as a guide.

Make the legs' rounded shoulder cuts using a skew chisel. Make a starting nick at the upper end of the shoulder holding the skew with its long end (the toe) down and the heel up.

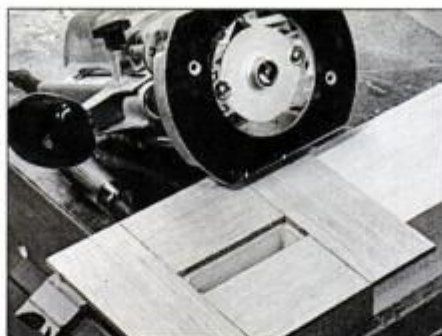
Slowly allow the toe to make contact. Then, rest the skew flat on the toolrest with the toe to the right, and push it gently into the leg (Photo 11). Finish the shoulder by pivoting the skew.

Next, shape the leg into a cylinder with a gouge. Pivot the gouge to the right and take a thin cut as you move left to right down the toolrest (Photo 12).

Stop the lathe, and measure from your left to make pencil marks on the blank corresponding with the depth grooves on the pattern. Start the lathe, and touch the pencil to the blank on the marks (Photo 13).

Set an outside caliper to about 1/8 in. more than the diameter at each depth groove location. Cut the depth grooves with the parting tool, and check them with the calipers (Photos 14 and 15). Back off from the cut periodically to avoid overheating the tool's tip.

With the depth grooves completed, shape the leg's beads and coves with round-nose and spear-point tools piv-



9 Clamp the mortise template to the leg. Cut the mortise using a plunge router, guide bushing and straight bit.



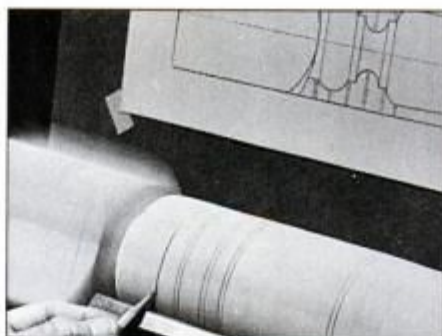
10 To make turning large leg blanks easier, make stopped bevel cuts on the table saw. Cut off scrap strips with a handsaw.



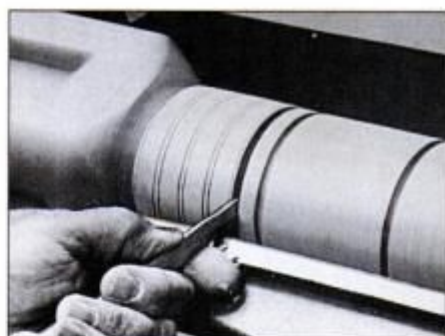
11 Shape shoulder in two steps. First, use skew vertically, with toe forward. Then, hold skew as shown, taking a thin cut.



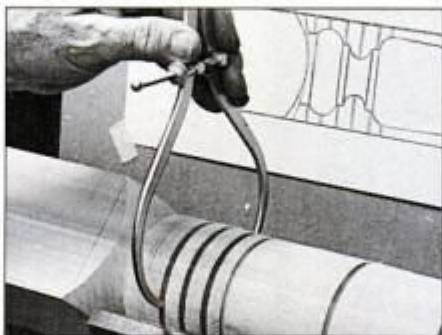
12 Rough the leg into a cylinder. Pivot the gouge to the right, and keep its bevel against the spinning workpiece.



13 First, mark depth groove locations with leg stopped. Then, to darken marks, touch pencil to the leg while it spins.



14 Cut on pencil marks using a parting tool. To prevent overheating the tool's tip, back off periodically to let it cool.



15 Check diameter at depth grooves using an outside caliper. Set caliper width a little larger than grooves on drawing.



16 Cut beads and coves using depth grooves as guides. Cut cove with a round-nose chisel held straight and pivoted.

oted as required (Photos 16 and 17).

The leg's long taper is shaped in a 3-step process. First, get it as close as you can to finished shape with the gouge.

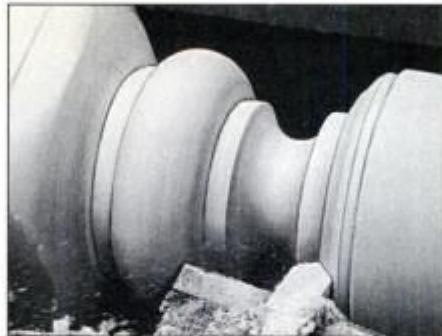
Next, using the skew, turn two narrow bands to finished diameter at opposite ends of the taper.

Finally, use a leg-tapering jig to bring the taper to final shape (Photo

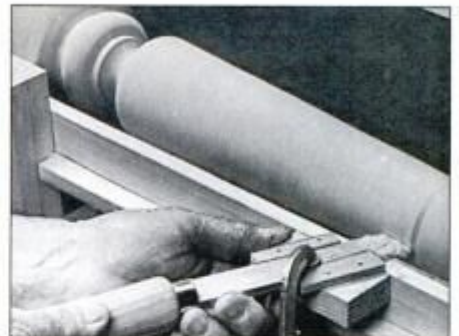
18). I designed the jig to fit my Rockwell-Delta lathe. You may have to alter the design to fit your machine.

The jig consists of a block that slides on a long toolrest. The toolrest height is equal to the leg's centerline, and it is sloped to parallel the leg's taper. The skew chisel is positioned at an angle on the block by two strips of wood. To ensure it won't overcut, the skew is set for a thin cut and held in place with a C-clamp.

Finish sand the legs first with 120-, then 180- and finally 220-grit sandpaper torn into strips.



17 Use a spear-point chisel to shape the convex curve at top of leg. Move the tool with its point leading into the waste.



18 After taper is roughed down with a gouge, trim it to final size and smoothness using a skew chisel on a sliding jig.

Aprons, Assembly And Finish

Cut the aprons to dimension. Using a dado blade in the table saw and a stopblock on the miter gauge, cut the apron tenons (Photo 19). Use a chisel to round the tenons to fit the mortise.

Glue and clamp two pairs of legs, each spanned by an apron. When the glue is dry, glue and clamp them with the other two aprons (Photo 20).

Rip and miter the corner blocks. Bore pocket holes in them on the drill press using the fixture shown. To make the fixture, cut two 45° mitered guide blocks, and nail the large guide block on a scrap piece of plywood. It's important the larger guide block be 1 3/4 in. thick. Next, mark a centerline across the larger guide block's width. Measure 5/8 in. from the guide block's edge, and mark a second line so it crosses the centerline. Bore on the intersection of the lines with a 1/2-in.-dia. bit.

Slide a corner block against the guide block. To determine the position of the second (and smaller) guide block, mark the corner block's mitered thickness on the plywood base. Nail the second guide block to the base with its edge on the line.

Mark each corner block's long face with two lines, each 1/2 in. from the block's edge (as shown). Slide a corner block into the fixture. Match the line on the corner block with the line on the guide block, and bore the pocket and pilot holes (Photo 21).

Hold the corner blocks to the aprons with a clamp and a notched block on the leg (Photo 22). Bore the pilot holes in the aprons, and attach the corner blocks.

Rip and crosscut the cleats, and bore the holes for fastening the cleats to the aprons and the top. Clamp the cleats in place to bore the pilot holes in the aprons. Glue and screw the cleats to the aprons.

Place the top upside down slightly

overhanging the bench on two adjoining sides to permit clamping the leg assembly on it. Center mark the lag-screw holes in the top by pressing the point of the 25/64-in. drill bit through the holes in the cleat and boring a shallow hole (Photo 23).

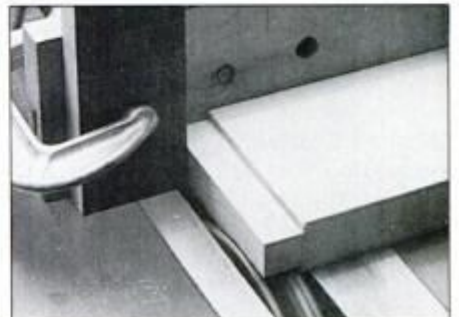
Remove the leg assembly, and use a drill guide to bore the 1 7/64-in.-dia. holes for the lagscrews in the top.

Finish for the top is optional. We applied several coats of Behlen's Salad Bowl Finish with a lintfree cloth.

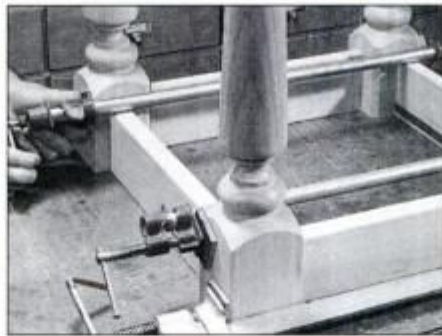
We finished the legs and aprons with two coats of Rust-Oleum Wood Saver Evergreen Spray Enamel over a basecoat of gray primer. These oil-based paints contain Teflon.

When all the parts are finished, lag-

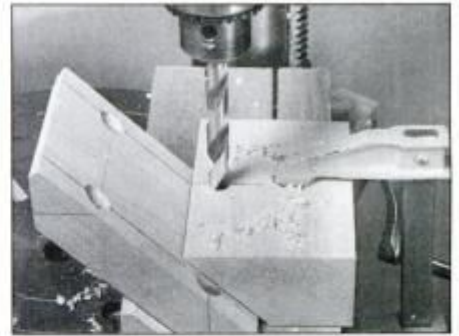
screw the top to the leg assembly. The clearance between the 5/16-in. lagscrews and the 25/64-in. holes in the cleats allows the top to expand and contract with changes in humidity. **PM**



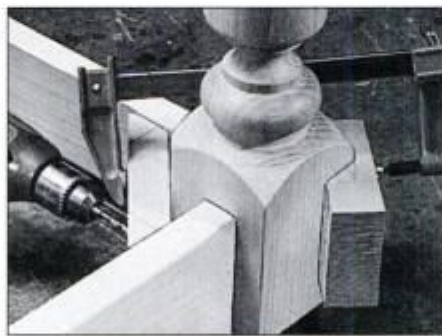
19 Cut apron tenons with dado blade mounted in table saw. Butt each apron against stop to cut face and edge.



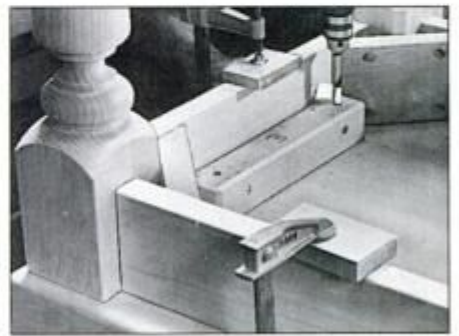
20 Glue and clamp aprons to legs. Use wood blocks under clamp heads, and position clamps inside and outside of legs.



21 Bore holes in corner blocks using fixture. Note that the line on corner block is continuous with the one on the fixture.



22 Extend pilot holes through corner blocks into aprons. Hold corner block with fast-action clamp and a notched block.



23 Fasten the cleats to the aprons with glue and screws. Center mark the pilot holes in the top with a 25/64-in. drill bit.

**LANDSCAPING
TREE
REMOVAL**

BY CLIFF GROMER
PM Illustrations by
George Retseck

● When Joyce Kilmer wrote that he'd "never see a poem as lovely as a tree," he didn't have in mind a tall pine raining sappy needles all over his car, raking mountains of leaves in the fall or listening to a snow-laden elm creak in a high wind as it threatens to crash through the roof of his house.

Your own yard may have problem trees that present a hazard to property and personal safety, and would be better off removed. Should you attempt the job yourself? Felling a tree in your yard is not the same as it is in the forest. A tall tree may have to be removed in sections and felled in a precise manner to avoid crashing down on power lines, roadways and nearby houses.

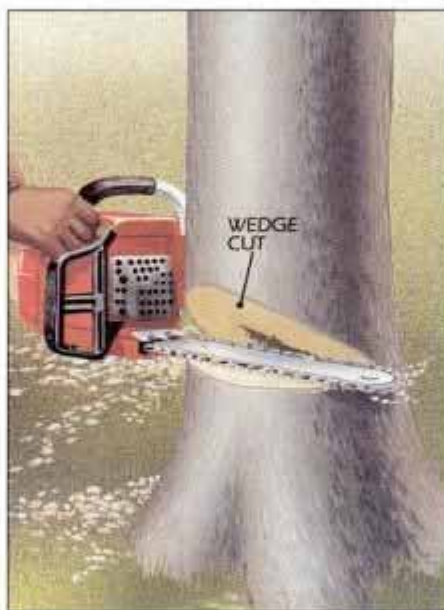
Once the tree is down, you'll have to contend with cutting up the trunk and branches, and disposing of all the waste wood—not to mention removing the stump. Of course, you can rent the equipment that a pro would use to handle the job. However, it's likely that you'll find the rental costs, specialized knowledge and hard work required make hiring an expert a real bargain.

Getting the right people for the job also takes some knowhow. First, make sure that the company carries liability insurance. Without this, personal injuries to anyone (including those hired to do the work), or damage to nearby property, can open you to a serious personal lawsuit. And, don't just take the company's word on insurance—ask for a copy of their insurance certificate.

While costs can vary depending on location, you're better off paying a flat rate for the entire job rather than paying on a time-and-materials basis. This way, you know the total cost before you start and can shop around to find the best deal. As a rule, you can expect to pay about \$500 to \$600 per 8-hour day, which includes the crew and equipment. You shouldn't have to pay anything before the work starts, and it's a good idea to look for a company that's been in business for a while and has references you can check.



Felling a tree in a residential area requires experience and the right equipment. The first step is to remove the branches from the bottom up. Then, the tree is cut down in sections.



Wedge cut on side of tree determines felling direction. Wedge is no less than 45° and extends about 1/4 of trunk diameter.



Back cut is slightly above wedge apex. Cut stops about 1/8 of trunk diameter from wedge. Wood at hinge area controls fall.

How it's done

Where a tall tree can't easily be felled due to potential damage to property, it's removed in sections. The first step is to remove the branches—working from the bottom up to avoid getting the upper branches entangled in the lower ones. A cherry picker (truck-mounted hydraulic lift similar to those used by utility companies for servicing overhead wires) and a chain saw are the standard tools for this work. Alternatively, some pros use a rope and climbing saddle, and cut the branches with a handsaw. Large branches are best lowered to the ground with a rope rather than letting them fall.

Once the trunk is cleared, sections are cut off starting at the top. Where the trunk diameter is small, 4-ft. lengths are cut—this length is reduced as the wood gets thicker and heavier. One common technique is cutting about $\frac{3}{4}$ of the way through the trunk with a chain saw, and finishing the cut with a handsaw. Another method is to cut the section $\frac{1}{2}$ through, tie a rope around it and have helpers on the ground pull and break off the log. Covering the ground with large branches helps to protect the lawn and also makes it easier to pick up and move trunk sections.

If space permits, an entire tree or large sections can be felled and then cut up on the ground. To ensure that the tree will fall as intended in a confined area, pros frequently tie a rope around the tree near the top, cut the trunk and then pull the tree down in the desired direction. The actual cut made in the trunk also controls the fall. First, a wedge that extends about $\frac{1}{5}$ to $\frac{1}{4}$ of the way into the trunk is cut on the side facing the fall. It's made up of a top cut that's angled at about 45° and a bottom cut that's roughly level. The finished wedge should be no less than 45° . The back cut, or felling cut, is made on the opposite side and slightly above the apex of the wedge cut. It extends toward the wedge cut but stops short a distance of about $\frac{1}{3}$ of the trunk diameter. The wood remaining between the wedge cut and the back cut acts as a hinge that directs the tree's fall. Trees that are balanced toward the back cut often require wedges or levers to start the fall in the right direction.

Once down, the tree is bucked (cut into manageable lengths). To buck a log that's off the ground but supported at the ends, pros cut a wedge on top and complete the cut from underneath. Logs on the ground are cut



A heavy-duty chipper is the fastest and most efficient tool for clearing tree limbs. The mulch that's produced is fed into a dumptruck or large trailer for disposal.

halfway through from the top, then the log is rolled over and the cuts are finished. To move around heavy logs, tongs are used. These look somewhat like old ice tongs and come in one- and 2-person models.

Cleaning up

At this point, the ground will be littered with more branches and sticks than you believed could possibly come from a single tree. All of this gets fed into the chipper—a very efficient, and dangerous, shredding machine. Because it generates such a large volume of mulch, a dumptruck or trailer is

needed to cart away the shavings.

Stump removal is best handled with a stump cutter or grinder. This powerful machine (a typical unit is at least 30 hp) has a large wheel that's fitted with carbide teeth. The cutting wheel is positioned hydraulically, and is moved back and forth over the stump until the wood is ground away to the desired depth. If you want to plant grass over the area, the grinder should work down to about 6 to 8 in. Increase the depth to about 1 ft. for a paved driveway. After removing the sawdust and chips, the hole is filled with stones and soil. **PM**



After the tree is down, the stump should be removed. A stump grinder is a powerful, carbide-tipped grinding machine that cuts away the stump to below ground level.

TOOL TEST

**DREMEL
DISC/BELT
SANDER**

TEXT AND PHOTOS BY
ROSARIO CAPOTOSTO,
Contributing Editor

● If you're in the market for a bench-top sander that handles typical light-duty wood smoothing—and a machine to handle grinding and sharpening chores as well—then the Dremel 1731 sander may be just what you need.

This die-cast aluminum tool combines the functions of a 1-in. belt sander and a 5-in. disc sander. A 1/5-hp induction motor drives the belt at 3150 sfm (surface feet per minute), and the disc at 3450 rpm.

For firmly supporting your work at the right angle, both the belt and disc sanders have tilting tables. The belt-sanding table tilts up to 60°, and includes a sliding plate that can be adjusted to minimize the gap between the table and belt. A platen behind the belt provides support for normal work, or the platen can be removed for flexible belt sanding.

The section of the belt over the upper idler wheel is well suited for smoothing inside curves. However, when the belt sander is used for grinding metal, the uncovered section of the belt at the idler wheel allows sparks and particles to stream directly out toward the operator. While safety goggles are a must for any power tool, this machine, and others like it, need a removable shroud that covers the idler wheel during grinding. Wood sanding is less of a problem, and the machine does have a dust-collection port for attaching a vacuum.

The belt sander does an excellent job at sharpening turning chisels, deburring metal stock and handling other light-duty grinding jobs. With the platen removed, the belt flexes sufficiently to follow gentle curves in metal scrollwork.

You can adjust the disc-sanding table 45° up or down, or install a miter gauge in the table slot for accurate angle sanding. Combining the table tilt and miter-gauge angle provides compound angle sanding. The disc runs remarkably true and steady, and produces fine surfaces when sanding outside curves.



The Dremel 1731 disc/belt sander is a well-constructed, moderate-duty tool that smooths and shapes both metal and wood. It's powered by a 1/5-hp induction motor.



Belt-sander table tilts to 60°. Sliding insert permits adjusting the gap between belt and table to properly support small work.



Lathe chisels are quickly sharpened on the belt sander. Unlike wheel grinders, the belt sander produces flat-ground bevels.



Exposed top idler wheel of belt sander acts like a drum sander for shaping and smoothing inside curves on wood and metal.



The disc-sander table tilts 45° up or down. In conjunction with the miter gauge, precise compound miters can be sanded.

The Dremel 1731 disc/belt sander costs about \$130. Accessories available include a buffing belt that replaces the sanding belt, buffing compounds and a drill-bit sharpener. If you're only interested in the belt-

sander half, Dremel offers the model 1631. In place of the disc sander, there's a 3450-rpm power takeoff for an optional flexible-shaft tool. For more information, contact Dremel, 4915 21st St., Racine, WI 53406. **PM**

APPLIANCE CLINIC

BY STEVE TOTH,
Contributing Editor

Cracked Seal

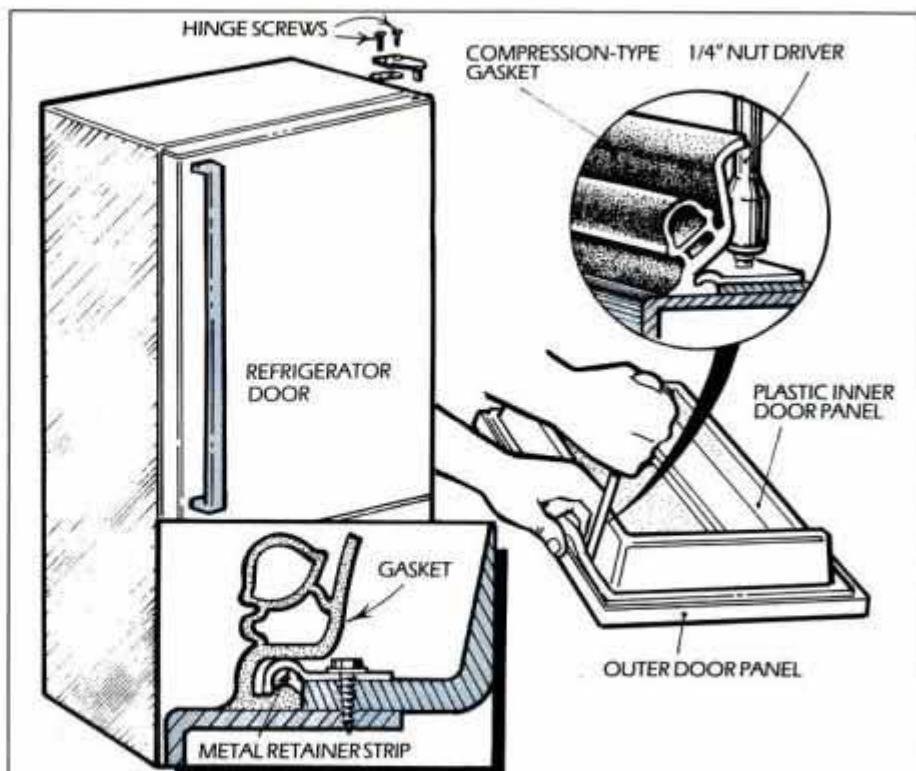
Our 1968 GE No-Frost Refrigerator model No. TCF-15DD-B, serial No. VG677743, has a crack in the rubber door seal. If I can obtain these seals, can I do the job myself?

STANLEY CZAPLINSKI
HYDE PARK, NY

Replacement door gaskets for your refrigerator are still available. The refrigerator door gasket is GE part No. WR24X222, and the freezer door gasket is GE part No. WR24X205. The cost for both is about \$100. They can be ordered from the GE National Parts Center at (800) 626-2002 or from a GE parts distributor.

Your refrigerator has gaskets held in place by metal retainer strips and

(Please turn to page 58)



Remove refrigerator and freezer doors. Peel back old gasket, and remove retainer strips and screws. Soften new gaskets in warm water, then install them.

PH ILLUSTRATION BY ED LIPINSKI



Yale. It's like having a security guard on your door.

A Yale lockset will protect your home. Giving you peace of mind whether you're inside or out. And at this Kmart price, you'll save money, too.

Yale Deadbolt lockset, single cylinder, full 1" bolt, steel reinforced, for use on wood or metal doors, in antique or bright brass finish.

Sale price 9.97

Yale Entrance lockset, pin tumbler security, easy to install, for use on wood or metal doors, in antique or bright brass finish.

Sale price 9.97

On sale October 6-19, 1991, at all U.S.A. Kmart stores.

The quality you need,
the price you want.



1/4-in. hexhead screws.

Lay the gaskets flat in your bathtub. Soak them in hot water for about 10 to 15 minutes to soften them. Unplug the refrigerator and empty its contents into an ice chest.

Close both doors and remove the two screws that hold the top refrigerator door hinge in place. Lift up the refrigerator door off the bottom hinge. Lay the door face down on a table covered with a blanket.

Take the new gaskets from the hot

water, and dry them. Lay them on the floor to cool down to proper shape. Roll back the old gasket to expose the hexhead screws and retainer strips. Loosen the screws about 1/2 in. with a 1/4-in. nut driver.

Slip out the old gasket. Start at one corner and gently push the gasket under the lip of the retainer strip until the gasket is properly seated along the perimeter. Retighten the screws.

Reinstall both doors and check for proper alignment. If the door gasket

doesn't contact the front of the refrigerator properly, loosen all the screws a turn and flex the door into shape so it fits the front.

Now, tighten every other screw and recheck the alignment. After the door is aligned properly, or there is a gap at the door's top or bottom, go back and tighten the remaining screws. Also check the hinge side of the gasket. If when you close the door, the new gasket surface sticks or catches on the refrigerator's front, rub the cabinet front and the gasket with paraffin wax. The wax allows the gasket to slide and make a good seal.

Turntable Binds

We have a Panasonic microwave oven "The Genius," model No. NE8070. Recently, the turntable mechanism has been making noises as if the motor or rotating action is binding during use. Is there anything I can do to fix this problem?

M.B. DODD
PEACHTREE CITY, GA

According to Panasonic, there is nothing that a consumer can do to correct the problem. The noise may be coming from the motor or the gear for the motor, or a part may need lubrication. The microwave needs to be opened up and evaluated.

The company recommends against consumers attempting to repair their own microwave ovens. You can contact Panasonic at (800) 447-4700 for the location of a service facility.

New Pans

Our old Dixie stove model No. 720-7S-C, serial No. 623667, works fine but the white porcelain inserts around the burner heads are discolored. Where can I buy new ones?

DAVID B. SMALL
SPRINGFIELD, MA

I suggest you send the old pans for re-porcelainizing to one of the companies listed below. Contact: Lansdale Porcelain Enamel Co., Sixth and Iron St., P.O. Box 188, Lansdale, PA 19446, (215) 855-6889; Cherokee Porcelain Enamel Corp., 5300 Homberg Dr., Knoxville, TN 37919, (615) 588-3553; or Prizer-Painter Stove Works, Inc., 600 Arlington St., Reading, PA 19611, (215) 376-7479. **PM**

DO YOU HAVE AN APPLIANCE PROBLEM? Just ask Steve about it. Send your question, along with the model and serial numbers, to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, NY 10019. While letters cannot be answered individually, problems of general interest will be discussed in the column.



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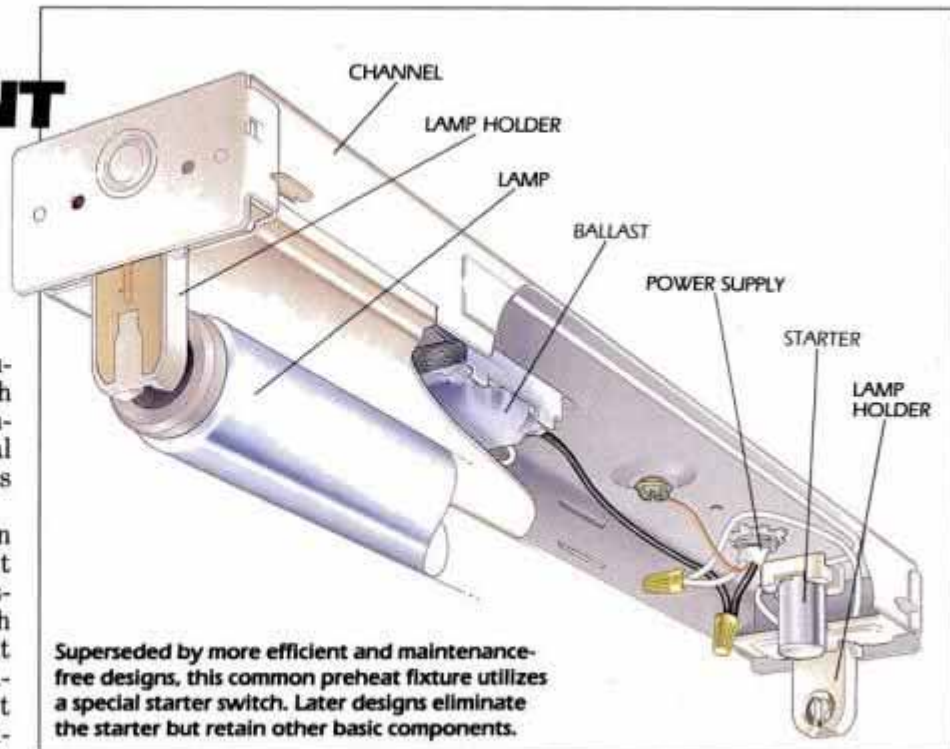
FLUORESCENT LAMP

BY MERLE HENKENIUS
PM Illustrations by Eugene Thompson

● Have you ever wondered how a fluorescent light works? Even though they're nearly as commonplace as incandescent fixtures, their unusual shape and well-known idiosyncrasies make them seem more mysterious.

There's more than a difference in appearance separating fluorescent and incandescent lamps. An incandescent bulb generates light through heat. When enough electrical current passes through the tungsten filament, it heats to the point where it glows and gives off a flattering yellow-red light. To keep the filament from burning up immediately, it's housed in a vacuum. Even so, the intense heat of the filament ensures a comparatively short and expensive life span.

A fluorescent lamp has no filament running through it. Instead, cathodes (coiled tungsten filaments coated with an electron-emitting substance) at each end send current through mercury vapors sealed in the tube. Ultraviolet radiation is produced as electrons from the cathodes knock mercury electrons out of their natural orbit. Some of the displaced electrons settle back into orbit, throwing off the excess energy absorbed in the collision. Almost all of this energy is in the form of ultraviolet radiation.



To turn this radiation into visible light, the inside of the tube has a phosphor lining. The phosphors have the unique ability to lengthen UV wavelengths to a visible portion of the spectrum. Put another way, the phosphors are excited to fluorescence by bursts of UV energy.

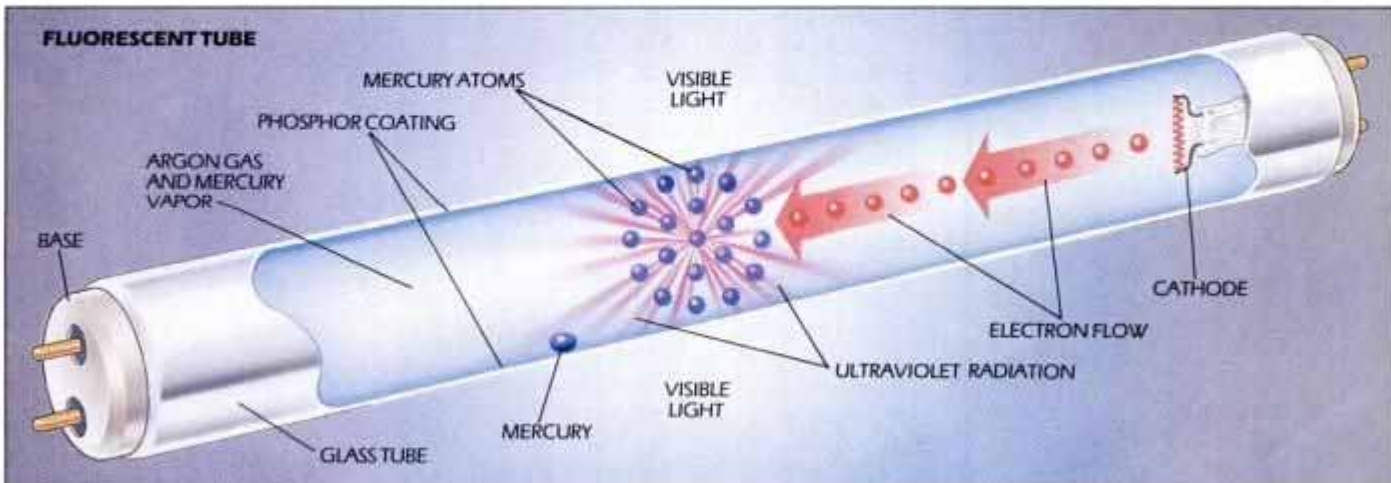
The easiest fluorescent fixture to explain is a design offered by Sylvania in 1938. This early preheat model is no longer made, but millions are still in service, and its principal design features are found in every new fixture.

Preheat fixtures

The heart of every fluorescent fixture is its ballast. The ballast consists of a wire winding on an iron core, which

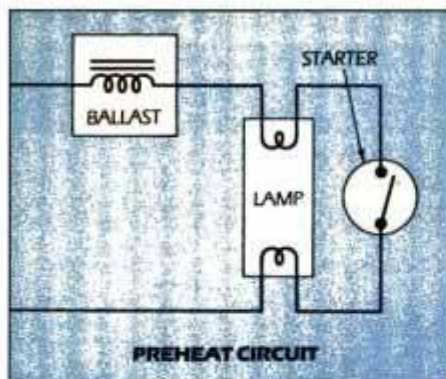
reduces and regulates the voltage that flows through it. Electrical current enters the fixture through the ballast. From there, it flows through wiring to lamp holders and, ultimately, to cathodes within the tube.

However, more power is required to start a fluorescent lamp than to maintain it. Preheat fixtures get their name from a starting circuit that sends increased current through the cathodes to heat their coated filaments. The heated cathodes send a high-voltage pulse along the tube that creates an arc through the mercury vapor. As the atmosphere inside the tube heats up, electron activity increases to its most efficient, ballast-sustained level, and the mercury va-



Typical fluorescent tube is filled with inert gas and a small amount of mercury that creates vapor. Generating fluorescent light occurs in two stages. First, electrons emitted from cathodes create an electrical

arc through mercury vapor. Then, resultant ultraviolet radiation strikes phosphor coating which then gives off visible light. Bi-pin bases are necessary for preheat and Rapid-Start fixture designs.



Original preheat circuit uses a starter. When starter switch is closed, current runs through and heats cathodes. When arc through tube is established, switch opens.

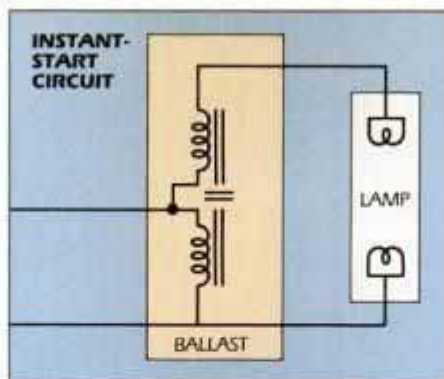
por carries the current on its own. The starting circuit is controlled by a starter switch that opens after a short preheat period (see preheat starter circuit diagram).

A variation of the starter-switch concept can be found in small desk lamps. Here, however, the starter switch is manual—you simply hold down the switch button until enough heat is generated to sustain the arc through the mercury vapor.

Instant- and Rapid-Start lamps

Beyond the starter mechanism and a little fine-tuning, subsequent fluorescent fixtures have changed very little. Both the Instant-Start (1944) and the Rapid-Start (1952) versions are merely adjustments to improve reliability and reduce maintenance.

Instant-Start fixtures have ballasts



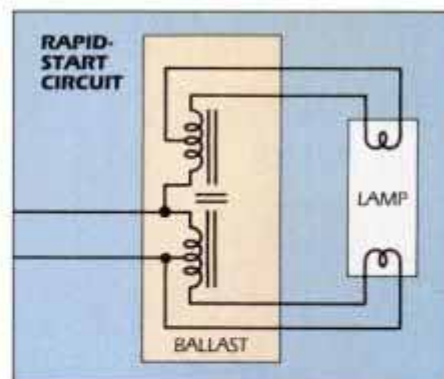
An Instant-Start fixture needs no starter switch. It uses a special ballast that supplies enough energy to start and maintain the electrical arc through the tube.

with continuous output high enough to strike an arc instantly. Because no preheating occurs, Instant-Start tubes need only one pin at each end. While some Instant-Start tubes have bi-pin bases, the pins are joined at the base. In this case, they're merely structural and not electrical (see Instant-Start circuit diagram).

Modern Rapid-Start fixtures are also designed without starters, though they are true bi-pin/preheat fixtures. They have smaller, more efficient ballasts with built-in heating windings that preheat the cathodes for quick starts (see Rapid-Start circuit diagram).

A fluorescent overview

Fluorescent tubes have several real advantages over incandescent lamps. They are a good deal more efficient, producing more light per watt of input



Newer Rapid-Start fixture is similar to preheat type, but without starter. Ballast has separate winding that heats the cathodes to start the electrical arc.

than incandescents. While a standard incandescent bulb might last 1000 hours, a fluorescent lamp might last 9000, with 6000 to 7500 hours being average. In fact, the number of hours that a tube operates has less of an effect on tube life than the number of starts it endures.

The greatest hesitation that most of us have about fluorescents is the ghoulish-green light given off by cool-white lamps. Warmer, more flattering lamps have been around for years, but they generally produce less light, and are more expensive to operate.

Recent advances have solved the color-versus-efficiency quandary. New rare-earth phosphors, applied in layers, now put warm-tone lighting in the high-efficiency category. You'll easily pay three to four times more for the tubes than for cool whites, but you'll also use less energy. **FM**

BOOK REVIEW

OLD HOUSE CATALOGUE

● *The Seventh Old House Catalogue* is a supermarket for people restoring an old house. Alphabetically arranged, this book offers 200-plus pages of goods from lumber, to custom-made hardware, lighting, door-knobs and plumbing, including the kitchen sink. Also included are service firms, such as those that restore ironwork.

For people embarking on their first restoration, the book also functions as a basic dictionary, defining terms such as barge board and niche cap.

Photographs and drawings of products and, in places, of historic buildings spice up the text. The catalog concludes with 500 suppliers of ser-

vices and materials, listed in alphabetical order.

Among the book's nice surprises are products and services that don't directly relate to the restoration of the house itself. For instance, I found a source for hitching posts, gazebos and handmade fireplace bellows. Tucked toward the catalog's end is a source for sundials, ranging from the proverbial garden variety to one 27 ft. across.

The only minor complaint I have with this book is the self-congratulatory talk that appears on its back cover and in the introduction. These blemishes are easily overlooked, however. Incidentally, the catalog is not related to the one published in Brooklyn, New York, by the magazine *The Old-House Journal*.

The Seventh Old House Catalogue delivers much useful information for its price of about \$15. It's sold at bookstores and through Sterling Publish-

ing Co, Inc., 387 Park Ave. S., New York, NY 10016-8810 (shipping is extra if ordered through Sterling).

—Roy Berendsohn

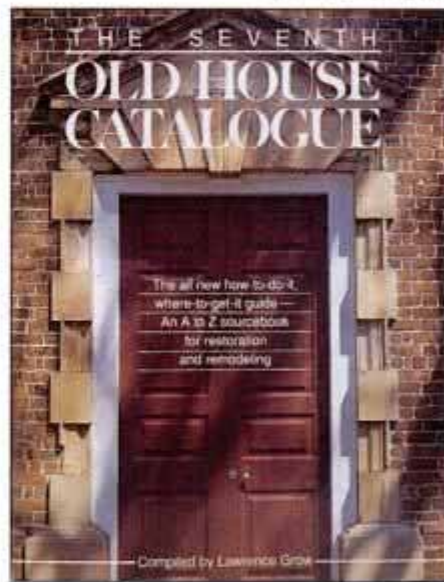


PHOTO BY ROSARIO CAPOTOSTO

HOMEOWNERS CLINIC

BY NORMAN BECKER, P.E., Contributing Editor

Septic Seepage Pit

I would appreciate your answer to the proper installation of a seepage pit regarding the crushed stone that is applied around the block liner. How many inches should be applied around the block liner?

JUDY SMITH
GLENORA, CA

For our readers who are unfamiliar with seepage pits, a pit is used instead of a leaching field in residential sewage disposal when the lot the house is located on is too steeply sloped to allow building a field. The pit allows effluent to percolate into the ground the way a leaching field does, but it takes up less surface area. Sewage leaving a house settles in a septic tank before it flows into the pit.

The pit's bottom should be filled with 6 to 12 in. of coarse gravel, and the space between the pit liner and the surrounding soil with 3 to 6 in. of coarse gravel. The specific amount of gravel depends on local codes.

GFCI Questions

My TV and VCR are plugged into an outlet that my kids can reach. Although it has a childproof cover, would I gain additional protection from a ground fault circuit interrupter outlet? Are there disadvantages, other than cost, of having a GFCI breaker in the panel box versus one in an outlet?

RAY NOEMER
RANDOLPH, NJ

A GFCI outlet receptacle certainly provides additional protection against a shock hazard. To do this, the circuit in a GFCI monitors the current in the "hot" and "neutral" lines. Under normal conditions, these two currents are always equal. If the circuit detects a difference between them as little as 5 milliamps, it interrupts the power in as little as one-fortieth of a second. However, childproof covers on an outlet are effective, and it shouldn't be necessary to install a GFCI outlet.

A GFCI receptacle has one advantage over a GFCI installed in a circuit breaker. The GFCI circuit breaker monitors the branch circuit. With it, there is a greater chance of nuisance tripping caused by a buildup of leakage currents due to deteriorated or damaged sections of insulation, multiple splices and moisture accumulation. When a GFCI breaker trips, the entire branch circuit goes out. Whereas when a GFCI receptacle trips, it deenergizes just itself, or the rest of the branch circuit that follows it, depending on how the electrician has it installed.

Drilling Holes In Ceramic Tiles

How do you drill holes in bathroom wall tiles? I would like to put rails in the shower area. I'd appreciate any advice.

MRS. D. V. PHILLIPS
CAMARILLO, CA

One method is to place a finish nail on the tile, and tap it with a hammer to score the glazing. Bore on the scored mark with a masonry bit.

The second method is to simply buy a carbide- or diamond-tipped drill to bore the hole. Using these bits eliminates the need to score the glazing. The diamond-tipped drill is more expensive but preferable to the carbide-tipped bit.

Both bits are available at hardware stores and industrial suppliers. Use a variable-speed drill when using these bits so that you can drill at a slow speed.

Health Tip

Lead contamination of tap water in homes is the focus of increasing public concern. According to the EPA, lead is one of the greatest health threats to children. As such, the EPA has mandated testing of all drinking water sources in schools and day-care centers. The University of North Carolina at Asheville (UNCA), through a grant from the Clean Water Fund of North Carolina, is conducting a study of lead contamination in household tap water.

UNCA has analyzed the tap water in more than 4000 homes, most of which are in North Carolina. The test consists of two samples. The first test samples water after it has been sitting in the pipe for at least 6 hours. The second (purged sample) is taken by drawing water after it has been flowing from the tap at a high rate for at least 1 minute. Early research results show the following:

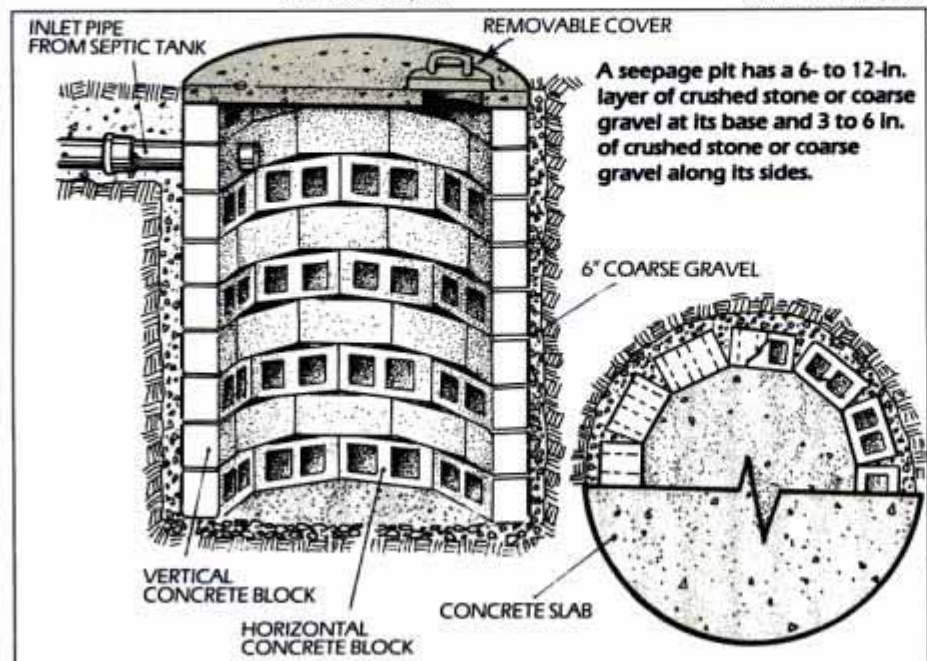
- About 30% of homes have high lead concentration in the first draw. Purging corrects the problem 90% of the time.

- High lead concentrations have been found in homes with plastic-pipe (PVC) plumbing systems, implicating faucet fixtures as a contamination source.

*UNCA is expanding its study and analysis to the national level. It provides homeowners with an unprecedented opportunity for low-cost testing. For your test kit, send \$12 to CWF-NC, Dept. PM, 138 E. Chestnut St., Asheville, NC 28801. **PM***

DO YOU HAVE A HOME-MAINTENANCE OR REPAIR PROBLEM?

Just ask Norman about it. Send your question to Homeowners Clinic, Popular Mechanics, 224 West 57th St., New York, NY 10019. While letters cannot be answered individually, problems of general interest will be discussed in the column. For more home-repair and maintenance help, get PM's Home Care Guide, \$5.95 postpaid. Send your order(s) to Popular Mechanics, Box 1014, Radio City Station, New York, NY 10101.



**HOME
IMPROVEMENT**
**INSTALLING
WEATHER-
STRIPPING**

BY GENE & KATIE HAMILTON
PM Illustrations by
George Retseck

● A typical 20-year-old house with adequate attic insulation loses more energy to air leaks than from any other source. A barely noticeable 1/8-in.-wide gap around an exterior door is equivalent to a gaping hole in the wall.

Even in a newer house, weatherstripping wears out and becomes ineffective. Also, previous owners may have installed weatherstripping incorrectly, in which case it's best to replace it.

Of all the small projects around the house, installing weatherstripping gives you the largest payback, and it can be accomplished with minimal tools.

When the cold winter winds start to blow, you'll be glad you undertook this project because your home will be more comfortable. Also, it's good to know, when you get the first utility bill of the winter, that you've done all you can to reduce your heating costs.

**Preparing for
weatherstripping**

First, pry off old foam or rubber weatherstripping with a putty knife (Fig. 1). Spring-metal weatherstripping, on the other hand, may be worth saving. Pry it away from the jamb using a wide putty knife. If it looks like it



will make a good seal along the door, keep it. If it's bent, replace it.

Next, to remove dust and dirt, wash the doorjamb with detergent and water or a solution of trisodium phosphate and water. Scrape off the loose paint.

When the wood is dry, apply an alkyd primer to the bare wood.

Weatherstripping doors

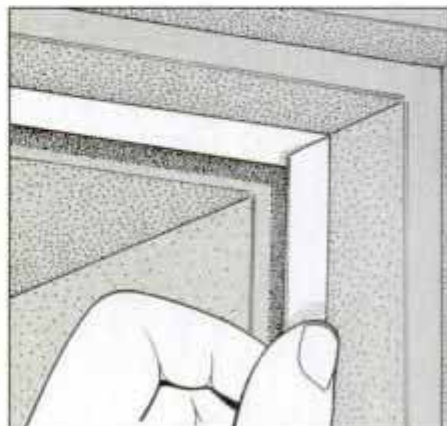
The most durable weatherstripping is the spring-metal type. A new version of this old standby is an easy-to-install



1 Pry loose old weatherstripping with a wide putty knife. Wash the doorjamb, and scrape off loose paint. Prime bare spots.



2 Peel off backing paper from under vinyl V-strip, and smooth it in place. Do the top jamb first, then do the side jambs.



3 Cut the protruding flap of the side jamb weatherstripping at a 30° miter. This way, side and top strip clear each other.

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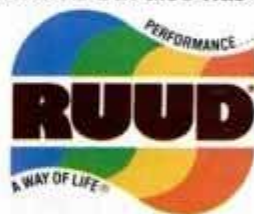
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vinyl V-strip that has an adhesive backing covered by a peel-off backing. One roll of V-strip is enough to seal a door or a few windows. To use this weatherstripping, fold it into a V with the adhesive to the outside.

If your door fits the jamb tightly, install the strips close to the doorstop with the point of the V toward the door. If the door is slightly warped, and doesn't contact the stop evenly, install the weatherstripping about $\frac{1}{8}$ in. back from the stop, to ensure it makes contact along the door's length.

Measure each of the jamb sides (they may be different), and cut two pieces of weatherstripping. Measure the top jamb, and cut a piece to fit.

Install the V-strip on the top jamb first. With both top and side pieces, peel off a foot or so of the paper backing from one end of the strip, and press it in place as you peel off the rest of the backing (Fig. 2).

At the top of the jamb, the side and top V-strip butt into each other. Trim the side strip at a 30° angle to allow the top piece to expand and meet the door (Fig. 3).

Doors with large gaps

If your door is not square in the frame or is severely warped, the V-strip will not be effective. In this case, apply tube-type weatherstripping to the doorstop. This weatherstripping consists of a vinyl or aluminum flange with a vinyl tube along the edge. With a warped door, you can bend the strips along the doorstop to seal it.

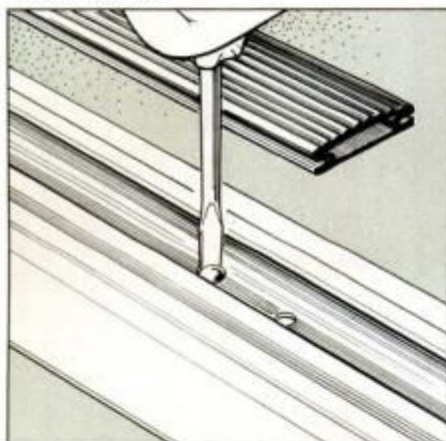
To install this type of weatherstripping, measure and cut the piece to fit the top jamb. Cut the aluminum or vinyl flange to the exact size of the jamb, but trim the vinyl tube so it's about $\frac{1}{16}$ in. long on each end. Close the door, hold the material snugly against the door, and nail it to the head and side doorstops (Figs. 4 and 5). Flex the weatherstrip so it con-



4 To seal a warped door, nail vinyl tube weatherstripping to the doorstop. Bend the tubing to follow the door's curve.



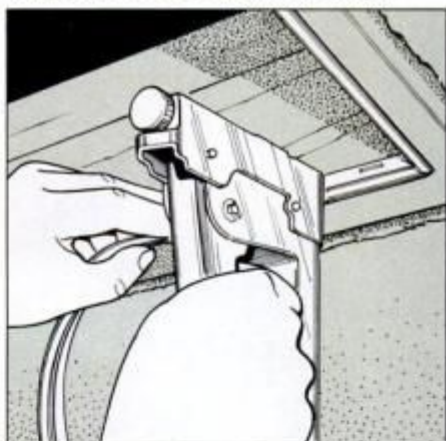
5 For doors that aren't warped, but fit the jamb poorly, use vinyl tube weatherstripping with extruded aluminum flange.



8 Screw aluminum threshold in place, and rehang door to gauge its clearance. Adjust threshold height by turning the screws.



9 Apply $\frac{1}{4}$ -in.-thick adhesive-backed foam rubber to the jamb of disappearing attic stairs to stop air leaks.



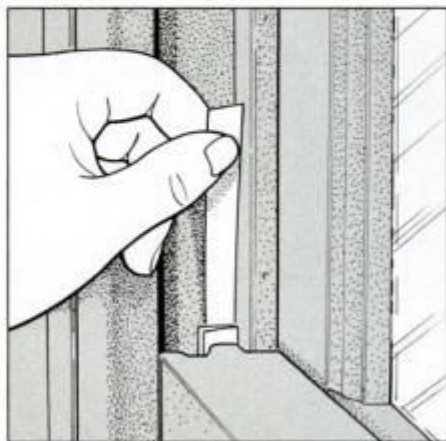
10 When the attic stair casing covers the jamb face, staple tubular vinyl weatherstripping inside the jamb.



14 Begin sealing inner sash by slicing backing paper about a foot down from top of V-strip. Fold paper back on itself.



15 Pinch legs of the V-strip flat, and poke end with folded backing paper into the small space between window and jamb.



16 After weatherstripping is in place between the window and jamb, lower the sash. Pull backing paper off top of strip.

forms to the contour of the doorstep.

Both the aluminum and vinyl extrusions can be painted to match the jamb, but don't paint the vinyl tube. Because the tube flexes as the door hits it, the paint will crack and fall off.

Sealing the door bottom

Closing off the space between the door and its threshold can be a prob-

lem when the threshold is badly worn. Installing a 2-piece adjustable aluminum threshold over the old threshold is the best way to seal under the door in such situations. Since few old jambs are truly square, this threshold adjusts to suit the door.

Cutting the threshold to fit the jamb is a 2-step process. First, slide the two pieces of the replacement

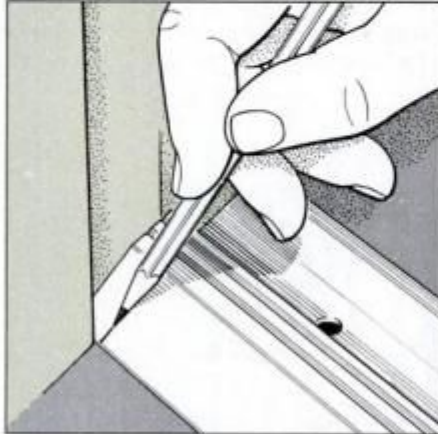
threshold so its screwholes line up (the top part will overhang the bottom). Measure the length of the existing threshold, and cut the new threshold to fit using a hacksaw with a fine-toothed blade. Measure and cut the threshold so that the overhanging end is removed (this ensures the screwholes remain in alignment).

Lay the threshold in place, and mark the position of the doorstops on the threshold (Fig. 6). Cut out a notch with the hacksaw so the threshold clears the doorstops.

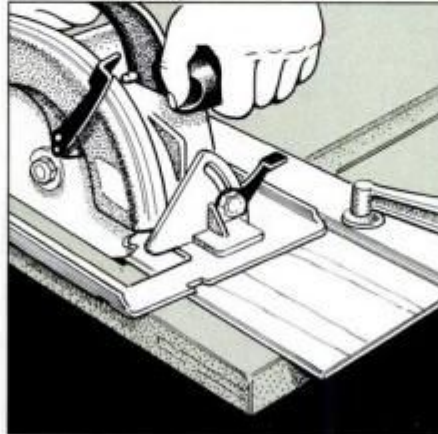
Next, cut about an inch off the door so it will clear the new threshold (the threshold manufacturer may have specific instructions on the exact amount that should be cut).

Knock the pins out of the door hinges with a screwdriver and a hammer, and place the door across a pair of sawhorses. Mark the bottom of the door for cutting.

We used a circular saw with a cutoff jig to trim the door to length. This jig consists of a piece of 1/4-in. plywood with a fence screwed along its length. Make the plywood wider than the



6 Cut aluminum threshold to the jamb width. Mark location of doorstep on the threshold, and cut notch with a hacksaw.



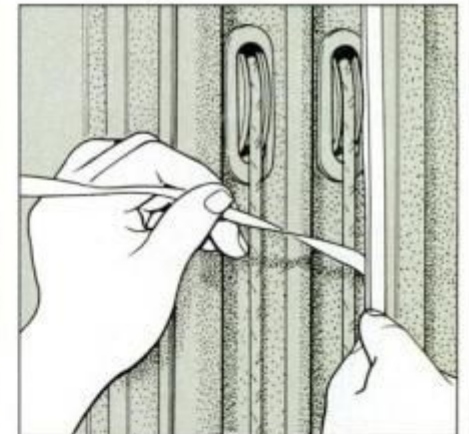
7 Set saw to cut a 2° bevel, and trim about an inch from the door bottom. Use a cutoff jig clamped to the door to guide the saw.



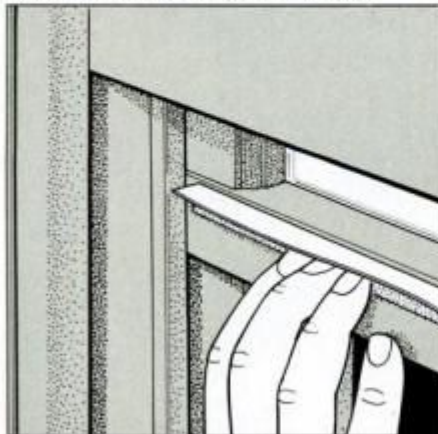
11 Remove worn-out garage door weatherstripping. Prime and paint door bottom, and nail on the new gasket.



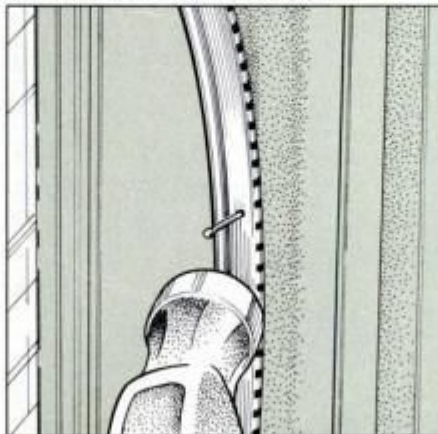
12 Nail flexible vinyl weatherstripping to garage doorstop to seal the opening. Press strip firmly against door as you nail.



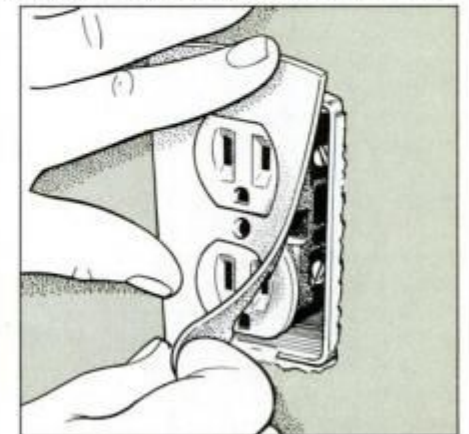
13 Apply V-strip weatherstripping close to the front of window track on double-hung windows. Point of V-strip faces you.



17 Clean the inside face of the meeting rail on the outer sash. Apply weatherstripping with point of V facing up.



18 Nail tubular vinyl weatherstripping to window stop to seal large gaps. Press strip against window, and nail it in place.



19 Seal around electrical outlets and switches with foam-rubber gaskets that fit behind the cover plate.

saw's shoe, screw a narrow fence to it, then run the saw along the fence to cut off the excess plywood.

Next, clamp the jig so its edge is on the marks on the door. Place the saw on the jig and lower the saw blade so it clears the thickness of the door, then make the cut (Fig. 7). Reduce splintering by using a crosscut or combination blade.

Screw the replacement threshold in place. Snap the vinyl strip in place on top of the threshold, rehang the door, and gauge how the threshold has to be adjusted to suit the door.

Remove the vinyl strip, and adjust the threshold screws (Fig. 8). The door should close easily but tightly. Reinstall the vinyl strip after cutting it to length. Complete the installation by caulking the inner and outer edges of the new threshold.

Attic door

Seal a standard hinged door leading to an unheated attic with V-strip. For a pull-down door, use tubular vinyl weatherstripping or foam strip.

If the pull-down door overlaps its jamb, install adhesive-backed 1/4-in.-thick foam rubber on the door's back, where it contacts the jamb (Fig. 9).

To seal a door where the casing completely covers the jamb, staple tubular vinyl weatherstripping inside the jamb (Fig. 10). Install the weatherstripping so it is lower than the jamb face. The door will shut against it, making a good seal.

Garage door

Most garage doors come with some sort of weatherstripping on the bottom, but few have any along the sides or the top of the jamb.

In time, the seal at the door's bottom flattens out and doesn't conform to the small irregularities of the garage floor. This allows wind and rain to enter. Remove the old weatherstripping and the fasteners that hold it in place. Paint the bottom of the door to prevent it from absorbing moisture and delaminating.

When the paint on the door's bottom edge is dry, cut a garage door seal to length, and fasten it with the nails provided or use galvanized roofing nails (Fig. 11).

Garage door weatherstripping for the top and sides is a heavy vinyl material similar to V-strip. Push the strip tight to the door, and nail the wide flange portion to the doorjamb (Fig. 12).

You can paint the weatherstrip to match the garage's trim color. Don't

paint the part that contacts the door because it flexes and the paint will eventually crack.

Sealing windows

Old drafty windows are one of the worst sources of heat loss. Double-hung windows are probably the worst offenders, because two moving sashes provide greater surface area for air infiltration.

The easiest weatherstripping to install on double-hung windows is V-

strip. It costs about \$5, and it only takes a half-hour to seal a double-hung window. If you clean the jamb carefully so the strip adheres well, it will last two to five years.

Wash the jamb carefully, especially the grooves where the sashes ride, with a solution of trisodium phosphate and water. Scrape away loose paint, and prime bare wood with alkyd primer. Measure the outer sash's length, and cut two pieces of V-strip about an inch longer than the sash. Lower the

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sash. Hold a piece of V-strip above the sash with the point of the V facing you. Peel an inch or two of the paper backing from the bottom of the V-strip, pinch the legs of the V together, and poke the pinched end into the narrow space between the sash and the jamb.

Raise up the V-strip, butting it against the head jamb. Peel off the remainder of the paper backing, and press the V-strip weatherstripping into position (Fig. 13). Repeat this on

the jamb's opposite side.

Next, press a piece of V-strip on top of the outer sash with the point of the V toward you.

To seal the inside sash, measure and cut two strips slightly longer than the sash's height. Raise the sash as high as you can.

Next, hold a piece of V-strip vertically with the point of the V facing you, and slice the backing paper about 12 in. down from the top. Starting at the slice, peel up about 6 in. of paper

(Fig. 14). Fold the paper over on itself so a little bit of the backing paper extends beyond the top of the V-strip.

With the point of the V facing you, pinch the legs of the V together and poke it into the narrow space between the inner sash and the jamb (Fig. 15). Feed the V-strip up, and position it with its lower end butting into the bottom jamb (the window sill). Peel off the backing paper below the slice, and press the V-strip into position. Repeat this procedure on the jamb's opposite side.

Lower the inner sash. Grab the little piece of backing paper, peel it off, and finish pressing the V-strip into place (Fig. 16).

Next, apply a piece of V-strip on the bottom of the inner sash with the point of the V facing you.

To complete sealing the window, install a V-strip on the outer sash's meeting rail (the bottom rail where the windows meet). To do this, raise up the inner sash all the way. Cut a piece of V-strip the length of the rail, and press it in place with the V pointing up. Staple it in place to ensure it stays put (Fig. 17).

Worn double-hung windows

The best way to seal windows that are worn and loose is with tubular vinyl weatherstripping.

To seal the inner and outer sash, nail the material to the parting and window stops (Fig. 18). Also nail the weatherstripping on the top and bottom of both sashes.

To seal the gap between the sashes, raise the inner sash and lower the outer sash to expose the meeting rail on the outer window. Nail a piece of weatherstripping to the inside face of the meeting rail.

Sliding, awning and casement windows

Sliding, awning and casement windows usually have built-in weatherstripping and are less likely to leak air than an old double-hung window.

These windows can be sealed with foam strip or V-strip. Since casement and awning windows operate like a door, seal around their jamb as you would a door.

Sealing outlets

Believe it or not, cold drafts can make their way into the room by the gap surrounding an electrical box. To seal around an outlet or switch, unscrew the faceplate, install a foam-rubber gasket and reinstall the cover. **PM**

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DETROIT '92



OLDSMOBILE
ACHIEVA SC

YANKEE CHIC

Led by GM, Detroit's 1992 new-car crop marks the rebirth of an all-American automotive style.

● In financial circles, where corporate good health is assessed strictly on a basis of profit and loss, the prognosis for the U.S. auto industry is rated as marginal. But for those of us who spent the summer previewing Detroit's new cars for 1992, it's a completely different picture. This fall's domestic new-car show suggests anything but an anemic industry. There's power, performance, technology and, perhaps most important, the re-emergence of a readily identifiable American automotive style. After years of various interpretations of the so-called Euro look, American de-

signers finally seem to be going their own way once again. Cadillac's stunning new Seville is perhaps the best example of this new trend in Yankee chic—but it's certainly not the only one, as our 1992 roundup will reveal on the following pages.

General Motors

With the Ford Motor Co. concentrating primarily on its new trucks and Chrysler loading up for an extended string of early '93 launches, it was left to the General to put on this fall's biggest show. And Cadillac had the starring role.

Cadillac

Although GM's luxury division has been inching its way back to parity with other prestige makes over the past few years, the new Seville promises to close the gap in one dazzling leap. Marking a distinct break with Cadillac's undersuspended, tufted-pillow past, the Seville is clean, contemporary and distinctively all-American. It has the aura of a sure-fire winner, and if you don't hear the words "car of the year" associated with this car, we will be very much surprised.

We believe the new sheetmetal, shaped under the supervision of Richard Ruzzin, head of Cadillac's exterior design studio, speaks for itself. Though there are some Cadillac reminders, such as the egg-crate grillwork and stand-up hood ornament of the standard Seville, every body panel is new—in the fullest sense of that word.

Flush glass, flush-mounted door



handles, a sloping hoodline, steeply raked windshield, angled backlite and higher decklid add up to a sharp improvement in aerodynamic efficiency (0.33 Cd versus 0.38 for the previous Seville). While we prefer the near-monochrome look of the STS (Seville Touring Sedan), trim is very restrained on both Seville models, inside and out.

This is a big sedan, substantially bigger—3 in. on the wheelbase, 2.4 in. wider, 13.1 in. overall—than its predecessor, and much roomier inside. In fact, it's roughly the same size as the original Seville of 1975.

Power is still provided by Cadillac's 200-horsepower 4.9-liter V8 engine, driving the front wheels through an electronically controlled 4-speed automatic. Although the basic running gear is largely unchanged, the front frame rails and crossmember have been beefed up, for more torsional rigidity. The antilock braking system continues as standard equipment, and the new car rides on new 16-in. cast-alloy wheels.

More impressive than its increased volume is the look of the new Seville's interior, which provides an American variation on understated German elegance. The seats have been overhauled, for better support, and as you would expect of any modern luxury car, there's a long list of standard equipment. The Seville Touring Sedan, of course, adds even more to this seductive list.

Pricing is something most automotive manufacturers like to keep secret until the last possible moment. However, while the new Seville is certain to be more expensive than the old, which started at about \$34,000, Cadillac's marketing people are determined to keep the numbers competi-

budget, the Eldorado also got plenty of attention. No longer can the Eldo be called a 2-door Seville—or vice versa. The only exterior commonality between the two cars is the windshield.

However, there are still other commonalities. Like Seville, the Eldora-



tive with the new invaders from Lexus and Infiniti.

If they do, we're inclined to think Cadillac won't be able to build these sophisticated new sedans fast enough to meet demand.

While the Seville absorbed the lion's share of Cadillac's 1992 design

do has grown for '92—10.8 in. longer, 3.5 in. wider and 0.8 in. taller, all of which adds up to a roomier car, by 2 cu. ft. inside and 1.2 cu. ft. under the new decklid. The larger size also adds up to about 150 pounds more weight for a total of 3605 pounds, which is not much, considering the car's dimensional increases.

The biggest visual change is the Eldo's all-new roofline, culminating in a sweeping backlite and rather substantial C-pillar. There's the tiniest hint of oldtime Cadillac fins at the rear, a swoopier snout up front and an



CADILLAC SEVILLE

updated interior, replete with tasty Zebrano wood paneling and a new instrument panel.

Functionally, the Eldorado benefits from stiffened front subframing, new 16-in. alloy wheels and bigger brake rotors all around, with expanded front calipers. Power comes from Cadillac's 200-horsepower 4.9-liter V8 engine, which will be supplanted by the 4.6-liter Northstar V8 sometime next year.

Like the Seville, the '92 Eldorado will be available in two flavors—the Eldorado Coupe and the sportier Eldorado Touring Coupe, which comes with stiffer suspension and 225/60HR-16 Goodyear GA tires.

Aside from a variety of minor trim changes, the rest of Caddydom will be much as it was in 1991. One significant exception to this status quo is the addition of Cadillac's Teves traction-control system to the Fleetwood and DeVille lineup. The system will be standard in the Fleetwood and an option in the DeVille.

Unlike the sophisticated Allanté system, the Fleetwood/DeVille application will only operate at low speed (below 30 miles per hour).

FIRST IMPRESSIONS

Cadillac Seville STS

● During the past few years, we've seen a lot of subtle hints that this car was coming—the carefully tuned growl of V8 exhaust, suspensions tuned away from the wallow and float of yesteryear, Touring trim packages devoid of glitz and digitalia.

Even so, for all these portents, the reality of the new Seville—the Seville Touring Sedan in particular—is still a very pleasant surprise.

Besides its restrained trim and analog instrumentation, the essence of the STS lies in its stiffer-than-stock suspension tuning. And what this yields is a level of steering precision and handling response that strikes us as simply excellent. The STS lacks the hard-edged feel of, say, a 5-Series BMW, but it's distinctly more athletic than something like the Lexus LS400.

And it yields its own distinctive level of comfort, taut enough to suggest its



CADILLAC SEVILLE STS

impressive handling capabilities, supple enough to sop up the small bumps and dips that BMWs have trouble ignoring. The new seating is appropriately supportive and impressively adjustable, while the instrument panel strikes us as a triumph of contemporary simplicity over outmoded tradition.

The STS is loaded with luxury features, including a sound system that

would improve most homes. But where this car wins is in its design, inside and out, a look that gets into uncharted territory for Cadillac. Stir in a surprisingly generous dollop of fun-to-drive and you've got a new breed of Caddy, one that says—unmistakably—that Cadillac is back.

—Tony Swan



Specifications

Layout	Front-engine, front-drive
Body style	4-door
Engine	200-hp ohv 4.9 V8
Transmission	4A
Wheelbase	111.0 in.
Track, f/r	60.9/60.9 in.
Length	203.9 in.
Width	74.4 in.
Height	54.0 in.
Curb weight (min.)	3721 pounds
Brakes, f/r	disc/disc, ABS

Buick

If David Dunbar Buick is watching current events from that big factory in the sky, he's got to be smiling. His old company has just staged one of the more dramatic turnarounds in recent GM history. And with lots of new hardware in the parking lot, Buick's 1992 prospects look promising.

Tops on the hardware list is the new family of Skylark compacts. Although chassis dimensions are identical to the previous generation—103.4-in. wheelbase, with front/rear track measuring 55.6/55.2 in.—no one will confuse the new with the old.

The new Skylark is bigger—over 9 in. longer and an inch wider—as well as roomier. More important, it looks different, embodying a good many styling themes from the Bolero concept car of a year ago.

Besides distinctive, it's aerodynamically efficient, with a Cd under 0.32, compared to the old car's 0.37.

The interior redesign is as far-reaching as the exterior, with a big instrument cowl dominating the dashboard and analog gauges housed within. Thoughtful touches abound: cup holders and versatile small-object storage in the dashboard and center console. New standard interior equipment includes power door locks, a split folding rear seat and remote releases for the fuel filler and trunklid.

Powertrain options are somewhat limited, compared to the Skylark's sister cars, Olds Achieva and Pontiac Grand Am. Skylark buyers can choose either the new 120-hp Quad OHC, essentially a 2-valve Quad 4, or a 160-hp 3.3-liter V6, mated to a 3-speed automatic transmission.

Chassis refinements include anti-lock braking as standard equipment, cockpit adjustable shock absorbers (standard on the Gran Sport, optional elsewhere) and a new 16-in. wheel/tire package.

Not quite as new as the Skylark, but equally important, is Buick's redesigned LeSabre. As Buick's best



seller, and a U.S. quality leader, this smooth new full-size sedan is critical for sales momentum.

The rounded exterior is a welcome update on the previous LeSabre. It's also more aerodynamic at 0.32 Cd compared to 0.35. Naturally, the redesign extends to the interior, which features a sweeping wraparound instrument panel, dual climate controls

(optional) and a driver's airbag.

There's also more LeSabre all around—3.5 in. more stem to stern, 2.5 in. side to side and some 200 pounds more at the curb.

Below the new skin, GM's 170-hp 3800 V6 replaces the old 3.8, providing more muscle and a 1 mpg improvement in highway fuel economy (18 city, 28 highway). GM's low-speed traction-control system is offered as an option on Limited models, while antilock braking is standard on the Limited, optional on the Custom.

Elsewhere in the Buick stable, the 205-hp supercharged 3800 V6 will be the only engine available in the Park Avenue Ultra. The Roadmaster lineup, limited to a station wagon last year, has been expanded to include a sedan series. There's also more power to move these big cars (2 tons plus), thanks to a 5.7-liter V8. It only produces 180 hp, but 300 ft.-lb. of torque makes the Roadmasters reasonably responsive and bumps their tow ratings to 5000 pounds.



BUICK LeSABRE LIMITED



BUICK SKYLARK GS

FIRST IMPRESSIONS

Chevrolet Corvette

● Though it's an uncharacteristically quiet new-model year from Chevrolet, it's by no means a silent one. The big news is about the fastest Chevy—the Corvette. And if you own or have ever driven a Corvette, that car will positively feel like a dinosaur after one brief stint behind the wheel of a '92. Space prohibits listing the many improvements that have been made to Chevrolet's hot one since the current model was introduced in 1984. Even since our last Corvette test, in 1987, the long list includes better brakes, 17-in. wheels, a 6-speed manual transmission, electronically controlled suspension, a removable hardtop for the convertible and now, for '92, Automatic Slip Reduction (ASR) and a brand-new, ultra-potent version of the small-block V8 engine, the LT-1.

Punch the throttle on the new 300-hp LT-1 and you have a whole new reason to proclaim the Corvette as America's premier sports car. The LT-1 won't peel your eyelids back like the LT-5 V8 in the ZR-1, but even so, most drivers will run out of breath long before the car does. Factory engineers



report quarter-mile runs of 13.6 seconds at a speed of 104 miles per hour.

And for those awkward moments when you've overcooked it in a turn, the ASR traction-control system retards the power just enough for you to recover. But for those immature times when wheelspin is desirable, simply push the ASR control button and smoke the rear tires in rubber-shredding burnouts to your heart's content.

It's a perfect system for a near-perfect car.
—Joe Oldham

Specifications

Layout	Front-engine, rear-drive
Body styles	2-seat coupe convertible
Engine	300-hp ohv 5.7 V8
Transmissions	6M, 4A
Wheelbase	96.2 in.
Track, f/r	59.6/60.4 in.
Length	178.6 in.
Width	71.0 in.
Height	46.7 in.
Curb weight (min.)	3327 pounds
Brakes, f/r	disc/disc, ABS



OLDSMOBILE ACHIEVA S



OLDSMOBILE 88 ROYALE LS

Oldsmobile

They say that a good product is the key to recovery in any business, and if it's true, Oldsmobile's '92 lineup should reverse the downturn of the past few years. Spearheaded by the new Achieva compact and 88 sedan, Oldsmobile's lineup looks about as good as it has in a decade.

The Achieva is the newest of the new Oldsmobiles, superseding the Cutlass Calais series. This is the only one of the N-car replacements (Achieva, Buick Skylark, Pontiac Grand Am) that's been renamed, which says something about the Calais.

Bigger, smoother and more contemporary in appearance than the Calais, the Achieva is designed to hit a little higher target in the crowded compact market. It's bolstered by an impressive array of standard equip-

ment, variable-assist power steering and a wide variety of engine options.

Details are spelled out below.

The new 88 has been drawing crowds since its debut at the Detroit Auto Show last January. Although it rides the same 110.8-in. wheelbase, it's bigger in every dimension—4.1 in. longer, 1.5 in. wider, a couple hundred pounds heavier—and it's an eye-catcher in a way its square-edged predecessor never was.

It's also 4-door only. Olds has elected to drop the 2-door version.

The 88's interior has also been redone, and there's more standard equipment—power windows, a driver's airbag, child security rear door locks—inside.

Available in two trim levels—Royale and Royale LS—the new 88 also includes some important functional changes. Tops on this list is the

availability of antilock braking (standard on the LS, optional on the Royale). Another LS option is GM's low-speed traction-control system.

Power has been improved, with GM's 170-hp 3800 V6 replacing the old 165-hp 3.8-liter V6, and GM's electronically controlled 4-speed automatic smooths out the shifting.

Improved power is also the theme elsewhere in the Olds lineup. The Silhouette minivan, like its cousins from Chevy and Pontiac, will offer the 170-hp 3800 V6 and 4-speed automatic as a powertrain option for '92 (the current 120-hp 3.1 V6 and 3-speed auto will continue as standard equipment). Oldsmobile's big rear-drive Custom Cruiser station wagon will get GM's torquey 5.7-liter V8 as standard equipment, while the 98 Touring Sedan will offer the option of GM's new 205-hp supercharged 3800 V6.



FIRST IMPRESSIONS

Olds Achieva

● We figure all the over and under Achieva jokes have already been told, so we'll confine our remarks about this new Olds to the hardware, which is slick, quick and a distinct improvement on the Cutlass Calais it replaces.

Improved in this case means more room inside the car. Chassis dimensions—wheelbase and track—are basically unchanged, but there have been some suspension component revisions that should provide better road manners and handling, which wasn't the strongest suit of the old Calais.

The SC (Sport Coupe) is the hot-rod version of the Achieva, with stiffer suspension (though still not stiff enough)

and the 180-hp H.O. edition of the Quad-4 engine. It's a potent and, with its specific trimpieces, spiffy package, one that'll make you forget the Calais in short order—if you haven't already.

If that's not enough, a W41 variant, with even more muscle, plus better gearing, will be along later in the model year.

Patterned closely on Oldsmobile's sophisticated and well-received Achieva concept car, the new Calais replacement presents a contemporary, aerodynamic appearance with flush glass all around and a faster backlite than the old N-car's formal roofline. Achieva will be offered in 2- and 4-door body styles, with three trim levels available and four different engines.

The engine category includes two newcomers—GM's new 3.3-liter V6,

and a 120-hp 2-valve version of the Olds-developed Quad 4, which is standard equipment on this and all other N-car replacements. The 3.3-liter V6 is available only with a 3-speed automatic transmission, the only automatic available in Achieva and its cousins.

We prefer the 5-speed manual that comes with the various 4-cylinder powerplants.

Other noteworthy Achieva installations: GM is making its own antilock-braking system available as standard equipment on all models, and a cockpit adjustable shock absorber system is offered in S and SC versions.

—Tony Swan

Specifications

Layout	Front-engine, front-drive
Body styles	2-door, 4-door
Engine	120-hp sohc 2.3 L4
Optional:	160-hp dohc 16V 2.3 L4 160-hp ohv 3.3 V6 180-hp dohc 16V 2.3 L4
Transmissions	5M, 3A
Wheelbase	103.4 in.
Track, f/r	55.6/55.3 in.
Length	187.9 in.
Width	67.2 in.
Height	53.1 in.
Curb weight (min.)	2690 pounds
Brakes, f/r	Disc/drum, ABS



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PONTIAC GRAND AM GT

Pontiac

The compact front-wheel-drive Grand Am has been Pontiac's perennial best seller since the most recent edition came along in 1985, and there's no reason to suppose the new generation is going to erode that popularity. Like the new N-car replacements from Buick and Olds, the Grand Am is bigger and sleeker than its predecessor, though it rides on the same 103.4-in. wheelbase.

Available in 2- and 4-door body styles, the new Grand Am shares the same wide range of engine offerings as the Olds Achieva, including the new 120-hp 2.3-liter Quad OHC 4-cylinder and the new 160-hp 3.3-liter V6. The 160- and 180-hp versions of the regular Quad 4 also remain in the order book. Transmissions are a 5-speed manual or 3-speed automatic.

A welcome addition to the running

gear is antilock braking, which becomes standard equipment across the board. Front brake rotors have been increased, from 13 to 14 in., but the rear brakes are still drums. Steering is via GM's new variable-assist power system, and the headlights have a new flash-to-pass feature.

The interior restyling includes a new instrument panel, considerable work in the rear-seat area to improve comfort and legroom, and two different instrument clusters for the two different models: SE and the sporty GT line. However, all the instrument packages use large, well-marked analog gauges.

Another laudable feature of the new Grand Am is what's been left out. With a reduction in parts numbers as a design priority, Pontiac was able to cut the Grand Am's parts count by 266, or about 11%.

Pontiac's Bonneville is also renewed for '92, with the exotic addition of a supercharged engine sweetening the model mix (SE, SSE, SSEi).

Longer and wider than previous Bonneville's, the new sedans are also roomier, particularly in the trunk, which goes from just over 15 cu. ft. to 18.1 cu. ft., a volume that can be enhanced by a pass-through feature.

The Bonneville's standard engine continues to be GM's 170-hp 3800 V6, matched with a 4-speed automatic transmission. The ABS is standard on almost all models, as is variable-assist power steering, which is new for '92. See the SSEi sidebar for more details.

For drivers who liked the style and versatility of Pontiac's Trans Sport minivan, but deplored its powertrain anemia, the good news for '92 is the option of the 3800 V6 and a 4-speed automatic.

FIRST IMPRESSIONS

Pontiac Bonneville

●It's been 35 years since the first Pontiac Bonneville rumbled onto the American automotive scene, and if the latest incarnation of Pontiac's famous big-car nameplate lacks the thundering presence of the original Bonneville, don't worry because it certainly won't put you to sleep.

The SSEi's supercharged 3800 V6 engine doesn't quite measure up to the original Bonneville's bodacious 359 ft.-lb. V8's torque standards, but the blown V6 has enough output to hustle this substantial (3607 pounds) hunk of sedan from 0 to 60 mph in less than 9 seconds.

And like that first Bonneville, it'll look good doing it.

As is true of all of GM's new cars, the transition from the 1991 Bonneville to the new entails increases from 198.7 to 200.6 in. (201.2 for the SSE and SSEi) in length and from 72.1 to 73.6 in. in width. Depending on the model, a few pounds more of bulk are added at the curb, as well.

What you get with these increases is a very stylish new sedan, particularly in SSEi trim. The side cladding, integrated airdam/front fascia and alloy wheels



that distinguish other top-of-line Pontiacs give the SSEi a decidedly jazzy look.

There's also a wealth of standard equipment to go with the exterior flash, including a new instrument panel and GM's new EZ Kool glass that filters out infrared and ultraviolet rays. Other SSEi standards: low-speed traction control, antilock braking, driver and passenger airbags, 16-in. alloy wheels matched to the exterior color, 225/60ZR-16 Z-rated tires and a stiffer FE2 suspension package that keeps the massive tires planted during hard cornering.

From the beginning, we've liked the Bonneville's big-car manners, and the new SSEi moves this car another notch up the fun-to-drive scale. Don't expect too much from the supercharger—since

boost levels are mild, there's no big rush. But do expect to be impressed with this car's all-around high-speed touring capabilities. —Tony Swan

Specifications

Layout	Front-engine, front-drive
Body style	4-door
Engine	205-hp ohv 3.8 supercharged V6
Optional	170-hp ohv 3.8 V6
Transmissions	4A
Wheelbase	110.8 in.
Track, f/r	60.3/59.8 in.
Length	201.2 in.
Width	73.6 in.
Height	55.5 in.
Curb weight (min.)	3607 pounds
Brakes, f/r	Disc/drum, ABS



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FORD TEMPO GLS V6



FORD CROWN VICTORIA TOURING SEDAN

Ford Motor Co.

The importance of truck sales to the overall well-being of the Ford Motor Co. is unique in the American industry. With minivans still counted in truck totals, Ford's passenger car and light-truck sales split about 50/50. Which is part of the reason there's as much activity in the Ford truck sector for 1992 as there is on the automobile front.

Ford/Lincoln-Mercury

There are no truly new vehicles in the Ford and Lincoln-Mercury car lineups this fall, at least not in the sense of new as defined by last year's Escort, Tracer and Crown Vic, or the previous year's runaway smash-hit Explorer.

But while Ford loads its new-product cannons for a mid-'92 barrage of early '93 models, there are plenty of changes to report for the autumnal rollout. And while they're mostly evolutionary changes, they nevertheless

reflect the manufacturer's determination to improve quality and performance while postponing major capital expenditures during times of poor sales.

However, there's more than this to the first redesign of the Ford Taurus and Mercury Sable. Even though these two breadwinners no longer command the absolute top of the sales charts, they've been exceptionally popular since their launch and don't show much sign of fading any time soon.

As a result, Ford was in the tricky position of facing a redesign for a product that didn't seem to require it. And this in turn allowed the design team to devote all their energies to small improvements, rather than a major overhaul (detailed below). If it ain't broke, don't fix it.

Ford design executive Fritz Mayhew summed up the company's position regarding this dilemma at the first showing of the '92 Taurus/Sable

lineup last summer.

"We don't want to make changes just for the sake of changes," he said. "Frankly, the Taurus and Sable were so advanced when they were introduced as 1986 models, they still had a



FIRST IMPRESSIONS

Ford Taurus

● New front-end sheetmetal for '92 is certainly not as dramatic a departure as the original Taurus and Sable were six years ago. It's recognizable and derivative, especially when you consider that the doors are unchanged, as is the basic platform. Sable models do get new doors, but retain the trademark light-bar grille between the headlamps.

Specifications

Layout	Front-engine, front-drive
Body style	4-door
Engine	140-hp ohv 3.0 V6
Optional:	140-hp ohv 3.8 V6
	220-hp dohc 24V V6*
Transmissions	5M*, 4A
Wheelbase	106.0 in.
Track, f/r	61.6/60.5 in.
Length	192.0 in.
Width	71.2 in.
Height	54.1 in.
Curb weight (min.)	3131 pounds
Brakes, f/r	Disc/drum (disc/disc*)

*Taurus SHO only.

But there's more to the "new" cars than a reskinning. Ford gave the interiors a thorough scrutiny, adding important ergonomic improvements by relocating many switches and controls. The trunk, big in the original, is a tad bigger, and the interior is more spacious.



Attention to detail has led to reductions in interior noise, helped by revised shock valving for improved handling and reduced tar-strip harshness.

The 3.0-liter V6 is now standard, replacing the anemic 2.5-liter Four. A worthwhile option is the 140-hp 3.8-liter V6, which raises torque from 160 to 215

ft.-lb. We found driveability with the 4-speed automatic transaxle to be acceptable with the smaller engine—and much improved with the 3.8. Unfortunately, neither powerplant is available with a manual transmission.

For 5-speed fun, check out the SHO

option, the 220-hp 24-valve 3.0-liter V6 rocket-propelled Q-ship. They haven't changed the key part of this combination—its ability to cover large expanses of real estate in a hurry—although there is a little more distinction in the front-end trim.

—Mike Allen



MERCURY SABLE GS



FORD TAURUS SHO



FORD TAURUS LX WAGON

look contemporary enough to carry them through for another model year or three.

"However, the changes that were made for '92 were made for good reasons—and Taurus/Sable will probably remain as market segment leaders for a while."

As a result, Ford's styling changes for both Taurus and Sable are very subtle indeed—difficult to detect, in fact, unless the old and new cars are standing side by side.

But there are many thoughtful changes inside the cars, as detailed at left.

The Tempo/Topaz story is a little different. Even though they're due for a complete redesign next year, Ford's marketing and product planning staff decided an improvement in horsepower was needed even sooner

if the cars were going to keep pace in an increasingly competitive segment—which is why this compact twosome will be available with a 135-hp 3.0-liter V6 for 1992.

Ford's 96-hp 2.3-liter pushrod Four, upgraded by the addition of multiport fuel injection, will continue as the base powerplant. The V6 will be standard equipment in the Tempo GLS and Topaz LTS and XR5, optional elsewhere.

V6-equipped Tempo/Topaz cars will also get a stiffer antiroll bar in the rear, while Tempo GLS and Topaz LTS and XR5 models will get new 15-in. alloy wheels.

With a major redesign coming soon, cosmetic changes to the two cars are minor this year. They include a return to body-colored grillwork for the Ford Tempo and a new Sable-style

light bar for the Mercury Topaz.

One other small but welcome change to the Ford lineup is the addition of the Touring Sedan model to the full-size Crown Victoria lineup.

With more power (210 hp versus 195 hp for the standard Crown Vic, thanks to a dual-exhaust system), a 3.27:1 rear axle, stiffer suspension, a heavier rear antiroll bar and 225/70-15 tires on cast-aluminum wheels, the Touring Sedan brings back a long-absent element of performance to the full-size American sedan market.

Other Touring Sedan distinctions—which are also available in the Crown Vic lineup Handling/Performance and Towing packages—are rear air springs, antilock braking with Ford's Electronic Traction Assist, a power steering oil cooler and a 120-mph analog speedometer.



FORD E-150 CLUB WAGON CHATEAU



FORD F-150 XL FLARESIDE



Ford Trucks

There are people driving around in 1991 Ford vans who have never known any other—the current body style/platform dates back to 1975.

There are several reasons for this. Most of the industry's recent effort in vans has gone into minivans and small 4x4s. Traditional big vans have lingered unchanged simply because the van buyers didn't really need something new to maintain their interest.

Ford has dominated this market for a generation with this same vehicle. Fleet buyers (a substantial portion of the market) care mostly about cost of ownership, and van converters would just as soon maintain the status quo so their jigs and fixtures still fit.

The new, more aerodynamically current styling of the Econoline and Club Wagon is still recognizable as

Ford. The design of the grille now shares the look of the pickups and Ford's big tractor-trailer rigs. One major improvement in the bodywork is tighter, more consistent fit of body panels, making for substantially lowered wind and road noise. The paint job is smooth and shiny. Exterior glass is now flush-mounted, contributing to lowered wind noise and improved mileage. Both the head- and taillamps wrap around and fit flush. Gone, unfortunately, are vent wings.

Also absent is the traditional over-assisted power steering with its on-center numbness. The Twin I-Beam front suspension remains, but road feel is much improved.

Ride harshness and noise are similarly improved (diminished), and the front suspension has simple adjustments to correct camber and caster.

One area of no change whatsoever is in powertrains. There continue to be five choices, four of them V8s. The offerings include a 145-hp 4.9-liter inline-Six, a 185-hp 5.0-liter V8, a 200-hp 5.8-liter V8, and torquey (345 ft.-lb.) 7.3-liter diesel V8 and the real heavy-duty hauler, a 7.5-liter V8 rated at 230 hp and 390 ft.-lb. of torque. The 6-cylinder can be ordered with either 3- or 4-speed automatic. All the others are mated to 4-speed automatics.

Interior appointments are more carlike than before, with all major controls mounted on stalks, rather than sprinkled over the dashboard. On high-line models, there are even air conditioning/heating controls and remote controls for the radio, mounted within easy reach of the passenger behind the driver's seat.

Ford audio sets the standard for the domestic manufacturers with the best-sounding stereos. And, the ergonomics of the controls on the sound systems are the best in the industry. A driver's-side airbag is available as an option on most models.

In response to customer preference, a 60/40 swing-out side door is now standard, while the sliding door is optional, except on the long-wheel-base models. Also available are a couple of models aimed at the conversion/motorhome market, both a cutaway chassis cab and a stripped frame/running gear. One nice touch is taps built into the heater and a/c system to sup-



FORD F-250 EXTENDED CAB



ply heating and cooling to the nether regions of whatever structure the converter adds.

Those who tow, but not often enough to justify adding a frame-mounted hitch, will be glad to hear that the rear bumper is compatible

with commercial clamp-on hitches.

Like the vans, Ford's F-series pickups have remained unchanged since 1980. This year's crop has a front-end restyling to match the vans, and there are also subtle changes to the body-side moldings and tailgates.

The interior sees instrument panel revisions, new climate controls and head restraints for the bench seats.

Back in the lineup after an absence of a few years is a stepside box, available in both regular and supercab short-wheelbase F-150s.

FIRST IMPRESSIONS

Ford F-Series

● Ford has long outsold the rest of the industry in full-size pickups. But the current truck lineup has had only minor refinements since first introduced in 1979, making it pretty long in the tooth. To make the case for change even more compelling, both GM and Chrysler have had major revisions of their hardware within the past few years.

As a result, this year's Ford light-truck crop looks different outside and inside, and sports a number of refinements to the running gear, depending on whether you're checking off the boxes for a 6-banger 4x2 to haul groceries or a 7.5-liter gruntmobile for towing.

One welcome retroversion to the good old days is the reintroduction of the stepside box, officially called the Flare Side at Ford. We'll take ours with the Nite option, devoid of brightwork except for the alloy wheels. Great for cruising the drive-in.

Interiors are spruced-up, with easier-to-see gauges and controls, spiffy seats and even a carpet-delete rubber-



mat option for real work trucks. Non-smokers who have radar detectors or cellular phones to plug in get a lighterless flap-doored 12-volt socket labeled Power Point.

Graced with new substantial sheet-metal, the new trucks are built on essentially the same platforms, with essentially the same powertrain options as the full-size vans. With dozens of detail refinements, the new trucks are handsome and functional. And perfectly capable of maintaining their industry leadership.

—Mike Allen

Specifications

Layout	Front-engine, rear-drive, 4wd
Body styles	Regular cab, super cab, crew cab, stepside
Engine	145-hp ohv 4.9 L6
Optional:	185-hp ohv 5.0 V8
	200-hp ohv 5.8 V8
	180-hp diesel 7.3 V8
	230-hp ohv 7.5 V8
Transmissions	4M, 5M, HD5M, 3A, 4A
Wheelbase	116.8-168.4 in.
Length	197.1-248.7 in.
Width	79 in.
Height	71 in.
Brakes, f/r	Disc/drum, rear-wheel ABS



Chrysler

Yes, the boys from Highland Park, Michigan, will be introducing new cars during the 1992 model year. However, when those new cars roll out, they'll be early '93s. For this fall's new-car show, Chrysler's contributions are engineering improvements, new safety features, some minor cosmetic updates and a new Eagle Summit wagon supplied by Mitsubishi.

Called the Expo LRV (Light Recreational Vehicle) in Mitsubishi trim, the new Eagle Summit further blurs the already smudged line between high wagon and minivan. But the Summit lands more on the minivan side of the line than the wagon, right down to its sliding side door. Dimensions—99.2-in. wheelbase, 168.5 in. overall length, 66.7 in. width, 65.0 in. height—are considerably smaller

than Chrysler's standard minivans, but thanks to its tallish profile and clever interior space utilization, the Summit has a surprisingly good cargo volume for its size: 34.6 cu. ft.

Buyers will have their choice of two 4-cylinder engines—either a 1.8 or a 2.4 liter—and all-wheel drive. Horsepower ratings of the two engines are almost the same at 113 and 116, respectively, but the 2.4-liter provides a

FIRST IMPRESSIONS Dodge Daytona

● With all those Eagles and Lasers, and even Eclipses flying around, we've had a tendency to forget the good old Dodge Daytona. But no one's likely to forget this one—not once they've had a chance to drive it, that is.

With Chrysler's own 16-valve dohc intercooled 2.2-liter turbo churning out 224 hp, the Daytona IROC/RT can get from point A to point B quicker than all but a very few cars, most of them a good deal more expensive.

While the IROC/RT's performance is startling, and the overall look is new,

Specifications

Layout	Front-engine, rear-drive
Body style	2+2 coupe
Engine	224-hp dohc 16V 2.2 turbo L4
Transmission	5M
Wheelbase	97.2 in.
Track, f/r	57.5/57.6 in.
Length	179.8 in.
Width	69.3 in.
Height	51.8 in.
Curb weight (min.)	2779 pounds
Brakes, f/r	disc/disc, ABS*

*Optional



there's also much that's familiar. The door, roof and hatch are the same, while the front and rear fascia are grafted onto the familiar front-drive running gear. Skinny wraparound headlamps add a very contemporary appearance. There's a new taillight signature to set off the revised rear, with styling cues drawn from big-brother Stealth.

Connecting the front and rear are new aero-look body side moldings and ground-effects appliques.

The inside is pretty retro—with the high window line and dated dashboard, it feels very much like the Daytonas of old—until you light up all that horsepower,



and the front tires along with it.

The suspension has had a general stiffening to accommodate this Daytona's impressive sense of urgency. One option you'll want and probably need is ABS, available on the Daytona lineup for the first time.

—Mike Allen



CHRYSLER NEW YORKER SALON

cluding a completely new look to the front end, thanks to uncovered headlights for the first time in the Daytona's 8-year history. There's also a new taillight stretching right across the back, new side cladding and special rocker panels to distinguish the Daytona ES.

Another Daytona variant will roll out at midyear, when Chrysler introduces the Daytona IROC R/T. Powered by Chrysler's new 16-valve dohc 2.2-liter turbo, this promises to be very hot stuff indeed, with 224 hp at 6000 rpm.

This is the same engine that powers the audacious little Spirit R/T sedan, and its output—more than 100 hp per liter—exceeds anything Chrysler has ever produced before.

Although the Daytona's hybrid rivals—Plymouth Laser and Eagle Talon—also get some cosmetic attention, including exposed aero headlights in place of the old pop-ups, the IROC Daytona promises to be king of the roost, at least until the Viper comes along.

Chrysler has also been busy with its truck powertrains for '92. Both the 3.9-liter V6 and 5.2-liter V8 have had healthy injections of horsepower and torque (for details, see "Engineering The '92s" on page 86).

Massive gains in truck engine output required improvements in drivelines, to accommodate the increased stress on all components. As a result,

big edge in torque—136 ft.-lb. versus 116 ft.-lb.

Transmission options include a 5-speed manual or 4-speed automatic. The Summit has 4-wheel disc brakes, and antilock braking is available as an option.

Chrysler's regular minivans—Dodge Caravan, Plymouth Voyager and Chrysler Town & Country, fresh from a complete redesign last year—will get two important safety upgrades for '92. Upgrade No. 1 will be the installation of driver's-side airbags for the entire Chrysler-built minivan fleet, an upgrade that will certainly give Chrysler some valuable bragging rights.

Upgrade No. 2, and equally marketable, will be the availability of built-in child safety seats—two of them—that fold into the backrests of the minivans' center bench seat. The child seats are positioned with an action similar to pulling down a center-mounted armrest, and each seat is equipped with its own independent 5-point safety-belt system. When they're not in use, these seats stow away completely, allowing for normal use of the bench seat by adult-size passengers.

The official name for this thoughtful device is the Chrysler Integrated Child Seat. It's been tested and is rated well within National Highway Traffic Safety Administration standards. The seats are designed for children who weigh between 20 and 40 pounds (essentially the same weight bracket that aftermarket child safety seats are designed for), and can be retrofitted to 1991 model Chrysler vans.

Another safety-related improvement for 1992 is the availability of antilock braking on Dodge Daytonas and Chrysler LeBaron models. As a result, Chrysler claims that it now has 85% ABS coverage for its passenger cars, which is tops among domestic manufacturers.

All-wheel-drive availability also continues to spread through Chrysler's lineup, with the option extended



EAGLE SUMMIT AWD

for '92 to the Plymouth Laser and Chrysler Town & Country minivan.

Facelifts for '92 include the New Yorker and Dodge Daytona lines.

For the New Yorker, the treatment is limited to new front and rear fascias on the Fifth Avenue and Salon models. The revision lends a softer, more rounded appearance to these upscale Chrysler sedans.

The Daytona revisions actually go a bit further than a quick facelift, in-

Dodge engineers had to come up with heavy-duty transmissions, both manual and automatic, as well as stronger universal joints and tougher axles, an inventory of items that represents a substantial capital investment for any manufacturer.

As an example, Dodge Ram 50 vans powered by the revitalized 5.2-liter V8 engine will have 9.25-in. rear axles, in place of the 8.25-in. axles used in previous editions. **PM**

ENGINEERING THE '92s

New power from old sources.

BY PAUL WEISSLER

● Although Big Three engineers have been busy in every phase of technical development in the 1992 car and truck lineup, the most significant activity seems to have been in the powertrain area. The truly new engines—Chrysler's Viper V10 and Cadillac's 4.6-liter 32-valve Northstar V8—won't be along until early next year.

But even so, Detroit's engineering brain trust has still found more power for almost all the new cars that will roll out this fall, thanks to wholesale reengineering of existing engines. Here's our manufacturer-by-manufacturer rundown.

General Motors

Certainly the best example of revitalizing a veteran powerplant is Chevy's new LT-1 Corvette engine. The 5.7-liter V8 is based on the small-block design that's been around since 1955, but even though the displacement and bore centers are unchanged, there's no parts interchangeability with the old L98 Vette V8.

The LT-1 engine is a half-inch shorter and 3½ in. lower than the L98 version. Horsepower is up, peaking at 300, compared to 245 for the L98. Peak torque actually is down a hair—330 ft.-lb. at 4000 rpm versus 340 at 3200—but the new torque curve is so nearly flat that overall performance is up. The secret is in the new intake manifold. It discards the long runners of the tuned-port system for a plenum-style intake with short runners.

Reverse-flow cooling

The LT-1's cooling system is key to the new engine's improved performance and reliability. It's a reverse-flow design: Coolant flows from the radiator into the aluminum cylinder heads first (rather than the block)

LT-1 CORVETTE ENGINE

New 300-hp LT-1 Corvette engine has wide torque band, thanks to major revisions of intake manifold, heads and cooling system.

when it's at its lowest temperature, allowing it to carry off more heat, which helps prevent detonation. The improved cooling efficiency allowed a small increase in compression ratio—from 10.0:1 to 10.25:1—which helped improve peak power.

The coolant flows down from the heads and through the block, where it warms the block more than in the typical engine, raising cylinder bore temperatures to a more uniform level top to bottom. This keeps the bore rounder, promoting better sealing by the low-tension piston rings. Better sealing means more power, and low-tension rings mean less friction.

To ensure a solid column of liquid coolant flowing through the engine, there's a vapor venting circuit from the rear of each cylinder head to a pressurized coolant reservoir.

The water pump is gear driven off the camshaft (no belt). The pump routes coolant into the heads without first running it through the intake

manifold, contributing to the lowered profile of the engine.

200-hp 4.3-liter V6

Destined for light-truck applications, GM's new high-performance V6 is a version of the 4.3-liter

V6 (originally derived from the small-block V8), and it provides a whopping 40-hp boost over the throttle-body-injected version.

Equipped with a balance shaft for smoothness, it has a novel fuel-injection system—GM calls it Central Port Injection (CPI)—and a sonic-wave intake manifold, a feature adapted from motorcycles.

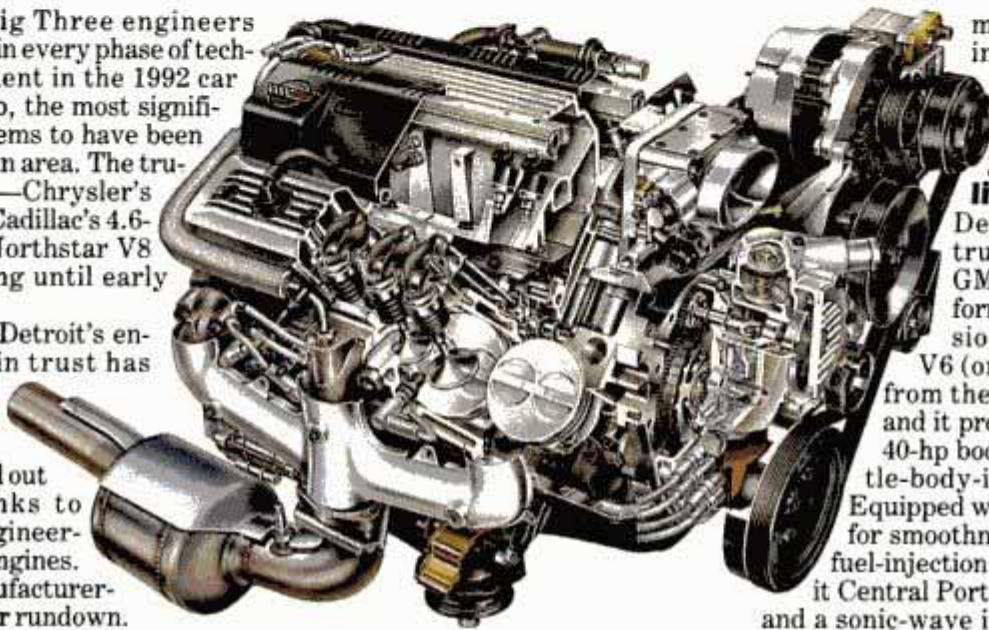
There's still a solenoid-type fuel injector in the throttle body, but it's an oversize design with six outlets feeding into individual hoses that connect to simple mechanical nozzles at the intake ports. The fuel flows through the hose to the nozzle, where it pushes open a spring-loaded ball valve and sprays fuel at the back of the intake valve. When the valve opens, the fuel is drawn into the cylinder. Result: port injection for little more investment than a throttle-body system.

The intake manifold is a tuned design, with a butterfly valve dividing the plenum into two chambers. At 2400 rpm, a computer-controlled motor opens the valve, effectively creating one large chamber with a different resonant frequency, providing a ram-air effect tuned for best midrange torque, up to 4000 rpm.

Supercharged 3800 V6

The 170-horsepower 3800 V6 may not have enough punch for everyone with a big GM sedan. So the 3800 V6 in the Buick Park Avenue Ultra, Pontiac Bonneville SSEi and Olds 98 Touring

(Please turn to page 87)

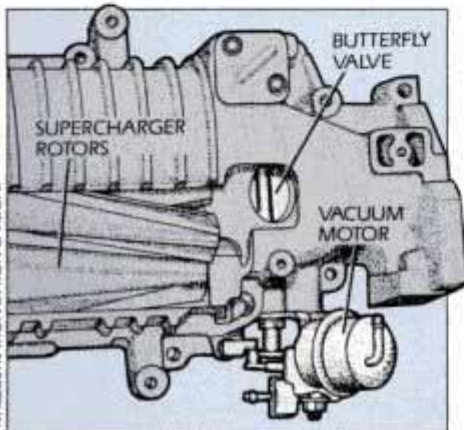


Sedan will come with a water-cooled Roots-type supercharger from Eaton Corp. It features a computer-controlled butterfly valve that opens to relieve all pressure between the blower inlet and outlet, so with a light foot on the gas pedal the engine runs with the fuel economy of a naturally aspirated engine. But when the pedal goes to the metal, the butterfly closes instantly, and 0-to-60 mph times shrink to less than 9 seconds.

Peak torque—260 ft.-lb.—comes on at only 2800 rpm. Peak horsepower is 205, a 35-hp increase.

Quad OHC

The 2.3-liter Quad 4, GM's first 4-valve engine, gets a 120-hp 2-valve



Computer-controlled valve bypasses unneeded boost on supercharged 3800.

kid brother—called the Quad Overhead Cam—for use in the new compacts (Buick Skylark, Olds Achieva and Pontiac Grand Am). The engine produces 40 fewer horses than the standard Quad 4, but 140 ft.-lb. of torque, just 15 ft.-lb. less than the Quad 4. More important, the Quad OHC makes more hp (10) and torque (5 ft.-lb.) than the venerable 2.5-liter Iron Duke, which leaves the GM powertrain lineup.

The Quad OHC comes down the same assembly line as the Quad 4 and has about 75% parts commonality with the 4-valve engine.

The 4-cylinder engines in GM's two domestic-built, entry-level cars, Chevy Cavalier and Pontiac Sunbird, get conventional port fuel injection for '92, replacing throttle-body injection systems. The Cavalier has a 2.2-liter pushrod engine, and the Sunbird has a 2.0-liter sohc engine imported from Brazil. Port injection contributes to better cold driveability and enables both engines to offer more performance without a cut in gas mileage. The Cavalier engine goes from 95 to 110 horsepower and from 120 to 130 ft.-lb. of torque. The Sun-

bird is up from 96 to 111 horses and from 118 to 125 ft.-lb. of torque.

Rattle refinements

GM has been on a near-fanatical push to make new models creakfree and smooth, and has added unit-body reinforcements all over the place.

In addition, the 4-cylinder and V6 engines in the new compacts are "torque-axis mounted," to get rid of a lot of idle shake and other engine-induced roughness. The engine mount is a hydraulic type, and it both supports loads and helps to curtail torque reaction. The transmission mount supports rear loads. A pair of dogbone struts, one under the front mount and the other on the front side of the engine, control fore-aft torque-induced motions. Separating the load and locating functions of the mounts permit each to be designed to do a better job.

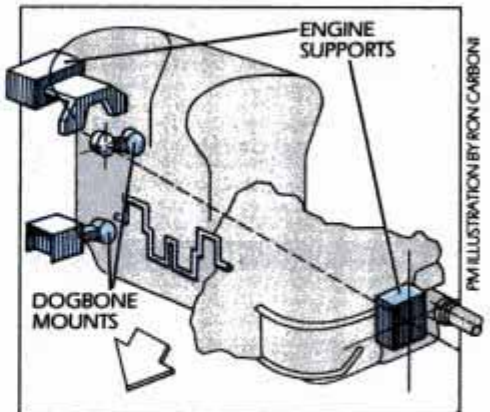
Many air-cleaner housings were stiffened to reduce noise, and some of the housings were reshaped to include "quarter-wave tuners." Inside these cavities, the intake air generates sonic waves in the same frequency but out of phase with the sound waves of the intake airstream, canceling noise during midrange acceleration.

Other GM tech highlights:

- There's more than one way to provide traction control. Corvette offers Acceleration Slip Control, which uses a computer to push the throttle partly closed and even apply the brakes. Chevy guarantees that you can't accelerate quicker without it, although you can flip a switch to disengage it.

The Cadillac Fleetwood/DeVille, top-line Olds 88 and 98 models, Ponti-

ac Bonneville SE, Buick Park Avenue and Roadmaster Limited offer another traction control system that operates (only at speeds of less than 30 mph) by applying the antilock braking system if the computer detects exces-

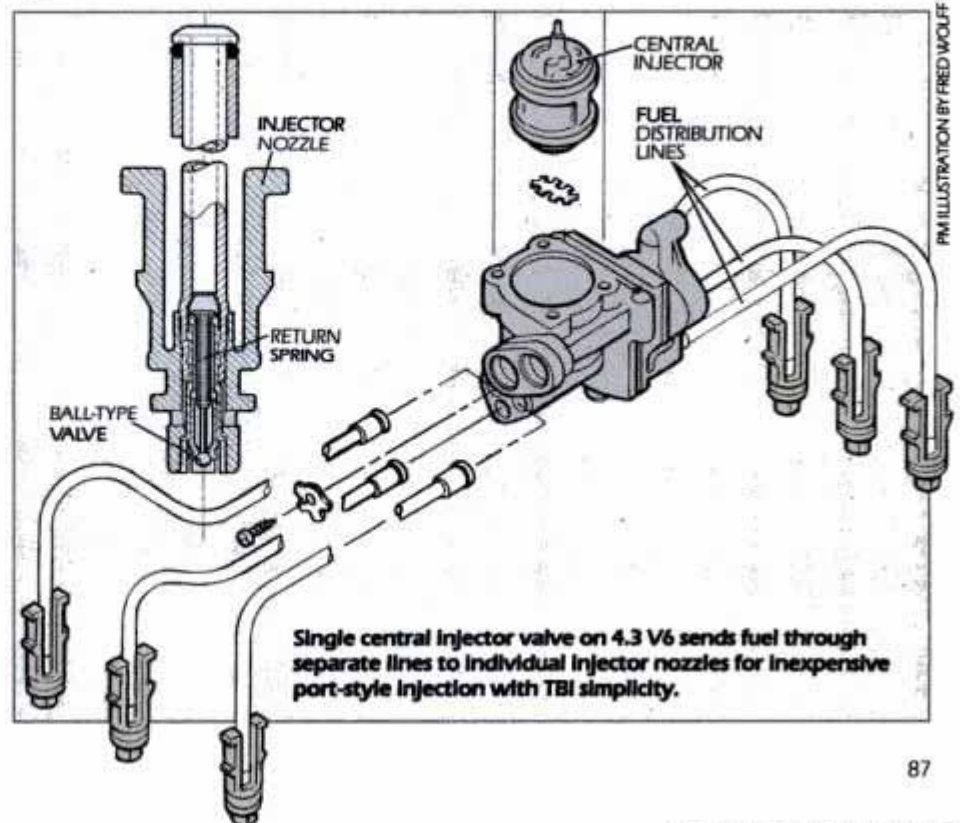


Torque-axis engine mounts reduce idle vibration on GM 4- and 6-cylinder engines.

sive wheelspin. This one also has an override button, which could be used to permit some extra slippage if needed to help get a car out of a snowbank.

- Cadillac's Eldorado and Seville get the definitive lumbar support. No more balloon cushion that's too much or too little and in the wrong place. There's a metal multifinger frame that curves gently inward and outward and moves up and down along motorized gear trains, pushing against firm plastic/fiber padding.

- The Seville also gets GM's first application of light-emitting diodes (LEDs) to replace conventional bulbs. A string of 72 LEDs is used for the center high-mount brake light, which is built into the decklid.

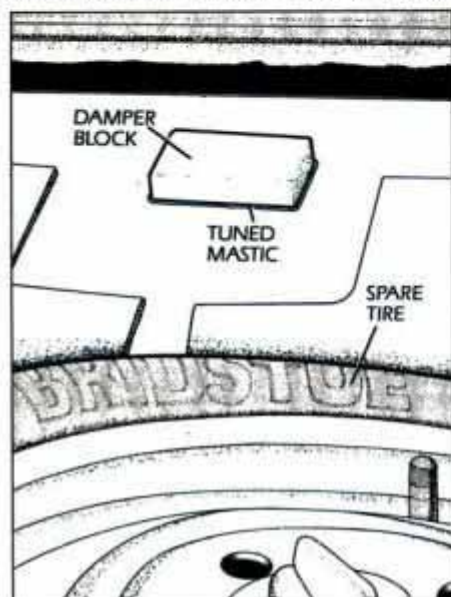


Single central injector valve on 4.3 V6 sends fuel through separate lines to individual injector nozzles for inexpensive port-style injection with TBI simplicity.

- GM steered away from airbags for its new compacts, installing instead its deforming/conforming steering wheel, already proved on the Sunbird/Cavalier. The wheel has legs that will deform in an accident to allow the wheel to conform better to the driver's chest, reducing injury.

- The plastic-body vans (Lumina APV, Trans Sport and Silhouette) get a flat sheet plastic/metallic film antenna sandwiched between the headliner and the roof.

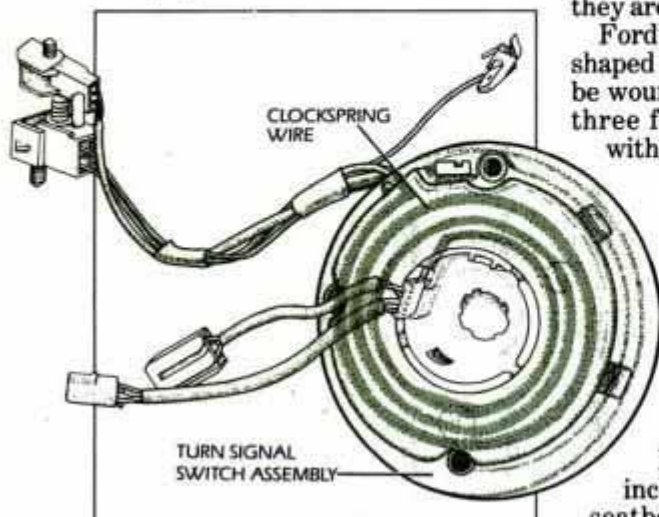
Some of the new compact sport coupes (Achieva, Skylark and Grand



Taurus trunk floor gets noise damping in the form of small, rubber-mounted weights.

Am) will use the rear-window defogger as the antenna. There's an electronic module with a radio-frequency choke to isolate the defogger grid's current flow from the radio.

A typical problem with windshield antennas is poor reception from a fringe station, but the module also includes a signal amplifier to handle this annoying trait.



Ford eliminates metal-to-metal contacts in steering column with spring-wound wiring.

Ford

Although the redesigned Ford Crown Victoria and Mercury Grand Marquis appeared as '92 models in mid-'91, Ford's only really new vehicle this fall is its full-size van series, the Econolines and Club Wagons.

It has the same powertrain lineup, and it still uses body-on-frame construction, but it isn't just a warmed-over restyle of its 17-year-old predecessor. The ride and handling are 1990's quality, and it has a lot less wind noise (in part thanks to flush windshield glass and the elimination of vent windows).

The paint job is every bit as good as a premium passenger car, and each color coat carries a specific primer of the same color, so most paint chips should be nearly invisible.

The a/c system on this van series was completely redesigned to get rid of uneven temperatures and airflow from side to side, as well as eliminate vapor blowing out of the registers on humid days.

T-Bird taillights

The Thunderbird's rear parking lights are a string of 20 light-emitting diodes (LEDs), instead of conventional bulbs. The reason for the switch is the same as for Cadillac's center high-mount brake light in the '92 Seville: It's built into the decklid, and bulbs just wouldn't last very long with the repeated shocks of closing the trunk. Because the LED assembly is compact, it also makes for superior packaging.

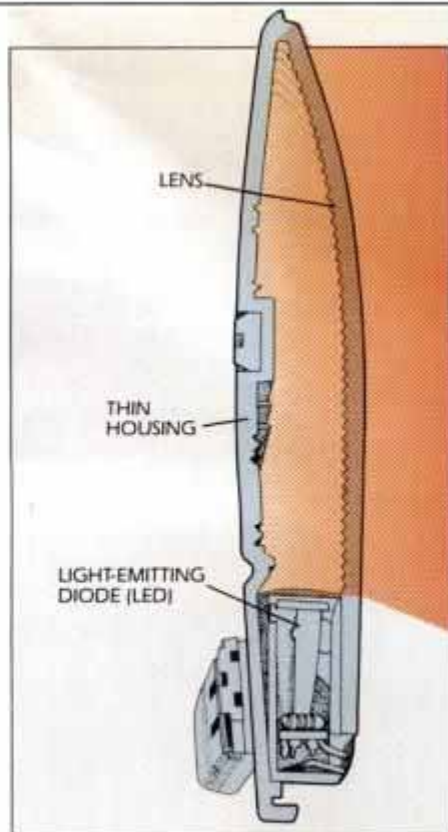
The '92 Taurus/Sable have one of Ford's better ideas for transferring a circuit from the wiring harness to the steering wheel for the horn, cruise control and so on. The customary way is through a slip ring and spring-loaded brushes, but brushes against slip rings can be noisy, and, even worse, they aren't reliable in the long term.

Ford's solution is a wiring harness shaped like an old clockspring. It can be wound up or unwound as many as three full turns in either direction without the danger of fracture.

Quiet, please

Like the other U.S. carmakers, Ford has been on a priority program to quiet its cars, even though many of its models are already U.S. leaders in this department.

The Taurus/Sable noise-reduction program was Ford's most intensive for '92, including antirattle pads on the seatbelt buckle assembly, and four bolts (instead of two) to prevent license plate rattles.



T-bird gets LED taillights housed in super-thin assembly mounted directly in trunk lid.

Lift the cargo area carpet on the Taurus/Sable wagon, and you'll see two small, metal rectangles glued to the floor pan behind the rear seat, one in the center, one at the right side. Those rectangles are actually engineered dampers, and the adhesive that holds them is actually a tuning mastic. It took lots of engineering time to locate these dampers precisely, to reduce transmission of road noise through the floor pan.

V6 Tempo/Topaz

The long-underpowered Tempo/Topaz get a lift with the installation of the Taurus 3.0-liter Vulcan V6. This engine got some modifications, primarily to the water pump, to shoe-horn it into the small engine bay. The exhaust system is also more restrictive, but performance—at 135 hp, 150 ft.-lb. of torque—is close to the Taurus/Sable's 140 hp and 160 ft.-lb.

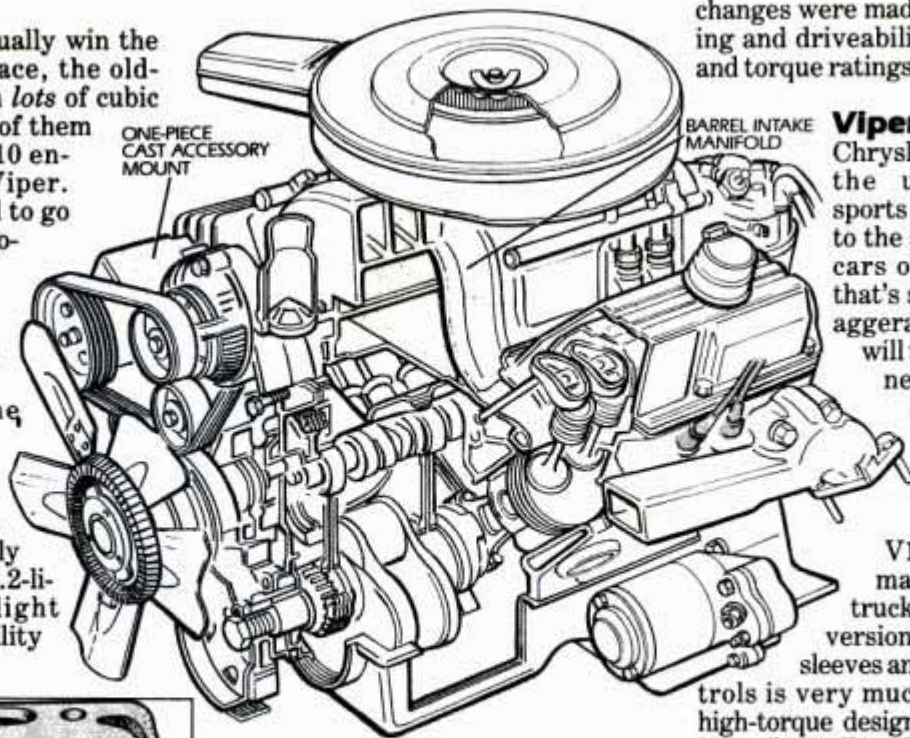
The Tempo/Topaz 2.3-liter 4-cylinder is being equipped with sequential port fuel injection, which should improve driveability over the conventional port system used previously, but there's no increase in output.

The Automatic Overdrive (AOD) is the transmission for Ford's prestige rear-drive cars (Lincoln Town Car, Ford Crown Vic and Mercury Grand Marquis). For '92, the AOD gets the electronics treatment, featuring the capability of modulating the converter clutch for smoother application.

Chrysler

Chrysler will eventually win the 1992 horsepower race, the old-fashioned way, with lots of cubic inches—almost 500 of them in the aluminum V10 engine of the 2-seat Viper. The car is scheduled to go into production in November, and the engine (8.0 liters in this metric age) will produce 400 hp and 450 ft.-lb. of torque.

However, in the meantime, other Chrysler engines are making some very impressive numbers, particularly the 3.9-liter V6 and 5.2-liter V8 in Dodge light trucks and sport/utility vehicles.

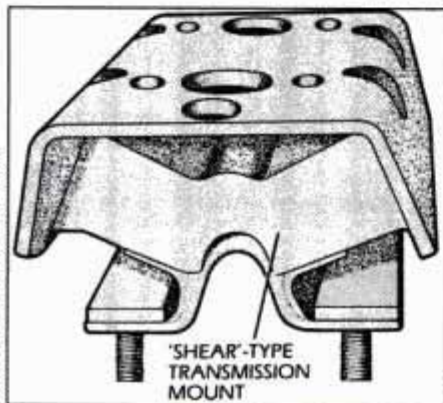


Chrysler V8 and V6 engines are up in power, and carry over only about 15% of parts.

5-speed produced by a joint venture with GM. The 3.9 V6 gets a heavy-duty Jeep manual box. Of course, that's a fair swap, because the upscale Jeep ZJ (a 1992½ addition to the Cherokee line) will offer the 5.2 V8 as its top engine option.

The Dakota's old transmission mount was fairly simple stuff—two pairs of thin, round rubber bushings. For '92, it's a single piece with a wide W-shaped piece of rubber, called a shear mount, adapted from Jeep engineering.

Chrysler's own passenger car V6s, the 3.3 and 3.8, both get sequential port fuel injection for '92, an upgrade from the simple port injection system previously used. However, the



Dakota transmission mount helps to reduce drivetrain vibration and harshness.

These engines had been very conservatively tuned, equipped only with throttle-body fuel injection. The 3.9 V6, which produced only 125 hp and 195 ft.-lb. of torque, goes up to 180 horses and 225 ft.-lb. for 1992. The 5.2 V8, formerly rated at 180 hp and 260 ft.-lb. of torque, is up to 230 horses and 280 ft.-lb.

Making more muscle was straightforward work. The cylinder heads were reworked to enhance combustion, barrel-shaped tuned manifolds and improved intake ports were installed for better airflow, and a sequential port fuel-injection system was mated to the new components, along with an improved exhaust system to reduce back pressure. None of these new components can be retrofitted to pre-'92 engines.

Of course, there's more to the higher performance than just the engines, because it also took a redesigned drivetrain to handle the extra torque, including larger rear axles, modified automatic transmissions and, for the 5.2 V8, an all-new heavy-duty manual

changes were made to improve starting and driveability, so horsepower and torque ratings are unchanged.

Viper tech

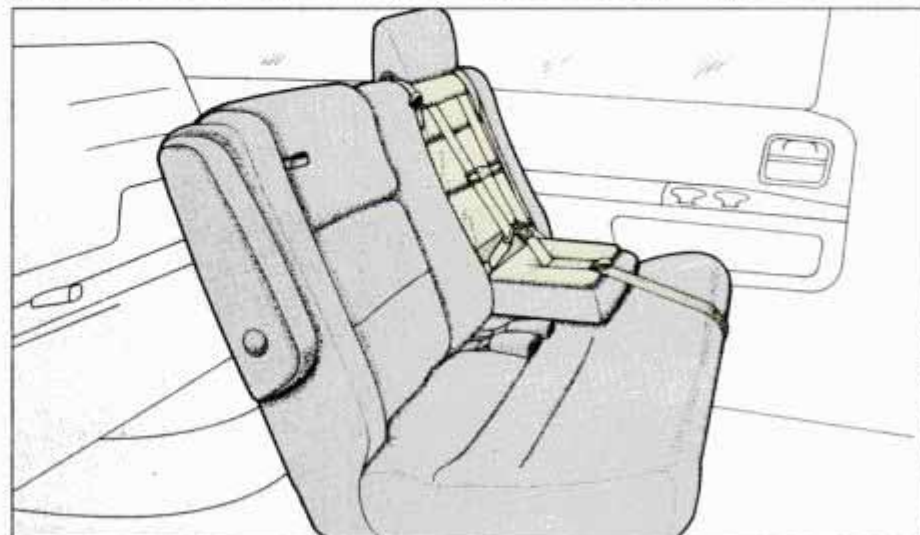
Chrysler has been touting the upcoming Viper sports car as a throwback to the simple, brute-force cars of yesteryear, but that's somewhat of an exaggeration. The 2-seater will use body panels of a new plastic that has never been used in large-scale auto production, hardly old tech.

Although the V10 will eventually be made in cast iron for truck use, the aluminum version with cast-iron wet sleeves and full electronic controls is very much a contemporary high-torque design. The transmission is an all-new Borg Warner 6-speed.

Even the windshield wipers are new tech. To ensure a large, clean wipe without a potential problem from a complex mechanical linkage, each arm is moved by a separate motor. And to ensure they work together and park neatly, the motors are run by a single electronic control unit.

Safety seats

If safety is now apple pie and motherhood stuff, Chrysler has a '92 option on its Plymouth and Dodge minivans that fits right in: two child safety seats built into the second row of seats. Made with a high-strength plastic shell, they fold down from the seatback and include an easy-to-adjust 5-point harness. Chrysler not only expects to sell the option (to be priced at about \$200) to parents, but maybe even to grandparents. **PM**



Chrysler's hideaway child-restraint seat eliminates need for awkward auxiliary seats.



...AND IN '93

Our Detroit Spy sneaks a look over the near horizon.

TEXT AND PHOTOS BY JIM DUNNE, Detroit Editor

● New designs are the lifeblood of automobile popularity. And with the paint scarcely dry on its 1992 models, Detroit is already well along with new styles for 1993, '94 and beyond. Here's a sampling of what's in store.

Pontiac has dramatic new shapes for its sporty Firebird next year. But styling isn't the whole story. Firebird (and Camaro) doors and fenders will be plastic, instead of steel, to reduce weight and improve overall performance, including fuel economy.

But the basic layout and chassis will remain the same—Pontiac and Chevy will stick with high-output V6 and V8 engines driving through the rear wheels.

One year later Ford will introduce the next generation of its always popular Mustang. It, too, will continue as a rear-wheel-drive setup, but there will be adjustments to the chassis, as our spy shot indicates.

Note the width of the tires and the fender bulges added to this development mule, which is wearing 1991 bodywork. Ford wants to match the track and tire footprint of the new Camaros and Firebirds, which will require a wider body and revisions to suspension and axles.

Naturally, besides being wider, the '94 Mustang's bodywork will be completely redesigned.

Reaching further into the future,

Ford is planning a bigger compact van for 1995. Code-named "Win 88," the vehicle will feature front-wheel drive and fit into Ford's lineup just below the full-size Club Wagon.

Eventually, Ford will replace the Aerostar with this vehicle, but that move isn't planned for at least five years. Vans like this one—and the proposed Mercury Villager—are the reasons Ford has dropped its big station wagon models. Vans, according to Ford's planning, will take their place.

Few new cars have as much riding on them as Chrysler's 1993 and '94 LH models. This 4-door sedan is world class in design. Dimensionally, it qualifies as midsize, and features front-wheel drive with V6 engines mounted longitudinally.



'93 CHRYSLER LH



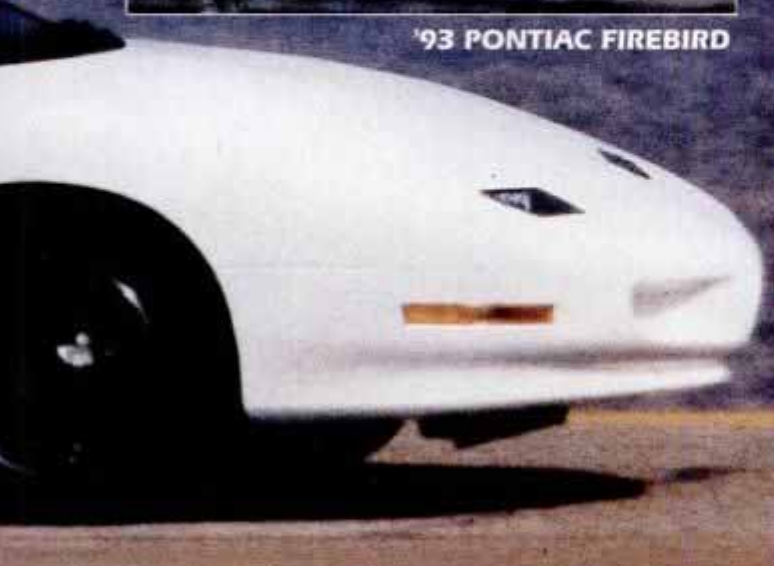
'93 FORD PROBE



'93 PONTIAC FIREBIRD



'95 FORD MINIVAN



'94 FORD MUSTANG

AND '94

Our spy shot shows a highly disguised Dodge version caught off guard during testing near the Chrysler proving grounds in Chelsea, Michigan. Chrysler will also build Eagle and Chrysler variants of the LH. Each model will have its own roof design, grille and taillight arrangement.

The LH is one of the first sedans to feature the so-called cab-forward design. The windshield extends about 8 in. over the engine bay at its base, lending a distinctive profile to the body. Axles are set closer to the ends of the car, creating a longer wheelbase, reducing overhang and improving interior space.

Chrysler is hoping the LH will be as successful in the sedan market as the Jeep Cherokee and Chrysler minivans have been in their fields.

Although it's only three years old, Ford's Probe is about to undergo a major redesign. The 1993 Probe prototype shown here is disguised, but not enough to hide its basic shape and some details.

Pop-up headlights, fastback styling and a basic 3-door body design are all carryover features. But a more massive appearance to the rear end and more rounded sheetmetal panels set this 1993 model apart from today's Probe.

The major jewel in Lincoln's triple crown will be unveiled next spring when the completely restyled Mark VIII makes its debut. Up front, the rectangular grille is gone, but the rear styling is still distinguished by a vestigial spare-tire bulge, long a Mark-series trademark.

Joining Continental and Town Car, the Mark will offer more than a new exterior design to the luxury-car buyer. Under the hood of this LSC prototype is the double-overhead-cam version of Ford's successful 4.6-liter V8 engine. The all-aluminum high-output 32-valve edition of the 4.6 will develop 285 horsepower.

Eight headlights? Yes, that's what appears on the front of this early version of the next generation of the Ford Tempo. As part of Ford's plan to upgrade the Tempo, the new styling will probably embrace more interior room, as well as the 3.0-liter V6 engine option that Ford introduced this year.

Note the low cowl and hoodline, as Ford, too, moves toward the cab-forward school of design. **FM**



'93 LINCOLN MARK VIII



'93 FORD TEMPO



CONCEPT 2000

Shapes and ideas you'll see on the street before the end of the century.

BY JIM DUNNE, Detroit Editor

In addition to this collection of near-future concept cars, our man in Detroit prevailed on the Big Three's design chiefs to forecast automotive design trends through the rest of the decade—and beyond. Their comments—and concept sketches—accompany this story. —Ed.

● Ordinarily, concept cars are test beds for ideas. Later, usually much later, successful elements of the concepts may show up in street cars.

But the Eagle Optima is no ordinary concept car. Unlike most members of its breed, this one may soon be tooling around in your neighborhood, pretty much as you see it here.

The cars that will soon appear with

Chrysler, Dodge and Eagle nameplates are essentially Optima clones.

Optima's most distinctive visual element is the relationship of wheelbase to overall length, 112 in. versus 194 in. These dimensions put the wheels out to the corners of the car, improving ride quality and interior volume.

Optima's north-south engine mounting is unique at Chrysler and

Tom Gale, Chrysler

● Chrysler design VP Tom Gale is not one to rest on his laurels. While his design concept is already being hailed as the shape other carmakers will imitate, he's looking at new horizons.

"The cab-forward shape will be around for some time," he says. "It gives more room to the passenger in relation to the car's length. And it also provides an exterior appearance that's different from any other shape on the road.

"But that's history, from our point of view. What do we do next? Where's the next breakthrough?"

"First, we're looking for smaller powertrains, like the 2-stroke engine.



Gale concept sketch mirrors Chrysler cab-forward philosophy.

We can translate that into more room inside the car.

"We'll use more glass. Side glass and windshields will get larger. And we'll use hidden headlights less—we want each car to have its own face.

"Inside, seats will be molded, which will save space. Don't look for the door

technology to change much. We won't use new door designs unless they work better.

"But fundamentally, our designs will evolve from a basic technical plan. Anyone can create lines and color. We want to have an underlying reason for all of our designs."



EAGLE OPTIMA



DODGE NEON



JEEP WAGONEER 2000



CHRYSLER 300



Optima engine is for show, but cockpit is LH sedan preview.

rare in front-drive cars from any maker. While transverse mounts enhance general package efficiency, a longitudinal mount does make for better front/rear weight distribution. It also makes it easier to adapt the basic floorpan to rear-drive.

The most celebrated aspect of the Optima design, of course, is its cab-forward greenhouse. This design puts the windshield's forward touchdown point about even with the centerline of the front wheel, a shape that improves aerodynamics and creates more interior space.

Chrysler's Wagoneer 2000 belongs more to the realm of pure show car.

This massive sport/utility vehicle rides on 20-in. wheels. It also carries the wheelbase-to-length ratio to an almost ridiculous extreme—138 in. for the former, versus 198 in. overall length.

The Dodge Neon, on the other hand, provides a strong hint of Chrysler compacts to come, perhaps as soon as 1995. The Neon is "environmentally friendly," and its plastic body panels are coded to identify their chemical composition to aid in recycling.

Like Optima, Neon is a cab-forward design, with impressive interior volume for a car of its size. Another interesting feature is its extremely com-

pact 1.1-liter 2-stroke engine that's in the developmental stage.

The surprise with Chrysler's 300 comes when you count the doors—there are four. This flashy sedan rides a 126-in. wheelbase, measures 206 in. overall and has a V10 engine. The rear-hinged rear doors can't be opened before the front doors, and the vulnerable-looking grillwork is actually part of an oversize bumper that meets all federal crash standards.

Why build one concept car, when two will do the job? That seems to be the thinking behind Ford's Zig and Zag, from Ford's Ghia studios in Turin, Italy, and they share experimen-

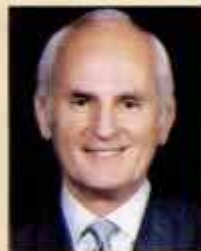
Chuck Jordan, GM

● Though the new Cadillac Seville seems to point to the rebirth of an American school of design, GM's design chief Chuck Jordan says his staff is headed toward an international flavor.

"There will be no more American car, European car or Japanese car," he says. "We'll bring all these schools together in one design."

"Look for the shape of our cars to come from within—we'll design from the inside out. Sure, we'll be more aero. But you'll see cars that will maximize man, minimize machine."

"Our interiors will be easier for the driver and passengers to get into and out of.



Jordan emphasizes airy passenger space, aerodynamic profile.

And yes, we'll have new door systems.

"We'll have longer wheelbases compared to car length, with wheels out to the corners of the car. That leaves more room for passengers."

"Wheels and tires will be taller, yet thinner, to relate to the car's profile and still provide good aero."

"Look for more glass, both windshield and doors. The windshield will stretch forward more, but not in front of the engine. We won't have a cartoon car."

"At GM Design we promote creativity and excitement in our products. Emotion is extremely important. That's what we intend to bring to all our models."



FORD CONTOUR



FORD ZIG



Most unusual feature of Ford Contour front-drive concept car is transverse-mounted inline 8-cylinder engine.



FORD ZAG

tal 2-stroke engines rated at 80 hp.

Zig is a tiny—86.5 in. wheelbase, 139.3 in. overall—2-seat roadster that seems to be a modern sequel to the old Austin-Healey Sprite. Zag is an ultralight microvan, even shorter (by about 4 in.) than the Zig. The roof is retractable so that big packages can be stowed standing up.

Ford's Contour sedan is a concept that draws attention for its T-Drive powertrain. The T-Drive concept places the engine transversely and

the transmission longitudinally, with the power takeoff at the center of the engine. To dramatize the concept, Ford showed the Contour with an inline 8-cylinder engine. The transmission tucks in between cylinders 4 and 5.

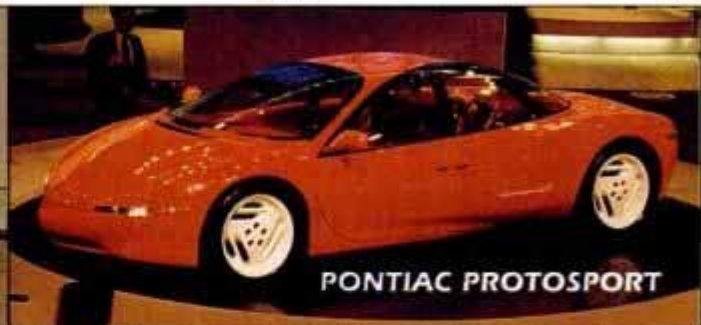
General Motors went to its Pininfarina connection for a 2-seat sports-car concept, the Chronos. The chassis was borrowed from an Opel Omega, and the whole package measures a tidy 176.2 in. long and only 49 in. high, with 17-in. wheels.

Another sporty concept from GM is Pontiac's ProtoSport 4. The unique feature here is door design—the doors swing up and out, to enhance entry and exit in the low-slung designs that are just over the horizon.

A TV set replaces the rearview mirror, something Pontiac has tested in other concept cars, and the headlights have a unique ultraviolet beam designed to improve a driver's ability to pick out hazards, lane markers and signs. **FM**



GM CHRONOS



PONTIAC PROTOSPORT

Jack Telnack, Ford

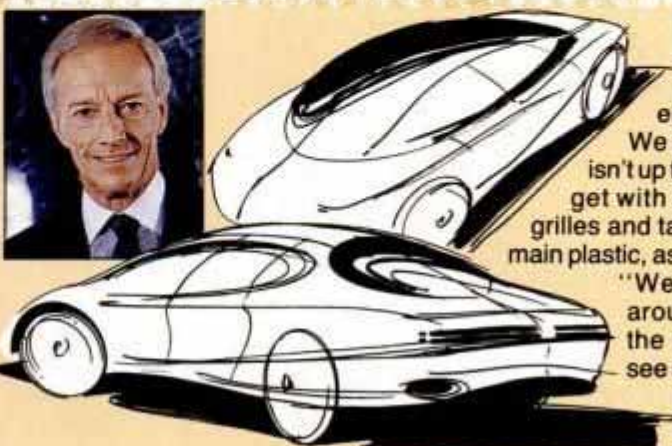
● Ford design boss Jack Telnack has already left an indelible stamp on American styling, thanks to the Ford Taurus. Now he and his staff are getting ready for another breakthrough.

"The most noticeable change will be in the proportions," he says, "and not just in the cab-forward concept.

"The whole side profile will be changed. Wheelbases will be longer, and greenhouses will be narrower top to bottom. Windshields will be much larger. We'll add glass there, and subtract glass in the doors. Glass is heavy, but the exchange of glass surfaces will be balanced out.



Telnack vision includes higher beltline, wider stance, stretched wheelbase.



"Plastic body panels aren't in our plans. We think the fit and finish isn't up to the standards we can get with steel. Still, bumpers, grilles and taillight sections will remain plastic, as on today's cars.

"We'll use some wrap-around rear windows like the Probe, but you'll also see sheetmetal back there.

It remains one of the best places to give each car its own separate identity. It is important that we maintain that differential."

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tact: Sunshine Makers, Inc., 15922 Pacific Coast Hwy., Huntington Harbor, CA 92649; (800) 228-0709.

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Pittards Dry Soft Chamois is a top-quality leather chamois that can absorb six times its own weight in water. It's ideal for drying and polishing all car surfaces without streaking. Unlike other chamois, Pittards does not dry hard after use, but remains out-of-the-package soft even after



months of rubbing and buffing your car's finish for that perfect shine. The chamois sells for \$14.99 to \$29.99, depending on size. *Contact: Garnar Booth, Inc., P.O. Box 367, Peabody, MA 01960; (800) 325-3545.*

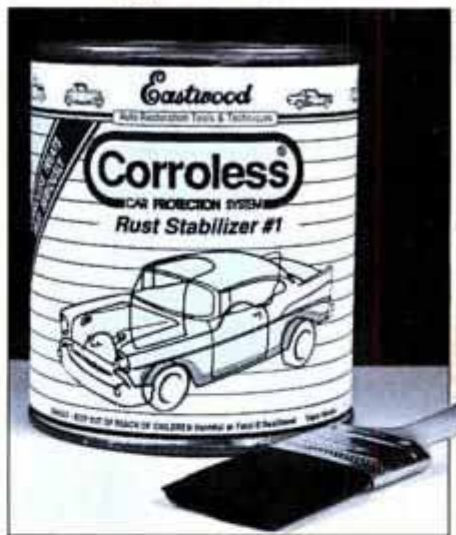
Interior Rejuvenator

Somthin' Else restores and protects interior vinyl, plastic, rubber and leather. It brings back original color and shine to your car's interior while guarding against the hardening and cracking action of the Sun. It contains an anti-static barrier to repel dust and dirt, and has a new-car fragrance. An 8-ounce can of Somthin' Else costs \$8.95. *Contact: Rhino Industries, 14512 Nebraska Ave., Tampa, FL 33613; (800) 329-8833.*



Rust Stabilizer

Corroless Rust Stabilizer penetrates pitted and corroded surfaces, displacing moisture. After removing any apparent surface rust with a wire brush, spray or brush the product onto the effected area. It immediately cures to provide a tough, chemically resistant coating, and contains an active anti-corrosion pigment to prevent further



deterioration. *Contact: The Eastwood Co., 580 Lancaster Ave., Malvern, PA 19355; (800) 345-1178.*

Super Polish

Zaino Bros' Private Stock Show Car Polish and Cleaner was rated No. 1 for highest gloss and greatest durability in a magazine test of leading car polishes and waxes. It gives a super gloss so deep that the surface actually appears to be wet. The polish contains a special sunscreen that totally protects your car's finish from UV rays, acid rain, bird droppings, etc. With

Show Car Polish and Cleaner, your car will maintain its shine through multiple detergent washings. Developed by a leading custom body/paint shop for its own show cars, the polish comes in two formulations: one for clearcoat and another for regular finishes. It's available by mail order only for \$15.95, which includes shipping



and handling. *Contact: ZBCO, 5700 Arlington Ave., Suite 9V, Bronx, NY 10471; (212) 796-5402.*

Carpet Stain Remover

Lifter-1 is formulated for removing difficult stains such as grease, tar, coffee and ink instantly from the sturdiest materials found in today's auto-



mobiles. And there's no need to rub or scrub it out. It's nontoxic, noncorrosive and environmentally safe. *Contact: Lifter-1, 805 N. Meadowbrook Dr., Olathe, KS 66062; (913) 829-8100.*

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California Car Duster cleans the average car in 2 to 3 minutes without water. It features a large dusting area of 100% cotton fibers specially treated with a baked-in paraffin wax, which helps lift up dust away from surfaces without leaving streaks. The duster is 26 in. long for good reach. *Contact: California Car Duster Co., 15430 Cabrito Rd., Van Nuys, CA 91406; (800) 228-1900.*

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Dashboard Covers

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Premium Spray Paint

Dupli-Color Premium Enamel and Engine Enamel are the first automotive-grade aerosols to meet California VOC standards. The paints provide



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styles. The covers are available in 13 foamback colors and 15 carpet-material colors. Installation is quick and easy with a sewn-in Velcro system. The retail price is \$36.95. *Contact: Dash Designs, 1837 E. Third St., Tempe, AZ 85281; (800) 843-3274.*



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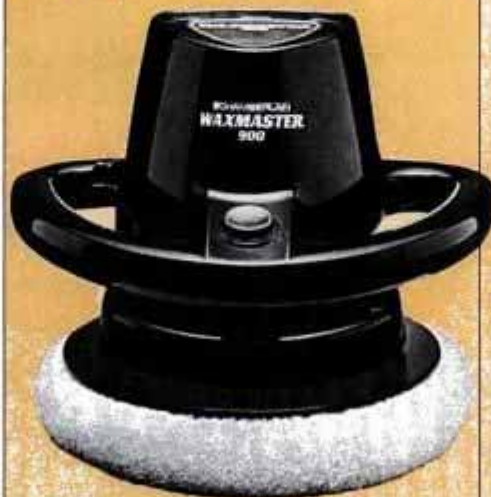
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hold AC current. The unit is priced at \$59.99. *Contact: The Chamberlain Group, Inc., 845 Larch Ave., Elmhurst, IL 60126; (800) 528-9131.*

Portable Mig Welder

Mig Master portable mig welder uses a variable-speed drill to regulate a fine-wire electrode at a constant rate. Two 12-volt car batteries hooked in series deliver 30 to 200 amps at 17 to 21 volts. It's priced at \$239.95. *Con-*



tact: Omniverse Research, Inc., P.O. Box 33243, Los Gatos, CA 95031; (408) 354-6611.

Vacuum/Bleeding Kit

Mityvac's Silverline Automotive Kit combines handheld vacuum/pressure testing tools and brake-bleeding accessories in a single kit. The Silverline metal pump features fluid-resistant valves, an easily readable vacuum/pressure gauge, graduated in inches and millimeters of mercury, and a



fully repairable design. A 100-page user's manual is included. *Contact: Neward Enterprises, P.O. Box 725, Rancho Cucamonga, CA 91729-0725; (714) 987-8975.*

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Cal-Van's Third Hand Self-Grip Wrench makes it easy to remove hard-to-reach nuts and bolts. The self-gripping design allows the wrench to firmly attach to nuts and bolts, even at extreme angles, allowing you to use both hands to set stubborn bolts free. The Third Hand



wrench is 3 in. in diameter and comes in SAE and metric sizes. It costs \$6.95. *Contact: Cal-Van Tools, 1500 Walter Ave., Fremont, OH 43420; (800) 537-2636.*

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Blue-Max is a low-profile creeper with a U-shaped design, welded uni-body frame and six 2½-in. ball-bearing casters. The 40 x 7-in. creeper



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Air-Tool Conditioner



B'laster 404 Air-Tool Conditioner instantly restores rpm to air tools by breaking the surface tension of built-up sludge, calcium, varnish and carbon—elements that cause the tools to fail. It coats internal parts to continuously condition and lubricate. A 16-ounce spray can costs \$4.95. *Contact: Wm. K. Westley Co., 9545 Midwest Ave., Garfield Heights, OH 44125; (800) 858-6605.*

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generates 130 ft.-lb. of torque and is more than powerful enough to remove the tightest factory/repair shop-installed lug nuts. The wrench comes in a case that includes both metric and standard sockets. *Contact: NTY International Corp., 111 Corporate Blvd., South Plainfield, NJ 07080; (908) 769-7700.*

Body Filler Shaper

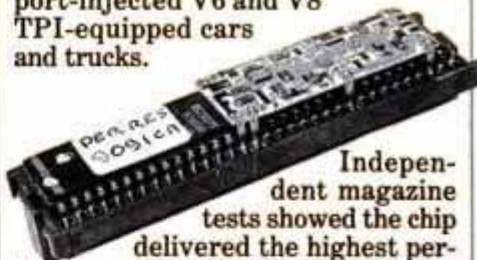


Who-Bar body filler shaper is a saw-tooth steel blade in a wood handle. It eliminates use of 40-grit sandpaper, as well as the second coat of filler for a skin coat. The tool makes coarse, medium and fine cuts, and comes in 3-size sets priced at \$36.75. *Contact: Who-Bar, 44 S. Church St., Bedford Hills, NY 10507.*

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(More Auto Parts Guide on page 104)

ters. The filter's airflow remains unaffected, even when wet. Easily washed and reused, they are available in black and neon colors. *Contact: Holley Replacement Parts Div., 11955 E. Nine Mile Rd., Warren, MI 48090; (313) 497-4000.*

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terminals to fit nearly every car, van or light truck. The battery carries a free-replacement warranty if it fails within 2 years of purchase. *Contact: any Chrysler, Plymouth, Dodge or Jeep/Eagle dealer.*

Header Mufflers

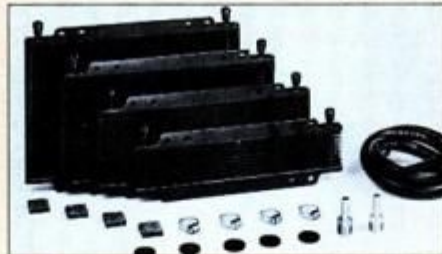
Maremont's new turbo header mufflers are engineered specifically for vehicles equipped with tuned exhaust headers. They feature a multiple-duty flange that fits most popular



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Coolers

B&M's new line of engine and auto transmission Supercoolers feature a stacked aluminum-plate design that cools better and is much stronger than



conventional fin and tube designs. The new design also permits a smaller-size cooler for a given vehicle. Coolers are available for cars, trucks and race applications. *Contact: B&M Automotive Products, 9152 Independence Ave., Chatsworth, CA 91311; (818) 882-6422.*

Axle Assembly

SLP Engineering now offers all-new Dana "44" rear-axle assemblies for 1982-'92 Camaros and Firebirds. The assemblies are bolt-in replacements, with no modifications, for the stock axles. The Dana axles come with a 3.54:1 ratio, Traction-Loc with high-strength spider gears and heat-treated, high-strength axles. They are designed to accept late-model rear disc brake calipers, caliper mounts, brake lines and rotors. They sell for \$1695.



Contact: SLP Engineering, 1501 Industrial Way N., Toms River, NJ 08755; (908) 240-3696.

Turbo Repair Kits

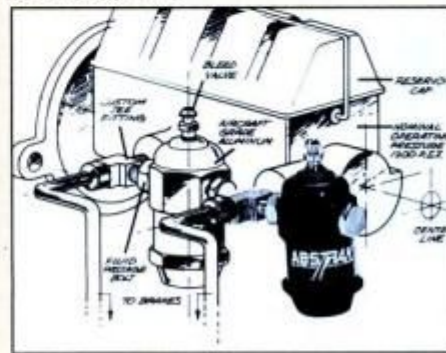
Turbo City's repair kits are designed so that any person with even minimum mechanical skills can successfully reconstruct a rebuildable turbo-charger. The repair kits come with all



the parts and instructions needed to rebuild the center section of the turbo. New center sections for non-rebuildable turbos also are available. This job requires only unbolting the housings and bolting on the new section. *Contact: Turbo City, 1137 W. Katella Ave., Orange, CA 92667; (714) 639-4933.*

Antilock Brake System

ABS/TRAX is a full-time, all-mechanical antilock braking enhancement system that can be installed on the existing brakes of most cars in less than 30 minutes. It retrofits almost any import or domestic car and automatically regulates the flow of energy to the brakes to prevent the wheels from locking up and causing reduced control. *Contact: Automotive Breakthrough Sciences, Inc., 35 Pinelawn Rd., Melville, NY 11747; (800) 4-SAFE-STOP.*



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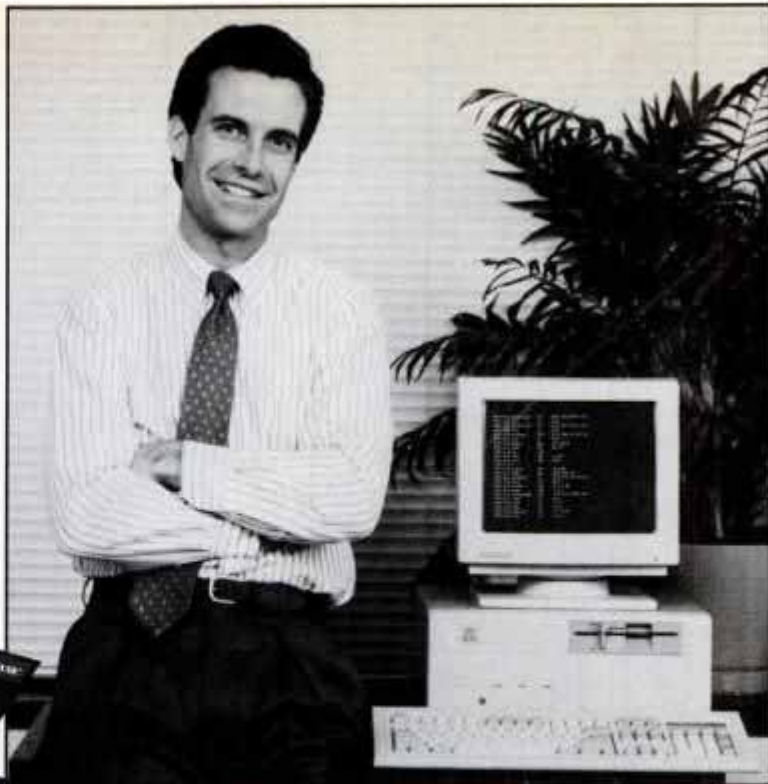
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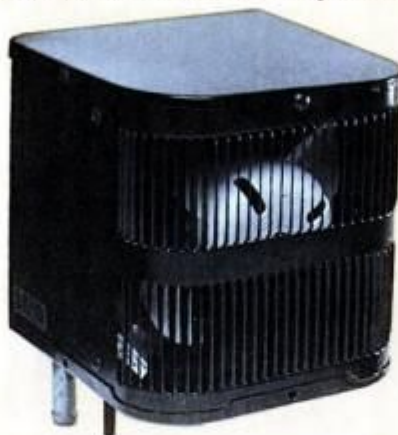


each package are enough to do two wheels. Each package costs about \$2.99. *Contact: Unival Corp., 498 Nepperhan Ave., Yonkers, NY 10701; (914) 969-6922.*

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moved from its base so the boom can be stowed for traveling. Prices start at \$498. *Contact: Ramsey Winch, P.O. Box 581510, Tulsa, OK 74158; (918) 438-2760.*

Cargo Tray

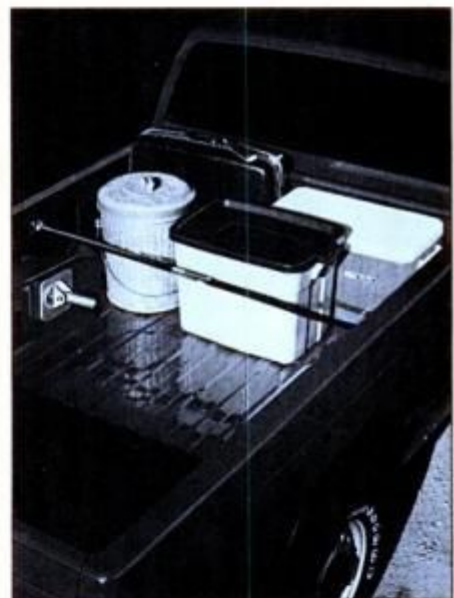
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standard and long wheelbase minivans. A nonskid surface reduces the sliding of objects. The lightweight thermoplastic rubber tray is easily removed for cleaning. *Contact: any Chrysler/Plymouth or Dodge dealer.*

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and won't scratch. Installation requires no tools. Simply twist by hand to tighten it. It's priced at \$27.59. *Contact: Keeper Corp., P.O. Box 675, Willimantic, CT 06226; (800) 533-7372.*

Pickup Cap

Leer's 590 LX pickup cap features new contemporary styling and is built with 8-layer, extra-reinforced fiber-



glass construction. Features include frameless, curved and contoured windows and a frameless glass gate. It comes with a lifetime warranty. *Contact: Leer, Inc., 28858 Ventura Dr., Elkart, IN 46517; (219) 522-LEER.*

Steering Stabilizer

Gabriel's Silver E steering stabilizer improves light-truck handling and control. The unit utilizes foam-cell technology and premium high-performance fluid with a special viscosity



additive to prevent fade and fluid foaming. It comes with a silver anodized shell and 10 boot and decal color combinations. It's priced at \$45.80. *Contact: Gabriel Ride Control Products, Inc., 250 E. Kehoe Blvd., Carol Stream, IL 60188; (708) 462-8500.*

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any width. The ramps can be set up for use in less than 2 minutes. Load capacity is 800 pounds per ramp. Pickup beds stay cleaner as dust flows out the endgate. Contact: Kuhn Mfg., Inc., RR2, P.O. Box 152C, Harvey, ND 58341; (701) 324-4644.



Running Lights

Pacer's Eurostyle L.A. Lights for light trucks are available in neon colors, along with black, gold, white and silver. They feature a low



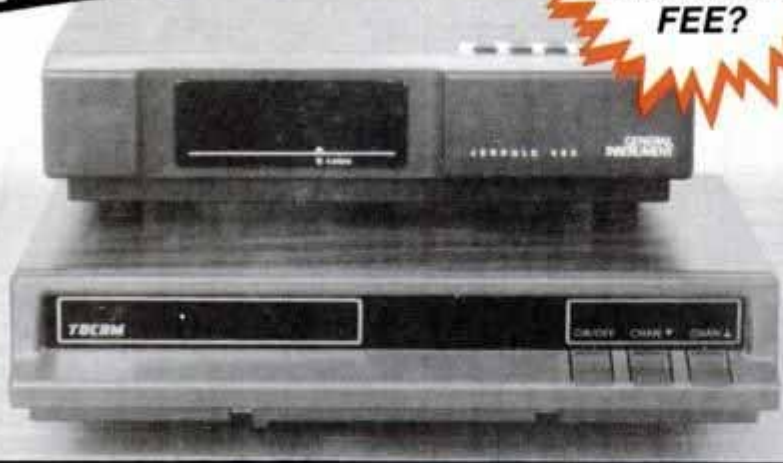
profile and come five to a set. The light kit includes all wiring, hardware and installation instructions. The lights use a standard amber bulb. Contact: Pacer Performance Products, 5345 San Fernando Rd. W., Los Angeles, CA 90039; (213) 245-3654.

Tie-Down System

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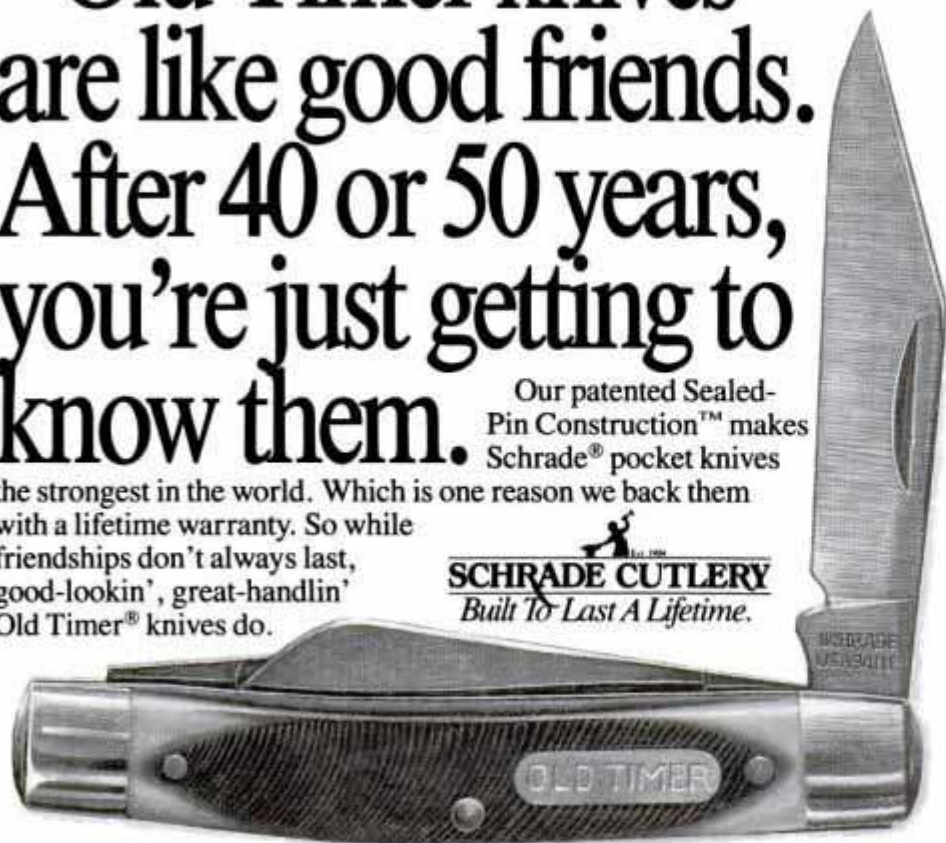
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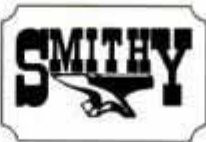
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ACCESSORIES

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Night Tracker RC-500K produces 500,000 cp, is cordless and will illuminate objects a mile away. It comes with batteries and AC and 12-volt car



cigarette lighter chargers. The quartz-halogen light costs \$79.95. Contact: Intermark World Products, Ltd., 632 Green Bay Rd., Kenilworth, IL 60043; (708) 256-6500.

Computer Tuneup

Diacom software and connectors allow onboard computer systems in Chrysler and GM vehicles to be monitored and diagnosed using a standard IBM PC or laptop. The system monitors sensors and controls, performs



vals. The unit installs in minutes using 1/4-in. dia. bolts spaced every 10 in. **Contact: Hi-Lift Jack Co., 46 W. Spring St., Bloomfield, IN 47424; (800) 677-2051.**

Toolbox

Bed-mounted toolboxes are a very popular item with the pickup truck crowd, and the usual choice is either steel or plastic. But the ProTecta Toolbox is an injection-molded toolbox that offers the strength of a steel box, but, unlike steel, will never chip, peel or rust. Sturdy injection-molded 1-in. crossbeam floor supports, corrugated sidewalls and indestructible



lids allow the box to support thousands of pounds without sagging or buckling. Lifetime warranted against sagging, buckling or rusting, it's priced at \$159. **Contact: LRV-Easco, 700 Lunar Dr., Wapakoneta, OH 45895; (419) 738-8536.**

actuator tests, and reads and erases fault codes. **Contact: Rinda Technologies, Inc., 5112 N. Elston Ave., Chicago, IL 60630; (312) 736-6633.**

Retractable Light

Reel Light uses a standard automotive 6- or 12-volt bulb and features an 18-ft. cord that reels back into the mounting base and locks the light securely. The scratch-resistant, mag-



netic base of the light module allows mounting to any steel surface. Reel Light is priced at \$19.95. **Contact: Maresh Industries, 10931 Ivy Ln., Orange, CA 92669; (714) 639-7987.**

Instant Garage



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104+ Octane Boost additive is offering a free disposable funnel through a checkout counter display in most auto parts outlets. **Contact: Octane Boost Corp., P.O. Box 271148, Dallas, TX 75227; (214) 289-0631.**

Booster Cables

Auto-Win's battery booster cables have a heavy-duty roll-away case for storage, quick-fit connectors and side terminals and electronic surge protection. **Contact: Auto-Win International, 1421 S. Ninth St., Alhambra, CA 91083; (818) 284-9983. PM**



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BOATING

100 MPH AT LAKE X

BY JOE SKORUPA, Boating/Outdoors Editor



PHOTO BY BILL STOVER

● Just *being* at Lake X gets your adrenalin pumping. Lake X is the Valhalla of high-performance boating. It's Mercury Marine's private, hidden-away testing grounds near Kissimmee, Florida. Ever since E.C. built the compound, it's been widely acknowledged as the fastest body of water in the world. Who's E.C.? If the initials are a mystery to you, then you never met the late E. Carl Keikhaeffer, the unforgettable founder of Mercury Marine, or never spent much time with Merc veterans who still speak as if E.C. roared through the state-of-the-art compound only yesterday.

If simply being at Lake X starts your adrenalin flowing, then driving 100 mph in a tunnel boat sends it into overdrive. For the record, that's not me screaming across the water at 140 mph in perfect racing trim in the above photo, but it's the kind of equipment I drove, with a few modifications. The lead shot shows racing legend Bill Seebold airing it out on the backstretch during a recent race. A shot of me in the cockpit getting coached by Seebold appears at right. Another shot of Bill and me, this time zipping along at about 100 mph, appears on page 117.

For Seebold, who worked the trim

in Merc's specially built 2-seater, 100 mph is a quiet Sunday drive. For me, it felt different. Much different.

Champ of champ boats

Serious body English is required to climb into the cramped cockpit of a low-to-the-water champ boat. Bill's precise, straightforward instructions are reassuring to a rookie driver, both



The rookie and champion racer, Bill Seebold.

during an early morning briefing and now on the water. As the dean of champ-boat racing, Bill has shoe-horned into more of these 17-ft.-long by 7-ft.-wide hulls than any man alive. In his nearly 4-decade-long career,

he's captured hundreds of national and international trophies, and holds more than 60 world records.

Bill's hair has a touch of gray and his son, Tim, is old enough to embark on his own racing career, but don't let these signs fool you. Bill still dominates the International Outboard Grand Prix (IOGP) circuit as he has since its inception in the early 1980s.

Last year, Bill finished second in overall IOGP points to Scott Gilman. The year before, he finished first. And this year, not surprisingly, he's running among the leaders and is the man to beat every time he suits up and appears at the starting line.

Like most longtime Merc veterans—Bill was a test driver and racer for the Merc-sponsored racing team in the 1970s—he takes a no-nonsense approach to most of life's endeavors. This is especially true of high-performance boating. Bill's driving instructions are clear, precise, concise, comprehensive. They're also sprinkled with devilish humor.

"If there's one thing I've learned over the years, it's that you're always the first one to arrive at your own accident," Bill says, smiling at me just before I buckle into the 5-point racing

(Please turn to page 117)

PHOTO BY MARK SPENCER

harness. Immediately, I see what he means. Looking out from the driver's seat, there's no boat in front of me. The bow drops practically straight down to the water. The pickle forks extend slightly beyond the driver's capsule, but, basically, it's like being strapped into the nose cone of a Cape Canaveral rocket.

Then he tells me that the people at Merc are bringing in an emergency water rescue unit. In fact, the ambulance pulls up as we speak. Two paramedics walk over and climb aboard the photo boat. As they begin pulling on scuba gear, one calls over to me. "It's kind of cool today," he says, "so don't make me dive in after you." Don't worry, frogman, the only water you'll feel will be the spray from my roostertail.

Best show in motorsports

If you hang around hardcore boat racers long enough, sooner or later you'll hear that champ-boat racing is the best show in motorsports.

Champ boats can reach 100 miles per hour in 5 seconds and a top speed in straightaways in excess of 140 mph. Also, they can turn 180° on a dime. Most champ-boat racecourse layouts have two corners of at least 110°, and the racers take them at full throttle, subjecting the driver to 4.5 g's.

The closed-circuit course is about a mile long and typically laid out with four marker buoys. In addition to running on the equipment's ragged edge, drivers must contend with weather and water conditions, plus the nasty, irregular chop kicked up by their own churning propellers.

The most common engine used by racers is the high-performance version of the Merc 2.0-liter V6 outboard. Out of the box, it develops 150 hp. When modified for racing, it produces about 300 hp at roughly 9700 rpm.

Champ boats, which are designed purely for racing, are true tunnel hulls because the bottom slot runs the entire length of the hull. This design traps air and creates lift. At top speed, the boats ride on the edge of the sponsons with a minimum of hull touching the water. Racers control lift by adjusting the engine's trim angle. Both aerodynamics and hydrodynamics are alternately used by drivers to maintain speed and control at different places on the racecourse.

Most champ boats are built out of wood. A few racers are experimenting with fiberglass and other high-tech composites, but their success has been underwhelming. Seebold himself is the builder of the most popular hull on the circuit, and he's convinced that the greater flexibility of wood



Seebold, winningest tunnel boat racer, takes unaccustomed back seat in modified champ boat on Lake X, widely acknowledged as the fastest body of water in the world.

over fiberglass gives it an edge in maintaining control while pounding away on the racecourse.

Complete with a reinforced safety cell and a cockpit canopy, both relative newcomers to IOGP racing, the boat weighs about 385 pounds. Outfitted with full engine rigging, the boat weighs in at 850 pounds. With fuel and driver, the boat must weigh a minimum of 1050 pounds to race.

Fast company

Bill tells me to press the start button, and the engine roars to life. We communicate through the magic of radio-equipped safety helmets. At the first marker buoy, Bill tells me to go in a counterclockwise direction. I explore the layout at a bit more than idle speed. The first and third turns are sharp corners, about 110°. The second and fourth are sharp, too, about 80°.

With each lap, I pick up confidence and speed. The boat corners so quickly that, initially, I sweep through the turns at about 50 to 60 mph. After a few laps, Bill tells me to stop and turn off the engine. We swap seats. He says to hold on.

For this project, the champ boat's engine is slightly detuned, but when Bill puts the pedal to the metal the boat blasts off like a dragster. We hit turn after turn in a blur of body-slaming motion. Bill keeps up a constant patter through my helmet radio. I hear him say, "Notice the angle of approach I take through the first turn."

Sorry, Bill, even after several laps I haven't seen a thing. I have to lean way over to the left to see the markers, but each time Bill pins the turn, my head slams against the right cockpit wall. Finally, after a few laps, I try pushing my head down with all my might onto my left shoulder an instant before Bill attacks the turn. It works. Now I can see what's going on, but what a pain in the neck. Literally.

Bill explains the visual reference points he uses to set the angle of attack for each turn and the position he chooses to dump air from beneath the tunnel to set the boat down in the water for maximum bite in the corner. During a race, Bill achieves this effect with trim alone and runs wide open at all times. For our purposes, Bill instructs me to back off slightly with the throttle.

Wide-open throttle

After experiencing the Seebold driving touch at maximum speed, I'm ready to attack the course. Within a lap or two, I've got the pedal floored and am pinning turns at about 7300 rpm. In a boat that's fully trimmed out, Bill can push the engine to 9700 rpm and 140 mph. At my detuned rpm level, it runs about 100 mph.

Bill explains that depending on water conditions, a racer's location in the pack and several other factors, it's not always wise to pin every turn. I learn to do a sweeping turn, which requires a different angle of attack, but I immediately go back to giving the markers a close shave. To me, all the fun is in cornering this incredibly responsive speed machine.

Before I can talk Bill into trimming up the engine so I can crank out more rpm, the sky darkens and the wind starts to kick up an 8- to 12-in. chop, signaling a hasty end to my champ-boat adventure on Lake X.

Compared to others who've boiled the water here before me, from Bob Magoon and Don Arronow to Reggie Fountain and Bill Seebold, my little speed boat caper doesn't register a blip on the chart. E.C. and others who left their imprint on Lake X have set an Olympian standard. Still, driving a tunnel-hull boat to a speed of 100 mph is a great thrill. But everything's relative. On Lake X, driving 100 mph is the least you can do.

BACK TO THE TITANIC

BY ABE DANE, Science/Technology Editor



UNDERSEA RESEARCH LIMITED PHOTO

● One of the world's saddest, and yet most fascinating, places lies 360 miles off the coast of Newfoundland, and 2½ miles straight down. The massive remains of the unsinkable *Titanic* stand there split in two, spilling the possessions of its luckless passengers over the floor of the North Atlantic. It is a monument to 1500 lives cut short, a museum from the dawning of the 20th century and a persistent warning to anyone who would overestimate man's mastery over nature.

Since its discovery six years ago, two expeditions have explored the wreck, bringing back pictures, samples and souvenirs. No one, however, has really captured the atmosphere of this dark and brooding place 12,500 ft. beneath the sea. But this summer, a multinational crew set sail aboard a \$100-million Soviet research vessel on a mission to produce the most powerful images possible with today's technology. Dives by two of the world's most-advanced manned submersibles brought large-format Imax movie cameras, high-resolution video and powerful new deep-sea lighting technology face-to-face with the wreck.

The result should be the best views the general public has yet had of the *Titanic's* gloomy resting place.

Moscow in Newfoundland

I met the research vessel *Akademic Mstislav Keldysh* in the harbor of St. John's, Newfoundland, where it docked after completing the expedition. Flagship of the P.P. Shirshov Institute of Oceanology in Moscow, the *Keldysh* is a full city-block long, and contains 18 laboratories and accommodations for 130 people. Cradled on the starboard deck are the two submersibles, *Mir 1* and *Mir 2*. Only three other subs in the world share their ability to dive beyond 20,000 ft. "What the Soviets have built here with the *Keldysh* and the *Mirs* is as close to the Starship Enterprise as man has ever constructed on this planet," says expedition member Emory Kristof, a veteran underwater photographer for *National Geographic*.

Dr. Anatoly M. Sagalevitch, designer of the *Mirs*, showed me around one of his creations. A sphere of nickel steel 40mm thick forms the main pres-

sure hull, which is occupied by a crew of three. Three smaller spheres, two mounted ahead of the main sphere and another behind, provide room for water ballast. All of the sub's components, including its valves, pumps and structural frame, are shrouded by a free-flooding fairing made of Kevlar and syntactic foam, which provides buoyancy down to tremendous depths. The *Mirs'* biggest advantage over their deep-diving brethren comes from their powerful nickel-iron battery packs. "We can stay on the bottom for 12, 14, 15 hours and work," Sagalevitch says.

This ample electricity supply is key to the subs' ability to support filmmaking. The unique HMI (Halide, Mercury, Iodide) lamp system developed specially for this expedition drew up to 10,000 watts off the sub's main propulsion batteries. Blazing through the murk, they provided 20 times the illumination available on earlier dives. "Previously, it was a flashlight in a graveyard," said Stephen Low, director and producer for the Imax film.

Like the common mercury vapor

streetlamp, an HMI bulb consists of two electrodes that pass an arc through a glass envelope full of gas. Unlike mercury vapor, however, the HMI chemistry produces multispectral light throughout the visible range. This quality has recently made HMI popular among producers in Hollywood, but never before have the lamps been adapted to withstand the pressures of the deep ocean.

Lighting engineer Christopher Nicholson described the process to me. The lamps themselves were rebuilt for compactness, then installed in test-tube-shaped glass enclosures 1/2 in. thick. Igniter coils and a special flickerfree ballast were enclosed in a custom-fabricated high-strength ceramic housing. One of the simplest and yet most vital parts of the system was the leakproof penetrator needed to pass power cables through the pressure hull so that the lights could be controlled from the inside. A failure at this point could be catastrophic, flooding the hull and sinking the sub. The simple, dual O-ring penetrator was certified by the Woods Hole Oceanographic Institute to 20,000 ft.

Mounting 340 pounds of Imax equipment inside each sub also posed considerable challenges. For optical reasons, the camera lens had to be as close as possible to one of the sub's acrylic viewports, but to prevent damage, it could not touch. Based on drawings and measurements, Imax technician Gordon Harris developed an aluminum frame rigid enough to hold the camera steady in impacts up to 6 g's.

The mounting also had to allow for quick removal of the camera, access to focusing controls and could not interfere with the operation of the sub. "It's sort of a mechanical packaging problem," Harris told me modestly. Numerous other fixes had to be improvised, ranging from a tiny video camera that allowed the sub pilot to see when his viewport was blocked by the camera, to gutters that kept condensation off the equipment.

Although the expedition massed a considerable amount of American and Canadian technical talent aboard the *Keldysh*, respect for the abilities of the Russians was universal. With little hard currency to spend on new equipment, they have become master improvisers, fabricating whatever they need in the ship's machine shop. "What's amazing is the skill level of the individuals," says Nicholson. "We always underestimate them."

The Imax film is scheduled to be out in October of next year, and a CBS special on the filming of the wreck will be aired in February. **PM**

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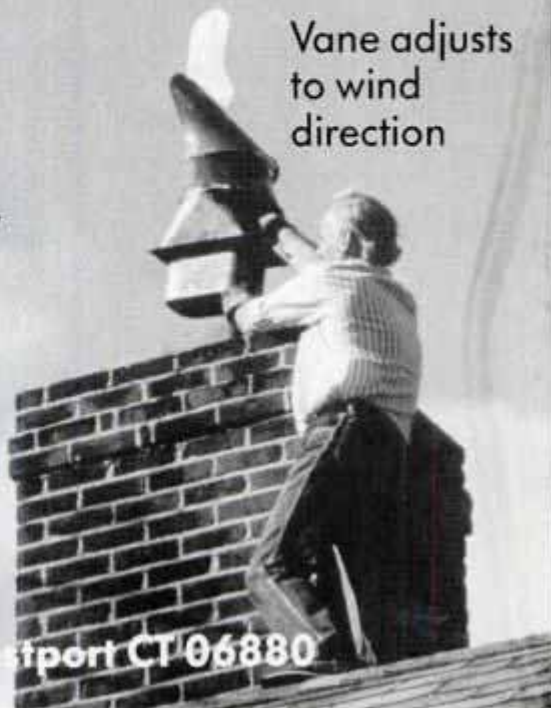
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GREEN BATTERIES

BY FRANK VIZARD, Electronics Editor



● As landfills begin to brim over with the nation's solid waste, new emphasis is being placed upon rechargeable batteries. Research indicates that the average household has nine battery-powered devices and makes 30 battery purchases per year. With an estimated 900 million battery-operated toys and portable electronic products now in use, you can see the extent of the problem. About 2.5 billion batteries are thrown away annually. All of them contain carcinogens, like mercury, that poison the environment.

Rechargeable batteries, of course, have been around for years and have long been a favorite of "think green" environmentalists. Their high price and the long recharging times made them less popular with consumers.

Batteries create an electric current with a chemical reaction that is one way with throwaways. In rechargeables, the chemical reaction is reversed by applying electricity, thereby returning the battery to its original state.

Recent technical improvements are making rechargeables more practical. Recharging time is down to between 1 and 3 hours, depending on battery size. Gates Energy Products, Inc., for example, now sells a 1-hour AA recharger under its Millennium brand name for about \$25. Gates says that

one set of rechargeables can take the place of as many as 300 alkaline batteries. Gates offers a lifetime guarantee, which stipulates the company will replace any rechargeable that fails to hold a charge.

Rechargeables last a long time, but they don't last forever. Here's where the argument for rechargeables is not entirely environmentally correct. Rechargeables are made with nickel cadmium (NiCad), a highly toxic substance to aquatic life that can cause kidney disease in people who eat the contaminated fish. Manufacturers are working to make NiCad batteries more easily recyclable. Sanyo, for example, packages its rechargeable batteries in a mail-back tube. Sanyo hopes this packaging will induce consumers to return used rechargeables for recycling. Other manufacturers have recycling programs as well. In any event, battery recycling is likely to become law in the near future.

The environmental problems associated with NiCad batteries may be relatively short lived. Gates has already introduced a nickel-metal hydride rechargeable battery that has the added benefit of twice the run time of NiCad. The nickel-metal hydride rechargeable is already being used in a Toshiba laptop computer. As nickel-metal hydride rechargeables

become less expensive to make, they should appear in a wider variety of portable devices.

The extended run time of nickel-metal hydride rechargeables will help overcome one shortcoming associated with today's rechargeables. NiCad rechargeables last only one-sixth to one-third as long as alkaline batteries. Multiple sets of rechargeables are almost a necessity.

Rechargeables are also only appropriate for medium- to high-energy-using products like Walkman-type personal stereos or radio-controlled toy cars. Because power drains from rechargeables even when the device is turned off, they're not suitable for products like smoke alarms.

Another problem is that many devices that use rechargeables, such as cordless telephones and power tools, are built in such a way that replacing the rechargeable battery is difficult or impossible. Vermont, Connecticut and Minnesota have already passed bills requiring that rechargeables that are built into products be easily replaceable. More states seem destined to pass similar legislation.

The fear is that consumers will put throwaways into rechargeable battery compartments, a move that will often short-circuit and irreparably damage the product. Gates is proposing a simple mechanical solution that would prevent throwaway batteries from making contact with the recharging circuit used for rechargeables. Products would be designed in such a way so that only the center point of the throwaway would come in contact with the connection. An out-



The center point of a Gates battery wouldn't touch the outer recharging ring.



Samsung's Scout-About home robot.

er, recessed ring used for recharging would not come in contact with throwaways. Such a standard would prevent devices from being inadvertently destroyed and would reduce the need for custom batteries designed for specific products. Battery-operated devices could then use either throwaways or rechargeables for power. Whether the Gates proposal is universally accepted remains to be seen. But once some standard is adopted, more products are likely to offer recharging as a feature.

Home Robot

About the size of a small footstool, Scout-About is a home robot that zips around the room of its own accord. Made by Samsung, Scout-About's main job is that of a watchdog. As it roams around a given area, it monitors a 30-ft. radius for intruders. If security is breached, Scout-About sounds the alarm and also beams a radio message to an automatic dialer connected to the phone.

Scout-About detects both motion and heat. It can also be used to listen for specific sounds, like a baby crying, within a 150-ft. radius. List price is \$1000.

One-Button Watch

Multifunction watches are nothing new, but they often require three or more buttons for all the functions. New watches, though, allow you to access all the functions using a single control or crown.

One example of this type of watch is the Cerullo Sportimer, listing for \$539. The Sportimer incorporates seven functions operated with a single crown. The watch is only 1/4 in. thick and is suitable for divers. In this instance, the dive bezel shows time remaining rather than time elapsed. There's also an audible alarm.

Other features of the Sportimer include a scratch-resistant face, a chronometer and the ability to set the watch for two time zones. The Swiss-made Cerullo Sportimer is sold by Isis Time. Call (800) 486-4865. **PM**



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REVIEW

AMERICA'S NEW WAR MACHINES

● Frankly, it's hard not to be biased when reviewing our own material, so we won't try to be. This stuff is great. We're talking about the new POPULAR MECHANICS video, *America's New War Machines*, Volume I in *The Technology Of War* series. Packed with fast-paced, riveting combat footage, the video presents an indepth look at our air, land and sea frontline weaponry, and reveals the technology that makes them work. Of special interest is the detailed discussion of stealth and night-vision technologies used in a variety of weapons systems.

It's been said of war that the side with the smartest gadgets will prevail. A lot also has been said about our smart weapons systems that helped the United States win such a decisive victory over the Iraqis in the Persian Gulf. The video vividly demonstrates the deadly advantage of these smart systems employed in our arsenal. You also get a close look at some SCUD-busting Patriot Missile batteries and learn about the technology that makes it possible for this missile to search out and destroy its fast-moving target.

There are some great action sequences of the F-117A Stealth fighter, and the video explains how this plane is virtually invisible to enemy radar. It also shows how the Stealth fired the first shot in the war by dropping a 2000-pound smart bomb through the roof of Baghdad's main communications center.

Additional combat footage puts you in the pilot's seat of an F-15 fighter, and you see actual air-to-air missile launches that blast Iraqi aircraft out of the sky. The video also covers in depth the capabilities and strategic deployment of the other aircraft in our high-tech arsenal, including the F-14 Tomcat, B-1B Bomber and F/A 18 Hornets. You see these planes in action and can appreciate how well suited they are for the tasks they were designed to perform.

Naval action shows combat sequences from the decks of the battleship *Missouri* and the aircraft carrier *Nimitz*. You also get a look at the so-

phisticated defense systems that protect our floating strike force. Looking ahead, the video gives you a preview of the Navy's next-generation Sea Wolf supersub.

On land, it was the tank that used to be the centerpiece of the action. In the Persian Gulf, it was the ground support and awesome firepower of the Apache helicopter and its Hellfire

nology—everything from World War II-vintage battleships, through Vietnam-era Wild Weasel and Corsair aircraft, to today's state-of-the-art weaponry. The video shows how the Iraqis faced an armada of more than 1300 planes, 1500 helicopters, 3700 armored vehicles, 3000 artillery pieces and 115 naval vessels.

But *America's New War Machines* is much more than an action tour of our current arsenal. Military insiders put the war into perspective and illustrate the conflict's biggest accomplishment—orchestrating the integration of our massive armada of air, land and sea forces into a unified strike force that simply overwhelmed the enemy and caused the mass surrenders that occurred. Military experts explain how conventional weapons, such as the bombs used by B-52s in their carpet bombing of Iraq's Republican Guard, were used with smart bombs in an overall cost-effective strategy.

Obviously, many lessons were learned from this conflict, not only by us and the Iraqis, but by military strategists of other countries as well. And this brings up some questions: What would happen if the hardware and tactics we employed were used against us in some future conflict? Or, what if defense strategies were developed to counter the offensive tactics we used in the Persian Gulf? These are just some of the intriguing scenarios played out in the video as military experts discuss strategy and also reveal what we'll be up against in terms of enemy hardware in future conflicts and what we must do to keep a strategic edge.

The production quality of the tape is very good, and the use of sophisticated graphics to make technical material very understandable is quite effective. This is one video that goes well beyond the nightly news reports to give you new insight on exactly what we did, and how and why we did it to win the war.

America's New War Machines costs \$9.95, and is sold at outlets that carry Goodtimes videos, including K-Mart and Wal-Mart stores. **PM**



missiles that took center stage. Here's a close look at the advanced guidance system based on the Apache pilot's special helmet. Taking a concept right out of science fiction, the helmet monitors the pilot's eye movements and aims the missiles where the pilot is looking. Turning to tank technology, the video shows why the M-1 Abrams rates as state of the art.

All told, the outbreak of war in the Persian Gulf brought together nearly 50 years of American military tech-

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HOME VIDEO

SMALL SCREENINGS

BY STEPHEN A. BOOTH, Contributing Editor

● Small-screen televisions are traditionally the technological runts of the manufacturing litter. Lately, however, television manufacturers have gotten the message that folks might want high-quality picture and sound in a small package. Videogames, more than anything else, have created this demand. Their computer-animation graphics and high-fidelity—often digital—sound effects are worthy of more than the “light-and-play” treatment. But larger displays aren’t really practical because games are played close up to the screen. And because they are played closeup, the shortcomings of an average television set become really evident. Desktop video editing also is performed close up, so compact size and high quality are required. And because tape editing involves multiple components (camcorder, video-cassette recorder, maybe even a personal computer for special effects), video and audio input jacks are necessary.

If you’re in the market for a small-screen monitor/receiver, at this writing there are a half dozen to choose among. In the 13-in. category, models are available from Magnavox, NAD, Panasonic and Sony. Memorex and Realistic (Radio Shack) offer monitor/receivers that are even smaller.

The Magnavox RS1360C (\$329) boasts stereo audio and a 178-channel MTS tuner, video and audio inputs, and a joystick-like Head-Up remote control that lets you make picture and sound adjustments through an on-screen display. Panasonic’s CTM-1355R (\$299) also has a clever remote control. It lets you return to factory-preset brightness, contrast, color and tint settings at the touch of a button—no matter how much you’ve altered these settings to compensate for a poor picture.

Sony’s recent entry to the field is the KV-13EXR90 (price not available at press time). It’s a stereo model in an attractive, contoured cabinet that



swivels 15° in either direction. Perhaps the most elaborate 13-in. monitor/receiver comes from NAD, based in Norwood, Massachusetts. The company’s MR13A (\$429) offers studio-level features, such as an S-video input (for Super-VHS, ED Beta or Hi8 camcorders or VCRs). Its 440 lines of resolution can do justice to this source. The MR13A offers stereo sound, and RCA-type video and audio inputs and outputs.

If you need something smaller—and portable with AC/DC operation—there’s the 9-in. Memorex Portavision (\$299) and Realistic’s 5-in. Portavision 16 (\$319). Each fills the basic requirements of a monitor/receiver but delivers monophonic sound.

Home Movies Deluxe

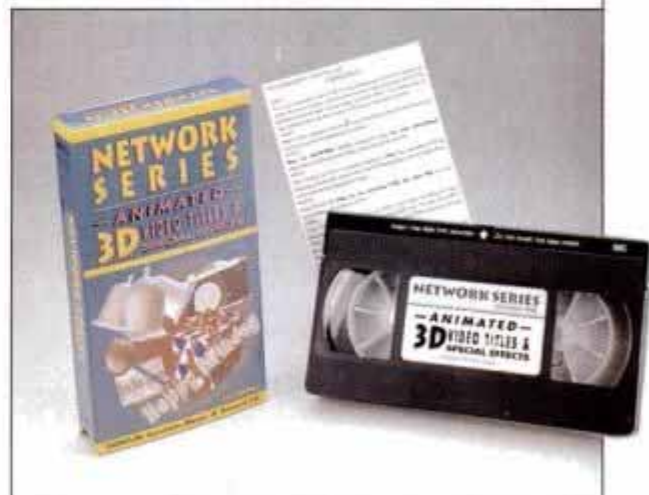
Ever watch the opening credits to a TV program, say, the World Series, and wonder how they generate those marvelous special effects—the bat swinging across your screen, then making contact with a ball that seems to be propelled right through your screen as it

grows ever larger? Ever wonder how you could add special effects of similar quality to your camcorder home movies?

Well, TV’s special effects are computer-generated animation, and it takes an awful lot of computer power (and money) to produce them. For \$29.95, though, you now can bring these awesome 3D-like effects to your home videos.

Creative Video Images, the Voorhees, New Jersey-based studio that did the special effects for football’s Blockbuster Bowl, has introduced a video-cassette that contains 50 special-effects screens you can copy onto your own tapes. The title screens on The Network Series, Vol. I, cover holidays, birthdays, weddings, vacations and other special events. The 2- and 3-dimensional graphics were created and recorded digitally. The various segments run 5 to 15 seconds and are accompanied by hi-fi stereo music and sound effects.

Copying the effects onto your own video is quite easy—instructions are provided on-screen. The cassette is available in all video formats and can be ordered toll-free: (800) 326-1387. In the future, additional special-effects tapes will cover sports, family life and children’s themes. **PM**



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REVIEW

DISCOVERING COLUMBUS

BY DEBORAH FRANK, Managing Editor



● When television viewers tune in to PBS's new 7-part series called *Columbus And The Age Of Discovery*, which is scheduled to premiere October 6 through 9, they'll think they've hit a time warp and been transported back 500 years to 1492. Filling the screen will be the *Niña*, *Pinta* and *Santa Maria*, full-size and under sail. These won't be models, but 1-to-1 scale replicas accurately handcrafted down to the final wood peg.

Executive producer Zvi Dor-Ner came up with the idea for the series in 1982, after reading about the debates that were taking place at the United Nations over Spain's proposal to declare a "Decade of Columbus." Although film production started two years ago, it took four years to build the full-scale replicas of Columbus's fleet featured in episodes two and three.

Sailing back in time

After the stage is set for Columbus's great adventure, the documentary fo-

cuses on the advances in shipbuilding and navigation that made the voyage possible. It then takes you along on an incredible journey with the modern-day crews that sailed the replicas on the same course their predecessors took in the 15th century. Not only is the route followed, but so is shipboard life. Columbus kept a detailed and well-documented log of his voyage, and the program gives viewers a real sense of how it might have been by quoting excerpts from these journals.

But unlike the well-documented logs, plans as to how the ships were built are nonexistent. To develop blueprints, the architects and builders commissioned by Spain had to rely on historical research and a combination of traditional European and Arab shipbuilding techniques.

Each replica was constructed at its own shipyard in the cities of Cartagena, Isla Cristina and Barcelona. Expert craftsmen used the same methods as medieval shipbuilders, carving

massive rib timbers to build a preconstructive frame. Then they hoisted the ribs into the belly of the ship and laid down the 100-ft. upper keel. The unfinished *Santa Maria* replica weighed 250 tons with just the hull in place.

The deck is supported by long, toothed curves of wood that were chiseled to fit precisely into the ship's framework. The deck's planks were then installed. As the mast was sanded, the deck was caulked then

(Please turn to page 128)



A worker prepares a spar in Barcelona, Spain, where the replica of the *Santa Maria* was constructed using traditional techniques.

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COLUMBUS (Continued from page 127)

sealed with hot tar. After the hull was painted, two massive cranes lifted the finished ship from its scaffolding and set it in the water, while its builders prayed that it was leakproof.

The *Niña* and *Pinta* are caravels—small, stout cargo ships used for coastal trade. Their size makes them fast and easy to handle. The *Santa Maria* is a nao—a bulky ship that's not as maneuverable as caravels but carries more cargo. Columbus needed ships that were strong enough to make the long voyage and could carry cannons for protection. When building the replicas, no one was quite sure if the new ships would have the same sailing characteristics as the originals because important details of rigging and hull configuration had to be guessed. Although Columbus described the size and capacity of each ship in his logbooks, he wasn't accurate enough. Details had to be derived from such diverse sources as depictions of vessels on old coins to the decorative elements that appear in period charts, maps and paintings.

Navigating by the stars

Today's crews learned to appreciate the skill of 15th-century sailors when they had to master the sails, each of which is controlled by up to nine separate lines. They reviewed whistle commands with their quartermaster who explained how to trim the sails correctly to match the wind's direction and speed.

They also used a quadrant—the medieval equivalent of a modern-day sextant—and astronomical tables to determine latitude and help them navigate. This was done at noon when the Sun was at its highest point. But calculations read from the quadrant were thrown off a bit by the Earth's tilted axis. The error, however, was consistent and corrected by using the astronomical tables.

To recreate the route exactly, the crews of the replicas launched their voyage from the city of Palos, in Southern Spain, and headed southwest toward the Canary Islands to take advantage of the tradewinds, as did Columbus. They then headed west. They estimated the distance sailed by determining speed and multiplying it by the time elapsed in a half-hour sandglass.

They recreated life on board a 15th century ship as best they could, in spite of not knowing the internal state-of-mind of Columbus's crew. In 1492, sailors had the knowledge of the sea instead of geography, which gave them a rare sensitivity toward the voyage they had undertaken. A thrill we, in this time, would never really be able to experience.

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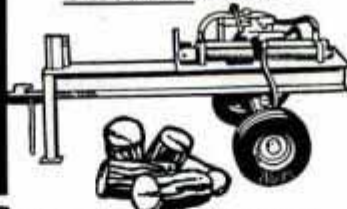
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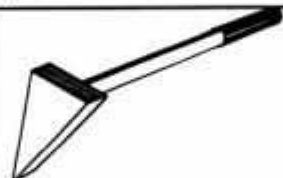
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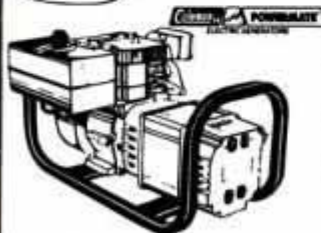
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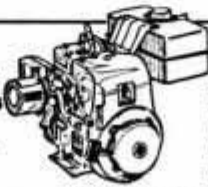
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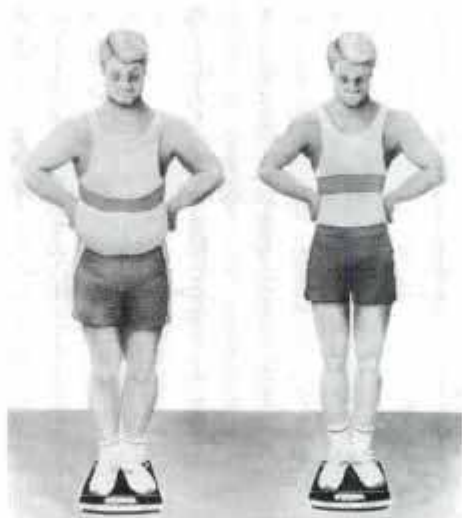
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MUST-KNOW MAN CONTEST WINNERS

The suspense is over. Here's what it took to win our Must-Know Man Contest that we announced in our October 1990 issue.

1st Grand Prize

AmerLink Walton Model Log Home

Max Fannesbeck
Logan, UT

Fannesbeck comes out on top in our contest for his ground-up restorations of three classic (1930s-'40s vintage) Boeing Stearman airplanes, which were essentially basket cases when he started. Each plane took about 15 months to complete. Fannesbeck, who is not a licensed aircraft mechanic, says he has no formal training in the field but developed expertise in rebuilding engines, wings and fuselages on his own. He follows regulations by having his work checked by an FAA inspector.



2nd Grand Prize

1991 Buick Regal Limited Sedan

David I. Webb
Los Angeles, CA

Webb designed and built a 46-ft., twin-mast schooner, a project he started in 1979, and launched in December 1988. Webb races his cold-molded wood-construction craft, winning one race outright, and taking two first-in-class victories.



3rd Grand Prize

ProCraft's Procaster 190

Michael K. Bernier
Huntsville, AL

Bernier, a biomedical equipment repairman, built a 2-story, 3200-sq.-ft. passive solar home in his spare time (evenings and weekends). He did everything himself, including the planning and designing as well as the total construction.

Bernier felled his own trees, laid out all the rock masonry for the 8-ft.-tall, 14-in.-thick rock walls, hand-mixed 20 tons of mortar in a hand-mixing trough, and laid out the footings and foundation. All framing, studs, joists, beams and so on are solid oak.

4th Grand Prize

Trip for four to Epcot Center at Walt Disney World

James R. Hildreth
Jacksonville, FL

Hildreth is completing a 1932 Ford resto-rod. Stock-looking on the outside, the street rod has a reinforced frame which anchors a homebuilt front suspension with Dodge Omni rack-and-pinion steering that works with Mustang spindles. At the rear is an independent setup from a '79 Corvette. Under the hood is a 305-cu.-in. Chevy running conventional intake and ignition systems, and backed by a rebuilt Turbo 350 transmission. Hildreth's cost so far on the 5-year project is \$15,000.



5th Grand Prize

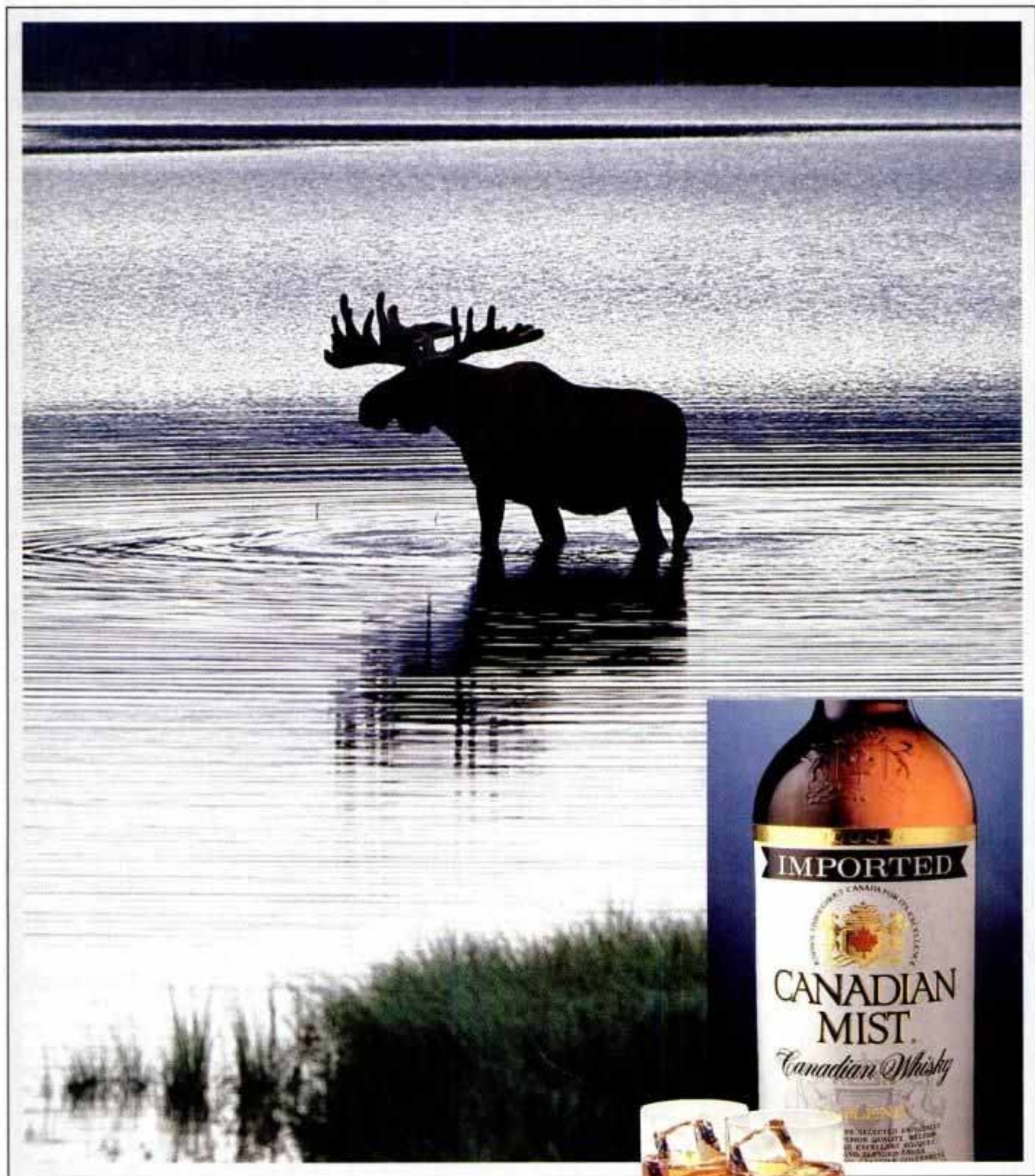
RCA 46-in. Color Trak 2000 Home Theater Projection TV

David C. Bishop
Dayton, OH

Bishop's philosophy is build a more comfortable bicycle seat, and the world will beat a path to your door. Bishop's door, however, hasn't been broken down yet by a pressing throng of cyclists because his bicycle seat post with a built-in shock absorber is still in the engineering stage. A working model is on the drawing board.



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LONG ON THE RANGE (Continued from page 36)

is sitting in a field of wildflowers, and you want to create a high-key effect, one where colors and tones become lighter. Turning the exposure control ring toward the plus side increases exposure and creates an ethereal, soft effect in the scene.

Changing colors

You can also change the overall color bias or tint of a picture manually, without having to add filters to the front of the lens. Let's say you're still taping the family on the beach and want to add more red to the sunset sky. You can do this by fooling the white-balance setup in the camcorder. To gain more of a red tint, set the white balance (WB) to manual, and point the camcorder at a blue card. The system will overcompensate with red (the opposite of blue here) and add the same to the scene. Naturally, an auto WB is standard with the L1.

Shutter-speed settings can also be varied on the L1. Generally, the faster the action (and the brighter the scene), the higher the shutter speed. The normal shutter speed on the L1 is $\frac{1}{60}$ second. However, if you're taping your own golf swing, and want to analyze the motion later during slow-motion playback, you can set a faster shutter speed when you tape. The L1 allows you to work in a range of $\frac{1}{100}$ to $\frac{1}{10,000}$ second. Take note that scenes shot with very high shutter speeds will look a bit like an oldtime movie in normal playback speed.

You can also work with slower shutter speeds with a function called Gain Up. Normally used for very low-light scenes, such as a harbor at dusk, you can also use the slow speeds to add blur to action sequences. This is akin to using a slow shutter speed on a still camera. This can add some artsy effects to shots of, say, volleyball games, swimming or even of a child running through the fields.

While we're on the subject of time, you might consider using the interval timer function for some very exciting time-lapse photography. Let's say you're camping in the Sierras, and your tent site overlooks a beautiful valley. The Sun is going down, and the clouds and light shift and dance continually. Rather than point your camera at the horizon and tape continuously for a few minutes (a sequence which will drive viewers to the microwave to make some popcorn), set the interval timer to record a frame every 60 seconds, put the camera on a tripod and let the camcorder handle the rest while you stoke the fire for the evening meal. The result will be a compressed version of the whole glory of

the sunset. The timer can also be set for 10- and 20-second intervals.

The L1 utilizes digital circuitry for many effects, some of which are available while taping, others of which can be utilized during playback. The live digital effects include Close Up, for a quick doubling of the image size. Let's say you're taping a clearing in the woods, and suddenly a deer comes out of the thicket. You zoom as close as possible, but the animal is still too small in the frame. Switch to manual focus, activate the Close Up function, and you'll fill the frame without having to waste time in changing lenses, or moving closer and possibly startling the deer away.

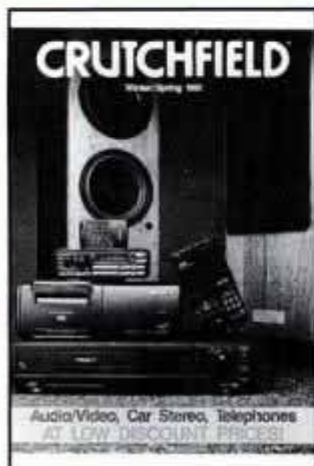
Overlap is a digital scene transition technique that allows you to fade from one subject to the next without going to black (though there is a fade button on the L1 as well). Say your child is about to try his hand at skiing for the first time. You can tape him while he practices, finishing up with a closeup zoom to his face as he determinedly eyes the slopes. You can freeze the frame with the glint in his eyes, then transition to the next scene, a long shot where he successfully handles his first run.

There are also digital freezes for sequence shots, where you can fix a still image (for about $\frac{1}{8}$ of a second) as you continue to tape. You can also use something called Art Freeze, which gives a posterized blending of colors. During playback, you can also get digital strobing effects (a sort of stutter-step action), frame-by-frame advance, more art effects and slow motion.

The beauty is that you can easily record these effects when you dub the 8mm tape to VHS for playback on your household VCR. (Tip: Use a high-bias VHS tape for the best results.) The wireless controller that comes with the L1 kit and the Canon VE-100 remote-control editor allow you to make highly viewable, edited tapes with ease. Just keep in mind that too many special effects can overpower the subject matter. Use them judiciously and you'll add a nice graphic touch to your tapes.

All these effects, and much more, are all part of the L1's capabilities. Yes, you can use it as a point-and-shoot camcorder, but you'll be wasting a good deal of potential if you do. Though the overwhelming amount of buttons on the camcorder can be intimidating, a thorough reading of the instruction booklet will guide you through them. Start with some basic functions, experiment with some digital effects, and get a feel of what this amazing image-making machine can do for you.

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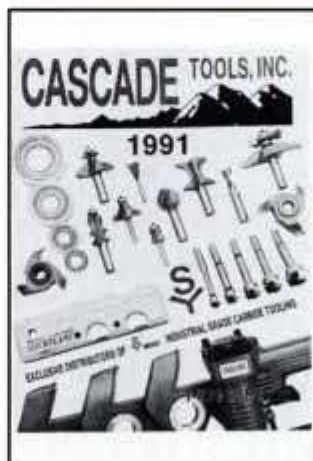
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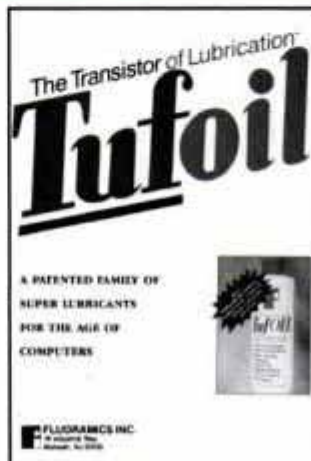
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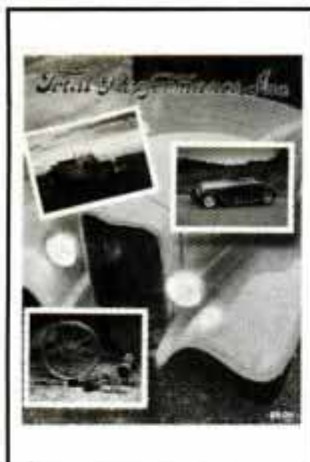


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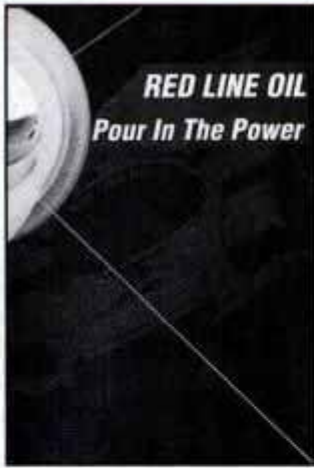


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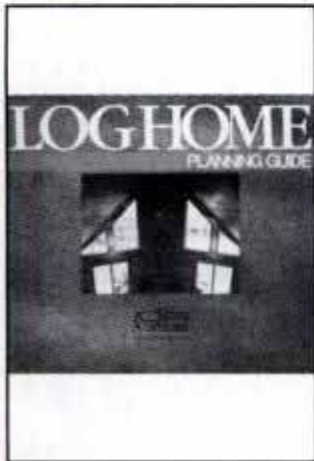


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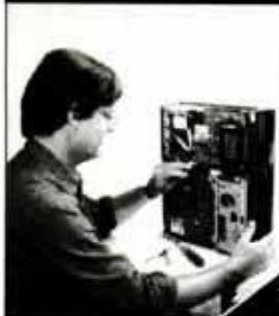
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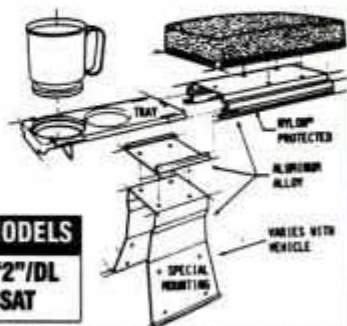
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(Continued from preceding page)

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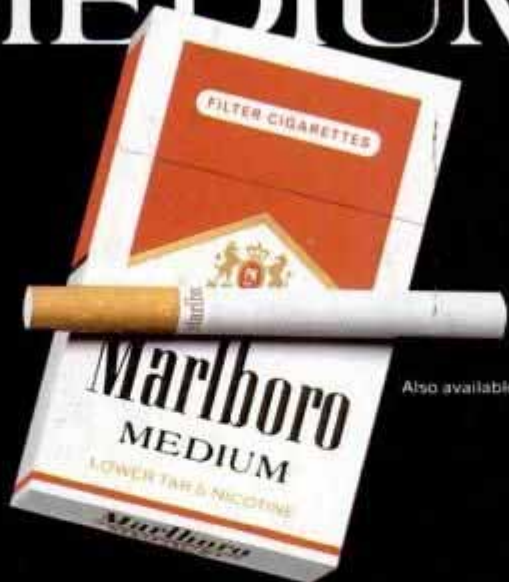
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