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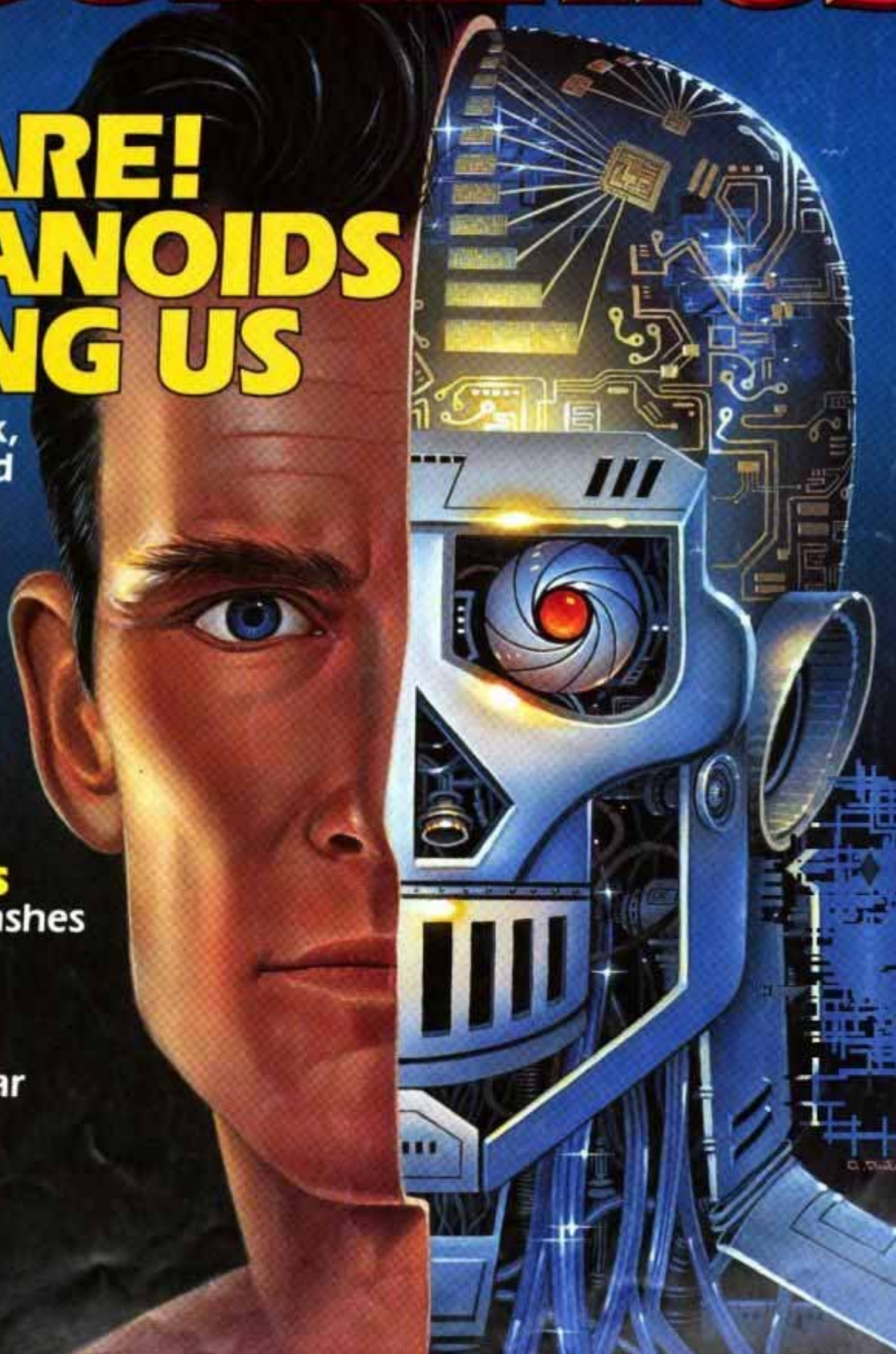
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# Popular Mechanics®

JULY 1995  
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NO. 7



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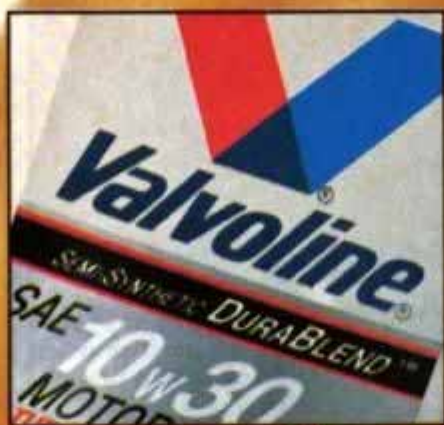
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# EDITOR'S NOTES



John Bostonian and his article-inspiring backyard storage shed.

● Lest you think we don't practice what we preach, take a look at Art Editor John Bostonian Jr. and the backyard storage shed he recently built. If it looks familiar, it's because it was the inspiration for the article, plans and information we published in our June issue. An informal conversation between John and Associate

Home Improvement Editor Tom Klenck resulted in some hastily drawn plans that John used for construction. Upon completion of John's shed, Tom and Home Improvement Editor Steve Willson decided that this would be a good article for POPULAR MECHANICS. And so it was. If you missed it and are interested in purchasing a back issue, call Patty Woods, our Reader Information Services Manager, at (212) 649-3127.... Our cover story this month, "Creation Of The Humanoids" (see page 39), borrows its title from the 1962 science-fiction movie of the same name. Both that movie—not to mention others since—and our article, by contributor Bridget Mintz Testa, raise compelling philosophical questions. Making robots more humanlike is one thing. Making them *human* is quite another. Where does engineering leave off and religious dogma begin? From the time the first tool was carved out of a piece of flint, we've had an innate fear that technology run amok would overpower the human race and take on a will—a soul, if you like—of its own. Machine would rule man. It has been a continuing fear of humankind and a relentless theme—first in our literature and now in our films. I'm not saying it's happening. But I'm not saying it couldn't happen, either. Read our article and then you decide if man is going too far.... You may have heard that scientists are planning a mission to Pluto. The most distant known planet in our solar system and the only planet we've never visited with a space probe, Pluto will have callers from NASA right after the turn of the century. The Pluto project is slated to be one of the new "better, faster, cheaper" missions that will be NASA's *modus operandi* for the foreseeable future. Blastoff is on page 64.... A ride on the fastest offshore racing boat in the world? Hey, count us in! Or rather, count Boating/Outdoors Editor Joe Skorupa in. And you're aboard with him beginning on page 50.... There are so many great things in this month's Home & Shop Journal section, which starts on page 67. For one, there's drywall installation—a lousy job, but someone's got to do it. Here's how to make it as good as it gets. Then, check out our complete guide to specialty fasteners that work where nails and screws fail. And finish off with a great barbecue, using some of the new gear we show. Bon appétit. Till next time.



Joe Oldham

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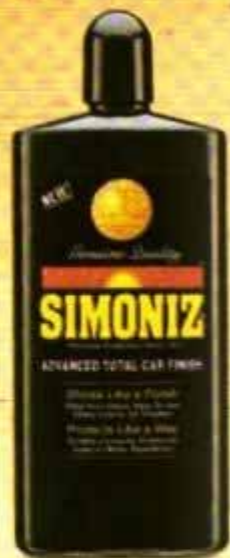
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## Cybermail



Thank God you finally got on the Net. We needed it. There was no excuse for POPULAR MECHANICS—a high-tech magazine—not to be online. PM is the best magazine on Earth. Forget about all those people who cancel their subscriptions over nothing.

ANTONIO DAVILA  
(VIA INTERNET)

I was enthused to find that you've finally supplemented your print version with a Web version. Your pages look great, are logically constructed and much appreciated. Thanks for a well-done piece of the Web.

GARY HOPKINS  
(VIA INTERNET)

I just noticed that you've finally become part of the new age that you so vocally espouse. Still, I feel that the quality of the magazine is deteriorating, and it no longer represents the high standards it had upheld for so many years. Your coverage of virtually every subject is much too pro-American. If you don't open your eyes and start seeing the rest of the world, it'll be the undoing of POPULAR MECHANICS.

DAVID ELLISTON  
(VIA INTERNET)

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

Most people don't understand why POPULAR MECHANICS—like so many other magazines and newspapers around the country—puts headlines trumpeting UFOs on the cover. For those people, here's a quick lesson in economics. Headlines and cover stories sell magazines, which means that all the great folks at PM will be able to eat this month. And that means they'll be able to give us amazing things to read about next month. As an editor for a local newspaper, I know that headlines—and generous advertisers—put food on the table. So the next time you think about kvetching to PM about its headlines, remember: No fancy headlines, no readers, no advertisers mean no POPULAR MECHANICS. But don't worry, this reader understands. Keep up the good work—especially that fantastic artwork.

CHRISTOPHER COLBY  
(VIA INTERNET)

### Fired Up

A recent Tech Update piece on the P-90 submachine gun was most disturbing. With the ease certain individuals have in getting guns, and the violence that usually results, this article was definitely in poor taste. If this is the avenue you're intending to follow, please cancel my subscription.

JOHN R. LEFEVRE  
PARADISE, CA

Please continue to be politically incorrect with your firearms articles.

RICHARD J. ANDREWS  
LORAIN, OH

A letter in your April issue characterized publications that advertise handguns as "under-a-mattress" fare.

During my well-traveled 45 years, I've never seen serious personal arms built to be operated by any other part of the body. I've also never seen gun-oriented literature treated as "under-a-mattress" material. Had I such perverse fantasies about moral culpability of inanimate tools, I'd hesitate to boast of it in writing—or to use the word "tempted" when referring to the exercise of an enumerated right. There's already a country where English is spoken, and no one may have any wee gun without the express permission and

direct supervision of Her Majesty's Government. Let those who long for that pack up and move there.

M. MICHAEL GRIFFING  
VIENNA, WV

I support your decision to allow gun advertisements 100%. The last time I checked, we were living in a democratic society that allows free speech. If people don't like certain advertisements, they should skip over them. I don't smoke, but that doesn't mean I'm offended by cigarette ads.

KARL  
(PM BULLETIN BOARD)

Advertisement



**STANLEY**

## Reader Project Of The Month

Through the years, I had retained issues of POPULAR MECHANICS that featured *The Sovereign Of The Seas* with the sole purpose of building this model. The December 1932 and March 1933 issues were lost, but fortunately, your Reader Information Services manager sent me Xerox copies of those issues. I began construction of *The Sovereign Of The Seas* on July 25, 1992, and completed it in December 1994. Many thanks to you all.

ROBERT S. WALLACE  
LOS ANGELES, CA

If your project is chosen as Reader Project of the Month, you will receive a Stanley Home Improvement Kit, complete with hand and decorating tools, and an electric stapler/nailer, valued at more than \$200. For your project to be considered, please send a clear, color photo and brief description to: Reader Project of the Month, Popular Mechanics, 224 W. 57th Street, New York, NY 10019.



# “4x4 of the Year(s)”

## *Petersen's 4-Wheel & Off Road* “4x4 of the Year” 1994, 1995.

When the new Dodge Ram Club Cab 4x4 was named “4x4 of the Year” for 1995, we felt doubly honored. Just last year, Ram 4x4 regular cab received the same honor. This marks the first time ever the same truck has won two years in a row.

Of the '95 Ram, *Petersen's Four Wheel & Off Road* said, “This just may be the best full size pickup ever made.” They noted that it was “...as comfy as your living room...” And marveled at how “Dodge Ram sneaks through trails...and glides over paved byways with aplomb...”

Ram's aptitude both on and off road

can be attributed to an ingenious quadra-link front suspension. Its four link design results in a smooth ride on the highway, while a live solid axle provides Dodge Ram 4x4 with exceptional off-road ground clearance.

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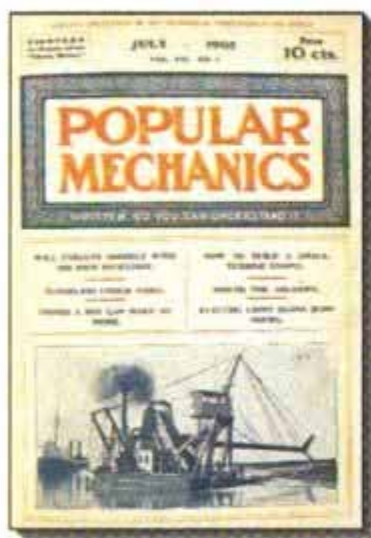


The New Dodge

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# TIME MACHINE

## 90 YEARS AGO: JULY 1905



### Safe Haven

Pacific storms frequently battered vessels steaming toward San Francisco or San Diego. To give ships some refuge between those harbors, the biggest seawall yet built was under construction in the San Pedro Bay, off Long Beach. Two kinds of rock went into the breakwater, which stood 64 ft. high, poking 14 ft. out of the waves at low tide. Meanwhile, on the harbor side, dredges were deepening the bay to accommodate ships of all sizes.

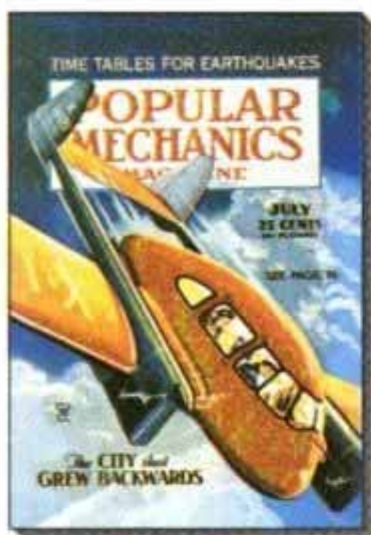
### Air Power

To drive the coming revolution in aviation, engines would have to deliver maximum power at minimum weight. Motormakers were up to the challenge, as witnessed in the 100-pound powerplant developed by Duryea Power Co. The en-

gine, with cast-iron cylinders clad in copper water jackets, cranked out 15 hp. Duryea was also building a 75-pound 3-cylinder motor for American airship pioneer Thomas Baldwin. But when biplanes first appeared en masse, the French radial became the top-flight engine.



## 60 YEARS AGO: JULY 1935



### Sky Car

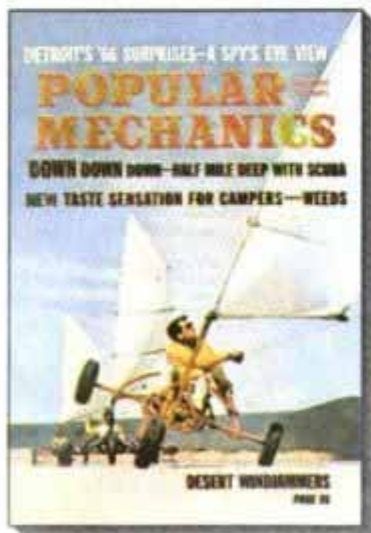
Lifted from aircraft design, the streamlined silhouette was reshaping the automotive world. Now the trend was turning around: Aircraft builders were fashioning planes to look like aviation-inspired cars. Case in point: the Shelton Flying Wing, a 4-seater designed by Thomas M. Sheets. While the plane wasn't a true flying wing in the Northrop sense, its cabin took up a third of the 36-ft. wingspan. Twin supercharged engines spurred the aircraft to 233 mph.

### G Force

Washington had an elite new squadron in the war against gangland—the Federal Bureau of Investigation. Drawn chiefly from lawyer and accountant ranks, G-men had long been expert sleuths—but with no powers of arrest. Now, brandishing submachine guns, they wheeled into action aboard hopped-up cars. They also harnessed '30s-vintage computing power, tracking criminals with punch-card processors.



## 30 YEARS AGO: JULY 1965



### Hard Tack

Europeans had been doing it for 200 years. Now, California's dry lake beds attracted waves of weekend sand sailors. Most brought homebuilt rigs. Although winds whipped the lightweight 3-wheelers to 60 mph, tumbles never led to serious injuries—thanks to safety belts and bucket seats. When sailors tired of the slalom course and oval track, they met in break-neck hare-and-hounds races, zigzagging madly through islands of sagebrush.

### Test Tubes

Remember when tubes ruled the radio, television and hi-

fi worlds? One of the big frustrations of that era was buying replacement tubes, only to find out that the TV set still wouldn't work.

We tested the testers—apparatus that pinpointed bum tubes—and the results sparked interest. Drugstore testers were able to spot burned-out, shorted and gassy tubes. But they also discredited tubes with lots of life left in them. **FM**



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# TECH UPDATE

News Of Tomorrow's Technology Today



## Holodeck 2000: The Walls Have A Thousand Eyes

CHAPEL HILL, NC—Step into the “Star Trek” holodeck and you can saunter about a 3-dimensional world, furnished and peopled with lifelike holograms. Although the holodeck is one of the show’s more far-out notions, researchers today are racing toward a similar idea. At the University of North Carolina, computer scientists are developing 3D virtual environments stocked not with computer-wrought scenery, but with real-life images from a remote location.

The key: A concept the researchers call a “sea of cameras.” At the remote site, video cameras stud the walls and ceiling. Each has a view from a slightly different perspective. The multiple video signals are transmitted en masse to a viewing location, then reassembled into a virtual environment.

At the viewing site, everyone wears

virtual-reality visor displays that are fitted with head-tracking sensors. As the participants walk around or turn their heads, the sensors maintain a fix on their positions and viewing directions. This information is used to determine which sets of video signals show up in the displays.

How do the images appear 3-dimensional—and blend seamlessly as different cameras come into play? First, a computer creates a depth map of the remote scene. The live images

Sea of cameras creates 3D rendition of real-life scene for remote viewers.

are then, in effect, draped over this map. The computer also gauges how the image should appear from any particular point in space, allowing it to hand off the view smoothly from camera to camera.

Using this technique, researchers have built a 3D image of an operating room. The goal: to let a large audience watch world-class surgeons at work without cramping their style.

### Highlights This Month

- **Field Of Dreams**—The world’s strongest electromagnet.
- **Skipping Rocks**—System ushers ships around obstacles.
- **Shoot The Moon**—Behind the filming of “Apollo 13.”
- **Straight Up With A Twist**—Vertical-takeoff flying wing.
- **Long Bomb**—Weapon taps turbojet to chase down tanks.
- **Jumping Jupiter**—Probe begins assault on the big planet.
- **Atomic Shrapnel**—Particle smasher finds missing quark.

Editor/Writer: Gregory T. Pope  
Reporters: Philip Chien, Chris Chinnock,  
Mike Fillon, Scott Gourley, Frands Hamit,  
Bob Scheier, Rick Schrader

## Vandyland's Dandy Spaceport

LOMPOC, CA—If space-flight ever becomes as routine as air travel, Vandy may one day be as familiar a departure terminal as O'Hare or LAX. A unique civilian spaceport opens next year at Vandenberg Air Force Base.

At the heart of the new complex is a payload-processing facility developed for Air Force space-shuttle missions—but mothballed after the *Challenger* explosion. While the building could still handle a shuttle, it's being expanded to accommodate commercial-satellite boosters.

California Spaceport will also include two stack-and-checkout facilities, a mobile launch platform and a blastoff pad. The pad's location



Commercial spaceport centers around integrated processing facility converted from shuttle program.

boasts several advantages, including the abilities to launch out over the ocean and to put spacecraft directly into polar orbit.

The West Coast port will specialize in small rockets that pack payloads between 300 and 5000 pounds.



LOCKHEED PHOTO

## Magnet's Record Magnitude

TALLAHASSEE, FL—The Sunshine State will soon boast a new attraction, perhaps the most "attractive" thing ever built. It's the world's most powerful continuously operating electromagnet. The National Science Foundation is building the device in the new National High Magnetic Field Laboratory at Florida State University.

The size of a minivan, the magnet will consume 24 mil-

lion watts of power in order to produce a magnetic field of 45 tesla—a million times stronger than that of Earth.

Around the magnet's outside curve two sets of superconducting coils. Tucked inside are conventional resistive coils. This hybrid design is the most economical way to achieve high magnetic fields.

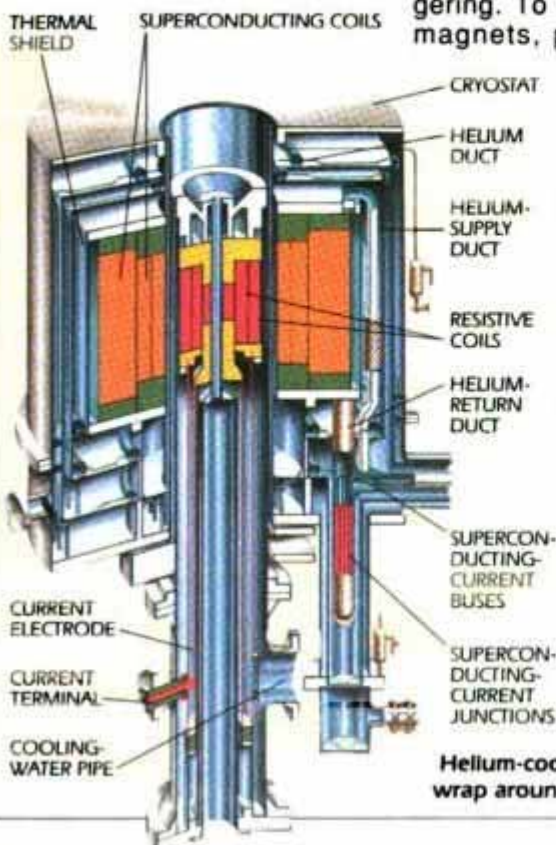
The engineering that has gone into the device is staggering. To cool the resistive magnets, pumps will force

through more than 400 quarts of water per second. That's a quarter of

the average flow to all of Tallahassee. In addition to the superconductors, the outer coils will house enough steel reinforcement to manufacture three automobiles—and enough copper to

wire 80 houses. When the magnet is fully operational next year, its immense field will probe atomic and biological structures.

Helium-cooled superconductors wrap around water-cooled coils.



ANS ILLUSTRATION BY ANDRZEJ BROWNAW



Future Disney fireworks will carry microchip fuses.

## Silicon Fireworks

LAKE BUENA VISTA, FL—Exploding microchips will spark a new generation of fireworks at the Disney theme parks. Sandia National Laboratories and Walt Disney Co. are collaborating on the devices, called semiconductor-bridge ignitors.

The chips are custom-designed integrated circuits doped with phosphorus. When hit with a current pulse, they ignite, triggering the pyrotechnics. But since the chips also include circuitry for timing, logic and safety, they detonate only after receiving specific electronic instructions.

About 100 times smaller than conventional hot-wire setups, the devices heat up faster and with less energy than the fuses they'll replace.



## Trolling For Toxic Fumes

GROTON, CT—When oil or chemicals foul the nation's waterways, the Coast Guard springs into action. To gauge dangers to public health, the service has long sought a device that provides snap analysis of vapors rising over a spill or fire.

Now it's got one. A prototype airborne emissions monitor, developed by the National Institute of Standards and Technology, samples the gases in midair. The air-foil-shaped package dangles on a 150-ft. tether beneath a helicopter.

Inside, instrumentation analyzes airborne chemicals and radios the data to a ground station. Measured weather parameters, such as wind speed and barometric pressure, accompany this information.

Instead of waiting hours for lab results, authorities can make quick decisions on the effects of the spill—and the possible threat to personnel and neighbors. The technology could also serve the armed forces by monitoring battlefields for chemical hazards.



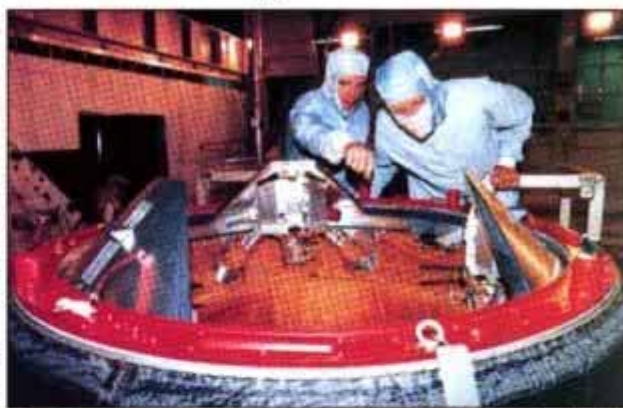
Helicopter swings airborne emissions monitor over burning oil slick during field tests.

## Interface In Outer Space

KALININGRAD, RUSSIA—So just how does the shuttle link up with the Russian space station *Mir* (see "Mission To *Mir*," page 52, May '95)? Linchpin of the operation is a Russian-built mechanism installed on both spacecraft.

The apparatus consists of a capture ring from which three triangular petals protrude. First, small motors extend this ring outward. As the shuttle inches toward *Mir*, the petals on the shuttle side interleave with *Mir*'s petals, and latches on each petal grapple the other side's ring.

Then, the shuttle fires space-craft thrusters to force the spacecraft together. The mated rings get pushed back onto their supports, where 12 more latches complete the docking.



Docking ring, mounted on airlock in shuttle bay (below), sports three petals with latches that initiate mating.



## Spy Satellites For Everyone

BOULDER, CO—No longer will the Pentagon monopolize high-resolution spy satellites (although military eyes will still be the sharpest in the sky). Starting in 1997, a new flock of Earth watchers will begin snapping hi-res pictures from space—for profit.

The first of these commercial imaging satellites will be QuickBird, which was designed by scientists who worked on the Brill-

iant Pebbles missile-defense project. Operated by Earth-Watch Inc., the spacecraft can discern details 3 ft. across. It will fly in tandem with EarlyBird, a 10-ft.-resolution satellite due for launch next year.

There'll be competition, however. Both Lockheed's Space Imaging satellite and Orbital Sciences' Eyeglass will also boast 3-ft. resolution.

QuickBird will usher in a new era of high-resolution imaging satellites.



## Safe-Passage Sonar

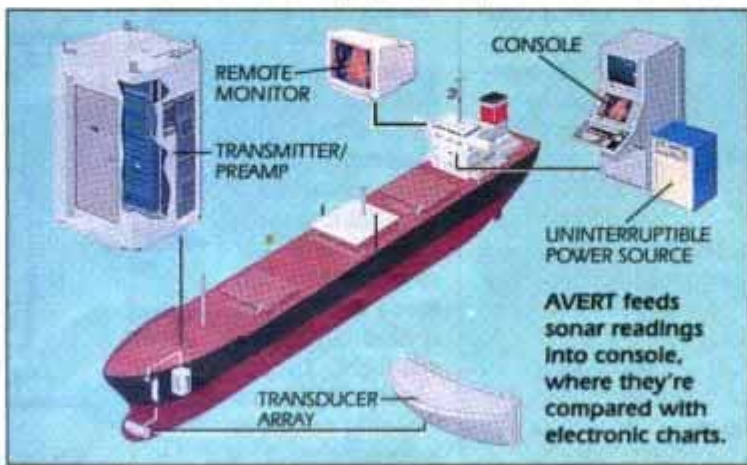
PORTSMOUTH, RI—Remember when the *Queen Elizabeth II* ran aground off the coast of Massachusetts? The 1992 accident brought home the fear that uncharted obstacles still lurk in shallow waters.

To keep ships off rocks and reefs, Raytheon has developed an Automated Vessel Alert system called AVERT. The hardware combines a forward-looking sonar with a database that

stores depth-profile charts. A Global Positioning System receiver keeps track of the ship's location, while an

acoustic data processor compares sonar readings with the electronic charts. If echo returns don't match the data—or the ship veers toward charted hazards—AVERT notifies the bridge.

Aboard its own vessel, Raytheon tested the system off Cuttyhunk Island, near the location where the *QEII* sustained damage. Not only did AVERT spot the uncharted rocks that pronged the oceanliner, it also discovered numerous inaccuracies in the current chart with respect to oceanfloor geology and shipwreck locations.



RAYTHEON ILLUSTRATION

## Reel-Life Adventure Of "Apollo 13"



"Apollo 13" dramatizes tribulations of astronauts fighting for their lives after oxygen tank exploded.

HOLLYWOOD, CA—This summer, you can relive one of the most suspenseful space dramas of all time—the Apollo 13 mission. Opening June 30, Universal Pictures' "Apollo 13" portrays the ill-fated Moon flight with loving attention to accuracy.

The movie's zero-gravity scenes look realistic because they were filmed in zero-gravity. Universal chartered NASA's KC-135, which flies

parabolic paths to give its occupants 20-second periods of weightlessness. Crews of up to 50 actors, directors and production people filled the plane, shooting zero-g scenes for 20 seconds at a time. Tom Hanks went through 700 parabolas—more than any living astronaut!

Director Ron Howard tells *POPULAR MECHANICS* that the aircraft lived up to its nickname: the Vomit Comet. "Everyone got green," he recalls, "and one of the camera operators lost it all over Kevin Bacon. But Kevin took it good-naturedly, and we kept going."

Meanwhile, on solid ground, four mockups of the Apollo command and lunar modules came to life at the hands of Max Ary, whose Kansas Cosmosphere and Space Center is restoring the real Apollo 13 command module *Odyssey*. In addition, the background sets feature plenty of actual Apollo-era hardware.

The sound stage, where



scenes were filmed conventionally, was chilled to 38° F, matching conditions aboard the spacecraft. While the film crew worked in ski clothes, Bacon, Hanks and Bill Paxton shivered in thin coveralls 12 hours a day.

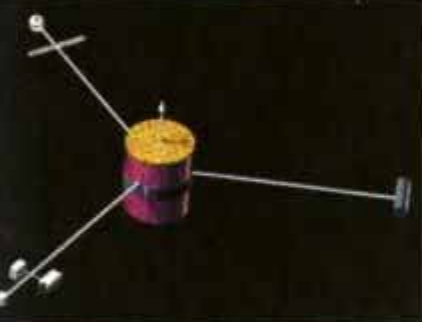
Howard, who was doing a "Gun-smoke" episode when the real Apollo 13 mission took place, says he went with authenticity to boost dramatic tension: "This is a bona-fide summer-time movie, not a documentary."



Film crew worked aboard NASA's gravity-defying KC-135 to lend authenticity to scenes of weightlessness.

## Shoestring Moonshot

SUNNYVALE, CA—A far cry from the big-budget Apollo days, NASA's next lunar mission will cost only \$73 million. *Lunar Prospector*, a concept that has been around since 1992, is being funded under the Discovery program (see *Tech Update*, page 14, Aug. '93). It will launch in 1997 aboard a Lockheed LLV-2 rocket.



*Lunar Prospector* will carry its instruments on three deployable booms.

The size of a beer keg, the Lockheed-built miniprobe will follow up on last year's Pentagon-sponsored *Clementine* mission (see *Tech Update*, page 20, Aug. '94). *Lunar Prospector* will detail the Moon's magnetic and gravitation fields and map the mineral makeup of its crust. The spacecraft will also keep an eye out for ice that might lie around the lunar south pole.

NASA has awarded further study dollars to three other Discovery concepts: the Venus Multiprobe and two sample-return missions—one for solar wind, the other for cometary dust.

## Sunlight For A Rainy Day

ARCATA, CA—A rare 25-pound blue lobster owes its life to a unique solar-energy storage technique.

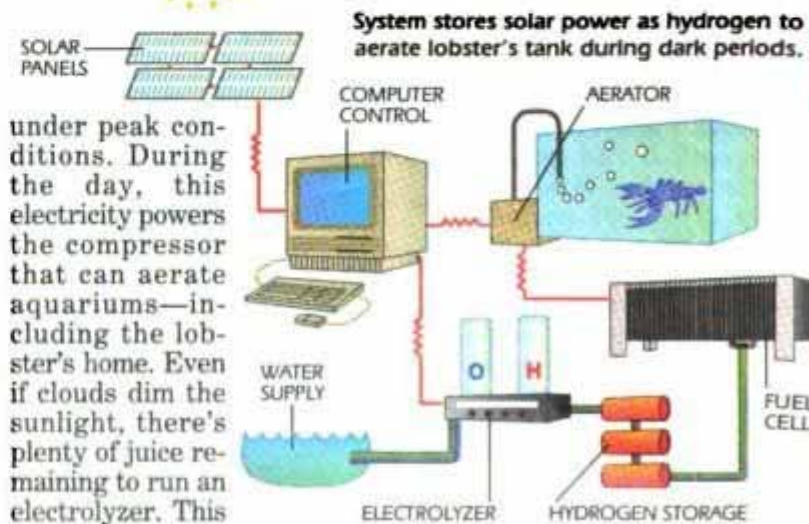
Built at Humboldt State University, the system relies entirely on hydrogen to bottle excess power generated by a photovoltaic array.

A solar array puts out 8 kw

machine splits water into oxygen and hydrogen, the latter stored in three 500-gal. tanks.

At night, the hydrogen is run through a fuel cell, where it combines with oxygen from air to generate electricity.

In an emergency, the system can switch to the local utility. But so far it has run faultlessly.



under peak conditions. During the day, this electricity powers the compressor that can aerate aquariums—including the lobster's home. Even if clouds dim the sunlight, there's plenty of juice remaining to run an electrolyzer. This

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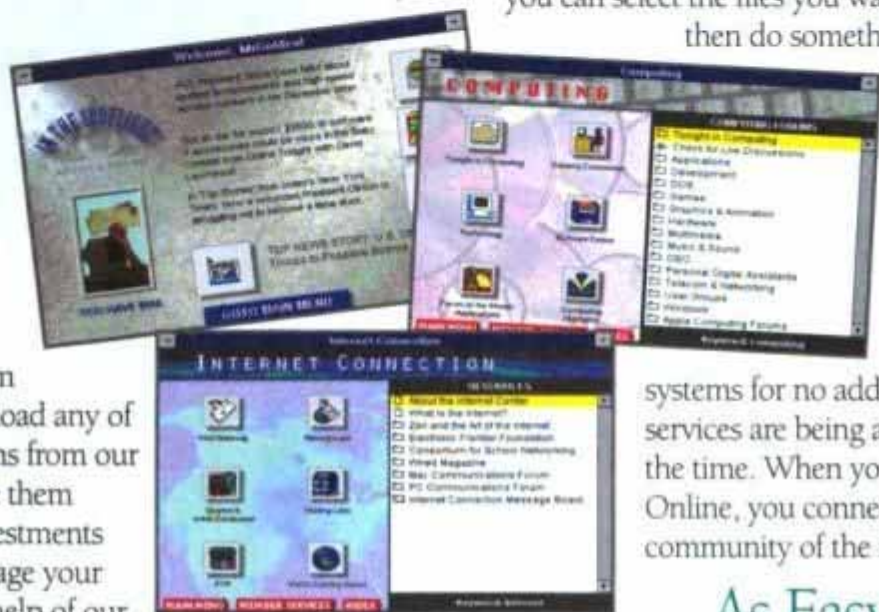
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## Flying-Wing Hoverplanes

GOLDEN VALLEY, MN—An outfit called EGR Co. has put a new slant on an old idea—deflecting the airstream from props to lift an aircraft.

The concept dates back to the late 1950s and an experimental aircraft called the Ryan VZ-3RY. In essence, big flaps bend propeller thrust downward. But investigators found that the downward-flowing air ricocheted back into the propellers, sapping their efficiency. The rebounding airflow also played havoc with the aircraft's horizontal tail surfaces.

EGR says its patented design does away with these problems. First, there's no tail—the aircraft is a flying wing. And wing-model tests reveal little air re-ingestion. Other advantages? Six powerplants



The EGR flying wing takes off vertically and can carry between four and nine passengers.

provide redundancy without needing power couplers between props. The forward-swept wing puts the payload at the plane's center of gravity.

EGR's Charles Stone, who helped shape the aerodynamics of the B-2 bomber, is building a 7-ft. radio model to verify his plane's handling.

## Grizzly Bears Down On Minefields

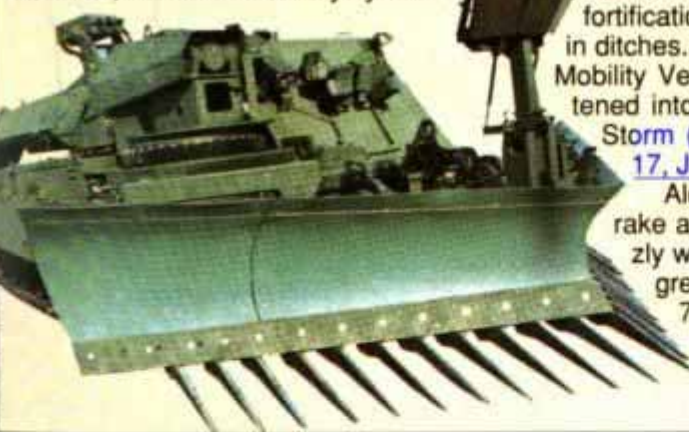
YORK, PA—No beast is more suited to digging and fighting than the grizzly bear. And no vehicle is more suited to those tasks than the Army's new breacher, nicknamed Grizzly by com-

bat engineers. Two prototypes, built by United Defense, will soon begin testing.

Grizzly will bear the brunt of the Army's mine-clearing operations. It will also destroy hostile fortifications, bust up wire and fill in ditches. Its forebear: the Combat Mobility Vehicle demonstrator, hastened into production after Desert Storm (see Tech Update, page 17, June '91).

Along with its mine-clearing rake and excavating arm, Grizzly will carry an Mk.-19 40mm grenade launcher and M240 7.62mm machine gun.

Based on hull of M1 tank, Grizzly will claw away battlefield obstacles.



## Factory's Free-Range Robo-Carts

GRAND RAPIDS, MI—Wires, laser targets and chemical trails keep automatic guided vehicles (AGVs) on track as they shuttle goods around factories. But they're expensive to reconfigure if the plant gets rearranged.

Rapistan Demag Corp. has skirted this problem with vehicles that navigate themselves. On board the Virtual Path AGV, a computer stores an AutoCAD map of the factory. The vehicle tracks its own progress by reading from an odometer, a gyro and a sensor that looks for magnetic reference points on the factory floor. New marching orders can be downloaded quickly from a central computer.



Wireless AGV navigates by comparing data from on-board sensors to reference map in its computer.

## New Birds For Space Talkers

GREENBELT, MD—Talk to the shuttle and your voice goes through a Tracking and Data Relay Satellite, or TDRS. One of these birds is set to fly this summer, joining five others perched 22,000 miles above Earth. But



New-generation TDRS will relay calls to shuttles and space station.

that's it for this generation—they're aging, and only three work properly. The next lot will be built by Hughes and launched around the turn of the century.

The new TDRS satellites feature a key upgrade—communications in the Ka-band. These high frequencies will keep NASA transmissions clear of interference from commercial satellites.

## Bombs Get Turbojets

DALLAS, TX—On a future battlefield, a rocket roars from its launch rail. Vaulting behind enemy lines, it releases anti-armor submunitions—but their targets have vanished! No problem. The bomblets form a lethal swarm that buzzes deeper into hostile territory, picking off tanks and missile launchers.



That's the vision behind the Powered Submunition, now under development by Loral Vought Systems. The weapon is an outgrowth of the Low-Cost Anti-Armor Submunition project (see

Tech Update, page 31, Dec. '92).

A small turbojet and fuel tank will give each bomblet half an hour to cruise overhead, seeking targets with an infrared-

Powered Submunition gains 100-mile range from miniature Sundstrand turbojet.

laser radar. Meanwhile, a GPS receiver and data-link will provide information about both the location and type of target discovered.

Loral Vought has tested the seeker, GPS and data-link in a helicopter-borne pod. Engineers are now completing two 30-in. airframes, hoping to fly the weapons next year.

## Hot-Wiring The Brain

ANN ARBOR, MI—The link between the nervous system and electronic technology just tightened. The University of Michigan is manufacturing electrodes that can stimulate or record signals from individual nerve cells.

The size of a pepper grain, each device is machined from silicon and laced with microcircuitry. Michigan engineers will be distributing the probes to neuroscientists free of charge.

Applications? For starters, they'll aid in the development of implants to cure deafness. Some of the long-range goals include the treatment of muscle paralysis and a better understanding of epilepsy.



Shown on a penny, microelectrodes can tap into single nerve cells.

## Monster Barge At Large

MARSEILLE, FRANCE—Call it the mother of all barges. This immense concrete vessel—722 ft. long and 151 ft. wide—will soon drop anchor off the coast of Congo. There, it will house production equipment for the offshore Nkossa oil and gas field. Bouygues is building the barge.



World's biggest concrete barge nears completion in dry-dock.

When loaded, the big tub will weigh 100,000 tons. The pre-stressed concrete is laced with more than 7000 tons of reinforcement bars and post-tensioning cables.

Rustproof and rugged, concrete suits a ship like this. True, the concrete hull weighs more than a steel equivalent, but it's not as if the platform has to go anywhere.



## Driving Der Überhummer

KREUZLINGEN, SWITZERLAND—Nothing's peaceful about U.N. peace-keeping operations.

Mowag Eagle grafts bulletproof body onto a Humvee chassis.

That's why the Swiss Army needed "Der Überhummer."

Manufacturer Mowag Motorwagenfabrik calls it the Eagle, but the armored reconnaissance car got the nickname because it's built on a heavy Humvee chassis. The Swiss will receive 150 of the air-transportable vehicles.

Inside, the drivetrain couples a 160-hp GM diesel with a 4-speed Hydra-matic transmission. The superstructure is clad in aluminum and composite armor to shield against 7.62mm ammunition. A rotating observation cupola sports a machine gun and six grenade-launcher tubes.

## Home Radon Watcher



The device tracks the electric charges triggered when decaying radon atoms ionize air molecules.

LOS ALAMOS, NM—The atomic scientists of Los Alamos National Laboratory have come up with a home radon monitor that's as convenient to use as a smoke detector.

The device tracks the electric charges triggered when decaying radon atoms ionize air molecules. Inside, a pin sets up an electric field that separates these charges. The result: a current that registers on an electrometer.

Not yet available on the market, the continuous sensor differs from today's one-shot home radon kits, which must be sent out to a lab for analysis.

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PHOTO ILLUSTRATION BY GEORGE RETSICK

A portable ultrasound system gives medic an instant view of internal injuries.

## Sound Vision For Combat Docs

FORT LEWIS, WA—Medics refer to it as “the golden hour.” That’s the time they have to identify, diagnose and treat a battlefield injury. Wait any longer, and the patient usually dies.

To give medics a head start, Madigan Army Medical Center and the Pacific Northwest Laboratory are collaborating on a portable imaging system based on ultrasound. The device will provide real-time 3D pictures to assess internal damage and locate bullets or shrapnel.

A handheld sensor, comprising an array of transducers, probes the soft tissues. In a backpack, a computer assembles the readings. A radio then relays them to a field hospital, where the information can be used to construct 3D images. These will appear on the medic’s visor display.

In future versions of the system, a gel-transducer blanket will replace the handheld array. Placed around the body, the blanket will generate a bigger and more detailed image.

## Welcome To Jupiter

PASADENA, CA—Last July, a string of comets bombarded Jupiter. Now NASA begins its assault on the giant planet. This month, the spacecraft *Galileo* is scheduled to fire a 750-pound probe toward Jupiter’s swirling clouds.

It’s the most difficult planetary entry ever attempted. *Galileo* must first adjust its trajectory to aim the saucer-shaped package, then spin to stabilize the probe as it jettisons. The probe will free fall for five months, reaching a speed of 100,000 mph. It will then slam into the atmosphere and aerobrake for 2 minutes. A parachute will slow it further.

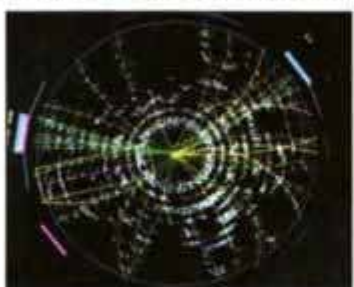
Mission controllers don’t expect the probe to last more than 75 minutes as it plunges through Jupiter’s atmosphere, but that’ll be enough time to radio data back to *Galileo*. The probe is set to measure clouds, wind and other weather features. Meanwhile, *Galileo* will maneuver into orbit around the planet.



Jupiter-bound probe will be the first to enter atmosphere of a giant gas planet.

## They Found The Missing Quark

BATAVIA, IL—It took more than 17 years, but the shyest of those subatomic particles known as quarks has finally revealed itself. The “top quark” has been winking



into existence inside the only machine strong enough to bring it to life.

Tevatron, king of all synchrotrons, set the stage for the discovery. The monster accelerator, located at Fer-

milab, slams protons and antiprotons head-on to produce a record 1.8 trillion electron volts—just enough

energy to create a top quark, which doesn’t exist in nature. But the topper never lasts long— $10^{-25}$  seconds is its lifetime—and it doesn’t pop up too often.

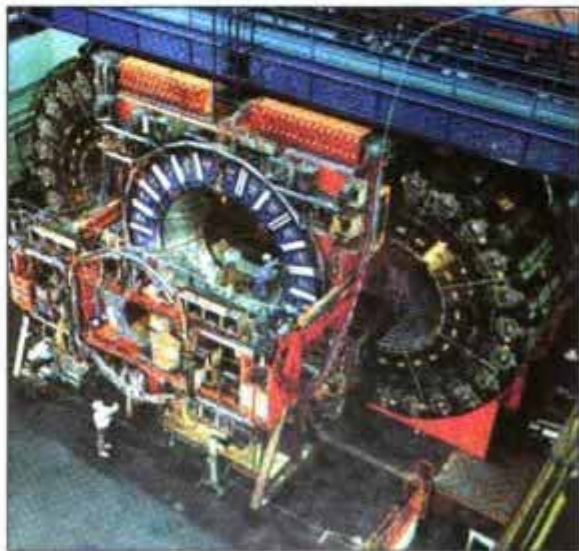
Fermilab physicists have piled up enough top-quark detections to rule out background noise. Now comes the hard part—figuring out



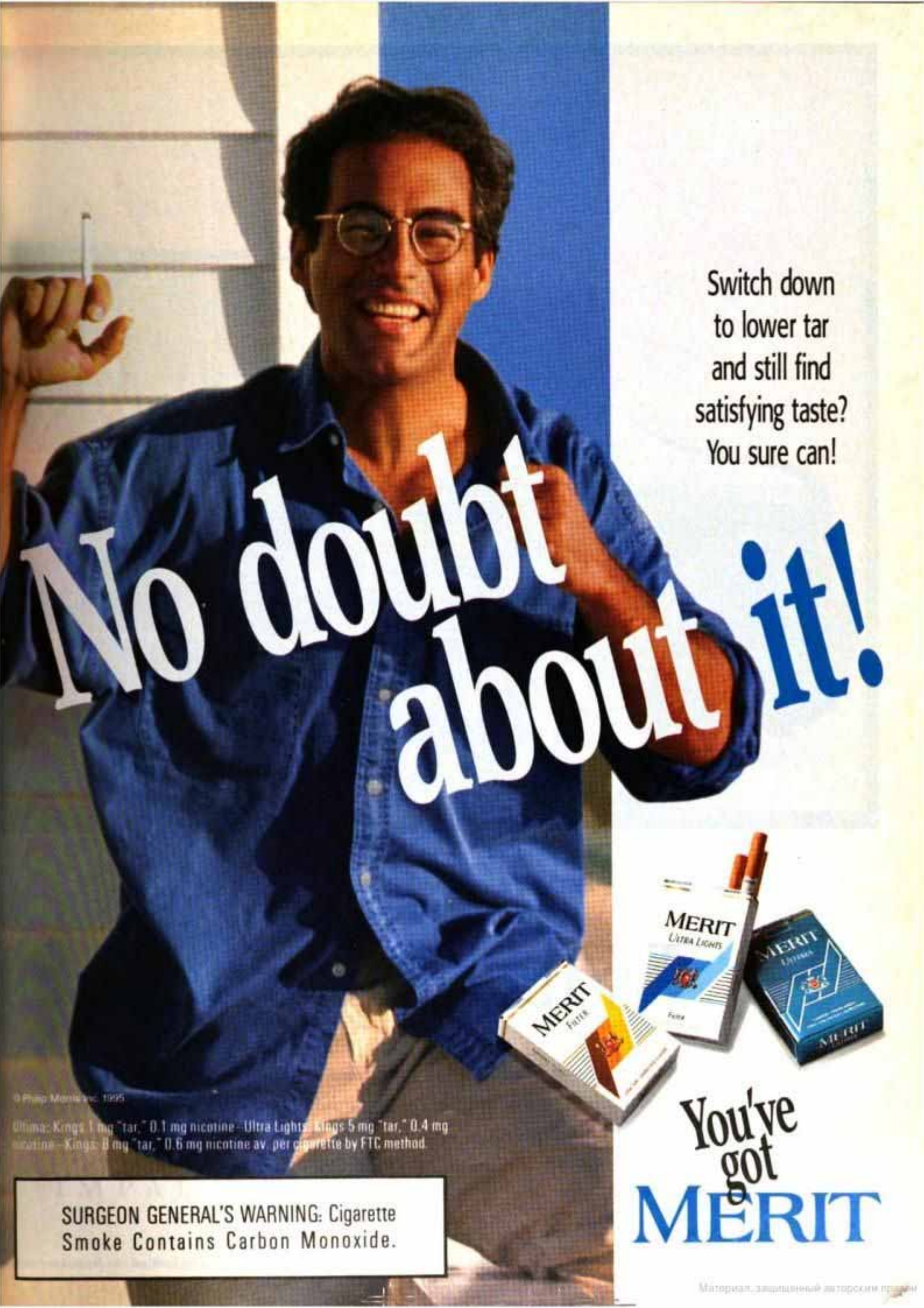
FERMILAB PHOTOS

Top quark leaves streaks (above) recorded by Tevatron’s particle detector (right).

what the quark can tell us about physics. The particle has a huge mass—roughly that of a gold atom. Researchers hope this trait will help them to solve a longtime mystery: Where does mass come from? **TU**







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# New Cars



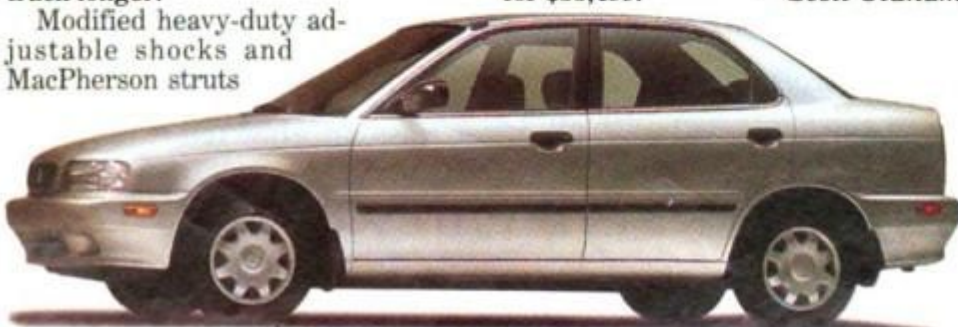
## Ford Mustang Cobra R

● "Go build a car that will beat the Camaro" was the order given to Ford's Special Vehicle Team (SVT). The result is a limited production run of 250 specially prepared Cobra R Mustangs. Although completely street legal, Cobra Rs are sold only to racers who intend to add a rollbar, fire extinguisher and 5-point seatbelt and compete in SCCA-, IMSA-, NHRA- or IHRA-sanctioned events.

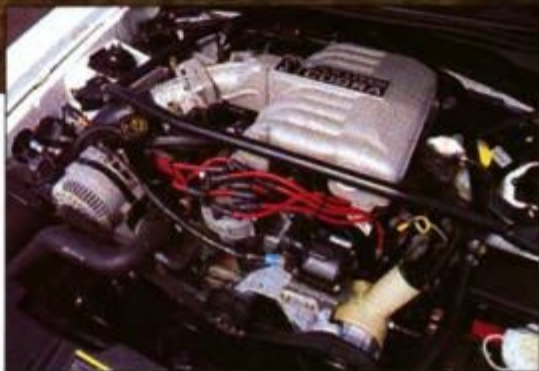
To get the job done, SVT replaced the Mustang Cobra's standard 240-horsepower 5.0-liter V8 with a 5.8-liter (that's 351 cu. in.) V8 that cranks out 300 hp and 365 ft.-lb. of torque. This is 25 more hp than you'll find in any stock Camaro, and enough power to turn the R's big (P255/45ZR17) BFGoodrich Comp T/A tires into a black gooey mess.

Getting the power to those tires is a heavy-duty Tremec 5-speed manual transmission, a heavy-duty clutch and 3.27:1 limited-slip differential. There's also a 20-gal. Fuel-Safe fuel cell that lets the Cobra R stay out on the race-track longer.

Modified heavy-duty adjustable shocks and MacPherson struts



The subcompact Suzuki Esteem is small on the outside and under the hood.



work with progressive-rate coil springs to lower the car and make the R a very responsive handler. An extra-thick front antiroll bar keeps body lean in check. The Mustang Cobra's huge 4-wheel disc brakes (13-in. front rotors) with ABS are also found on the R, but SVT added a heavy-duty master cylinder that provides drivers with better brake-pedal feel.

All Cobra Rs are Crystal White, have a saddle cloth interior, wear unique 5-spoke aluminum wheels and have the taller hood necessary to clear the larger engine. It's sold only through SVT-certified Ford dealers for \$35,499. —Scott Oldham

## Suzuki Esteem

After owning the compact sport/utility market for the past decade, Suzuki has entered the subcompact sedan market with a new car that's named the Esteem.

The Esteem is available in two trim levels: the GL base model, priced at \$11,399, and the more luxurious GLX, starting at \$12,699. The GLX comes with power windows, door locks and mirrors as standard. Both have dual airbags and offer antilock brakes as an option.

However, the Suzuki lags behind its competitors—literally—in power. It's the least powerful car in the subcompact class. The Esteem's only engine is a 98-hp 1.6-liter 4-cylinder that's available with a 5-speed manual or an optional (\$1000) 4-speed automatic transmission.

—S.O.

## Isuzu Rodeo

To a casual observer, the 1995.5 Isuzu Rodeo may look just like the 1995.0 model. However, the astute car buff will notice that the half-year designa-



The midyear introduction of the Isuzu Rodeo brings with it dual airbags.

tion brings with it some very welcome refinements. First among them are dual airbags. Yes, now each and every Rodeo—2-door and 4-door—boasts the crash security of standard front airbags. Also new are the dashboard—with improved ergonomics—a revised power door-lock system and power-window switches.

And so the neighbors will know your Rodeo is new and improved, the .5 version has a restyled front airdam and grille logo. —Don Chaikin

## PM HOTLINES

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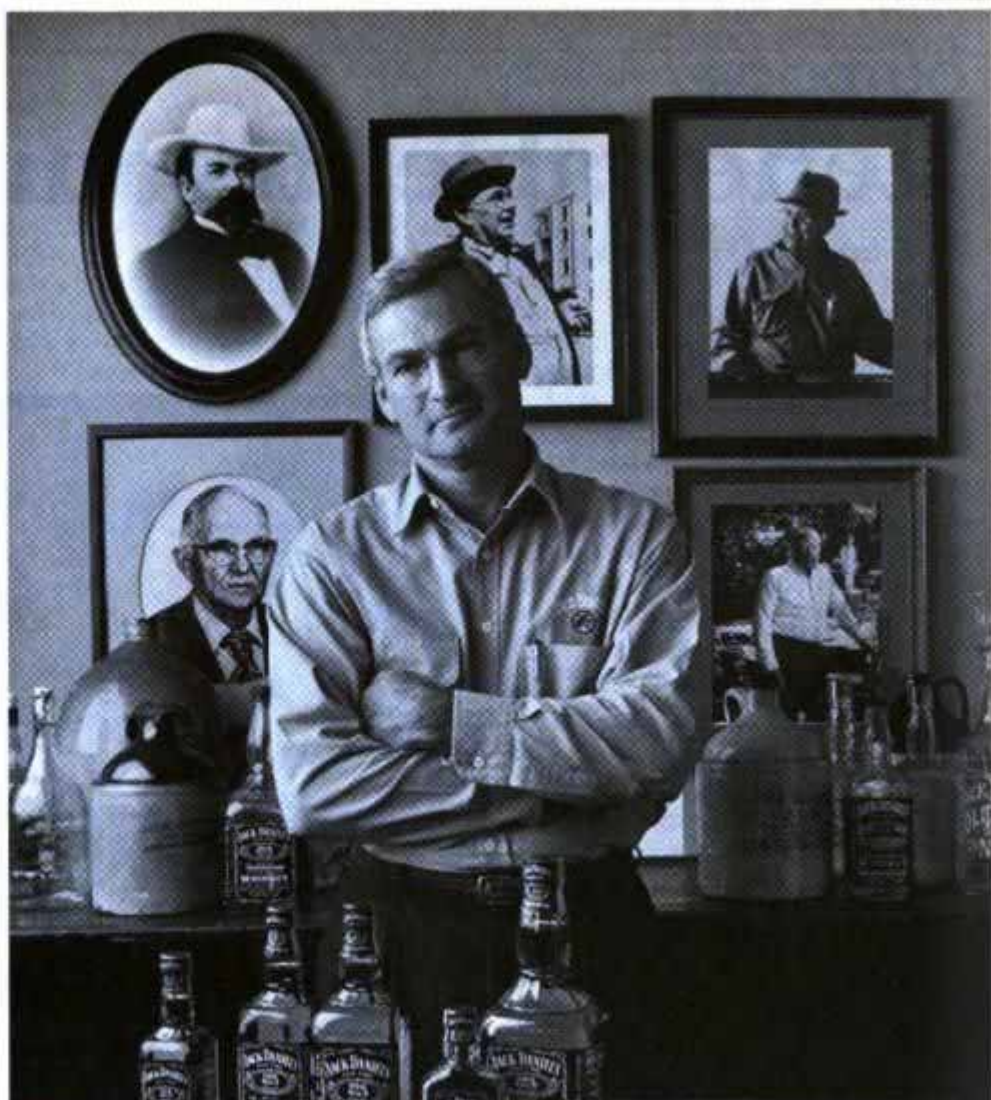
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Clockwise from top left, that's Jack Daniel, Jess Motlow, Lem Tolley, Frank Bobo and Jess Gamble. (Jimmy's in the middle).

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Since 1866, we've had only six head distillers. (Every one a Tennessee boy, starting with Mr. Jack Daniel himself.) Like those before him, Jimmy's mindful of our traditions, such as the oldtime way we smooth our whiskey through 10 feet of hard maple charcoal. He knows Jack Daniel's drinkers will judge him with every sip. So he's not about to change a thing. The five gentlemen on his wall surely must be pleased about that.

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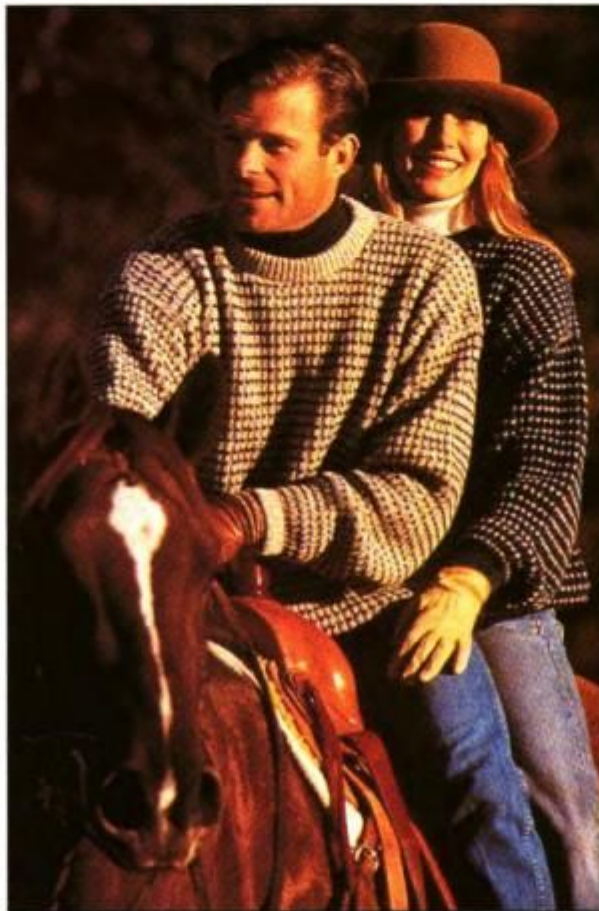
# Renewable Resources

BY JOE SKORUPA, Boating/Outdoors Editor

● Today, outdoorsmen of all genders support recycling efforts. But we do so in a general, 3rd-party kind of way. We separate trash. We take oil and batteries to collection centers. We cart reusable sacks to the supermarket (at least some of us do) to avoid using throwaway bags. But what's the end result? Our junk goes off somewhere and is never seen again. An exception to this rule is paper goods and aluminum cans that sometimes sport a tag line indicating that they're made partly of recycled materials.

Aside from these products, all that most of us really know about recycling is that someone takes our disposables (called post-consumer waste because it has been used once) and gives them to someone else. That someone recycles them, we hope, and makes the end product available to others for a second use. The problem is that the fruit of our efforts is largely invisible. The belief we all have that the unseen process is working amounts to little more than blind faith.

Not anymore. Today, you can actually touch, feel and wear something that's made from post-consumer plastic. That's right: New outdoor gear



now on the market is made from shredded Coke bottles. The next sweater you buy could be made from 25 bottles of Dr. Pepper. The next insulated jacket you pick up could contain 10 bottles of Mountain Dew.

How is this possible? Last year, a mass-produced fabric began appearing in a limited number of products made from 100% recycled plastic fibers. The fabric, Fortrel EcoSpun, was introduced by Wellman Inc., of Shrewsbury, New Jersey. This year, following a successful first season, a larger number of name-brand manufacturers came out with outdoor apparel and gear made with the fabric. So many manufacturers, in fact, that the products could fill the L.L. Bean catalog. Companies currently using the fabric are Patagonia, JanSport, Coleman, Samsonite and Cannondale. Other textile makers, notably 3M, DuPont and Hoechst

Celanese, are following Wellman's lead and introducing their own recycled-polyester fabrics.

What's unique about EcoSpun and similar materials is that they're composed entirely of post-consumer plastic. Post-consumer distinguishes it from other recycled plastic, which can be made from industrial scraps. Most recycled paper, for example, contains a large portion of waste collected at mills and other manufacturing facilities.

The new generation of recycled plastics is made of products all of us buy in the supermarket. While most of it comes from soda bottles, a portion is also derived from water, juice and food containers. Containers that handle edible products, especially soda bottles, are typically made of an exceptionally high-quality plastic called PET (for polyethylene terephthalate).

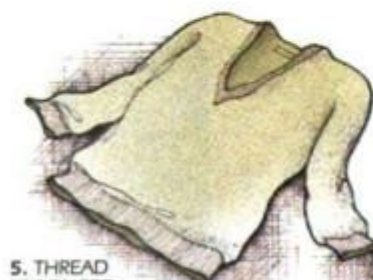
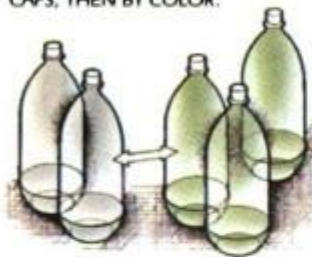
To make clothing from post-consumer PET, Wellman spent millions of dollars to develop a high-tech manufacturing process that only recently came on line. It begins with the removal of low-quality containers, such as those used for detergents. From

## Soda-Bottle Chic

1. PLASTIC SODA-BOTTLE BODIES ARE SEPARATED FROM LABELS AND CAPS, THEN BY COLOR.

2. AFTER STERILIZATION, BOTTLES ARE CRUSHED AND CHOPPED.

3. TINY PIECES OF FLAKE ARE MELTED IN VATS. THIS PRODUCES A THICK LIQUID THAT'S EXTRUDED THROUGH SHOWER-HEAD-LIKE DEVICES TO CREATE FIBERS.



5. THREAD PRODUCED FROM DISCARDED SODA BOTTLES IS WOVEN OR KNIT INTO FABRIC THAT'S USED IN SWEATERS, SHIRTS, BELTS AND SHOES.

4. THE FIBERS ARE STRETCHED TO PRODUCE THINNESS AND STRENGTH. THEN THEY'RE CRIMPED, CUT INTO SHORT PIECES AND BALED. THIS PRODUCT IS SOLD TO CLOTHING MANUFACTURERS.

here, contaminants—such as labels, caps and black-base cups—are removed. At this point, the containers are sterilized, crushed and chopped into small pieces called flake.

This flake is melted in vats. The most difficult part of the process is removing impurities so that a consistent molecular weight is maintained. The pure, thick liquid is then extruded through filters and shower-head-like devices called spinnerets. As the hot liquid is extruded, it cools and solidifies into fibers as thin as human hair. (The fibers must be this thin to be comparable to those made from virgin polyester.) After cooling and drawing, the fibers are crimped and cut to lengths of 1 to 3 in. Fabric makers then spin this large mass of fibers into thread, which can ultimately be knit or woven into garments.

The first company to offer clothing products made with this fabric—Fortrel EcoSpun—was Patagonia, the large, eco-minded outdoor outfitter. A year ago, several pullover sweaters made with the fiber were sold. This year, however, Patagonia's Fortrel-EcoSpun products number in the dozens.

There is considerable motivation for finding high-volume use for post-consumer plastic. For one thing, it makes up about 20% of the waste in the U.S. Second, many states have bottle-deposit laws and strict curbside recycling programs, which result in the collection of huge amounts of post-consumer plastic. Something has to be done with this stuff. Companies like Wellman are doing it.

In addition to fine fiber made of post-consumer plastic, outdoorsmen are finding other recycled materials in an array of garments and gear. North Face, for example, offers products that feature fabric made of recycled fleece, and Roffe has switched its entire line of jackets to insulation made of recycled polyester.

After sweaters and jackets, footwear is the most common item to

utilize recycled materials. Nike and Reebok led the way last year with cross-trainer boots made partly from recyclables. The Reebok Telos boot, for example, is made from 70% recycled and reclaimed materials. While most of the recycled substances are taken from the manufacturer's own cutting-room floor, some also come from automobile tires and other post-consumer sources.

Another increasingly important manufacturing area using recycled components is outdoor gear. These products include backpacks, travel bags and sleeping bags. JanSport has developed an entire line of backpacks and bags, called the Muir Woods

will appear in casual and business apparel as early as this fall.

Right now, approximately 40% of Wellman's worldwide fiber production is made from recycled materials. This adds up to a recycling program that uses more than 100 million pounds of post-consumer PET, or about 1 billion bottles. The amount of petroleum saved by using post-consumer bottles instead of virgin materials in the manufacturing process is enough to power a city the size of Atlanta for a year, according to Wellman. And each year the amount grows.

Now to switch gears a bit. Certainly, it's a rare occasion that this column, or any in POPULAR MECHANICS,

features a story about clothing. But while we're on the subject, it would be a mistake not to mention how you can win a Chevy truck, thanks to a member in good standing of the clothing industry. The Fort Worth, Texas-based Dickies line of rugged clothing and workwear is sponsoring such a contest, and PM readers are invited to enter. The two grand prizes are 1996 full-size Chevrolet pickup trucks. Five first prizes are \$1000 in cash and \$100 Dickies gift certificates. More than 5000 other great prizes are also being offered.

The Dickies American Worker Of The Year Contest is a way of recognizing the hard labor, spirit and perseverance of the American work ethic and individual workers. To enter, write 75 words or less about the nominee (yourself or someone you know) that completes the thought, "I think my nominee deserves recognition as an American Worker because..." Then send it to Dickies American Worker Of The Year, P.O. Box 670589, Dallas, TX 75367. No purchase is necessary, and you can enter as many nominations as you'd like. Entries must be postmarked no later than August 23, 1995.

Just think of all the soda bottles you can haul off to the recycling center with a full-size Chevy pickup. **PM**

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kills jock itch fungus

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Collection, made of recycled canvas.

How much of a difference can this type of recycling make? Truthfully, it doesn't figure to have much of an impact in the overall waste-management picture until fiber-making technology improves and the demand for recycled apparel increases. It has been demonstrated many times over that most of us are happy to support environmentally friendly products—but only if they're as attractive, durable and priced comparably to products that have no environmental claim.

Still, the picture looks promising, especially since Wellman introduced a 2nd-generation recycled fabric that

# Asia Spy Report

BY SCOTT OLDHAM, West Coast Editor



## 1996 Nissan Pathfinder

● Nissan's long-awaited all-new Pathfinder, which will reach dealers in the spring of 1996, certainly looks more modern than the squared styling on the present model. The change is evolutionary, thanks to the truck's wide stance, unique rear-door handles and smallish rear quarter-windows. Glass is flush and in abundance, the body lines are swooping but subtle. The cowl is low, giving the driver better forward vision. The side glass and side mirrors are bigger. In back, there's a one-piece hatch, and, at the expense of some cargo room, the spare tire seems to have been moved inside, providing for a cleaner, less trucklike rear look.

In the race to be the first Japanese luxury nameplate with a sport/utility, Infiniti dealers also will be getting a version. Both the Nissan and Infiniti will be V6 powered.

## More Japanese Luxury Sport/Utilities

Infiniti is not running the luxury sport/utility race alone: Toyota plans to put Lexus off-road by January. The Lexus sport/utility vehicle, based on the Toyota Land Cruiser, will be called the LX 450 when it arrives at dealers. Power will come from the Land Cruiser's 4.5-liter inline 6-cylinder engine, but the LX version will have more luxurious interior appointments than the Toyota, and it will be restyled with the characteristic Lexus-family features. And, if every-



one holds to their current schedules, the Lexus may well be the first Japanese luxury-brand sport/utility.

In the meantime, Acura—Honda's luxury division—has thrown its hat into the ring by



Toyota's RAV4 compact sport/utility is coming in 2- and 4-door versions.



In 1996, Kia will import this 2-door version of its new Sportage sport/utility.

announcing that Acura dealers will soon have a sport/utility vehicle (essentially a re-badged Isuzu Trooper) of their own to sell.

## Toyota RAV4

The popularity of Toyota's RAV4 compact sport/utility has exploded in Japan. There, the 2-door version consistently sells at an amazing rate of 6000 per month. It should arrive at U.S. dealerships in the fall. The 4-door version goes on sale in Japan early this summer, and it's expected to come to America soon after we've all recovered from the dreaded New Year's Day hangover. The 4-door RAV's 94.9-in. wheelbase is 8.3 in. longer than the 2-door's, and it's 16.1 in. longer overall than the 2-door. In Japan, the 2-door RAV4 costs between \$16,306 and \$19,367. Those prices sound about right for the U.S. version. The 4-door will probably start at just under \$17,000.

## Kia Sportage 2-Door

The 4-door version of the Korean-made Kia Sportage compact sport/utility is at Kia dealers now. In the fall, those same dealers will also be pushing the sportier 2-door version. Geared to young buyers, the '96 2-door Sportage will cost less than the bigger truck's \$15,250 base, but it will still be powered by the same 139-hp dohc 2.0-liter Four that moves





Isuzu will add the Oasis minivan and the Hombre entry-level compact pickup to its model lineup in January of 1996.

the 4wd 4-door truck. It won't be a rocket, but the smaller, lighter 2-door should beat the 4-door to the next stoplight. And it'll run circles around any 95-hp 2-door Suzuki Sidekick or Geo Tracker. Dwarfed by its bigger brother, the 2-door Sportage's 93-in. wheelbase and 148-in. length are both 11 in. shorter than the 4-door's. This truck's rear cap is removable, as is its large glass sunroof, making the Sportage a quasi-convertible, like the Suzuki Sidekick/Geo Tracker. We expect that a folding-canvas rear cap will also be available.

### Isuzu Oasis

Isuzu is slated to enter the ever-crowding minivan market in January 1996 when its dealers begin selling the Oasis, a version of the Honda Odyssey. The van is part of a growing partnership between Honda and Isuzu, which already supplies Honda dealers with the Passport sport/utility. The Oasis, which is Isuzu's first minivan, will have the same 2.2-liter 16-valve 4-cylinder engine and electronically controlled 4-speed automatic transmission that move the Honda. Dual airbags and antilock brakes will be standard. Expect the cost to be within dollars of the Odyssey's \$23,000 base price.

### Isuzu Hombre

Also scheduled for a January 1996 on-sale date is Isuzu's new pickup—affectionately called the Hombre. The Hombre will replace Isuzu's present no-name pickup. For this vehicle, Isuzu looked to General Motors, which

owns 37.5% of Isuzu. At its essence, the Hombre is a stripped and restyled Chevy S-10/GMC Sonoma. The Hombre's appearance combines a new nose and quarter panels from Isuzu stylists with GM's cab, pickup-box inner panels, taillights and tailgate. Only one model will be offered: a regular cab with a standard bed and 2-wheel drive powered by GM's 118-hp 2.2-liter 4-cylinder and backed by a 5-speed manual. Isuzu will not offer the optional V6 in GM pickups. Options will include a rear step bumper, sliding rear glass and a/c. Pricing should start at \$10,500.

### Suzuki X-90

Suzuki says its X-90 is like no other 2-passenger vehicle on the road. Others say the X-90 looks like somebody put a Honda Del Sol body on a Suzuki Sidekick chassis. Both camps are correct. The 4wd X-90, which will arrive at dealers this fall, sits on the same 86.6-in. wheelbase and uses the same drivetrain as the 2-door Sidekick. That means 95 hp from an sohc 16-valve 1.6-liter Four. A 5-speed is standard, a 4-speed automatic, optional. The 2-speed

transfer case, automatic free-wheeling front hubs and power steering are right out of the Sidekick parts bin as well. Four-wheel antilock brakes will be standard. Dimensionally, the X-90 is within inches of the Sidekick in every direction—it's just a bit lower, longer and wider. Inside the T-top sportster are dual airbags, power windows and door locks, a center console and full carpeting. Pricing should start in the \$10,000 range.



The 1996 Suzuki X-90 is part sports car, part sport/utility.

### Hyundai Elantra And Scoupe

This slick-looking subcompact sedan will replace the boxy Elantra at Hyundai dealers in January 1996. The name Elantra should stick around, but not much else will carry over from the present car. Wrapped in a smooth skin that bears a striking resemblance to the Korean carmaker's new Accent and midsize Sonata, the '96 Elantra should have more interior volume than the current car—it needs the space to battle the Dodge Neon and Mazda Protegé. The new car will be powered by Hyundai's own family of 4-cylinder engines—ranging from a 90-hp 1.8-liter to a 2.3-liter making 150 hp—undergoing development.

Along with the Elantra, Hyundai dealers will also be getting a racy-looking coupe (to replace the Scoupe) in early 1996. Whether this all-new hatchback will be called the Scoupe is unclear, but it will be no surprise if Hyundai lets the name expire. Based on the same platform as the Elantra, this coupe will be powered by the same family of new 4-cylinder engines. These shots were taken at Porsche's proving grounds in Germany—so, apparently, Porsche is helping with the car's handling. **PM**



Hyundai gets this coupe—spied at Porsche's proving grounds—and new Elantra sedan.

# Detroit Spy Report

BY JIM DUNNE, Detroit Editor



## Pontiac Grand Prix, Circa 1997

● If you've seen Pontiac's Grand Prix 300 GPX concept car at a recent auto show, you know what the '97 Pontiac Grand Prix 4-door sedan looks like. Like the showcar's front- and rear-fender flares, the 300 GPX is pretty much a dead ringer for almost showroom-ready prototypes that have been spotted around Detroit. Other than the lack of flares around the wheels, the Grand Prix sedan prototypes show less lower-body cladding than the concept car. The prototype 4-door's wheels are a new design, and the round running lights in fascia are taped over as a disguise.

Compare the details of the 2-door Grand Prix prototype with the sedan and you'll see that the cars have a different greenhouse. Other unique features of the 2-door are the styling details of the front end. The cooling air intakes of the coupe are low and molded into the bumper surface. The wheels on the coupe are identical to the ones on the 300 GPX, which means



those wheels will most likely be available on production Grand Prix models.

## 1997 Buick Park Avenue

Major styling changes are in store for Buick's flagship sedan. Hints of those changes can be seen through the disguises that mask the spied proto-



The distinctive, rounded profile and shortened nose help define the '96 Saturn.

types. For one thing, Buick's traditional grab-type door handles will be discarded in favor of the common flipper type. Also, the front doors are redesigned, with mirrors mounted at



the leading edge of the window, rather than to the metal below the beltline. The wheels are a fresh look and the wheel wells show a hint of a flare. The changes continue around front, where the parking lights and turn signals are mounted in the bumper face. The grille maintains the vertical-bar design of current Park Avenues.

## Massaging Seats

The seats in your next car may be more expensive than the plush ones in your home. GM is planning to include seats that not only warm up your back and backside separately, but also give you a massage at the same time. Look for these vibrating seats in some GMC sport/utility models in the near

future. The massage can be tailored to relax either your keester or your back, or both. You'll also be able to lean back on warm cushions and get a stress-reducing massage.

## 1996 Saturn Sedan

Saturn's first major body restyling since the car was introduced is planned for 1996. These models show a more rounded body shape and a snub nose replacing the sharp lines of the current car. Also, the rear doors on sedan and wagon prototypes that have been seen show the same rear door. With both versions using a single rear-door shape, Saturn can realize a manufacturing economy by eliminating the costs of unique rear doors and quarter panels. **FM**



The Buick Park Avenue is getting new mirrors and door handles for 1997.

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# In Trouble? Call Ford

BY FRANK VIZARD, Electronics Editor



● You're driving down an unfamiliar road when, right in front of you, two cars collide. You can see a cracked windshield and a driver slumped over the steering wheel. Your first instinct is to call for help. Fortunately, you have a cellular phone. Then you realize you don't really know where you are.

It's no secret that, for many drivers, the space between destinations is unexplored territory. And if trouble looms—whether it be car failure or worse—you suddenly start asking yourself the same questions 19th-century pioneers did: Are the natives friendly, and where is the cavalry?

The notion of car safety—once solely posited around a vehicle's ability to survive a crash—now extends to personal security. And while sophisticated car alarms and cellular phones are marketed with an eye toward such concerns, none of them compares to the new high-tech safety net devised by Ford and featured in its new 1996 Lincoln Continental.

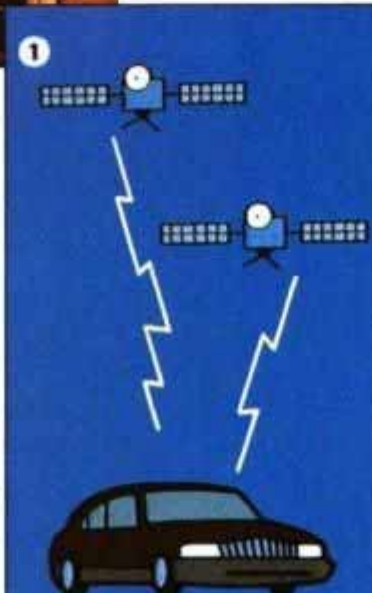
The Lincoln security system, called Remote Emergency Satellite Cellular Unit (RESCU), is remarkable in that it links the orbiting global positioning satellites with the cellular-phone network to assist motorists in distress. Here's how it works.

There are two buttons on a car's overhead console—one with a tow-truck icon and the other with an ambulance icon. Once either button is pressed, your cellular phone dials the Westinghouse Emergency Response

Center, the Irving, Texas-based clearinghouse for all calls. Depending upon which button is pushed, the center relays the call to the local 911 emergency system or to Lincoln's roadside-assistance program.

Thanks to the GPS antenna built into the trunklid, additional information is sent to the response center without you having to lift a finger. The data, automatically transmitted via the cellular phone, includes the

be a weakness in the RESCU system. Technically, it's relatively easy to link a car alarm to RESCU. If the car moves without authorization—by failing to enter a numeric code, for instance—RESCU could automatically report the car as stolen if the driver, when contacted by phone, fails to give the proper password. Plus, a remote device could be linked to RESCU so you'll be able to call for help even before getting into the vehicle.



The Global Positioning System (GPS) continuously updates the vehicle's location. This information is retained by the Lincoln RESCU system in the 1996 Continental.



The motorist pushes the Lincoln RESCU button inside the car to initiate a cellular call. As part of the call, vehicle location and owner data are relayed to the Lincoln Security Center.



Via cellular-phone system, Lincoln Security talks to the motorist, confirming location and determining what assistance is needed. The security agent then brings the appropriate public emergency response agency or roadside dispatch service in on the call.

latitude and longitude of the car, its last recorded speed and direction, the vehicle identification number and the call-back phone number.

During such an emergency, the RESCU operator maintains voice contact with you, seeking additional information concerning the nature of the emergency and letting you know how soon help will arrive.

If the emergency buttons were pressed accidentally, the operator will ask you for a secret password to confirm the error. If no password or an incorrect password is given, the operator will assume the car is being stolen and direct police to the car's location.

This last point brings up what may



Of course, if the car is stolen, you could call RESCU directly and locate the vehicle that way. Still, time may be an issue if the car is headed for a chop shop. Undoubtedly, RESCU will eventually be offered in more cars. And that's a good thing. **FM**

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# X-Rays Go Extreme

BY GREGORY T. POPE, Science/Technology Editor



● Fly over any of the world's research hubs and you're likely to see rings—great circles described on the land, or buildings that loop like giant doughnuts. Some are big enough to be seen from space and, if we ever spot one on another planet, we can assume it's the mark of a civilization like our own, driven to probe nature's deepest mysteries.

These rings house beams of subatomic particles for science's biggest instruments: accelerators, with which experimenters pulverize matter's building blocks. Combining brute-force magnets with exquisite electronics, the machines are monuments to atomic-age engineering. They foster the kind of research that can unlock the secrets of the universe.

True, unless you're a physicist, atom smashers have little direct impact on your day-to-day life. But that may be about to change—thanks to a unique synchrotron-based facility poised to enter service this summer.

Among particle accelerators, the synchrotron has long been lord of the rings, reaching the greatest energies and forging the most elusive forms of matter (see [Tech Update, page 20](#)). But the synchrotron is shaking its image as a high-priced tool for highbrow

physics. Researchers from all walks of science—even applied industry—now clamor for access to synchrotrons.

The reason? Just as a spinning grinder sparks friction, a synchrotron throws off abundant electromagnetic radiation, which is useful for probing

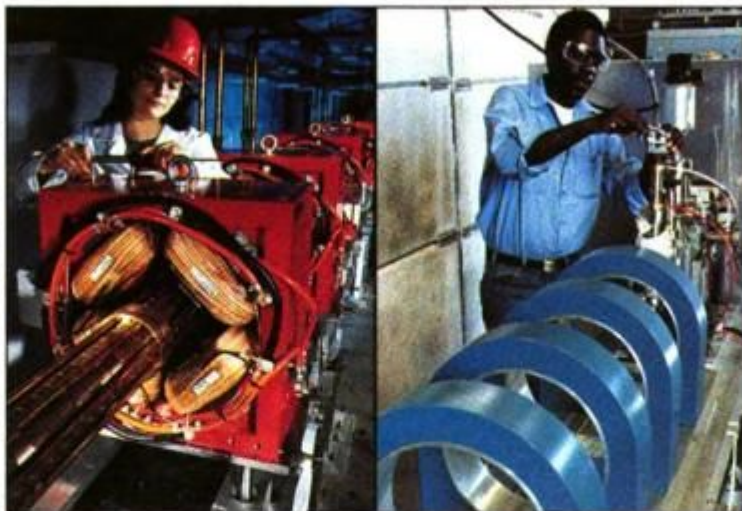
others. Called the Advanced Photon Source, or APS, the \$800-million ring has just begun to crank out X-rays thousands of times more brilliant than any ever generated. The APS puts out a trillion times the intensity of a hospital X-ray machine, in piercing beams of unprecedented focus.

"An ordinary X-ray source is like a flashbulb on a camera," says Russ Huebner, a physicist responsible for planning and policy at the APS. "But the APS is like a high-powered laser. In fact, these beams start to look as much like X-ray lasers as anything that's been produced."

The APS is a fittingly high-tech way to celebrate the 100th anniversary of the X-ray's discovery. State-of-the-art design and engineering bring the rays to life. Inside the APS

synchrotron, a beam of charged subatomic particles sweeps about a circular vacuum tube, its looping path defined by magnets. (The particles are positrons, the antimatter equivalents of electrons.) With each lap, the beam gains energy from electromagnetic boosters that fire in synchronization with the positrons' orbit.

The boosters hike the particle energy to billions of electron volts. (By



Advanced Photon Source (top) measures two-thirds of a mile around.

the chemical anatomy of everything from proteins to plastics. Synchrotron radiation has spurred the development of medicines, materials, micro-devices—things with a lot more practical value than sub-subatomic particles.

In the past decade, several synchrotron rings have been built exclusively to reap this radiation. But a new facility at Argonne National Laboratory, near Chicago, outshines all

comparison, the electron beam that lights up your TV screen runs to only 10,000 electron volts.) Once the positrons have been whipped up to speed, the synchrotron volleys them into the great storage ring seen in the illustration. This ring extracts synchrotron radiation in a novel way.

The ring actually contains a number of straight sections, in each of which lies a series of powerful permanent magnets, set about a centimeter apart. Arranged to generate an alternating magnetic field, these devices force the positrons into an undulating path. As they zig and zag, the positrons emit radiation—something particles are wont to do when forced to change direction. Wiggled many times in succession, the APS positrons radiate copiously.

The velocity at which the positrons whirl about the ring is what creates the radiation's unique traits. At 7 billion electron volts, positrons travel at just a hair below the speed of light. So exotic effects, dictated by the laws of relativity, come into play.

One of these occurs as the positrons snake their way through the magnetic undulator. From the speeding particles' perspective, the distance between the magnets shrinks to less than an angstrom (one hundred-millionth of a centimeter). Accordingly, the particles radiate their energy at wavelengths of less than an angstrom. These are the wavelengths of so-called "hard" X-rays, which have great powers of penetration.

In another relativistic effect, the radiation doesn't scatter in all directions—as radio waves do from an antenna. Issued by particles flying at near-light speed, the energy can radiate only in the direction the particles are traveling. The result: a powerful beam less than 1/10 of a millimeter wide.

Researchers are lined up to wield these beams like flashlights, probing the thickets of atoms in complex molecules. "Almost everything we know about the arrangement of atoms in any material," notes Huebner, "comes from hard X-ray crystallography."

Huebner is referring to a technique, invented 80 years ago, in which chemists shine X-ray beams through crystals to determine their structure. The X-rays tickle the crystal's electrons into releasing their own X-rays, which scatter, interfere with one another and diffract through the crystal. Film captures this diffraction pattern. Researchers can then interpret the resultant image of light and dark spots, which translates into a map of electron distribution—and a good clue to atomic structure—of the crystal.

This technique works well with simple molecules. But with large structures—such as biological molecules—

the diffraction image is complex and blurry, with dimly shadowed regions that reveal little useful information.

The intense beams from the APS should sharpen these images. "We can put a lot more light on the subject," says Huebner. "Whenever you have more light, you can take pictures better, faster, with more detail." This capability has lured pharmaceutical researchers and genetic engineers. Armed with X-ray diffraction patterns, they hope to build models of newly concocted proteins that promise biomedical applications.

The APS can also spit out machine-

gun bursts of X-rays—just like a high-powered strobe light. Directed at a crystal that's being heated or electrified, these pulses record movies of the split-second structural changes that the molecules undergo.

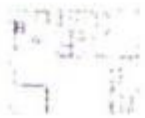
The opening of the APS comes as a slightly less energetic European facility ends its first year of operation, and a more energetic Japanese machine marches to completion in 1998. APS officials hope their synchrotron will give the U.S. a research edge over the next few years—and that their X-ray vision can penetrate American industry and academia alike. **PM**

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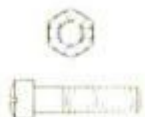
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# CREATION OF THE HUMANOIDS

Get ready for a new generation of robots that look, move and think like people.

INTEL CORP



BY BRIDGET MINTZ TESTA  
PM Illustration by Jeff Mangiat

● In "2001: A Space Odyssey," an artificial intelligence named HAL controlled the Jupiter-bound space *Discovery*. Movie-trivia buffs may recall that HAL became operational on January 12, 1992. But when the real thing came and went with no HAL, Rodney Brooks resolved to create his own. Instead of imbuing a spacecraft with a human soul, however, Brooks is putting the mind of a human into the body of a robot.

The result? Not HAL, but Cog—a collection of computer chips, motors, joints, rods, cables, wire and video cameras hung together on a black anodized aluminum frame. Cog perches on a gray steel pedestal bolted to the floor of the Artificial Intelligence Lab at the Massachusetts Institute of Technology, where Brooks is a professor of electrical engineering and computer science.

Looking like some 21st-century relic that came to light through a time warp, Cog right now is little more than head, neck, shoulders, chest and waist. Still, no other machine has come closer to the humanoid robots



IBM PHOTO BY MICHAEL SEITON

Brainchild of Rodney Brooks, Cog defies conventional wisdom about intelligence.

of science fiction—the mechanical creatures that most of us envision when we think of robots. An ambitious, even brazen project, Cog foreshadows the day when robots will interact seamlessly with regular folks. Cog's creators are endowing their machine with the ability to do just that, while other roboticists take the formidable challenge of duplicating humanoid arms and legs.

Precisely *because* it has some anatomy, Cog is a far cry from HAL. A brain in a box, HAL represented what researchers term GOFAI—Good Old-Fashioned Artificial Intelligence. Chess-playing computers are examples of this traditional approach. Programmed to a fare-thee-well, they wield enough brute-force computing power to check every possible chess move at each turn of the game. GOFAI has produced at least one chess grandmaster, named Deep Thought.

But can GOFAI create a machine that thinks and acts so human that you or I can't tell the difference? That's the ultimate test, proposed by artificial-intelligence pioneer Alan Turing in 1950. Contrary to GOFAI researchers, Turing believed that the best way to build a humanoid was to put the brain not in a box, but in a body, and equip it with senses that allow it to learn.

"Turing argued that you should make a robot like a human and let it wander around the countryside and

experience what humans do," says Brooks. "Putting all that together—and not totally uninspired by Commander Data of 'Star Trek'—I decided to build a human."

### High-brow beetles

Creating a humanoid was a big leap for Brooks, whose followers style him "the bad boy of robotics." Brooks last rattled the artificial-intelligence community by building small robots that scurried about like insects. As it turns out, though, Cog and the insect robots have much in common: Both flout the GOFAI approach. For a mobile robot, GOFAI means charting a complete map of the world that the machine will encounter. That may work fine in the lab, Brooks reasoned, but what about the real world, with its vast spaces and unpredictable obstacles?

To overcome the problem, Brooks programmed his robots with so-called parallel behaviors—no all-encompassing maps, just simple leg routines, such as up-down and forward-back motions, that can operate together, in parallel. On the robots' legs, sensors warned of obstacles and triggered these behaviors like reflexes. The machines ran riot in the lab, where graduate students built fresh obstacle courses every day. Combining parallel routines

and sensor data, the robotic insects managed to conquer all.

"Cog represents the same principle," says Brooks. "We just jumped a few evolutionary layers. The idea is that the complexity of the world happens in the world, not in the creature." That sophisticated intelligence can be built up through thousands of simple sensory interactions—hearing, seeing, moving—remains a controversial concept. And that's just how Brooks likes it.

### Cog's cognition

Unlike the insect robots, whose brains bumped around with them, Cog's 16 Motorola 68332 chips—similar to Macintosh processors—are located in an adjacent room. Patch cables attach them to Cog. "Very hard-wired," Brooks comments. Cog may ultimately get 256 of these chips, and Brooks plans to replace at least some of the 68332s with digital-signal processors for tackling special tasks. While not modeled after the human brain, Cog's mind—like our own—will be able to handle multiple functions at once. Cog's software is based on LISP, the traditional programming language of artificial intelligence.

Although all this computing power is impressive, Cog will be considered a success if it reaches the intelligence level of a 2-year-old child. Right now, like a human infant, Cog is using its brain to learn how to see. Each of Cog's eyes has a



Japan's Leg-12 walker robot is a step toward walking humanoids.

wide-angle and a narrow-field camera, and each camera can pan and tilt. Through the wide-angle cameras, Cog's peripheral vision detects motion. Then, the narrow-field cameras focus in for a closer look. Cog can also move its head forward, back and around like a human.

"Cog must learn to relate what it sees in the camera to its own head motion, to know what motion is in the world and what is due to its own head," says Matt Williamson, a graduate student on the Cog team. The robot must also gain skill in jerking its eyes to the center of a moving object—an action it may later learn to suppress if it's attending to something else.

"We're trying to find ways for Cog to learn about the world by itself—let it get its calibration from the world, just as humans do," says Brooks.

After Cog learns to see, Brooks will teach it to hear. In preparation for this tutelage, a polystyrene head representing Cog—complete with micro-

phones and processors—sits atop a bench in the AI Lab. Says Brooks, "The first thing we'll do is map sensor coordination between the eyes and ears. If Cog hears a sound, it'll point its eyes at it. If it sees motion, that will reinforce the coordination of the two." While sound will help Cog figure out where to look, the robot will also be able to separate sounds, much as people do at a noisy cocktail party.

These senses will allow the robot to interact with its creators, much as an infant picks up cues by observing the reactions of its parents. "It will learn somewhat like a human baby," Williamson says. "Cog is motivated to explore the environment, itself, and to attract and hold the attention of people. It will learn about its own body—what it sees versus what it's doing."

### Armed forces

Although Cog may be getting in tune with the world, at the moment, the robot can't reach out and touch it. Cog

can lean forward and sideways at the hips, turn its neck like a human and even shrug its shoulders. But it has no skin, no arms, no fingers.

Williamson is building Cog's first arm as part of his Ph.D. research. Once he perfects that arm, he'll build the second one. "The idea is to iron out the problems of one arm and then the other," Williamson says.

"The arm has a completely new way of operating," adds Brooks. "Each joint has a spring in the drive mechanism, so it has compliance." Compliance, he explains, is a way of dealing with an obstacle. If you're feeling around in the dark, for example, and you encounter a brick wall, your arm's compliance lets you stop pushing without consciously thinking about it. Without any compliance, says Brooks, Cog's robot arm might knock a hole "through our bellies." But with compliance, Cog's arm, like a human's, will be able to adapt to unexpected barriers.

## Back When It Was Only Science Fiction



● Asked what inspires them, robotists often tip their caps to Hollywood. But if the movies hold a mirror to life, then humanoid robots have a serious image problem. Sci-fi flicks cast robots in two contrasting stereotypes. The clanky, metal-clad machines, such as Robby of "Forbidden Planet" and C3PO of "Star Wars," are good guys. But the most humanoid of robots—Yul Brynner's Gunslinger from "Westworld" and the "Terminator" assassins—are sinister.

This humanoid paranoia traces its roots to an obscure 1962 B-movie. "The Creation Of The Humanoids" pits man versus machine in a post-nuclear-war society where lingering

radiation has throttled the human birthrate to 1.4 per union. To rebuild their shattered world, the survivors rely on robots. Most are servile automatons, marked by silvery contact lenses and stilted speech. But a renegade scientist has perfected a "thalamic transplant" that loads memories and emotions from a

fresh corpse into a robot's circuitry. His aim: to supplant the dying human race with immortal humanoids. Vigilante flesh-and-blooders, fighting to preserve mankind's biological heritage, resist his efforts. Meanwhile, the robots have their own ideas and seek the secrets of self-replication.

"Creation" hardly crackles along, burdened with howlers like "I'll have your memory pulled so fast you'll never forget it." But the movie does preview the artificial-intelligence issues that challenge today's robotists. For example, the robots draw comprehensive knowledge from a huge central computer. Yet that's not enough to make them human. Only

when they acquire the sensory experiences of real persons do they overcome their robotic nature—and pose a threat to the technophobes.

Much the product of its times, "Creation" played on anxieties over the Cold War and the civil-rights struggle. But it also crystallized the fears that arise when technology crosses paths with our human identity. Perhaps that's why Cog's creators look elsewhere—to Commander Data of "Star Trek"—for inspiration. After all, Data's a rare Hollywood role model: a humane humanoid.

—Gregory T. Pope





SARCOS PHOTOS

Teleoperated arms are approaching human dexterity, but they require human control.

Since Cog's arm will be attached to its operator, it's completely different from a teleoperated robotic arm like the one at Johnson Space Center's Dextrous Anthropomorphic Robotic Testbed, or DART (see [Tech Update, page 22, May '95](#)), or those of the entertainment robot Sarcos, seen at automobile shows and similar venues.

Both DART and Sarcos are operated by humans wearing virtual-reality helmets and gloves, and, for Sarcos, a sensor suit that transmits the operator's body motions to the robot. DART is an experiment designed to make it easy for humans on Earth to operate robots on other planets. Sarcos is intended to amuse. But in both cases, the real operator is human, not machine.

## Walk this way

Though Cog will manage its own arms, it won't be able to walk. It has no legs, and there are no immediate plans to provide any. Brooks has deferred humanlike walking, and other roboticists aren't surprised.

"It's very difficult to duplicate the human tendon-muscle-bone structure and power," says Carnegie Mellon University researcher John Bares, a co-investigator on the volcano-exploring, 8-legged Dante robot (see [Tech Update, page 24, March '94](#)). Humans walk dynamically, a process in which we must quickly plan foot repositioning—and then realign the body's center of gravity as we change feet and move forward. That's tough for robots, engineers have found. "Control of legs and body to maintain an up-

right position is a worldwide challenge," notes Bares.

But one researcher—MIT's Marc Raibert—has met the challenge with his own running, balancing robots. "We think running is simpler than walking," he says, "so one of our mottoes is, 'You have to run before you can walk.'"

At Raibert's Leg Lab, engineers split running into three components: bouncing up and down, balancing and body leveling. Though related, the latter two aren't quite the same. Control systems that plan foot position are what keep Raibert's robots from tumbling. "It's like balancing a broom on your finger," he says. To understand this concept, think about the adjustments you have to make if you suddenly introduce a short step into your normal stride. Meanwhile, hip actuators level a robot's body a little each time a foot touches the ground. They work to keep the robot as vertical as possible.

With these techniques, Raibert's group has built hoppers, 2-legged runners and a 4-legged machine that trots, paces and bounds. A Raibert biped even strode into Hollywood, making a cameo appearance in the movie "Rising Sun."

Appropriately enough, walkers have also been built in Japan—by Isao Shimoyama at the University of Tokyo and by Atsui Takanishi and others at Tokyo's Waseda University. Shimoyama's BIPER-3 robot used stilts as feet.

"That means the robot

had to continue stepping to keep its upright posture," Shimoyama points out. Takanishi's Leg-12 biped learned how to keep its balance and walk from a guiding human. After a little training, the headless robot could walk by itself.

If all this research continues at a steady pace, Cog—or a follow-on descendant—may one day take its first steps. But Brooks and company don't plan to stop there. It's possible, for example, that the amount of current passing through Cog's motors could be controlled to teach it to feel fatigue, even pain. In addition, Cog may eventually get a skin with sensors so it can learn by touch.

"The end result will be, yes, like Commander Data," says Brooks. "But that's a long, long ways away." Still, Cog could be just the first in a humanoid robot revolution. Its mission: to bridge the gap between HAL's boxed brain and Data's embodied, near-human mind. And if Cog could speak and we asked its opinion, it might just say—as HAL did—"You know that I have the greatest possible enthusiasm for this mission." **FM**

Sarcos cavorts at shows.





# BUICK PARK AVENUE

Big, elegant and eminently satisfying.

BY MICHAEL LAMM, Contributing Editor; PM Photos by Scott Dahlquist

• For the 1991 model year, Buick gave the Park Avenue full-series status and a new, modern look. Under the new Park Avenue's body were the former Electra's mechanicals: front-wheel drive and 3.8-liter V6.

Soon after its 1991 introduction, Buick announced that 150 buyers of the upmarket Park Avenue Ultra model would be able to order their cars with a supercharger. By 1992, the supercharger became standard on the Park Avenue Ultra. Why only 150? Because the Eaton Corp., supplier of the Roots-type blower, didn't yet have the capacity to build more. Besides, no one at Buick knew whether the mature audience that Buick appealed to would cotton to a hot-rod option like a supercharger. The blower initially raised the V6's horsepower from 170 to 205 and then, for 1994, up to 225 horsepower.

As opposed to a turbocharger, the supercharger raises midrange torque for passing and merging. Because most drivers need full-throttle bursts of accel-

eration less than 1% of the time, the supercharger freewheels until a computer-controlled solenoid shuts an air-bypass valve. The computer bases its decision to shut the valve on input from throttle-position and engine-speed sensors. With the bypass shut, the blower immediately starts stuffing a charge into the intake manifold and, within milliseconds, the car takes off like a moderately scorched cat. With the supercharger freewheeling, there's virtually no power loss, so it barely affects fuel economy. In fact, the EPA gives the supercharged engine the same highway rating as the Park Avenue's normally aspirated V6: 27 mpg.

But there's a 2-mpg penalty in the EPA's city mileage: 19 mpg for the base V6 versus 17 mpg for the supercharged engine. In our survey, the supercharged Ultra delivered about 1.5 fewer mpg overall, city and highway. Most owners appreciated their cars' performance whether it was supercharged or not, and several pronounced it "outstanding."

# BUICK PARK AVENUE



For many, gauges are a trifle hard to see.



Ultra offers dual-zone front temp settings.



Both V6 engines have enough power.



Just over 80% of our respondents chose the base Park Avenue, which retails for \$27,236—\$4666 less than the Ultra. Standard equipment in all models includes ABS, dual airbags, air conditioning, automatic load leveling and power just-about everything.

In addition to the supercharger, the Ultra adds an alarm system, dual 6-way power leather seats with optional memory (the base Park Avenue has 6-way only for the driver's seat), lighted rear swing-down vanity mirrors, keyless entry, and on and on and on—

way too much to list. Both versions are nicely topped up with standard equipment and there's almost nothing you can't order additionally.

The Ultra also has an interesting dual-temp climate-control system that allows the driver and front passenger

## SUMMARY OF BUICK PARK AVENUE OWNERS REPORTS\*

<b>Total miles driven</b>	1,642,668	<b>Average</b>	1.3	<b>Power</b>	15.6	<b>Alarm system</b>	5.6
<b>Average miles driven</b>	5248	<b>Poor</b>	0.3	<b>Specific dislikes:</b>		<b>Oil leaks</b>	5.6
<b>Purchase price:</b>		<b>Braking:</b>		<b>No complaints</b>	21.8%	<b>Valves</b>	5.6
<b>Average</b>	\$27,278	<b>Excellent</b>	77.5%	<b>Noises and rattles</b>	8.7	<b>Repair it yourself?</b>	
<b>Range</b>	\$22,000-\$34,000	<b>Good</b>	20.3	<b>Instrument panel</b>	8.7	<b>No</b>	98.1%
<b>Why did you choose the Buick Park Avenue?</b>		<b>Average</b>	2.3	<b>Obstructed rear vision</b>	7.3	<b>Yes</b>	1.9
<b>Owned Buicks before</b>	44.9%	<b>Poor</b>	0.0	<b>Price too high</b>	5.3	<b>Dealer repairs satisfactory?</b>	
<b>Styling</b>	31.5	<b>Overall performance:</b>		<b>Unfriendly climate controls</b>	4.9	<b>Yes</b>	72.7%
<b>Comfort</b>	14.7	<b>Excellent</b>	72.2%	<b>Suggested changes:</b>		<b>No</b>	27.3
<b>Price/value</b>	13.4	<b>Good</b>	27.2	<b>No changes</b>	14.4%	<b>Dealer service opinion:</b>	
<b>Ride</b>	11.6	<b>Average</b>	0.6	<b>Better instrument layout</b>	6.7	<b>Excellent</b>	66.2%
<b>Handling</b>	7.5	<b>Poor</b>	0.0	<b>Yearly styling updates</b>	6.7	<b>Good</b>	29.5
<b>Model choices:</b>		<b>Control layout:</b>		<b>Fewer squeaks and rattles</b>	6.6	<b>Average</b>	3.0
<b>Park Avenue</b>	81.3%	<b>Excellent</b>	57.3%	<b>More powerful engine</b>	6.1	<b>Poor</b>	1.3
<b>Park Avenue Ultra</b>	18.7	<b>Good</b>	35.8	<b>Better rear vision</b>	5.0	<b>Dealer sales policy:</b>	
<b>Options/Accessories:</b>		<b>Average</b>	5.9	<b>Workmanship opinion:</b>		<b>Excellent</b>	68.6%
<b>Luxury package</b>	74.2%	<b>Poor</b>	1.0	<b>Excellent</b>	76.2%	<b>Good</b>	28.1
<b>Premium sound system</b>	74.0	<b>Instrumentation:</b>		<b>Good</b>	22.1	<b>Average</b>	2.6
<b>Automatic ride control</b>	64.6	<b>Excellent</b>	53.8%	<b>Average</b>	1.3	<b>Poor</b>	0.7
<b>Traction control</b>	48.5	<b>Good</b>	36.7	<b>Poor</b>	0.3	<b>Number of vehicles owned:</b>	
<b>Prestige package</b>	47.8	<b>Average</b>	7.2	<b>Comfort opinion, front seats:</b>		<b>This vehicle only</b>	28.1%
<b>Heated driver's seat</b>	20.6	<b>Poor</b>	2.3	<b>Excellent</b>	78.6%	<b>Two vehicles</b>	50.2
<b>Gran Touring package</b>	20.0	<b>Driver sightlines:</b>		<b>Good</b>	19.5	<b>Three vehicles</b>	13.2
<b>Astro roof</b>	7.9	<b>Excellent</b>	51.8%	<b>Average</b>	1.9	<b>Four or more</b>	8.4
<b>Trailer package</b>	2.6	<b>Good</b>	36.8	<b>Poor</b>	0.0	<b>Principal driver:</b>	
<b>Avg. mpg, city/hwy:</b>		<b>Average</b>	9.4	<b>Comfort opinion, rear seats:</b>		<b>Male</b>	57.8%
<b>170-hp V6</b>	20.2/27.2	<b>Poor</b>	2.0	<b>Excellent</b>	70.2%	<b>Female</b>	36.8
<b>Supercharged 225-hp V6</b>	18.7/25.4	<b>Overall convenience:</b>		<b>Good</b>	28.4	<b>Equal</b>	5.4
<b>Performance opinion:</b>		<b>Excellent</b>	54.5%	<b>Average</b>	1.4	<b>Age distribution of owners:</b>	
<b>Engine power:</b>		<b>Good</b>	40.5	<b>Poor</b>	0.0	<b>Under 20</b>	0.3%
<b>Excellent</b>	64.3%	<b>Average</b>	4.3	<b>Any mechanical trouble?</b>		<b>30-49</b>	7.9
<b>Good</b>	33.4	<b>Poor</b>	0.7	<b>No</b>	82.3%	<b>50-plus</b>	91.8
<b>Average</b>	2.3	<b>Specific likes:</b>		<b>Yes</b>	17.7	<b>Based on your experiences, would you buy a Buick Park Avenue if you had it to do over again?</b>	
<b>Poor</b>	0.0	<b>Comfort</b>	47.9%	<b>What type of trouble?</b>		<b>Yes</b>	80.6%
<b>Handling:</b>		<b>Ride quality</b>	38.1	<b>Transmission (various)</b>	11.1%	<b>Maybe</b>	16.8
<b>Excellent</b>	74.2%	<b>Size</b>	36.2	<b>Electrical system</b>	9.3	<b>No</b>	2.6
<b>Good</b>	24.2	<b>Handling</b>	35.0	<b>Heater slow to warm up</b>	9.3		
		<b>Overall economy</b>	16.7	<b>Fuel-filler door wouldn't open</b>	7.4		

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

to individually set the temperature on his/her side of the car. There's one set of climate controls on the instrument panel, a second set on the front passenger's door and an optional third set on the steering hub. Steering-wheel touch controls come only with the Prestige package—an additional \$1385 to \$2671. The drivers who ordered them considered the hub-mounted switches a great convenience and safety factor.

Nearly 45% of our respondents had owned Buicks before. They were obviously happy with their previous cars, since satisfaction with earlier Buicks ranked as the No. 1 reason for choosing a new Park Avenue. Only 31.5% listed styling as their main purchase motivator—surprisingly few, considering. Another 14.7% cited comfort and 13.4% mentioned price/value as important reasons for buying.

Workmanship rated excellent with 76.2% of our owners, and another 22.1% gave quality a rating of good. Only 17.7% of all respondents' Park Avenues needed service. It would seem that Buick's high J.D. Power and Associates' ratings and other customer surveys are justified.

The Park Avenue would also seem to be a status symbol for many older Americans. More than half the respondents listed their age as over 65—most happily confessed to being retired. These owners liked their cars a lot, specifically praising comfort and roominess, the warehouse-size trunk and all those standard conveniences. However, there were complaints about details: too dim turn-signal arrows, the profusion of small, black central climate-control buttons that are hard to see—particularly with bifocals—the high trunk liftover sill and the small, crowded instrumentation. Several owners pointed out that they didn't need or want the tachometer, and that this space might be better used to make the other dials larger.

However, just because Park Avenue buyers are mature doesn't mean they don't want to enjoy driving their cars. A full 20% equipped their base Park Avenues with the \$224 Gran Touring package (standard on the Ultra). This includes 16-in. alloy wheels, grippier tires and firmer shock settings. There's also an FX-3 "automatic ride control" suspension that senses body yaw and roll at low speeds and firms up the damper settings accordingly. And nearly half had ordered traction control at \$175 additional.

Clearly, most of our respondents were very hopped up on their cars—more than 80% said enthusiastically that they'd buy a Park Avenue once again. Only 2.6% gave us an unequivocal "no thanks."



The stately lines of the Buick Park Avenue have remained basically unchanged since its redesign in 1991. The conservative styling was not a prime sales motivator.

#### EDITORS REPORT

## More Sedate Than Sensual

● The Buick Park Avenue stands as a paradigm of what's evolved into the old guard of automotive Americana. Its softly angular lines are stately, tasteful and—certainly by today's standards—eminently conservative. Its front-wheel-drive powertrain boasts a traditional pushrod engine—albeit with state-of-the-art electronics and fuel injection. The large rear overhang accommodates a proper American-family-size trunk. And the 6-person passenger compartment easily swathes a half-dozen full-grown people in cushy elegance. The car's ride is boulevard comfortable, and its handling is predictable, if also less than nimble.

When equipped as a Park Avenue Ultra, the big sedan boasts a supercharger to help its V6 pull the car around with a pleasing rush of mid-range torque—kind of like the big-block V8s of Buick's recent past.

After all is said and done, there's really not much wrong with the Park Avenue, and there's even less wrong with the Ultra. In fact, the folks who flock to Buick dealerships with \$30,000 or so in hand appreciate this car's solid, traditional qualities.

Clearly, the Park Avenue—and its smaller sibling, the LeSabre—appeals to older, traditional-minded buyers and drivers, drivers who relish the large, smooth and isolated feel that American sedans were famous for decades ago. These Buicks are far nimbler, smaller and more efficient than their forebears, but they're closer to their roots than many other models on the market.

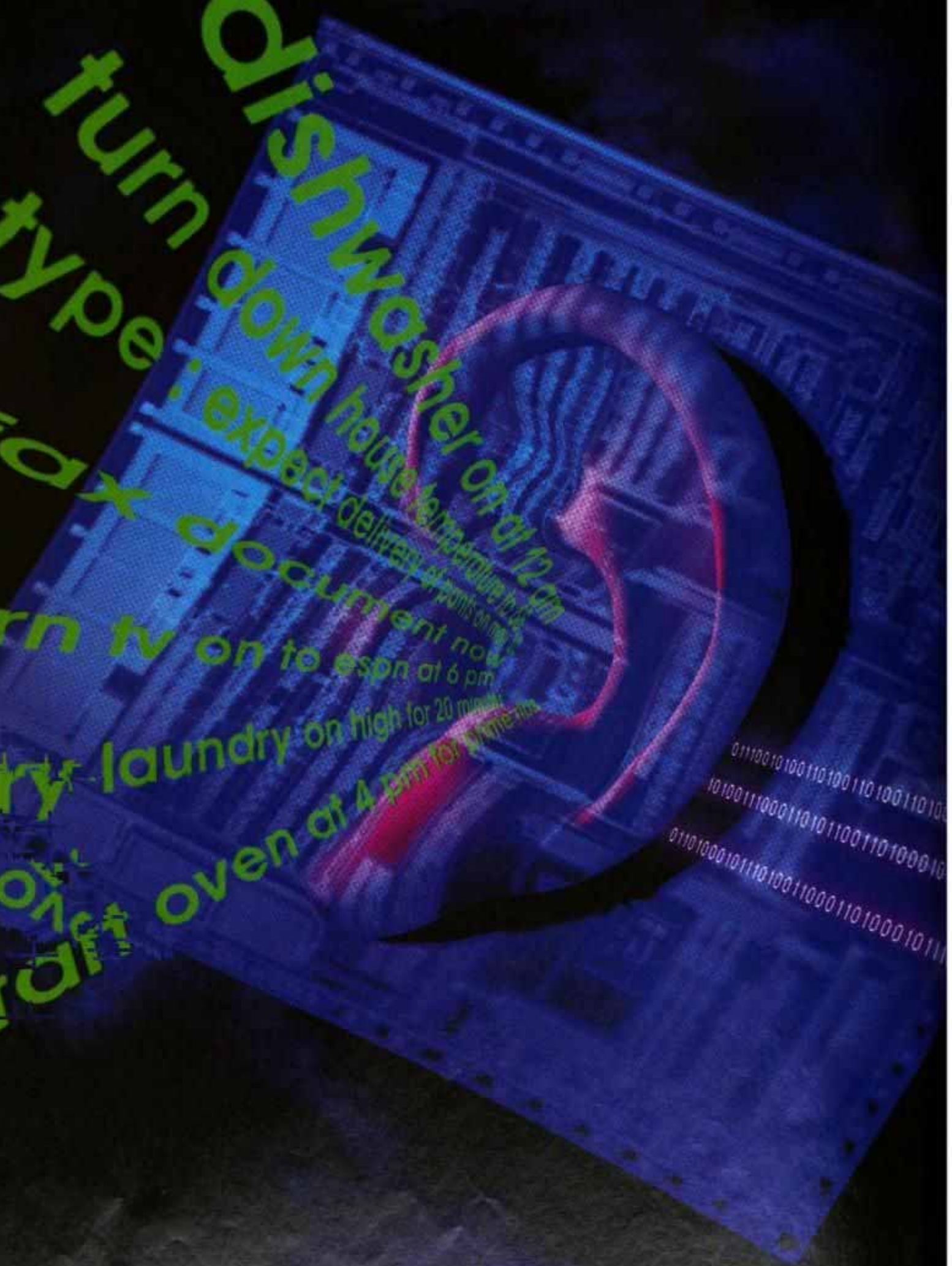
Basically, life behind the wheel of this big Buick is good. The Park Avenue represents simple point-and-shoot motoring at its best.

However, there is an increasing number of drivers who want something different. So if your tastes are closer to ours, you may find that the comfort of the Park Avenue's interior is diminished somewhat by the lack of firm, lumbar-loving seating. You also may be somewhat frustrated by the car's difficult-to-read instrument panel and even more difficult-to-operate minor controls.

Further, the performance potential of the supercharged V6 in the Ultra is seriously compromised by the direction of the Park Avenue's chassis tuning. Now don't get us wrong: To our way of thinking, any car with a supercharger is already pointed in the right direction. But when you're driving a car with a blower on the engine, you should be able to totally enjoy the car's performance. That means more than simply stabbing the throttle and keeping it straight. Unfortunately, to our tastes, the softly sprung Park Avenue simply doesn't want to be driven as quickly or with as much élan as the 200-plus horses under the hood encourage you to.

However, if you accept that the Park Avenue's mission is to provide comfortable, quiet, competent and even elegant transportation for a driver and up to five of his or her closest friends, the Buick Park Avenue is an excellent representative of the American automobile industry.

—Don Chaikin



turn down house temperature to 65°  
expect delivery of goods on time  
document now  
turn tv on to espn at 6 pm  
laundry on high for 20 minutes  
oven at 4 pm for 20 minutes

01110010100110100110100110100  
10100111000110101100110100010  
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# MACHINES THAT LISTEN

The next generation of smart devices will recognize your voice and obey your commands.

BY GEORGE MANNES; PM Photo by Michel Tcherevkoff

• For people who have labored over computer keyboards—and for people who have never touched them at all—one of the most seductive images of computing has been the television show “Star Trek.” If you want a computer to figure something out for you, all you have to do is talk to it.

Computers that understand people’s every spoken wish and then talk back to them are, unfortunately, still the stuff of future centuries. But desktop computers that can recognize tens of thousands of spoken words are already here. And in the world of telephones, speech recognition is a growing alternative to button-pushing for placing calls. Thanks, in part, to ever cheaper and more powerful computer chips, speech recognition could one day play a large role in people’s lives. Cars, air conditioners and even dishwashers may respond to the sound of our voices. People might not be able to command

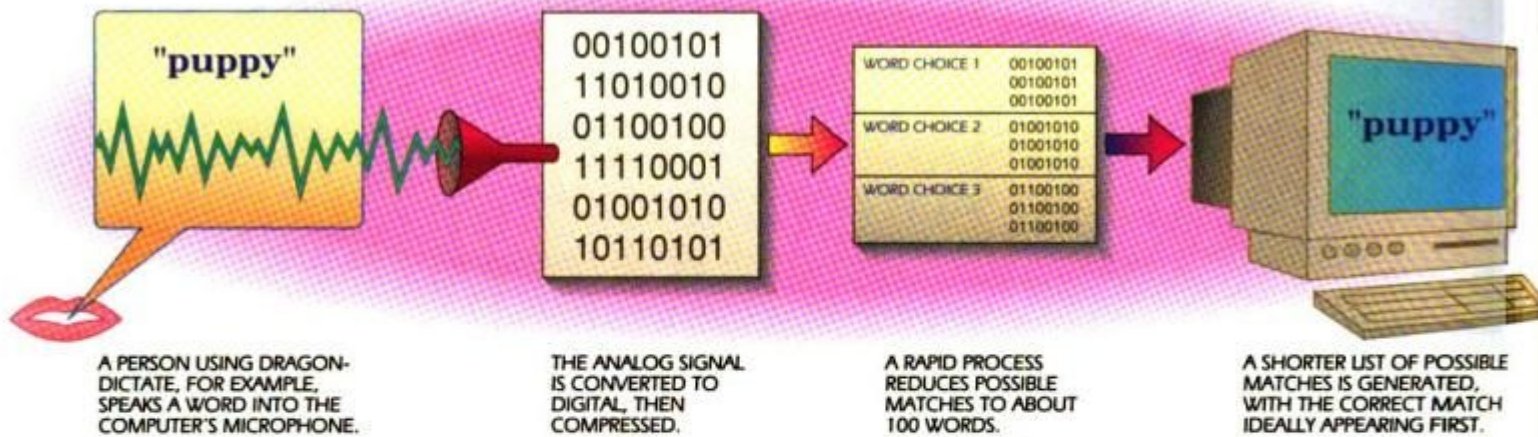
the Starship *Enterprise* by voice, but they’ll likely use it to pilot a videogame spaceship.

Some of the most impressive applications of speech recognition available are PC-based dictation systems. Speak into a microphone and a \$1000 hardware/software package that recognizes up to 30,000 words will type your commands as you speak. None boast 100% accuracy, but people don’t type with 100% accuracy, either. Three Windows-based dictation systems are already on the market: DragonDictate, from Dragon Systems of Newton, Massachusetts; Kurzweil Voice, from Kurzweil Applied Intelligence of Waltham, Massachusetts; and VoiceType Dictation from IBM, which also sells VoiceType Dictation for OS/2.

How does speech recognition work? Assume you have a computer loaded with IBM’s VoiceType Dictation. You speak a word—say, “tickle”—into a microphone hooked up to the machine. That word, explains Vince Stanford, lead engineer of the Spoken Language Systems Group in IBM’s Power Personal Systems Division, is sampled electronically at the rate of 11,025 times per second. It’s then converted into a digital signal—one that describes the sound in a numerical computer language. That signal is then sliced into smaller pieces, each  $\frac{1}{1000}$ th of a second in length.

The computer analyzes these pieces, called acoustic frames, by dividing them up into a series of frequency bands—from the lowest bass pitches to the

## How Voice Recognition Works



highest altos, then measuring the signal's power within each band.

At this point, the computer begins reassembling the audio data to make an educated guess at the word that has been spoken. It starts with the acoustic frames: Given the appearance of a particular frame, the computer asks, what is the probability that a certain phoneme (for example, the "t" sound or the "i" sound in "tickle") is being uttered?

The computer ends up with a set of probabilities that a particular series of phonemes have been spoken to create a word. Using a relatively simple test, the computer culls from a database a short list of, say, 20 words that phonetically resemble the utterance—maybe, in this example, the words "pickle," "nickel" and "tackle." Then, using a more detailed acoustic comparison plus information about the probabilities of word order, the computer selects the most likely candidate.

Strategies for speech recognition are complex processes over which researchers have labored for many years. "It's not something where you dream up an algorithm and all of a sudden you've got it right," says Terry Kero, director of the Advanced Technologies Laboratory run by the Sprint long-distance telephone company. "It's a trial-and-error process."

To make the recognition operation manageable, these products require what's known as discrete speech. That means the user must briefly pause between each of the words, saying something like, "I... want... to... buy..." rather than the more natural, "I wanna buy..." The pauses between words make it easier for the computer to recognize where one word ends and the next one begins. And it makes the spoken words more regular and complete—as in the phrase "want to," people's pronunciation of particular words changes as a result of adjacent ones.

It's a good bet that more advanced continuous-speech PC-based dictation

products will be available in two years, says Howard Fields, director of marketing for speech and pen products at IBM. Meanwhile, continuous-speech recognizers that don't have to recognize tens of thousands of words are available today. One such program—Listen For Windows, sold by Verbex Voice Systems of Edison, New Jersey—is designed to help you navigate through Windows applications, not for dictation of text.

While speech recognizers are welcomed by disabled computer users, as well as by people who just don't like to type, not all computer-speech recognition is designed to increase productivity. Some of it is simply for fun. A Los Angeles-based company called Intertainment, for instance, is developing a computer game for kids that will use speech recognition to create the illusion that a child is participating in a quiz show. In the game called "Robby Rabbit: Rhyme, Reason 'n' Remember," the animal host quizzes the child on subjects such as math, spelling, colors and shapes. When the child utters right or wrong answers, the program will recognize his words and make an appropriate response.

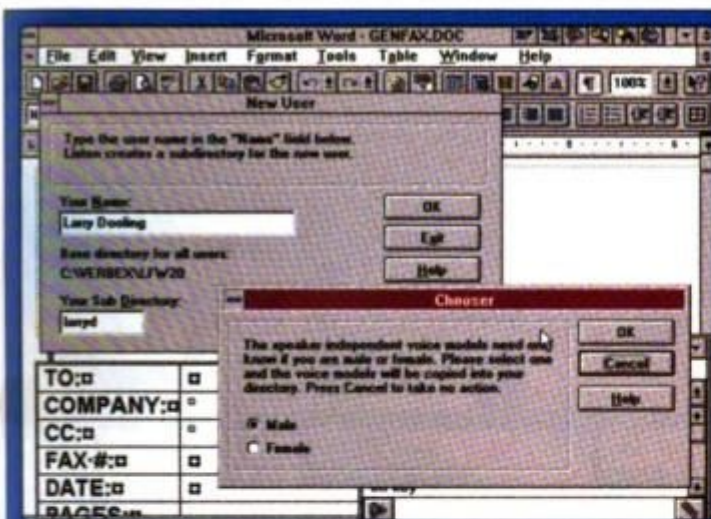
Speech recognition will be useful for many other types of games, says Michael Marconi, Intertainment's vice president of creative affairs. When you play a game like "Mortal Kombat," Marconi says, it's a pain having to remember all the button combinations for certain actions. Wouldn't it be easier, he asks, if you loaded up a special move just by saying "roundhouse kick"—and then executed it by pushing a particular button?

Perhaps the widest application of speech recognition is in telephones. AT&T cuts down on operators by having computers recognize words like "collect" or "third party." Sprint offers customers a voice-operated calling card. At least two regional telephone companies—U.S. West and Southwestern Bell—give their clients

the chance to dial a preprogrammed number by speaking a name, be it "Cousin Richard" or "Pizza."

When using cellular telephones in cars, voice recognition is a safety precaution as well as a convenience. The less time people spend punching digits, the more time they can spend with their eyes on the road. AT&T's McCaw Cellular, the nation's largest cellular-telephone operator, offers a speech-recognition service called VoiceTouch in its systems, many of which operate under the name Cellular One. For a few dollars a month, VoiceTouch subscribers can call pre-selected numbers just by saying something like "Dial home." They can also call by reciting the digits in the number they want to reach. Some cellular manufacturers make phones with similar voice-recognition features, but because the intelligence for the McCaw service resides within the cellular network, no special voice-recognition receiver is required.

Telephone-related speech recognition isn't limited to dialing. The Wildfire Assistant, for example, integrates voice recognition with a design that serves as an all-around telephone assistant. If users call into the office from a pay phone, they can tell the computer-based assistant to retrieve and organize their messages—they don't have to push any buttons. If they want to place a call from that pay phone, they don't have to hang up and start dialing. Instead, they can just tell the system to place the call for them. If a user is out of the office—for instance, driving to a meeting—the Wildfire Assistant will screen and forward calls made to that person's empty office. Wildfire asks callers to state their name, then rings the called party on his or her cellular phone. If the traveler wants to talk, Wildfire connects the call; if not, the system takes a message. The Lexington, Massachusetts-based Wildfire Communications sells the computer-



With Listen For Windows, you create a subdirectory for each user and then train the computer by speaking the listed commands.

based system for \$50,000 to \$100,000.

Just beyond the horizon are voice-recognition systems that will automate complex transactions over the phone. BBN Hark Systems of Cambridge, Massachusetts (the state seems to be the voice-recognition center of the world), is developing an automated travel agent for Thomas Cook Travel and other companies. Although the system isn't perfected yet, it's intelligent enough to recognize rambling, continuous speech. For example, when a demonstration version of the system asks, "From which city or airport do you wish to travel?" it can decipher departure and destination cities from an imperfectly phrased response such as "Like to go from, uh, New York to Chicago."

In the future, speech recognition won't be limited to just computers and telephones. You might end up talking to your dishwasher, too. Earlier this year, KitchenAid demonstrated a refrigerator, an oven, a dishwasher, a clothes washer and a clothes dryer that could all be operated by voice commands. With a speech-recognizing microwave oven, says KitchenAid, cooking could be as simple as saying "prime rib" and "eight pounds." "You can control a washing machine with 30 words," says IBM's Fields.

Talking to your television—and getting a response, for a change—is also close at hand. BBN Hark is developing a system that will allow subscribers to Time Warner's experimental cable system in Orlando, Florida, to navigate by voice rather than remote control. Eric R. Nahm, vice president of marketing and sales for Verbex Voice Systems, predicts that voice-operated television will be available as a premium cable service within two years.

As enticing as all this sounds, people may not be clamoring for it. KitchenAid says it's still evaluating the benefits and potential consumer

demand. And Voice Powered Technology, the company that supplied the technology for the KitchenAid Test, has decided to withdraw its VCR Voice Programmer remote control from the market. Not enough people wanted to pay the extra money it costs to buy a remote that isn't deaf.

## Speech Vs. Conventional Methods



### Continuous Speech:

"Schedule a meeting with Jeff Nelson for July 1st at 3:15."



### 14 Mouse Clicks:

Click on **Lookup**  
Click on **Everyone**  
Click on **View**  
Click on **Contact List**  
Click on **Untag All**  
Scroll to **Nelson**  
Click on **Tag**  
Click on **OK**  
Click on **Schedule**  
Click on **Meeting**  
Click on **Day in Monthly Calendar**  
Click on **OK**  
Click on **Time in Daily Calendar**  
Click on **OK**



### 26 Keystrokes:

Alt+L  
L  
Type "Nelson"  
Press Enter  
Alt+S  
M  
Press Escape  
Alt+D  
Type "7/01/95"  
Alt+1  
Type "3:15"

SOURCE: VERBEX VOICE SYSTEMS, INC.

Although a TV remote control that recognizes speech is more expensive than one that doesn't, several people in the voice-recognition business claim certain products will cost less money, not more, with voice control. One such product is the car, says Nahm. "If I can eliminate all the levers and knobs and buttons and all that crud," he says, "and have it all—raise the temperature, unlock the doors, lock the doors, set cruise control—done by the computer, that increases the electronic content of an automobile and reduces the mechanical content. Which makes it easier to design, easier to build and, therefore, cost less." He says that auto manufacturers are interested in applying speech-recognition technology, but people won't see it in cars "probably till the end of the decade."

Essential to widespread use is the ability to recognize natural speech. "You aren't going to say 'Raise . . . temperature . . . to . . . seven . . . two . . . degrees,'" Nahm says. "You're going to say 'Seventy-two degrees,' or 'Make it hotter,' or 'More air conditioning,' or something like that. You've got to recognize continuous, natural phrases or it's not a consumer technology." Cost, he points out, is not a problem. "Putting a 486 [chip] in a consumer device is trivial to the cost of the device. Horsepower to run sophisticated speech recognition is no longer an issue."

We may one day have a system, suggests Sprint's Kero, in which speech recognition makes telephone dials and touch-tone keypads obsolete. Though that sounds like sci-fi fantasy, it really isn't, he says. In the early days of the telephone, if you wanted to make a call, you picked up the phone and told the operator who you wanted to reach. "It was all done with what?" Kero asks. "With speech!" Ironically enough, the future of voice recognition looks a lot like the past. **PM**

# WARP SPEED

Climb in, buckle up, grab the wheel and come along for a blistering ride in Reggie Fountain's revolutionary 130-mph screamer.

BY JOE SKORUPA, Boating/Outdoors Editor





• The world changes at 130 mph, especially in a speedboat. Aerodynamic forces feel like a hurricane. Hydrodynamic forces turn water into concrete. The combination adds up to an extremely challenging environment, which is especially pertinent to world-record holders. Daredevils who enter this rarefied realm must conquer physical forces that make their sport arguably the most dangerous in the world.

So, why am I suiting up and climbing into a boat that recently set the world record for V bottoms at 130.246 mph? Why am I squeezing into the cockpit and sliding behind the wheel? And finally, why am I steering the boat as the throttleman adjusts the trim tabs and pushes the triple-engine fire breather into the upper atmosphere of speed?

The answer is because, recently, I ran into the king of fast boats, Reggie Fountain, and he said, "Let's go for a ride in my record boat." That's all it took.

The fire-yellow boat I'm steering is named *Ohio Steel*, after the company run by Craig Rebahn. I'm temporarily taking his seat, the one he'll occupy during the upcoming offshore racing season. And, oh, what a seat it is. Since the boat currently owns the world speed record, it's safe to say that Rebahn will see a few checkered flags in 1995. The last time Rebahn put in a full year of racing was 1992, and he won two world championships (on different circuits) and a national championship.

While I sit in the hottest seat in offshore racing and watch the twin speedos (air-speed indicator and GPS) break the 100-mph barrier, Reggie Fountain sits next to me working the throttles. For those not familiar with offshore racing, the throttleman is the person in charge of the cockpit. The man behind the wheel steers the boat, but this function is less critical on a long, wide-open course than the duties performed by

ing wheel for safety).

The throttleman sets the boat to run in the proper attitude during the race. He does this by observing water conditions and adjusting the trim tabs (up or down) and the engines (in or out). He also works the throttles to ensure that the three 1000-hp engines don't blow up—a frequent occurrence in offshore racing.

As good a throttleman as Reggie Fountain is, he's much more than a driving specialist. The body of water that the *Ohio Steel* presently scorches is the Pamlico River, near Washington, North Carolina. This is the home of Fountain Powerboats, a high-tech manufacturing plant that produces premier performance and fishing boats.

Rebahn teamed up with Fountain not only to obtain the fastest production boat on the market and ride with a top throttleman, but to gain access to Fountain Powerboats' vast resources. As a result, the company



sharp moves with the steering wheel. However, with some encouragement from Fountain, I take *Ohio Steel* up and down the river at near-record speeds. During our fastest runs, we top out at just under 125 mph.

This isn't my first ride at near-record speeds. A number of years ago, I was in the cockpit of the *Popeye's* superboat, a 4-engine catamaran that topped out at about 115 mph. That boat was a one-trick pony compared to *Ohio Steel*,

even though it was the fastest and winningest offshore racer of its time. It took a mile for the boat to get on plane, and it ran at top speed only during long straightaways on calm water.

*Ohio Steel*, by comparison, has less horsepower and one less engine, jumps up on plane, slices through rough waves, pins corners like a Formula One racer and tops out at least 15 mph faster. *Popeye's* was the prototype offshore catamaran of its day. *Ohio*



Squeezing into the cockpit with Reggie Fountain (above). MerCruiser engines (right) are at the command of a dash that has redundant systems for every function.

built *Ohio Steel* to Reggie Fountain's personal specifications.

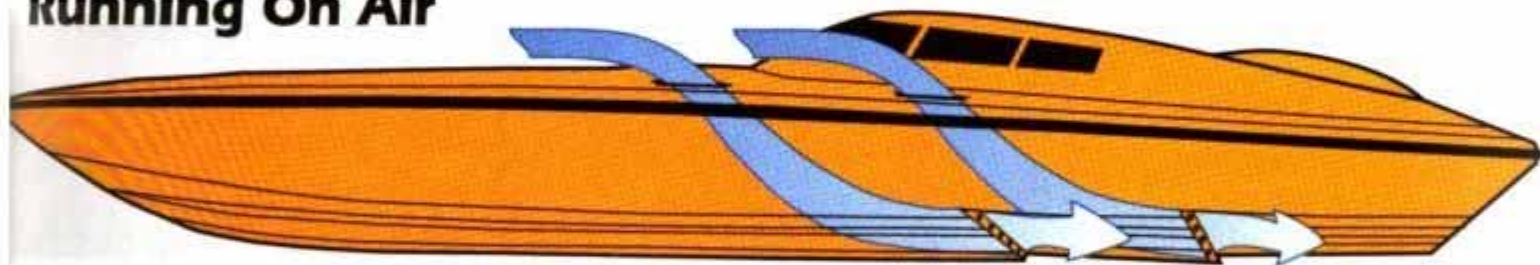
Rebahn also struck a unique deal with Fountain for continuing R&D and race tuning. Rebahn stores the boat at the Fountain complex and has it delivered to each race, fully tuned and prepped to win. In return, Fountain is permitted to use the boat for company promotions (such as my exclusive ride today) and to make record runs.

Although running beyond the 100-mph mark on water is a risky business, I must admit that I don't feel much fear. Maybe I'm too naive to recognize the danger. Even so, I'm extremely nervous about making



# OHIO STEEL

## Running On Air



Transverse steps kiss the water at 125 mph (top photo). Bullet-size holes in the steps (bottom photo) are outlets for air channels that lead to naca vents on the deck. At speed, a vacuum develops beneath the boat and pulls air down to the running surface (above illustration).

*Steel* is the prototype offshore speedboat—period. It sets the standard for the foreseeable future.

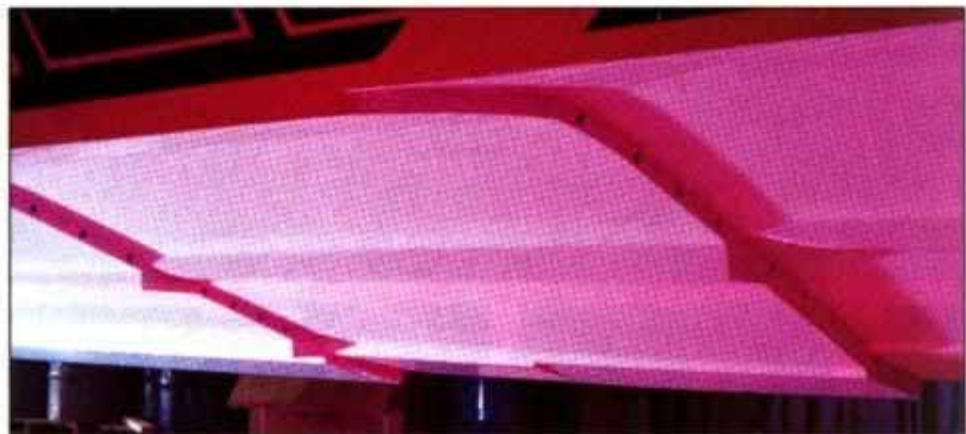
Certainly, *Ohio Steel's* MerCruiser Hi-Performance 1000SC engines have something to do with its speed. Each of these 542-cu.-in. intercooled supercharged thoroughbreds is mated to a Merc Six Drive with a 4-blade 18 x 32-in. Kiekhaefer cleaver prop. This is the hottest offshore-racing setup money can buy.

What's interesting is that it comes right out of the box. That's right: The boat uses engines any racer can buy. Would highly massaged custom mills give the boat more top end? Maybe, maybe not. The point is that the engines are factory tuned to proven tolerances and, as a result, they don't break. You can't make that claim about custom engines.

Another point that needs to be made is that Fountain trusts the MerCruiser Hi-Performance division to perform its magic. After all, Merc is the premier performance engine builder in boating. This leaves Fountain time to focus on other areas—most notably the boat.

The key to *Ohio Steel's* record-setting speed isn't in the engine compartment—it's beneath the waterline. Here, the boat has a cutting-edge running surface that revolutionizes high-performance boating.

Out of the water, it's easy to see that this is no ordinary hull. The aft running surface is divided into three segments by two transverse steps. (Typical V hulls have a solid keel, which forms a base line that runs the entire length of the boat.)



Look closer and you can see that the base line angles off true horizontal after each step. Moving from bow to stern, the middle segment angles down 0.2°. The aft segment angles up 0.2°. Something you can't see is that the hull's center of gravity is located about 1 ft. behind the point where the boat breaks the water. This feature is difficult to achieve, but it's crucial if the boat is to maintain control while it's flying over waves.

So how do these elements (called "Positive Lift" by Fountain) increase speed? Basically, they allow the boat to run in aerated foam instead of dense water. Along with two pairs of strakes, these bottom components ventilate the hull and permit it to operate with minimal drag.

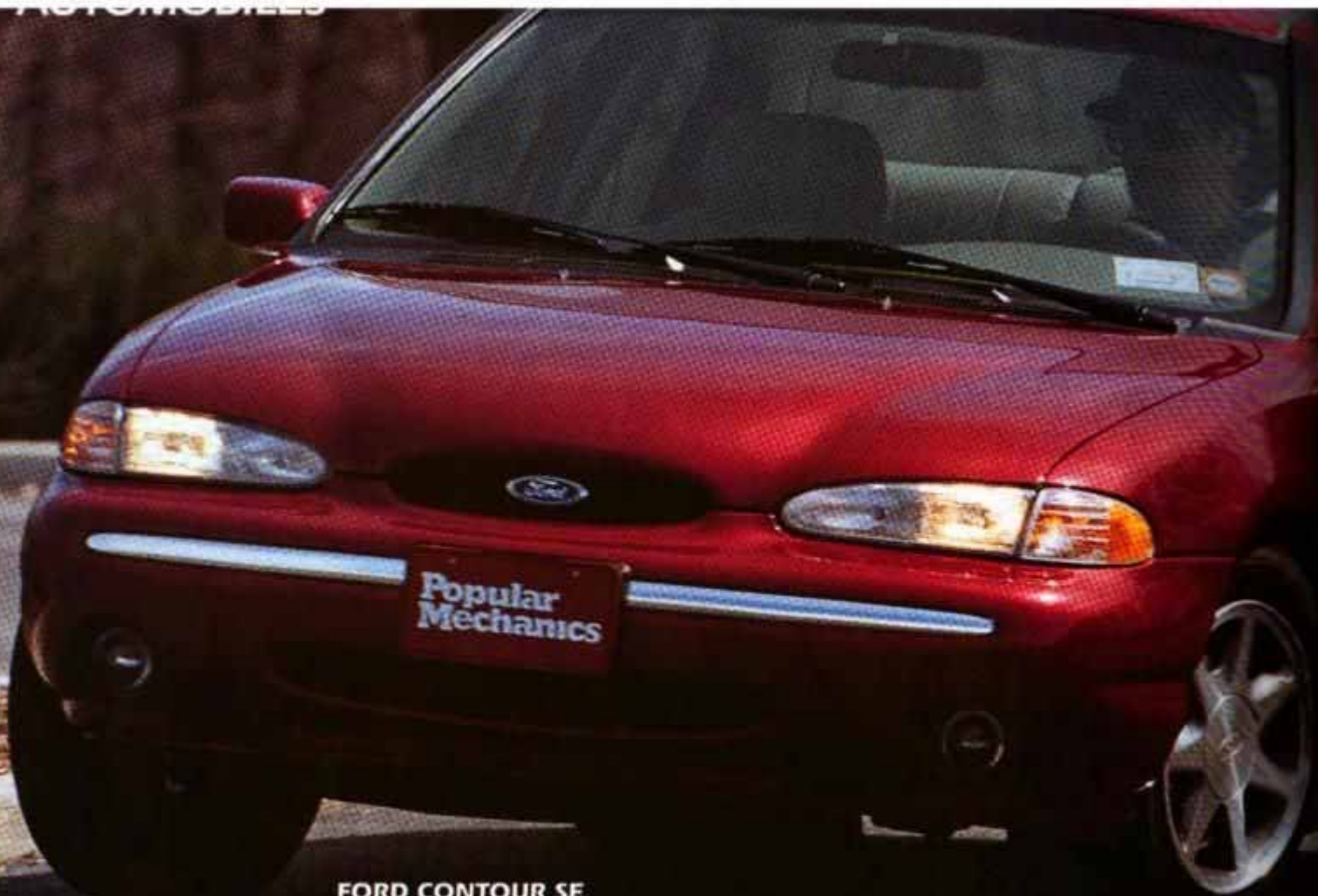
Two other hull features also reduce drag. One is a pad bottom—an 18-in.-wide section centered on the keel line that maintains a deadrise of 12° to 14°. There's also a notched transom, which allows the drive units to be raised to a low-drag position. Interestingly, all of these elements

are found on every stock 47-footer, which is the base hull for the trimmed-down *Ohio Steel*. In fact, "Positive Lift" is a standard feature on every Fountain Powerboats model, which, according to Fountain, makes his production-line boats closer to a NASCAR-type racer than any available car.

However, one element of *Ohio Steel* is, as far as I know, unique among all racing boats: this boat is full of holes. That's right. There are about two dozen bullet-size holes in the hull that are connected to air channels that run to naca vents on the deck. This ventilation system draws air from the outside and delivers it to the running surface, where it enables the boat to run on a cushion of air. The system is simple, effective and ingenious.

In previous eras, the key to fast boats was found in engines and drives. This is no longer the case. Reggie Fountain's pioneering hulls are rewriting the rules and the record books. Take it from me, we're in for a heckuva ride.

FM



FORD CONTOUR SE

# LONG-TERM

We say "Hej" to some sporty newcomers and "Bye" to our heavy-duty hauler.

## Ford Contour SE

● When we tested 10 small V6-powered sedans back in April, one thing became abundantly clear: we all loved the Ford Contour SE. Naturally, we felt it was imperative to arrange a long-term test.

To gain full benefit and maximum pleasure from the Contour's chassis and drivetrain, we ordered an SE with the V6 engine and 5-speed. We also specified

an in-dash CD-player sound system, leather interior, traction control and ABS—comfort and safety to complement the anticipated fun.

A metallic-red sedan—with barely 20 miles on the odometer—was delivered to our offices just a couple of weeks ago. We took the car for a quick shakedown drive, then turned it over to a photographer. As soon as we can pry his fingers off the shift lever, we'll start racking up those

### TEST SUMMARY: FORD CONTOUR SE

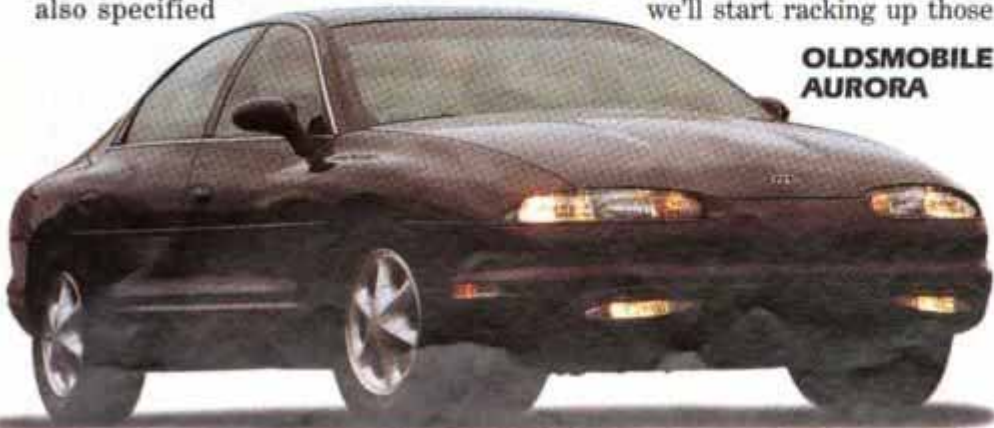
Report number: 1  
 Base price: \$15,695  
 As-tested price: \$20,310  
 Extra-cost options: antilock brakes, traction control, power moonroof, air conditioning, power windows, mirrors and door locks, AM/FM/compact-disc stereo, leather interior, power driver's seat and remote keyless entry  
 Drivetrain: 2.5-liter dohc V6 engine, 5-speed transmission, front-drive  
 Engine performance: 170 hp/165 ft.-lb.  
 EPA fuel economy: 21 city/29 hwy.

## OLDSMOBILE AURORA

miles and let you know if our initial assessment holds up through the duration of our test. —Don Chaikin

## Volvo 850 Turbo Wagon

Unless you've been wandering around a parallel universe for the last couple of years, you should know that Volvos have a solid reputation for safety. In fact, Volvo won a 1994 POPULAR MECHANICS Design & Engineering Award for its innovative side-impact airbags. However, word around the





NISSAN  
MAXIMA SE



LEXUS LS 400



PHOTO BY BILL DELANEY

# TEST CARS

old quadrangle is that these Swedish sedans and station wagons—especially the wagons—are also, well, oh what the heck, somewhat dull.

But lately, Volvo has been hyping the performance and out-and-out fun of its current products, specifically the front-drive 850 in turbocharged trim. Well, we've never shied away from driving fun, nor have we ever turned our back on important new technology—safety or otherwise. So we decided to call Volvo out on this fun/practicality/safety business by ordering up an 850 Turbo station wagon.

Ours has a beige-leather interior, red-metallic exterior, power sunroof and CD player. Like every other 850 Turbo, it's already got power just-about everything, dual-setting automatic climate control and a remote keyless-entry system. Oh, almost forgot: It's also packing better than 220 hp and rides on far-from-dull 50-series Z-rated tires on 16-in. alloy wheels.

Now we'll see if the folks at Volvo have a point about fun. —D.C.

## Lexus LS 400

Okay, so maybe only the cognoscenti see our Lexus LS 400 for what it is. The masses simply don't recognize it as the new-and-improved '95 version. We know it's faster, crisper, smoother and quieter than the origi-

VOLVO 850  
TURBO WAGON



### TEST SUMMARY: VOLVO 850 TURBO

Report number: 1  
Base price: \$32,345  
As-tested price: \$36,495  
Extra-cost options: leather upholstery, power front-passenger seat, cold-weather package, traction control, instrument-panel wood trim and compact-disc player  
Drivetrain: 2.3-liter dohc 5-cylinder engine, 4-speed automatic transmission, front-drive  
Engine performance: 222 hp/221 ft.-lb.  
EPA fuel economy: 19 city/26 hwy.

## LONG-TERM TEST CARS

FM PHOTO BY GREG JAREM



CHEVROLET LUMINA LS

nal. And, we're reminded of the car's amazing abilities each time we slip behind the wheel—or into the Plaza suite of a back seat.

Our sedate-looking white sedan is one bodacious ride. Thanks to the serpentine shifter, flicking between Third and Fourth, in conjunction with some well-timed right-foot action, keeps all of those valves and cams moving in the big V8. Cranking the steering wheel brings a near-instant response from the front wheels. It's no surprise that the LS 400 was one of the favorites in a test of luxury sport sedans conducted by our sister publication, CARSMART.

However, though most of the staff loved carving up the miles while enjoying the in-dash compact-disc changer and the rest of the killer stereo, others thought our brand-new Lexus stunk. Literally.

Some staff members thought the interior carried a particularly nasty odor—others felt it was nothing more than your basic new-car aroma of leather, plastic and assorted industrial adhesives. A visit to the dealer-



GMC SONOMA SLS

### TEST SUMMARY: LEXUS LS 400

Report number: 2  
 Total miles driven: 3404  
 Miles driven since last report: 2983  
 Average fuel economy: 21.0 mpg  
 Worst observed fuel economy: 16.1 mpg  
 Best observed fuel economy: 21.8 mpg  
 Maintenance/repair costs: none

ship found nothing amiss. In any case, as the miles accumulate, the aroma dissipates.

As for other problems, it's like we said: Only cognoscenti recognize the LS 400 for what it is. —D.C.



PLYMOUTH NEON HIGHLINE

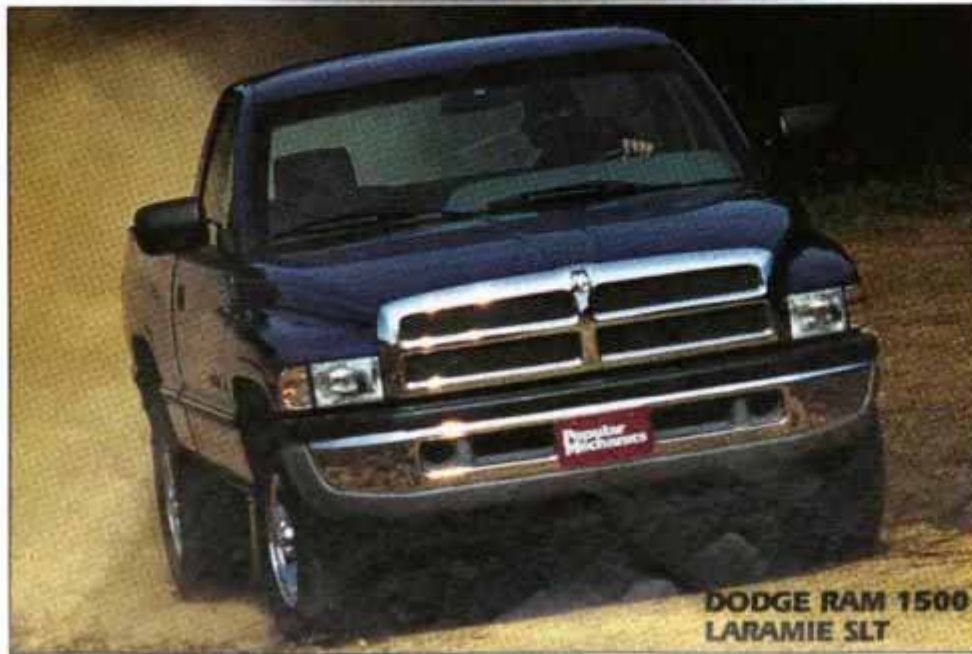
### Nissan Maxima SE

This Maxima is a luxury performance sedan. Our 5-speed SE model is a (relatively) poor man's BMW 540i 6-speed.

The Maxima's drivetrain is a standout. The 5-speed is a perfect match for the 190-hp V6, which provides plenty of low-end grunt and loves being revved to its 6500-rpm redline. This is a fast car—we've even embarrassed a few Mustang GTs from stoplight to stoplight. But the Maxima's softly tuned suspension, while great on the highway, makes it cumbersome to throw down a mountain road.

Scarring this mostly pleasurable driving experience, however, has been a growing list of teething problems. At the 1000-mile mark, a loose hood latch began to clunk, an out-of-whack front-end alignment made the car pull to the left, one of the rear seatbelts refused to work and the clutch master cylinder began dripping fluid. Everything was fixed under warranty.

By the 7500-mile service, the pull to



DODGE RAM 1500 LARAMIE SLT

FM PHOTOS BY BOY ATTAWAY

## CHEVROLET BLAZER LT



the left was back and the driver's window was moving around on its track. Again, both were fixed under warranty.

Problems aside, we really like driving this car. The leather seats are first rate and the well-laid-out interior is very quiet, making the Maxima ideal for hauling four from Los Angeles down to Laguna Beach for a meal or up to San Francisco for a long weekend. And it has proven to be a thrifty long-distance runner, recently making the 450-plus-mile trip from Sonoma to L.A. on one tankful.

—Scott Oldham

### TEST SUMMARY: NISSAN MAXIMA SE

Report number: 2  
Total miles driven: 8297  
Miles driven since last report: 8297  
Average fuel economy: 23.3 mpg  
Worst observed fuel economy: 16.1 mpg  
Best observed fuel economy: 31.7 mpg  
Maintenance/repair costs: 3700-mile scheduled maintenance, \$31.94; 7500-mile scheduled maintenance, \$71.15

### Chevrolet Blazer LT

Apple Red is definitely the hot color for this year's crop of Chevy Blazers. We see ourselves a lot on New York's suburban roads. Yet despite its ubiquity, our Apple Red long-term Chevy Blazer still draws admiring glances wherever we drive. To us that means winner, and Chevrolet has certainly got one in this vehicle.

We did make one mistake, though. We ordered the ZW7 Premium Ride suspension package rather than the Z85 Touring suspension, which comes standard with the LT Preferred Equipment Group. We thought it would make the ride softer and more carlike. Wrong. What it does is make our Blazer a

roly-poly handful around corners and when we're pushing along at a fast clip. Chevrolet engineers definitely went too far on the soft side in specifying the spring and shock rates of the Blazer's Premium Ride suspension. We recently drove a friend's '95 Blazer that's identical to our test vehicle—except that he got the Z85 Touring suspension package. His Blazer rides more firmly than ours, but it isn't harsh or stiff. And the increase in stability and driver confidence is amazing. This is the way to go if you buy a Blazer.

Aside from our too-soft suspension, the '95 Blazer is a great ride. We've just come through winter and spring, so we can attest to the Blazer's aplomb at taking rain-, snow- and ice-covered roads in stride. And isn't that what this vehicle is all about? The shift-on-the-fly transfer case is a joy, making the switch from 2-wheel to 4-wheel-drive with just the push of a button.

The 195-hp and 260

### MAZDA MILLENIA S



### HYUNDAI SONATA GLS

ft.-lb. of torque pouring out of the 4.3-liter V6 make the Blazer feel like it weighs 500 pounds less than it does.

Last, we love the LT's rich leather interior appointments and power-as-

### TEST SUMMARY: CHEVROLET BLAZER LT

Report number: 2  
Total miles driven: 6675  
Miles driven since last report: 6201  
Average fuel economy: 15.4 mpg  
Worst observed fuel economy: 11.6 mpg  
Best observed fuel economy: 16.0 mpg  
Maintenance/repair costs: none

sisted everything. We wouldn't trade any part of this vehicle—except the springs and shocks.

—Joe Oldham

(Please turn to page 105)

T  
HERE ONCE WAS A GUY



NAMED CLYDE,

WHO WAS SEARCHING FOR A COOL

ONE DAY HIS HOPES SOARED,

WHEN HE DROVE THE RANGER FROM FORD



\*Always wear your safety belt. \*\*Feature optional. †Based on an average of consumer-reported problems at three months ownership in a survey of Ford and competitors.



NEW RIDE.

AND DISCOVERED ITS **HOT** NEW INSIDE.

NEW ERGONOMIC INTERIOR

NEW STANDARD  
DRIVER'S AIR BAG\*

MORE POWERFUL ENGINE

NEW 4-WHEEL  
ANTI-LOCK BRAKES\*\*

HIGHEST QUALITY OF ANY  
DOMESTIC COMPACT PICKUP†

100,000 MILES  
BETWEEN TUNE-UPS\*\*

NEW REMOTE KEYLESS ENTRY\*\*

NEW SIX-WAY  
POWER DRIVER'S SEAT\*\*



## THE '95 FORD RANGER



BUILT FORD TOUGH

Models designed and built in North America. †3.0L and 4.0L engines only.

# UNPLUGGED

New portable gear for work and play makes roaming easier.

BY FRANK VIZARD, Electronics Editor

● Untethered, yet connected. Today's road warrior can't afford to operate in a vacuum, and, with the right mobile gear, there's no reason anyone should know you're not at your desk.

With portable cellular phones now almost standard equipment, the centerpiece of mobility is increasingly becoming the laptop computer. The trend is what you might expect: higher performance, lower cost and lighter weight. The power race, in fact, shows no sign of slowing down. Microprocessors are now being designed expressly for the mobile environment. Intel's new 90-MHz Pentium chip is remarkable not only for its speed

but also for its construction. Using a technique called Voltage Reduction Technology, the chip interfaces with other components at 3.3 volts, while its core operates at 2.9 volts. This means that the microprocessor works significantly faster but consumes less power, thereby promoting longer battery life—always a major concern.

At the same time, new technologies promise to make sending data over the phone as easy as, and maybe cheaper than, talking. The next step—and it's not that far away—is to make document sharing between mobile users simple as well. Soon, the first thing we'll say when we make a call will be: "Hello, where are you?"

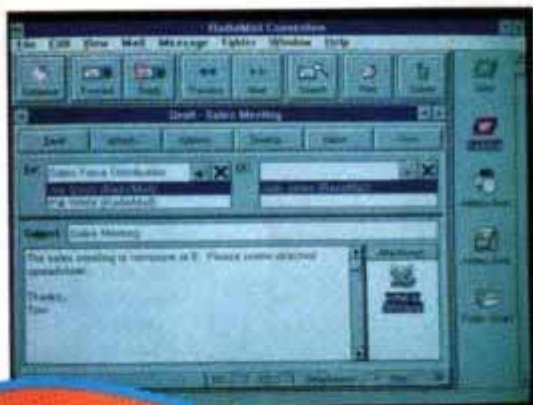
## Spread Your Wings

Open IBM's Thinkpad 701C laptop and you'll watch two keyboards unfold and interlock to form a full-size 85-button keyboard that's 2 in. wider than the computer itself. Now you know why this computer is nicknamed the Butterfly. But that's only the beginning. Other features of this 4½-pound machine include a 10.4-in. color screen, 14.4-kilobits-per-second modem, speakerphone, answering machine and fax capability. The 701C also comes loaded with 15 software titles. Available in a variety of memory configurations, its list price starts at \$3799.



## This Car Has Your Number

Cellular phones are now as much a part of the car as the radio—which the 1995 Lincoln Continental so convincingly demonstrates. Ford Electronics has integrated the phone into the vehicle's communications network. The result is a hands-free voice-activated system that interacts with other electronic components in the car. A message-center display to the right of the zippy speedometer shows the number dialed, elapsed time, signal strength and other related information. And to make talking easier, the 145-watt 6-speaker JBL stereo system automatically mutes when the phone is in use, picking up where the CD left off when you hang up.



## Wireless Messaging

Staying in touch while you're unplugged is easy when you've got the *RadioMail Connection For Windows* software program loaded into your laptop. The \$39 program provides hassle-free access to Internet e-mail, wireless faxing and lots of other related services. Personal communicators such as Motorola's Envoy, which has a radiofrequency (RF) modem built-in, make using *RadioMail* a one-step process. Otherwise, you need a stand-alone RF modem. RadioMail Corp. can be reached at (800) 597-MAIL.

# GGGED!



## This Cradle Won't Rock

Who says a good idea has to cost a lot of money? Aries Manufacturing Inc. (708-885-0021) makes cradles for cellular phones. Simply plug the cradle into your cigarette-lighter socket and your phone is securely anchored. You don't even have to give up the use of your cigarette lighter because each cradle has its own lighter. List price is \$40. Cradles are available for both flip and universal-type phones. Dash-mounted cradles are also available.



## Human Antenna

Ever touch a TV antenna and see the picture improve? This happens because the human body is an excellent conductor. When you touch an antenna, your body lengthens the conductor that's available, making the antenna operate more efficiently. Sony's FDL-22 portable color TV relies on this phenomenon—just put the strap around your neck and you're a walking antenna.

Reception, we found, is better outdoors. One drawback: It eats batteries. List price is \$160—body not included.

## Big-Screen Computing

While most color laptop computers weigh in with screens measuring 9½ in., Canon's *Innova Book 200LS* series of laptops offers an 11.3-in. screen, thus narrowing the gap between portable and desktop displays to under 2 in. There are two models in the 200LS series, which list for \$2959 and \$3633, respectively. The top-end model features a 100-MHz 486DX4 microprocessor, a 520MB hard drive, 8MB of RAM and one Type III PCMCIA slot.





## Slam Dunk!

Basketball junkies will get their fix with the Hoop Commander from Casio. You can compete against the computer or another Hoop Commander via an infrared transmitter. You control the shot selection, play defense and generally have a lot of fun. Oh yeah—Hoop Commander also has a built-in telephone directory, calculator, calendar and other business functions that help justify its existence. There's even a secret password function, so no one will know that your win/loss record is below .500. This is definitely not a traveling violation. List price is \$80.



## Give Me A Board Light

The screen is lit and your fingers are doing the walking. Trouble is, sometimes you can't see where they're going. The NCL 480 Notebook Computer Light from ASF Associates Inc. brings you out of the dark. Simply clamp the 7.8-ounce light onto your laptop to put a shine on your keyboard and adjacent work areas. The NCL 480 runs on four AA nickel-cadmium rechargeable batteries. List price is \$40. You can buy it direct by calling (800) 771-3600.

## Give An MD The Business

MD—in this case—means MiniDisc, Sony's diminutive disc-based audio format now being billed as the heir to cassette tape. Maybe, but not until the price comes down. The MZ-B3, for example, is way overpriced at \$900, but the application is great. The MZ-B3 is a portable recorder that lets you store 74 minutes of stereo or 148 minutes of straight talk in clear, digital sound. What's more, you can randomly access or erase sections and play recordings back at high speed—understandably. It may be presumptuous, but Sony could be onto something here. In the meantime, MD means only doctors can afford this one.



## Sidetracks

Hewlett-Packard's first color notebook is notable on two counts. Most striking is a side-tracking mouse that deploys to the right of the computer, a feature some users might prefer to keyboard-mounted tracking devices. The other attraction is called Instant-On, a feature that automatically returns you to where you were when the computer was turned off. The 486-based OmniBook 600 is available in various configurations, with list prices starting at \$2599.







## ROM On The Run

Play your multimedia discs anywhere with Sony's portable CD-ROM Discman. Weighing less than 10 ounces and powered by two AA batteries or an AC adapter, Discman connects to your laptop via a PCMCIA card. The basic package lists for \$500, but there's a \$750 package available that includes a portable speaker box—a handy item if you're doing multimedia presentations. Naturally, the Discman also operates as an audio-only player—so you can listen to your favorite tunes after hours.

## Pick A Color, Any Color

What with fast modems and all the online communications options available these days, you may not be using the printer as much as you used to. And you certainly don't need one taking up precious desk space. By the same token, when it's time for hard copy, making a splash is a plus. Canon's new BJC-70 bubble-jet printer offers you the best of both worlds. Weighing about 3 pounds and measuring 11.8 x 6.2 x 2.2 in., the BJC-70 is portable enough to tuck away until you need to put something on paper. The BJC-70 prints a color page in just under 1 minute. The list price of \$399 includes a *Color Advisor* software package.



## Not Just Talk

This cellular phone from Toshiba has got more going for it than just its small size and slim looks. The TCP-2000 is one of the first cellular phones to make transmitting data easy. Built into this 5.3-ounce phone is a transmission protocol called Cellular Data Packet Data. When connected to a portable computer via a PCMCIA card, the TCP-2000 provides a friendly handshake for virtually all communications software. This also simplifies fax transmissions and online access. The TCP-2000 uses a nickel-metal-hydride battery for a rated 60 minutes of talk time. Its list price is \$179.



## Waving The Magic Wand

Panasonic joins Sony in marketing a personal communicator based on General Magic's Magic Cap and Telescript software [see "EPCOT's Innovation," page 37, Jan. '95]. With both of these consumer electronics giants in its camp, General Magic seems to be on its way to establishing a de facto communications standard linked to AT&T's PersonaLink service. As readers of *POPULAR MECHANICS* already know, this class of portable devices lets you navigate through an on-screen virtual world full of messaging options—all with the tap of a pen. **PM**



TECHNOLOGY

# DESTINATION: PLUTO

With a daring, high-speed mission to the icy planet, NASA sets its sights on the solar system's final frontier.





BY MARK WHEELER; PM Illustration by Ed Valigursky

• Talk about your long shots. If NASA wanted to impress Congress and the public with its new leaner, meaner entrepreneurial attitude, it couldn't have picked a tougher goal than Pluto.

As a planet, it's far, far away—some 3 billion miles. As a target, it's tiny—smaller than our Moon. But as an object of curiosity, Pluto looms huge. Its surface is thought to be neither terrestrial, like Earth's, nor gaseous, like Jupiter's, but frozen, like no other planet—at minus 446° F, a strange brew of iced nitrogen, carbon monoxide and methane. Its moon, Charon, just as curious, is half Pluto's 1,460-mile diameter, and is believed to comprise mostly plain old water ice.

Pluto's oddball 248-year orbit can swing it as far as 4.6 billion miles from the Sun. The only time it's thought to have any atmosphere at all is when the planet nears perihelion—the orbital point closest to the Sun. Then, some of the surface ice vaporizes. Pluto hit perihelion in 1989. Now, as the planet retreats, that atmosphere will refreeze and fall with a clunk back to the surface sometime between 2010 and 2020.

Because getting a whiff of that atmosphere is a primary goal of a newly proposed mission—dubbed Pluto Express—time is tight. The spacecraft must launch soon after 2000 to arrive around 2010. This constricted timetable also means that the craft must be smaller, lighter and faster than anything built before. And

much of the technology needed to make it happen is still being designed. The last little detail is its development budget, which has been slashed to \$250 million. To meet that figure, NASA may throw in with the Russians on a collaborative Express.

So just how will NASA get to Pluto on the quick—and on the cheap? "It's a very demanding mission," admits Robert Staehle, the Pluto pre-project manager at the Jet Propulsion Laboratory (JPL) in Pasadena, California. "People liken it to the Mount Everest of solar-system exploration."

### Double vision

To meet this challenge, an unprecedented design has evolved. Pluto Express calls for twin spacecraft, each weighing less than 250 pounds and measuring roughly 3 ft. across. Each will house a radioisotope power supply, thrusters and a new ultralight flat-mesh antenna about 5 ft. wide. Completing the package, a small suite of instruments—weighing a scanty 15 pounds—will gather the information.

One Express will follow the other into space and arrive a few months later. Getting to Pluto directly will keep operations costs down, so planners won't divert the spacecraft to accelerate them with a big planet's gravity. Each Express must, in effect, shoot from a cannon mighty enough to hit Pluto in a straight trajectory.



Pluto has an atmosphere only when its orbit carries it toward the Sun, causing gases to vaporize from the icy surface.

To save money, NASA is negotiating with Russia to use two of its "cannons"—Proton rockets—instead of the United States' own powerful, but pricey, Titan IVs. In return, the Expresses would carry Russia's 30-pound Drop Zonds—probes that would jettison from the vehicles to study the makeup of Pluto's atmosphere.

The craft will streak through the solar system at 63,000 mph. If all goes well, upon arrival, one vehicle will skirt one face of Pluto while the other will fly across the opposite face. That way, while the Expresses maintain their blazing speed, both Pluto and Charon can be mapped and photographed despite their poky 6½-day rotation. The second vehicle can also explore any questions the first Express may raise. It will also serve as a backup should craft No. 1 go awry.

### Man on a mission

The timing couldn't have been better to propose a Pluto fly-by. For several years now, NASA administrator Dan Goldin has been walking the halls of NASA chanting "better, faster, cheaper" to any engineer within earshot. The reasons: a budget-conscious Congress, the perception of NASA as a moribund bureaucracy and the need to spruce up the agency's image after one too many public-relations disasters.

Once NASA agreed to consider the mission, Staehle first had to bring harmony between JPL's engineers

and scientists. "Traditionally, there's always some friction between these groups," Staehle notes, "and there was indeed a little adversarial discussion at first. I tried to foster more mutual understanding." Now the entire Express team convenes regularly to bat around ideas.

By April 1992, three goals were clear. First was mapping the surface to within a ½-mile resolution. At such a resolution, says Staehle, you could detect Pasadena's Rose Bowl if you were looking down at Earth. Determining Pluto's surface composition was second. Third was to characterize Pluto's atmosphere. In addition to the Drop Zond, an ultraviolet spectrometer will gaze at the Sun through Pluto's atmosphere as the spacecraft enters the planet's shadow. This will allow measurements of gases that can't be detected from Earth.

Once the instrumentation was determined, recalls Staehle, "almost off the top of my head I said: 'We're going to design these instruments at 7 kilograms [15 pounds] using 6 watts of power, at a cost of \$30 million.' People said I was crazy. And I said, 'Well, it's easy for me to say because I've never built an instrument before'."

Staehle used the recent Clementine lunar mission (see "Beyond The Moon," page 96, July '94) as a basis for this estimation. "A lot of that technology had just been declassified," he recalls, "and it was impressive. They were lightweight instruments, but not

precise enough to do the Pluto job. But I felt that by using those as an example, it would be possible to go the next few steps along the way. So I picked a challenging set of numbers."

The engineers have come through. Prototypes of the proposed instruments weigh less than 15 pounds—and are well under budget. They include the ultraviolet spectrometer, a visible-light camera and an infrared spectrometer for scanning the surface. In addition, a radio receiver with a precise clock will help gauge pressure and temperature as Pluto's atmosphere slows up the signals that are arriving from Earth.

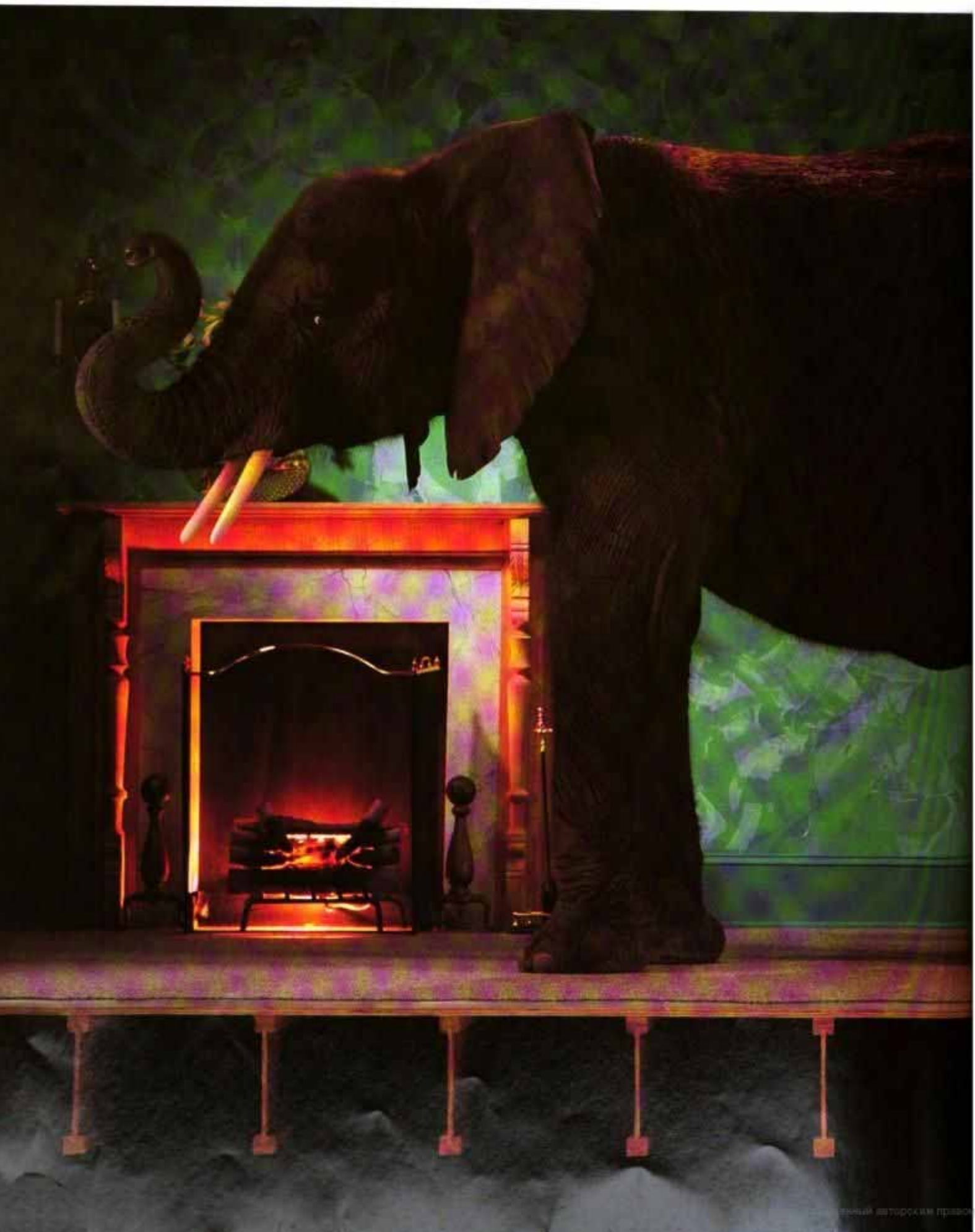
Whether Express takes off remains to be seen. Congress must cough up the dough, the Russians need to pony up their Protons and NASA has to maintain its interest in less glamorous missions. What's more, Staehle and his colleagues are relying on a radical design, along with the most recent advances in electronics—quite a departure from NASA's conservative ways. While risky, Pluto Express holds symbolic import to a revitalized NASA. Staehle, though, seems to be taking it all in stride.

"I'd rather be doing it this way instead of walking around saying, 'Okay, it's week No. 37 and, according to the manual, here's where we should be.' That's no fun. It's more fun to be the first to meet these new challenges than it is to be one in a long, long established line." **PM**



SOME FLOORS WILL SQUEAK NO  
MATTER WHAT WALKS ACROSS THEM.

# THE SILENT FLOOR® I



# S QUIET AS A MOUSE.

You can tell a lot about how a home was built by listening to it. A squeaky floor will keep reminding you that something isn't quite right. A quality floor doesn't make a sound.

No matter how big an entertainer you are, your floor doesn't have to squeak. Use the Silent Floor® system and it won't. We guarantee it.



Instead of ordinary 2 x 10 lumber standing on edge, the Silent Floor® system consists of wooden I-beams. These Silent Floor® I-beams are made by rearranging wood fiber into a material that is uniform, strong and guaranteed to be free from warping and defects. (Considering the herd you'll probably have running through your house, it better be.)

The Silent Floor® system creates a stronger joist, yet does it while using substantially less wood. Our revolutionary "I" shape lets us put the wood only where it will deliver the strength you need. That means we can use up to two or three times less than a traditional, lower quality floor.



No two ordinary 2 x 10s are alike. Their strength varies from one joint to the next. Plus, they warp and shrink differently, leaving gaps around the nails. Then as the flooring rubs on these nails—you hear the dreaded squeak.

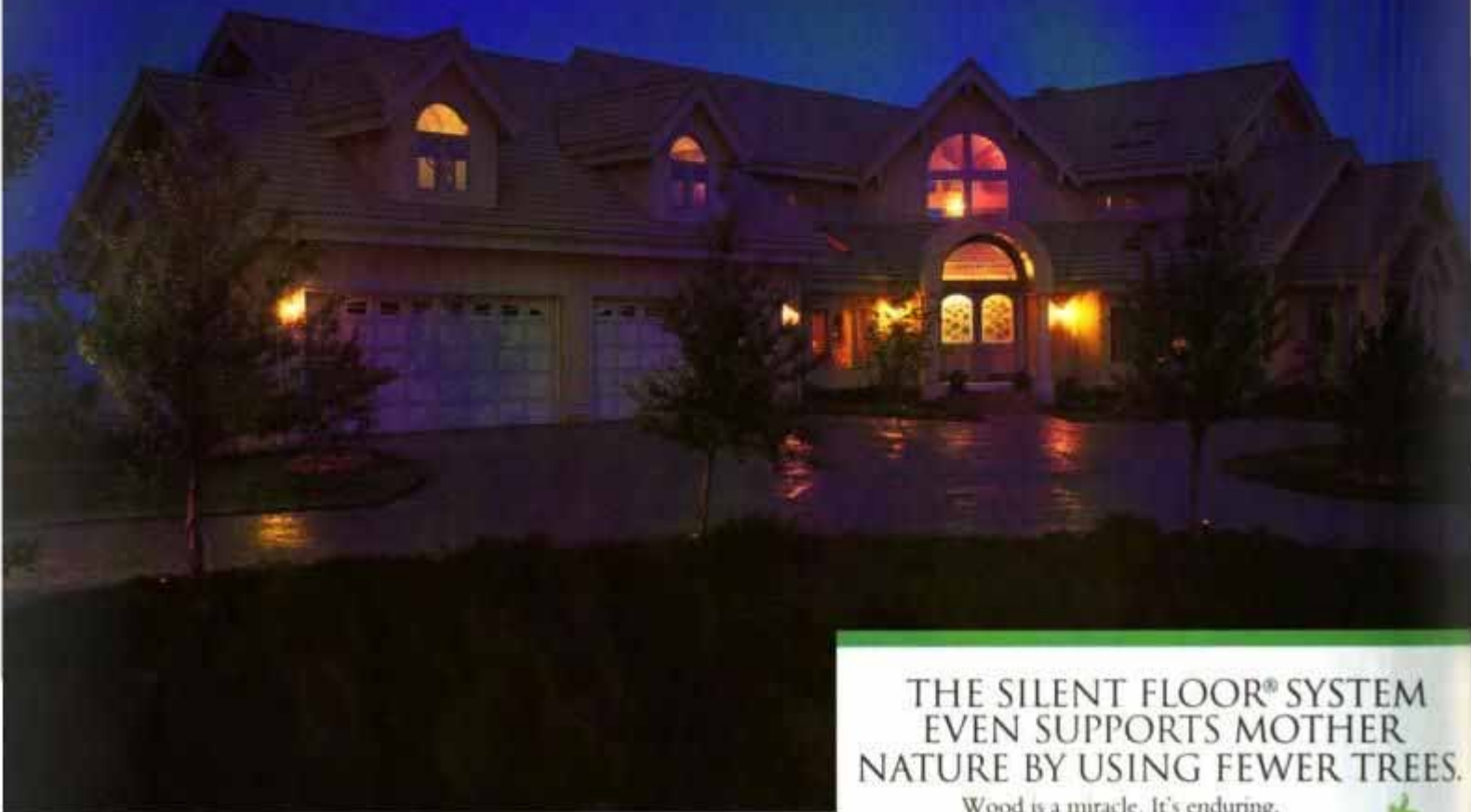
You may never have heard of the Silent Floor® system. (It is quiet after all.) Truth is, you've probably been in a home built with it. Since we invented it in 1970, it's been installed in more than 1,000,000 homes, condominiums and apartments.

Talk to your builder about the system. He's probably already building with it. For more information, the name of a TJM technical representative or a dealer near you, call 1-800-338-0515.

 **Silent Floor.**  
*Tone Joint MacMillan*

Part of the FrameWorks® building system.

# BUILDERS ARE SOME OF OUR STRONGEST SUPPORTERS.



A builder's business rests on his reputation. And the only way to get a good reputation is to have happy customers like you. He knows that to keep from hearing a squeak from you, you better not hear a squeak from your floor. That's why so many builders and architects are using the Silent Floor® system.

But the Silent Floor® system does more than stop squeaks. The consistency of the materials makes for a trouble-free installation, with no surprises at the site. The incredible strength and integrity of the System also give builders design flexibility and the ability to create spans that would be impossible using ordinary methods.

And since the Silent Floor® system comes with a guarantee, good for the life of your home, both you and your builder will be able to sleep a little better at night.

Builders are also using more of the other products developed by Trus Joist MacMillan, inventors of the Silent Floor® system. Products such as Microllam™ LVL headers and beams, Parallam® PSL posts and beams, and TimberStrand® LSL rim board are all engineered wood products that make even more out of every wood fiber.

## THE SILENT FLOOR® SYSTEM EVEN SUPPORTS MOTHER NATURE BY USING FEWER TREES.

Wood is a miracle. It's enduring, economical, beautiful and extremely more energy-efficient than any other common building material. But wood is also in demand for the vital role it plays in the forest ecosystem.

The Silent Floor® system uses two to three times less wood than old-fashioned building methods. This System and all the products produced by Trus Joist MacMillan are designed to make the most of each wood fiber. This is one important reason more and more home buyers, builders and architects are demanding these innovative materials.

The good news is that you don't have to give up a thing to do the right thing. No compromises. The Silent Floor® system is stronger, quieter and uses far less wood—which is pretty cool even if you're not a forest. To find out more about how these technologies from Trus Joist MacMillan use our forest resources more efficiently, call 1-800-338-0515.



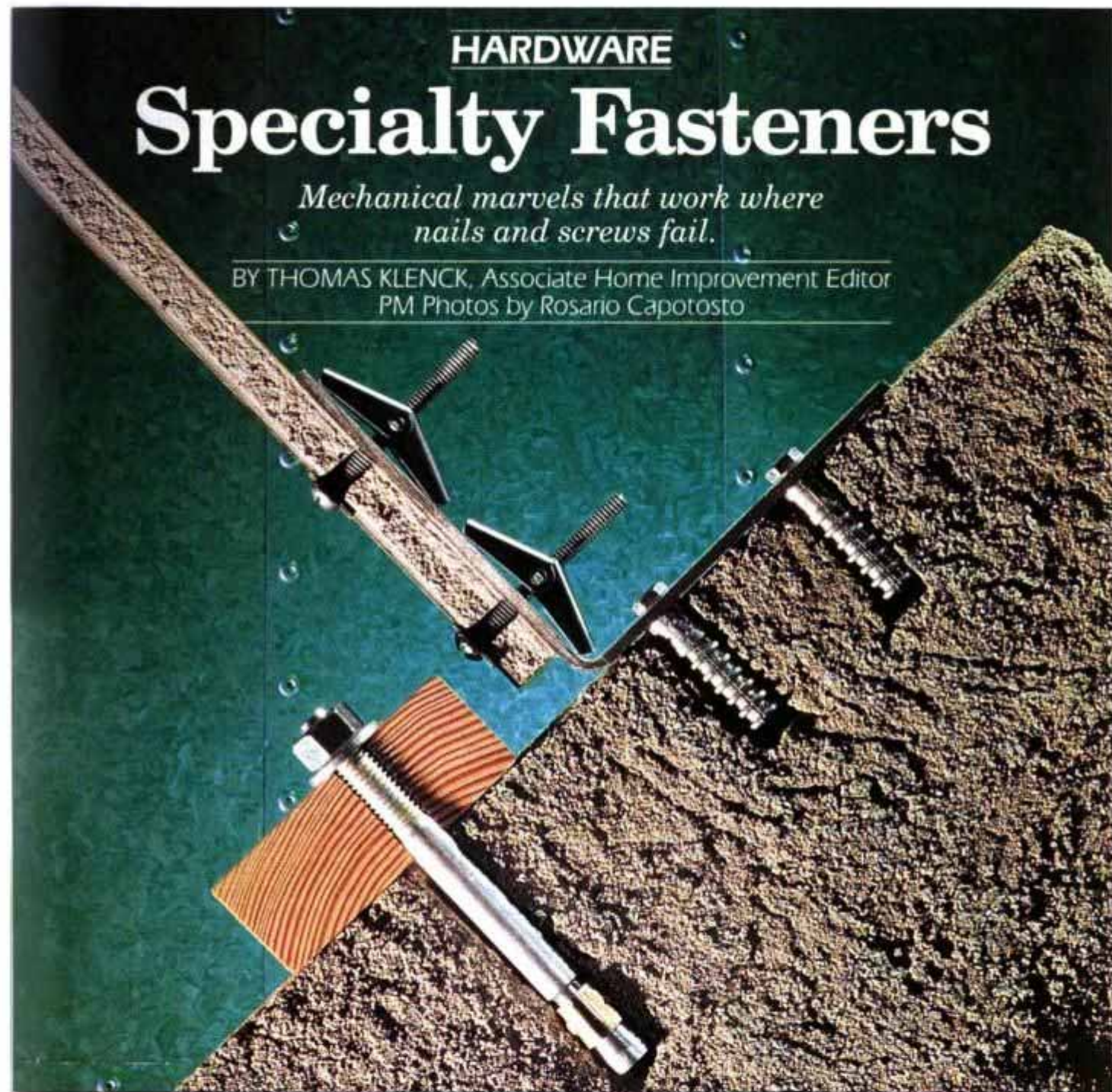


**HARDWARE**

# Specialty Fasteners

*Mechanical marvels that work where  
nails and screws fail.*

BY THOMAS KLENCK, Associate Home Improvement Editor  
PM Photos by Rosario Capotosto



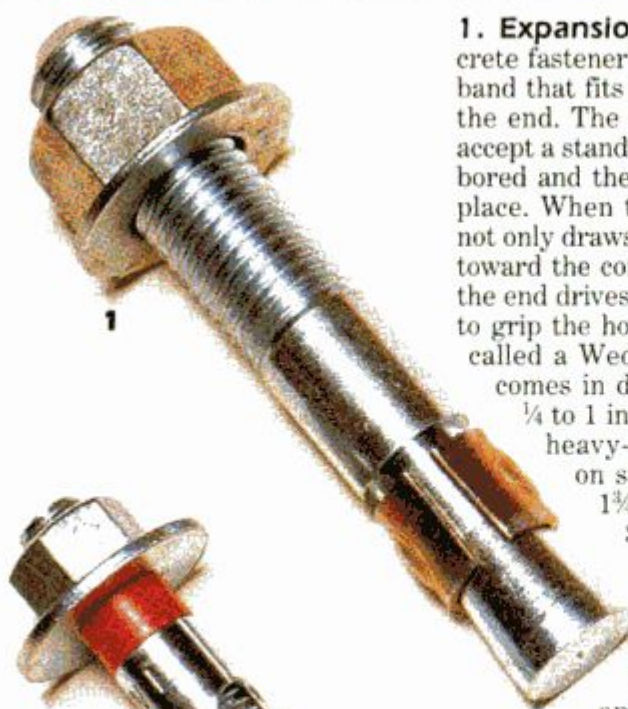
● Have you ever wondered why a nail works so well in wood? It's not the nail that's doing all the work—it's the wood. Because wood is resilient, it grips the nail—not the other way around. The trouble is, there are a lot of building materials that aren't so cooperative. While hardened spiral nails will stay in concrete, their holding power isn't so great. And forget about drywall. Nailing to a wall really means getting out the stud finder to locate a 2 × 4 hidden inside.

Fortunately, there's a wide assort-

ment of fasteners that don't rely so much on the gripping power of the base material. These devices provide their own power and are designed to suit distinct applications. There are concrete fasteners that expand to grip the walls of a hole, and a myriad of hollow-wall fasteners that latch onto drywall with a vengeance.

You'll find most of these fasteners—or close variations—at your hardware store. Bear in mind that each design has specific capacities. Manufacturers test maximum sustainable loads in

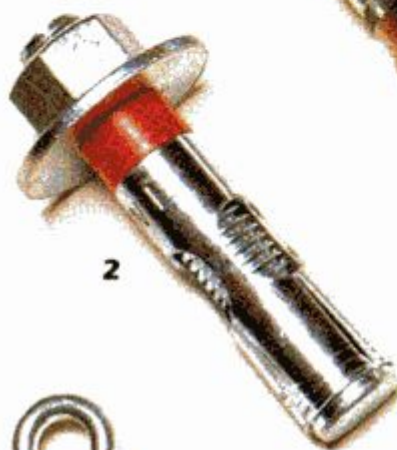
terms of tension (a load parallel to the fastener axis) and shear (a load perpendicular to the fastener axis). Loads are also based on the base material, and safe working loads are rated at one-fourth the maximum load. In general, light-duty loads are less than 400 pounds, medium-duty loads range from 400 to 4000 pounds and heavy-duty loads are above 4000 pounds. For demanding structural uses, discuss the problem with your dealer. Better yet, contact the manufacturer for the fastener specifications.



**1. Expansion anchor**—This concrete fastener features a carbon-steel band that fits over a reverse taper at the end. The top half is threaded to accept a standard nut. In use, a hole is bored and the fastener is driven into place. When the nut is tightened, it not only draws the connected member toward the concrete, but the taper at the end drives the steel band outward to grip the hole. The model shown is called a Wedge-Grip anchor and it comes in diameters ranging from

$\frac{1}{4}$  to 1 in. It handles medium- to heavy-duty loads, depending on size. A pack of five  $\frac{1}{4}$  ×  $1\frac{1}{4}$ -in. anchors costs about

\$2. Contact Star Expansion Co., Pleasant Hill Road, Mountainville, NY 10953.



**2. Lok/Bolt**—For light- and medium-duty applications in concrete, brick and solid block, this fastener comes in diameters from  $\frac{1}{4}$  to  $\frac{3}{4}$  in. The central threaded stud has a conical, unthreaded end. As the nut is tightened, a split metal shield around the stud expands to grip the hole. A nylon compression ring helps to ensure that the fixture being fastened is drawn tightly to the base material, and the ring also improves performance under vibration. The Lok/Bolt shown costs about \$3.60. Write to The Rawlplug Co. Inc., 200 Petersville Rd., New Rochelle, NY 10802.



**3. Anchor eye**—If you've ever wondered how to secure a line to masonry, here's your answer. In place of a straight, threaded stud, this fastener has an eyebolt. Like other anchors, the split expansion shield is activated by tightening the nut over the washer. A package of two anchor eyes costs about \$7. Write to Plasplugs Inc., 780 Vassar Ave., Lakewood, NJ 08701.



**4. Threaded SPIKE**—When driven into a hole that matches the shank diameter, the bend in this fastener exerts tremendous force against the surrounding wall. Available in sizes ranging from  $\frac{3}{16}$  to  $1\frac{1}{4}$  in. in diameter, the manufacturer rates this fastener with up to a 4000-pound working load, depending on size and the base material. The  $\frac{1}{2}$ -in.-dia. Threaded SPIKE shown costs about \$1. Contact The Rawlplug Co. Inc., 200 Petersville Rd., New Rochelle, NY 10802.



**5. Light-duty SPIKE**—For light-duty applications, the stainless-steel SPIKE (top) comes in a  $\frac{1}{4}$ -in.-dia. size and is suitable for concrete or concrete-block base material. It costs about \$1.

The  $\frac{1}{4}$ -in. nylon SPIKE (bottom) is also suitable for stone and brick. For more information, write to The Rawlplug Co. Inc., 200 Petersville Rd., New Rochelle, NY 10802.

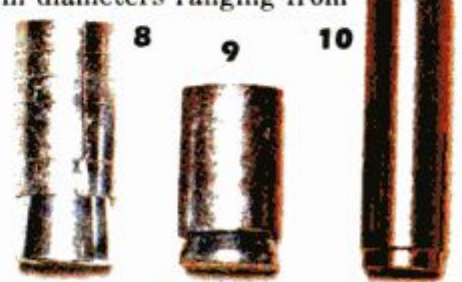


**6. Nail anchor**—When it comes to such light-duty tasks as securing junction boxes, conduit or ductwork to concrete or block, a nail anchor is a good choice. Available  $\frac{3}{16}$  or  $\frac{1}{4}$  in. in diameter, this fastener has an expanding body that contains a steel driving pin. After being inserted in a hole, the pin is driven flush with the anchor to grip the base material. These  $\frac{1}{4}$ -in. nail anchors cost about \$1.20 for a pack of four. Contact Star Expansion Co., Pleasant Hill Road, Mountainville, NY 10953.

**7. Nylon anchor**—Similar to the nail anchor, this fastener has a nylon body that increases its versatility. In addition to concrete, it's appropriate for masonry applications, and it even handles hollow-wall fastening. Its head has a screwdriver slot, and the top of the pin is threaded so it can be withdrawn to remove the fastener. The  $\frac{1}{4}$ -in. nylon anchor shown costs about \$1.20 for a pack of five. Write to Star Expansion Co., Pleasant Hill Road, Mountainville, NY 10953.

**8. Hollow set drop-in**—Similar, in principle, to the expansion anchor, this fastener is designed for light- to medium-duty use in the relatively thin walls of hollow concrete block. It's made up of a tubular, split body and a lower, internally threaded cone. A bolt threaded into the cone expands the body against the hole. The hollow set drop-in is available in sizes from  $\frac{1}{4}$  to  $\frac{3}{8}$  in. The model shown costs about \$2.50. Write to The Rawlplug Co. Inc., 200 Petersville Rd., New Rochelle, NY 10802.

**9. Tampin**—Similar to the hollow set drop-in, this fastener requires a bolt that, when tightened, forces the lead-alloy sleeve against the base material. It's suitable for light- to medium-duty uses in concrete and stone and comes in diameters ranging from





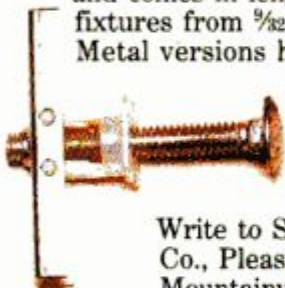
**11. Blind rivet**—The blind rivet is one of the fastest ways to join sheet-metal stock. This self-contained fastener works in conjunction with a specifically designed riveting tool. After inserting the fastener in a hole, the riveting tool grips and withdraws the pin. In the process, the head mushrooms over to grab the opposite side of the work. Available in grip ranges from  $\frac{1}{64}$  to  $\frac{1}{4}$  in., the rivet shown costs about \$3 for a pack of 25. Contact Star Expansion Co., Pleasant Hill Road, Mountainville, NY 10953.

**10. Steel drop-in**—

For more demanding applications in concrete, the steel drop-in is similar to other expansion anchors, except that its expanding action works in reverse. The sleeve is internally threaded, and the hole tapers to a smaller opening at the bottom. A tapered plug fits in the sleeve. As the bolt is tightened, it bears down on the plug, expanding the split bottom of the sleeve. Sizes are available to handle  $\frac{1}{4}$ - to  $\frac{3}{4}$ -in. bolts. The  $\frac{1}{2}$ -in. size shown costs about \$1.25. Write to The Rawlplug Co. Inc., 200 Petersville Rd., New Rochelle, NY 10802.

**11. Blind rivet**—The blind rivet is one of the fastest ways to join sheet-metal stock. This self-contained fastener works in conjunction with a specifically designed riveting tool. After inserting the fastener in a hole, the riveting tool grips and withdraws the pin. In the process, the head mushrooms over to grab the opposite side of the work. Available in grip ranges from  $\frac{1}{64}$  to  $\frac{1}{4}$  in., the rivet shown costs about \$3 for a pack of 25. Contact Star Expansion Co., Pleasant Hill Road, Mountainville, NY 10953.

**12. Pingrip**—Rivets of this type are available for both metal-to-metal and masonry applications. The aluminum fastener has a stud that fits in a blind hole in the body. The solid, bottom end of the body is split by two small slots. As the pin is driven flush, the slotted end expands to grip the hole. The fastener shown is designed for masonry and comes in lengths to handle fixtures from  $\frac{3}{32}$  to 1 in. thick. Metal versions handle thinner stock. A  $\frac{3}{16}$ -in. version will run approximately \$1.20 for four.



Write to Star Expansion Co., Pleasant Hill Road, Mountainville, NY 10953.

**13. Toggler toggle bolt**—This unit features a pivoting metal bar that grips a hidden hollow-

wall surface (bottom). It's installed by flipping the metal bar parallel to the plastic strap and passing the bar through the hole in the wall. Then, the plastic stop on the strap is moved flush to the wall and the excess is snapped off. A bolt threaded through the metal bar further tightens the grip on the wall (top).

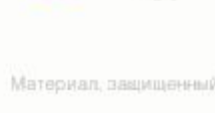
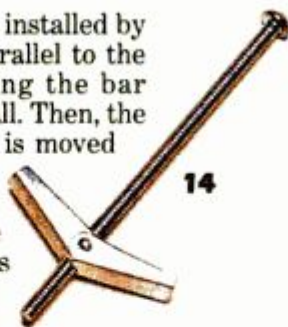
These fasteners handle greater loads than conventional hollow-wall anchors and come in two sizes to accommodate wall thicknesses between  $\frac{3}{8}$  and  $2\frac{1}{2}$  in. A pack of two costs about \$2.30. Write to Mechanical Plastics Corp., 444 Saw Mill River Rd., P.O. Box 554, Elmsford, NY 10523.

**14. Toggle bolt**—The basic toggle bolt uses two spring-loaded wings to grip a hollow wall. The large size of the wings makes this fastener a good choice for less structural materials, such as drywall. While these fasteners can be easily removed, the wing section falls behind the wall. The size shown costs about 50 cents. Contact The Rawlplug Co. Inc., 200 Petersville Rd., New Rochelle, NY 10802.

**15. Cavity anchor**—This colorful, plastic hollow-wall anchor handles wall thicknesses from  $\frac{1}{4}$  to  $\frac{3}{16}$  in. and requires a  $\frac{3}{8}$ -in.-dia. hole. Once in place, the black arms spread to grip the back of the wall. A No. 8 screw firmly tightens the arms against the base material. A package of five cavity anchors costs about \$2. For more information, contact Plasplugs Inc., 780 Vassar Ave., Lakewood, NJ 08701.

**16. Hollow-wall anchor**—A variation on the toggle-bolt principle, hollow-wall anchors consist of a bolt and a slotted anchor sleeve (top). They're first inserted in an appropriate-size hole. As the bolt is tightened, the sleeve bends out to grip the back of the wall (bottom). In contrast to a toggle bolt, removing this bolt leaves the sleeve locked to the wall. These anchors cost about \$1 each. Write to The Rawlplug Co. Inc., 200 Petersville Rd., New Rochelle, NY 10802.

**17. Drive anchor**—This Wallgrip drywall fastener performs like the hollow-wall anchor above, except that it doesn't require a hole—it's simply driven into place. The cost is approximately \$1.20 for three. For more information,



contact Star Expansion Co., Pleasant Hill Road, Mountainville, NY 10953.

**18. Toggler hollow- and solid-wall anchor**—This unique anchor is suitable for light- to medium-duty loads. It's installed in a hole by pressing the two legs together. Then, a small key tapped into the anchor flips the legs apart. Threading a screw into the anchor forms a rigid truss that locks the unit into place. In solid walls, the key isn't required—the legs simply compress against the sides of the hole. These fasteners come in three sizes to handle hollow walls ranging from  $\frac{1}{8}$  to  $\frac{3}{4}$  in. thick, and cost about \$2 for a package of five. For more information, contact Mechanical Plastics Corp., 444 Saw Mill River Rd., P.O. Box 554, Elmsford, NY 10523.

**19. Plastic drywall anchor**—For light-duty fastening to drywall and other hollow walls, this flexible plastic anchor requires a  $\frac{1}{4}$ -in. hole and a No. 8 screw. The screw spreads the arms and expands the ribbed body to grip the wall. A package of 10 costs about \$1.39, from Plasplugs Inc., 780 Vassar Ave., Lakewood, NJ 08701.

**20. Hollow-door anchor**—Designed for the thin faces of hollow-core doors, these small fasteners (about \$1.39 for 10) have integral wings that expand to grip the back surface. They require a  $\frac{1}{4}$ -in. hole and a No. 6 screw. Write to Plasplugs Inc., 780 Vassar Ave., Lakewood, NJ 08701.

**21. Heavy-duty plastic drywall anchor**—Similar in operation to previously described hollow-wall anchors, these fasteners use a screw to expand the anchor body and pull the arms against the back of the hollow wall. This design requires a  $\frac{3}{8}$ -in. hole and comes in a package of 10 for about \$2. Write to Plasplugs Inc., 780 Vassar Ave., Lakewood, NJ 08701.

**22. Plastic anchor**—For quickly securing to masonry under light-load situations, plastic anchors fit the bill. After being pressed in a hole, a screw grips the flexible plastic while spreading the material to lock the anchor in place. Plastic anchors come in a wide variety of sizes. The 1-in. size shown fits No. 10 and No. 12 screws and costs about \$1.20 for eight. Contact Star Expansion Co., Pleasant Hill Road, Mountainville, NY 10953.

**23. Plastic anchor plug**—To make plastic anchors easier to select, these are coded to match corresponding drill bits. The anchor design features transverse ribs to help prevent withdrawal when under load. The plug shown costs about \$1.79 per package of 25. For more information, contact



Plasplugs Inc., 780 Vassar Ave., Lakewood, NJ 08701.

**24. Lead anchor**—Similar in principle to the plastic anchor, lead anchors grip concrete and masonry when expanded by a screw. They come in a variety of sizes for light-duty applications. A 1-in.-long version costs about \$1.20 for eight. Contact Star Expansion Co., Pleasant Hill Road, Mountainville, NY 10953.

**25. Lag shield**—The lag shield works with  $\frac{1}{4}$ - to  $\frac{3}{4}$ -in. lagscrews. As such, its capacity moves into the medium-duty range. It's ribbed to prevent turning and to inhibit withdrawal, and the inside conforms to the lagscrew threads. A  $\frac{3}{8}$ -in. lag shield costs about 85 cents. Write to The Rawlplug Co., Inc., 200 Petersville Rd., New Rochelle, NY 10802.

**26. Fluted plastic anchor**—This light-duty plastic anchor works along with sheetmetal and wood screws for securing to concrete and masonry walls. It comes color-coded for easy drill-bit matching and is available in

sizes to match No. 4 through No. 14 screws. For more information, contact The Rawlplug Co. Inc., 200 Petersville Rd., New Rochelle, NY 10802.

**27. Rawlplug**—Made of a braided jute fiber with a lead core, this anchor offers increased holding power compared to similar anchors. In addition to standard screw sizes ranging from No. 6 to No. 20, the Rawlplug is available for lagscrews without the lead lining. The  $\frac{1}{4}$ -in.-dia. size shown costs about 25 cents. Write to The Rawlplug Co. Inc., 200 Petersville Rd., New Rochelle, NY 10802.

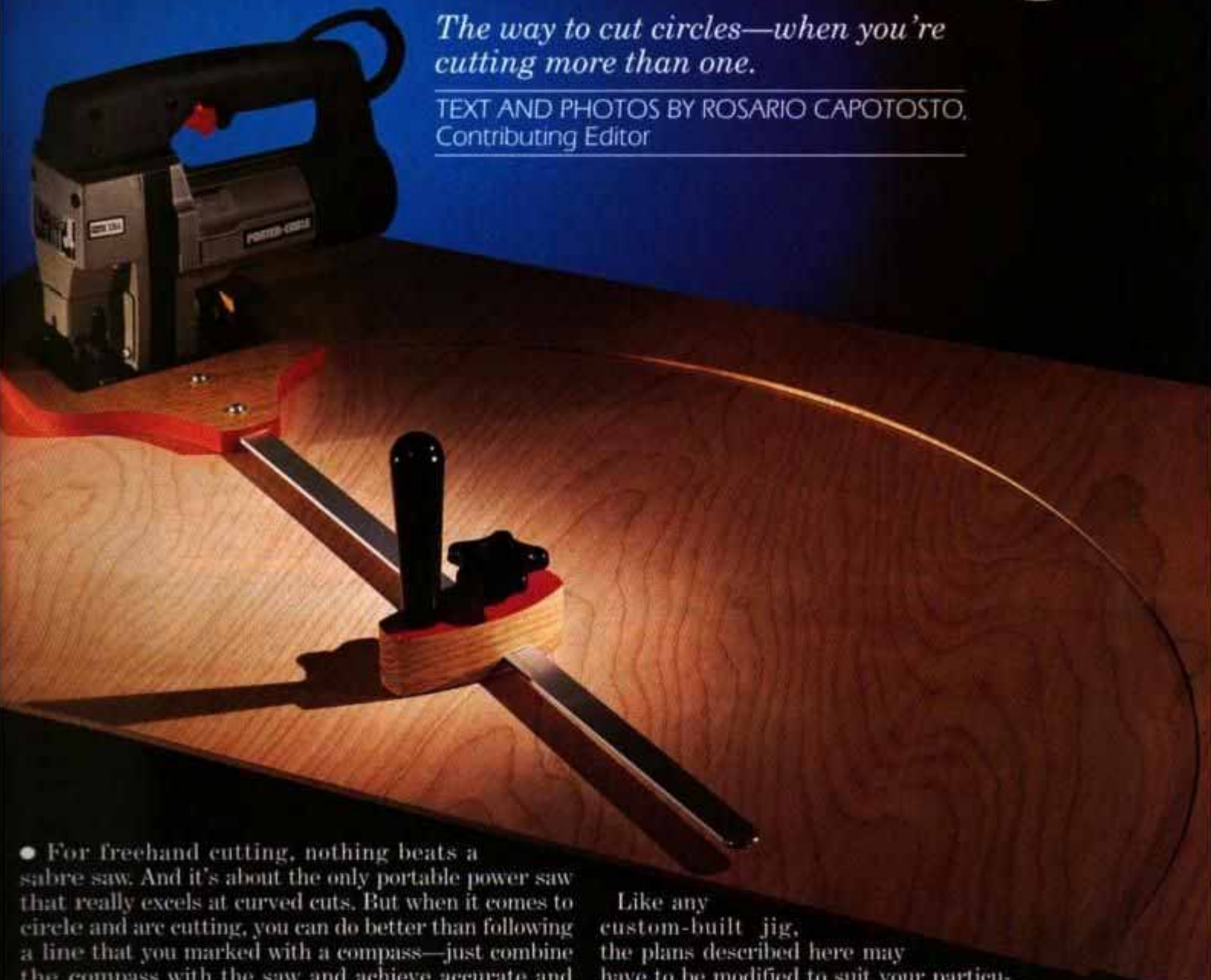
**28. Alligator**—The manufacturer claims that this anchor's polymer plastic body molds to the inside of the base material hole. Closed (top), it's inserted into a hole. A screw expands the jaws (bottom), and the serrated jaw faces grip the threads. Available in several head designs, the  $\frac{5}{16}$ -in. version shown costs about \$3 for a pack of six. Contact Mechanical Plastics Corp., 444 Saw Mill River Rd., P.O. Box 554, Elmsford, NY 10523. **PM**

WOODWORKING

# Sabre Saw Circle Jig

*The way to cut circles—when you're cutting more than one.*

TEXT AND PHOTOS BY ROSARIO CAPOTOSTO,  
Contributing Editor



• For freehand cutting, nothing beats a sabre saw. And it's about the only portable power saw that really excels at curved cuts. But when it comes to circle and arc cutting, you can do better than following a line that you marked with a compass—just combine the compass with the saw and achieve accurate and consistent no-sweat circles every time.

Our circle jig is adaptable to all standard sabre saws. It features a 25-in. aluminum-strip pivot bar that enables you to handle circles up to 48 in. in diameter. If you need to cut a larger circle or arc, just install a longer bar. The jig can also cut in clockwise and counterclockwise directions to make the operation easier in a variety of situations.

The saw sits in a wrap-around platform, and the radius is adjusted by sliding the pivot block along the aluminum strip and locking it in place with a hefty knob. The bottom of the platform is faced with plastic laminate to reduce friction, and a post handle over the pivot point helps control the cutting operation.

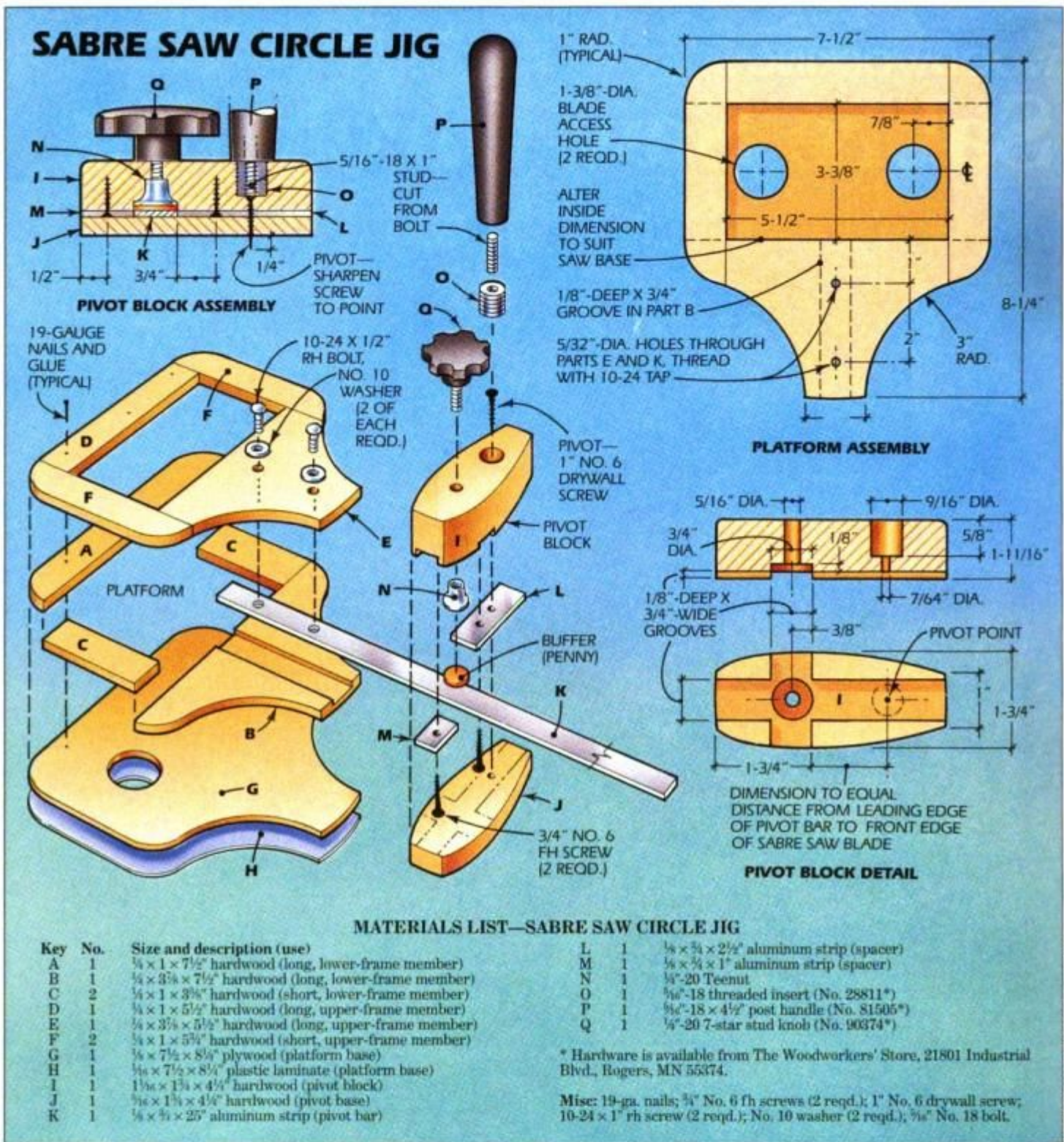
Like any custom-built jig, the plans described here may have to be modified to suit your particular model of saw. Our dimensions are based on the Porter-Cable 7549 sabre saw. If your saw is different, pay particular attention to the platform layout and construction so that your saw base will fit securely into the platform recess.

## Platform construction

We used oak for our circle jig, but any hardwood is suitable. The platform assembly is made by sandwiching two frames made from  $\frac{1}{4}$ -in.-thick stock. The ends of the top frame pieces overlap the bottom frame pieces, as shown in the drawing on page 72.

If you have the equipment, resaw  $\frac{3}{4}$ -in. oak on a table saw or band saw and then use a thickness planer

## SABRE SAW CIRCLE JIG



to mill the stock to 1/4 in. thick. If you don't have a thickness planer, smooth the sawn surfaces with a hand plane. In a pinch, you can use quality 1/4-in. plywood to make the platform pieces.

The platform component dimensions that we show suit our Porter-Cable saw. Before cutting the pieces to length and width, measure the base of your sabre saw and, if necessary, adjust the dimensions.

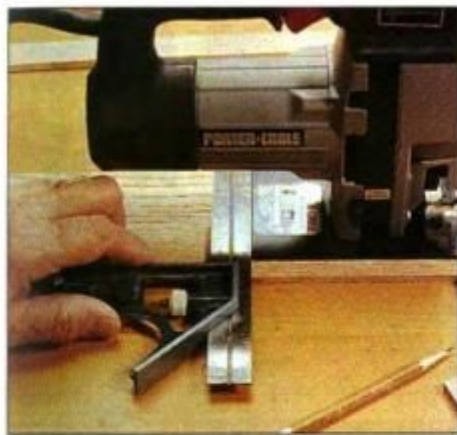
Using the base of your sabre saw as a guide, determine the exact length of the two long, top platform pieces.

Position each piece against a long base edge and use a square to mark their lengths (Photo 1). Then, repeat the procedure with the bottom short pieces, using a short edge of the saw base as a guide. Temporarily lay the bottom frame pieces together and position the top frame pieces over them so that the corners overlap. Double-check that the sabre saw base fits into the opening.

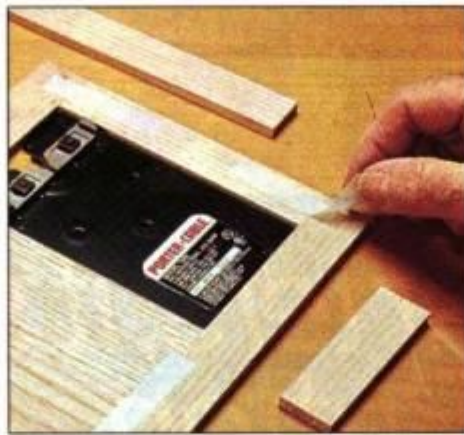
Use a router or dado blade and table saw to cut a 1/8-in.-deep x 3/4-in.-wide groove in the large, lower-plat-

form member, as shown in the drawing. The location of the groove isn't critical, but it should be approximately 2 in. behind the front edge of the saw-blade position and perpendicular to the inside edge of the frame.

Assemble the bottom frame, using masking tape on the bottom surfaces to hold the pieces together (Photo 2). Then, apply glue sparingly to the top surfaces of the bottom frame pieces and the bottom surfaces of the top frame members in place and secure the platform



**1** Use a square to transfer base length to upper-frame long pieces. Use base width to determine lower-frame short pieces.



**2** Temporarily assemble lower frame with masking tape at corners. Then, flip frame over and glue top frame pieces in place.



**3** After applying glue, secure the upper- and lower-frame halves with nails. Bore pilot holes to avoid splitting the wood.

halves with 19-ga. nails. Bore pilot holes for the nails to avoid splitting the wood (Photo 3). Check that there's no glue in the cavity formed by the groove in the large bottom piece. If necessary, clean the channel.

Next, cut a piece of  $\frac{1}{8}$ -in. plywood, slightly larger than the assembled frame, and glue it to the frame bottom. Follow by gluing a piece of plastic laminate to the plywood. When the parts have been assembled, mark the platform outline and use a scroll saw, band saw or sabre saw to cut to the line.

## Making the pivot block

First, cut an oak block to  $1\frac{1}{16} \times 2\frac{1}{4} \times 6$  in. long. Cut a  $\frac{1}{8}$ -in.-deep  $\times \frac{3}{4}$ -in.-wide groove along the long centerline of the block face. Then, cut a second, similar groove that's perpendicular to the first, as shown in the drawing. Use a band saw or handsaw and chisel to cut the block to size and shape. Sand the surfaces smooth.

To bore the holes for the Teenut, first bore a  $\frac{3}{4}$ -in.-dia. recess  $\frac{1}{8}$  in. deep, centered at the intersection of the groove centerlines. Next, bore a  $\frac{5}{16}$ -in.-dia. hole—on the same center—that goes completely through the block. Then, drive in the Teenut (Photo 4).

Prepare two lengths of  $\frac{1}{8} \times \frac{3}{4}$ -in. aluminum strip to fit the long groove on both sides of the Teenut recess. Cut these strips slightly oversize and secure each in the groove with a single screw. Then, cut a bottom piece of  $\frac{5}{16}$ -in. oak and glue it to the grooved side of the block to encase the strips. If necessary, use a piece of the strip to clean excess glue out of the cross channel. Trim the small aluminum strips and the oak bottom piece flush with the contoured block.

## Assembly

Use a holesaw to cut the two blade holes in the platform base. Cut a  $\frac{1}{8} \times$



**4** After cutting grooves in pivot block, bore Teenut hole and recess. Then, tap the Teenut in place with a hammer.

$\frac{3}{4}$ -in. aluminum strip to 25 in. long and insert it into the platform channel. Bore two  $\frac{5}{32}$ -in. holes through the platform and bar, then tap 10-24 threads in both the wood and aluminum. Secure the bar with  $\frac{1}{2}$ -in.-long screws (Photo 5).

To determine the correct pivot-point position, first place the saw in the platform. Measure the distance



**5** Attach an aluminum-strip pivot bar to the platform with screws threaded into tapped holes in aluminum and wood.

from the leading edge of the blade to the edge of the aluminum strip. Then, slide the pivot block onto the aluminum strip and transfer this dimension to the bottom of the block, measuring from the same edge of the strip. Next, bore a  $\frac{7}{64}$ -in.-dia. pilot hole at the mark. On the top, counter-bore a  $\frac{9}{16}$ -in.-dia.  $\times \frac{5}{8}$ -in. recess to accept a  $\frac{5}{16}$ -in.-18 threaded insert.

Grind the end of a 1-in. No. 6 dry-wall screw to a point, and shape the head so it passes through the threaded insert. Drive the pivot screw through the pilot hole so that it projects  $\frac{1}{4}$  in., as shown in the drawing. Cut a 1-in. stud from a  $\frac{5}{16}$ -in.-18 bolt and use it to join the post handle to the threaded insert. Finally, attach the knob, inserting a penny as a buffer between the lock-knob stud and the aluminum strip.

The jig permits cutting in either direction to suit your particular application (Photo 6). Always keep the pivot point on the same side of the aluminum pivot bar as the blade. For best results, use a blade with ample set, and always make sure that it has the same width as the blade you used to locate the pivot point.



**6** Twin blade holes in platform allow cutting in both directions. Locking pivot block slides on bar to adjust circle radius.

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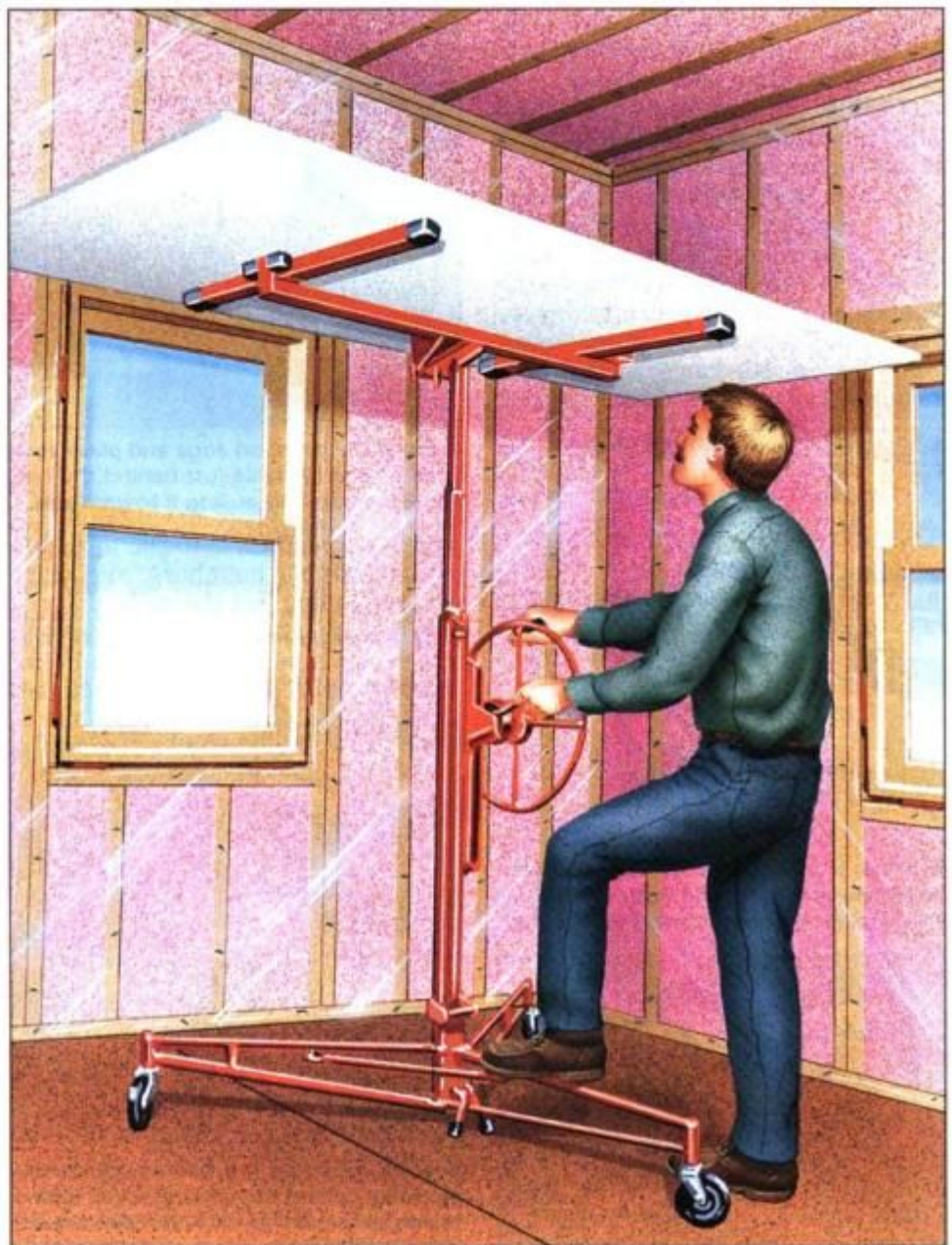
# How To Install Drywall

*A step-by-step guide to making a hard job easier.*

BY STEVEN WILLSON,  
 Home Improvement Editor  
 PM Illustrations by  
 George Retseck

● Installing drywall, also called wall-board and Sheetrock (a U.S. Gypsum brand name) isn't easy. The typical drywall panel measures 4 × 8 ft., is ½ in. thick, weighs about 53 pounds and can be very awkward to maneuver. That's the bad news. The good news is that it's inexpensive and, when properly finished, yields a first-rate interior surface.

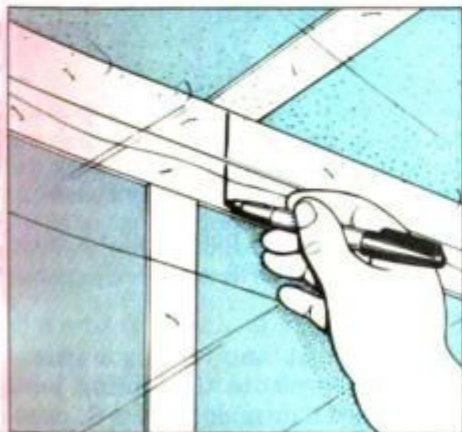
The product comes in a variety of sizes and thicknesses. In addition to the typical size, you can usually get longer panels—in 2-ft. increments up to 14 ft.—on special order. The thickness ranges from ¼ in. to ¾ in., but for consumers, the usual choices are ¾ in., ½ in. and ⅝ in. All can be used on ceilings and walls as long as the framing members are on 16-in. centers. But if you plan to apply texturing to your ceiling, ¾ in. isn't viable, and if you need to install a firewall—between your garage and living area or around your central heating system—many codes require ⅝ in. The ½-in.-thick panel is by far the most common because it performs well in most situ-



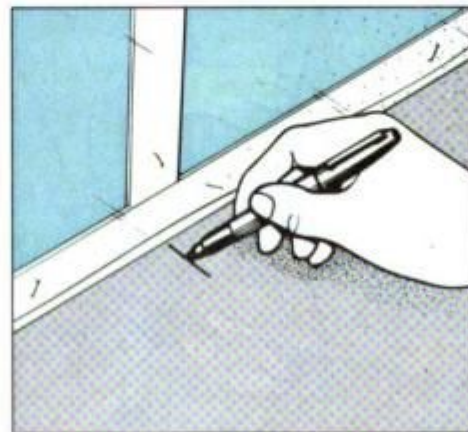
ations, especially those you're liable to confront around your own house.

Regardless of their length or thickness, most panels are constructed in the same way. The ends are full thickness, but the long sides are tapered

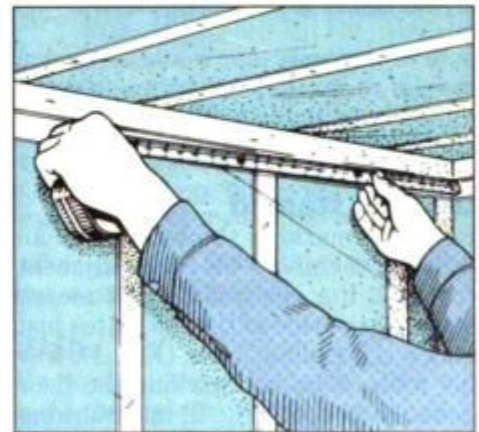
toward the edge of the panel. This taper is about 1½ in. wide and about ⅛ in. deep. When two panels are abutted, edge to edge, a depression is created to accommodate the compound that's needed to finish the



**1** Begin work on the ceiling. First, mark the centerline of all the ceiling joists on the top plates. Use a soft pencil or felt marker.



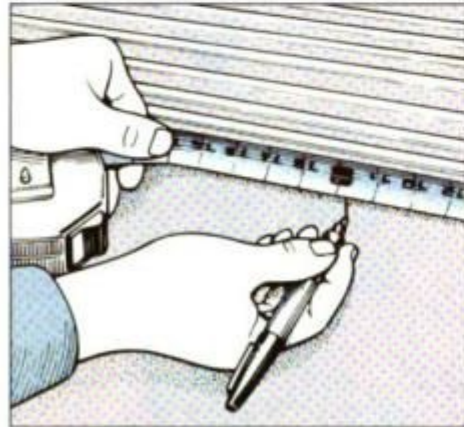
**2** Continue to locate the framing members that will be hidden by marking the centerline of all wall studs on the floor.



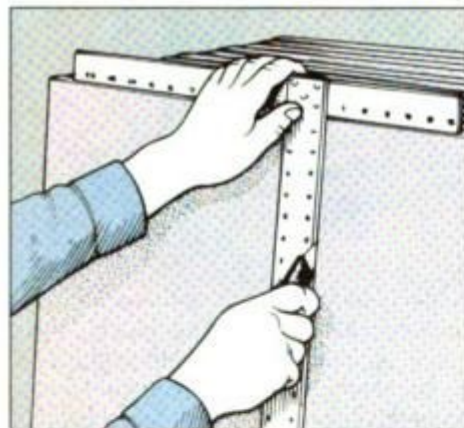
**3** Start at one corner of the ceiling and measure to the centerline of the appropriate joist. Make sure the tape doesn't sag.

joints later. Because the board ends don't have tapers, finishing these butt joints is harder—and usually more noticeable. So it's best to avoid butt joints whenever possible, even if you have to waste some material.

For this story, we installed the drywall in a typical 2-story house. This gave us the chance to try out a number of techniques before settling on the ones shown here. We paid attention to things that made the job easier—even if they took a little longer or cost a little more. And we tried to make special



**4** Mark the panel at the appropriate length along the top and bottom edges of the panel face. Connect marks with a line.

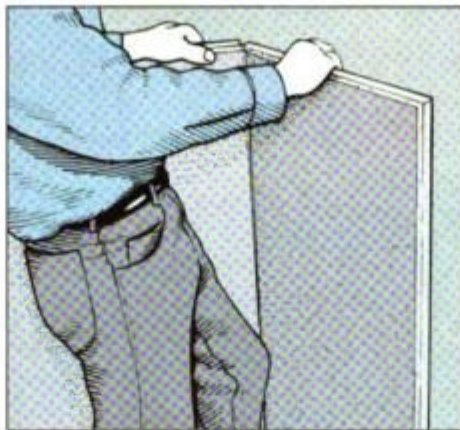


**5** Cut along the line with a sharp utility knife. Use a metal straightedge or a large drywall square to help guide the cut.

note of methods that would allow one person to do the job. In a couple of months, we'll show you how to tape and finish everything.

## Getting started

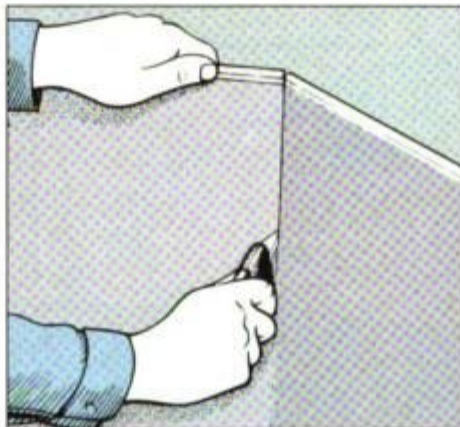
Begin by marking the location of all framing members on their adjacent surfaces. For the ceiling, that means marking the side of the top plates just under the ceiling joists (Fig. 1). For the walls, it means marking the floor under each stud (Fig. 2) and marking the ceiling panels, once they're in place, to show where the top of the studs fall. Plan to install all of the



**6** Stand the panel on edge and place your knee on the backside just behind the cut. Break the panel by pulling it toward you.

panels perpendicular to the direction of the framing members, and start with the ceiling, not the walls.

We used 1/4-in. drywall screws to attach our 1/2-in. panels, though 1/4-in. drywall nails are a suitable alter-



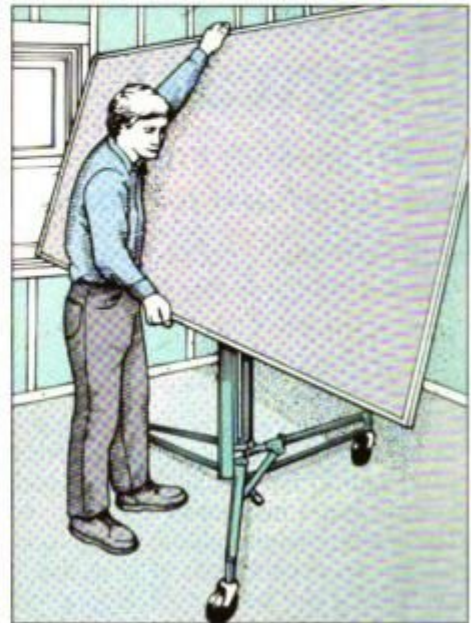
**7** Once the panel is broken, separate the pieces by cutting the backing paper with a sharp utility knife. A dull knife causes tears.

native. We prefer screws because they hold better and are only marginally harder to install. If you have a variable-speed drill, that's all you need to drive the screws. But if you have a lot of work to do, renting or



**8** To set up the lift, first tip the support platform into the vertical position. Then fold down both of the support brackets.

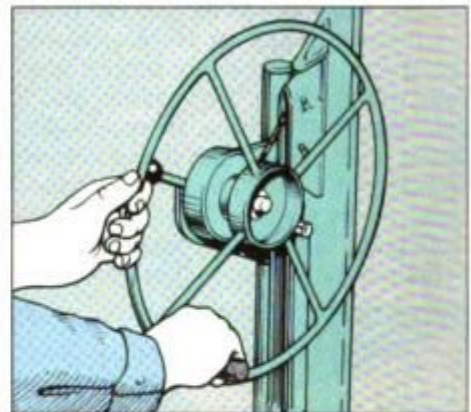
buying a drywall screw gun is a better idea. These tools have adjustable nosepieces that regulate the depth that the screw can be driven. When set properly, the gun should drive the screw just below the panel surface. The screw should compress, but not



**9** Position the lift near the panel and engage the brake pads on the bottom of the main shaft. Place the panel on the brackets.

tear, the paper. Nails need to be driven to the same depth.

While a screw gun is a nice convenience, a drywall lift is almost a necessity. By renting a lift like the one shown here—it cost us \$25 a day—the ceiling work became nearly

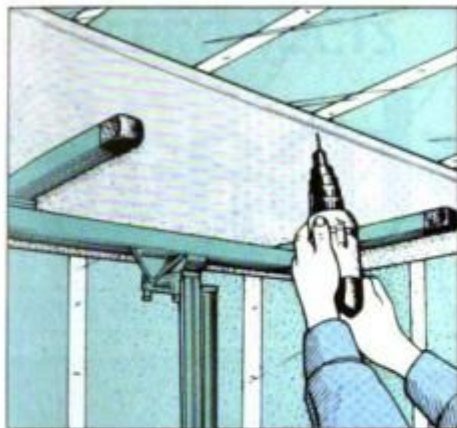


**10** Tip up the support platform until the panel is resting flat. Then fold back the support brackets and turn the lift wheel.

effortless for one person and a complete breeze for two.

## Ceilings

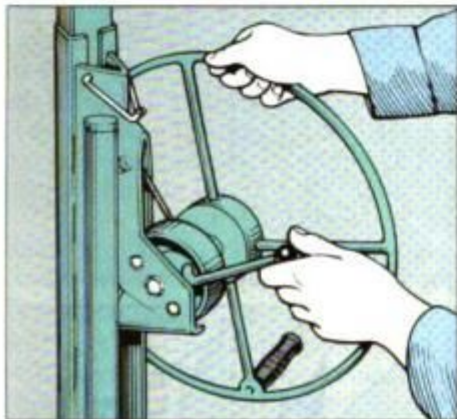
Beginning at one ceiling corner, measure across to the ceiling joist that's just at, or under, the 8-ft. point (Fig. 3). Then transfer this measurement to the front surface of a panel (Fig. 4). Mark this length at the top



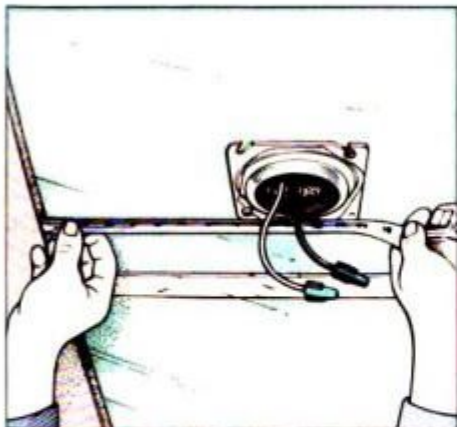
**11** Move the panel into position, then elevate it with the lift wheel. Attach it using drywall screws driven into the joists.

and bottom edges of the panel, and connect the lines. Make a cut along this line using a sharp utility knife and a metal straightedge or drywall square (Fig. 5).

Once you've scored the surface,



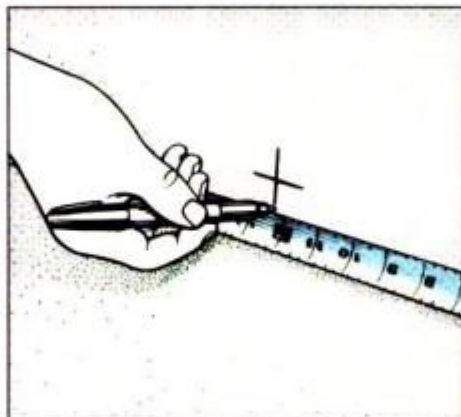
**12** Once the ceiling panel has been screwed or nailed into place, release the brake handle and turn the lift wheel down.



**13** With light fixtures and other obstacles, measure the distance from the adjacent panels to the center of the opening.

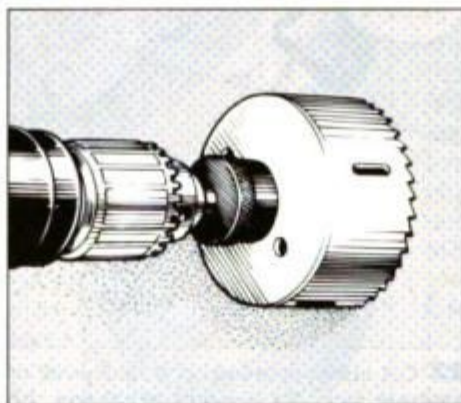
move to the back of the board and place your knee just behind the cut-line. Break the board against your knee by pulling back on the two sides (Fig. 6). After the board snaps, cut the backing paper with a sharp knife (Fig. 7) and separate the two pieces.

Tip the support platform on the drywall lift into the vertical position, flip down the support brackets (Fig. 8) and engage the foot brake on the bottom of the lift. Then lift the panel



**14** Mark the centerpoint of the ceiling opening on the face of a drywall panel. Then mark any other pertinent dimensions.

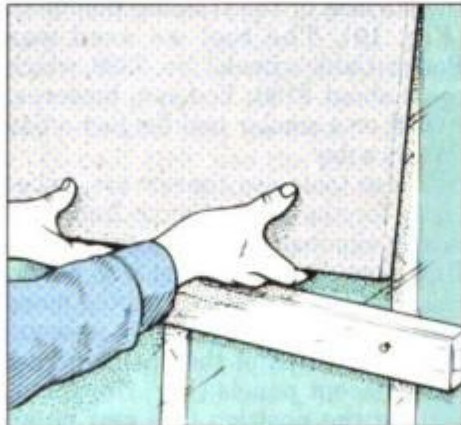
onto the brackets (Fig. 9), centering it from side to side, and tip the platform so it's in the horizontal position. Elevate the panel by turning the wheel



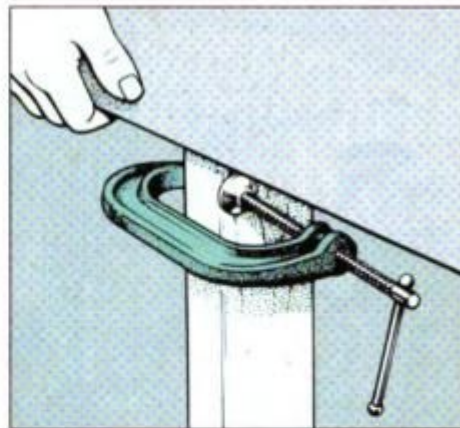
**15** Because our light openings had round plaster covers in place, we made the cuts using a holesaw and a portable drill.

in a clockwise direction (Fig. 10).

Once it's where you want it, force the panel against the joists by tightening the wheel, then attach the panel



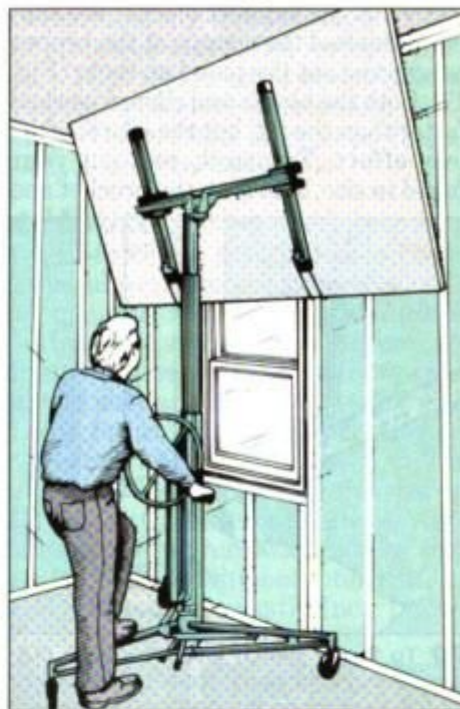
**16** When working on walls, the lift isn't so important. One support option is to rest the panel on a block attached to the studs.



**17** Another temporary support option for partition walls is a C-clamp. Tighten it to a stud and lift the panel onto the clamp.

to the joists with screws or nails (Fig. 11). When the fastening is complete, lower the platform by releasing the handbrake and turning the wheel counterclockwise (Fig. 12).

When you reach an electrical outlet or other opening in the ceiling, measure from the adjacent panels (Fig. 13), in both directions, and transfer these dimensions to a new panel (Fig. 14). All of our light-fixture outlets were covered with round plaster covers, so

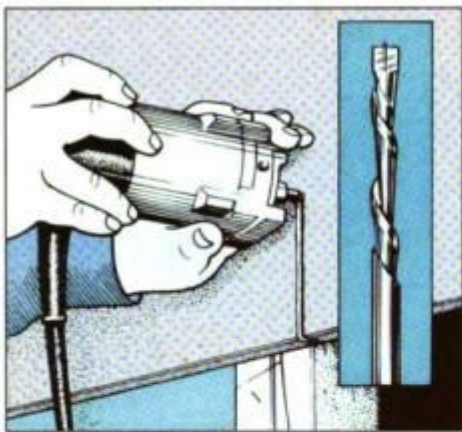


**18** Use the brackets to lift a panel to within 1 in. of the ceiling. Tip the top of the panel against the wall, then complete the lift.

a holesaw was the best tool for cutting the openings (Fig. 15).

## Walls

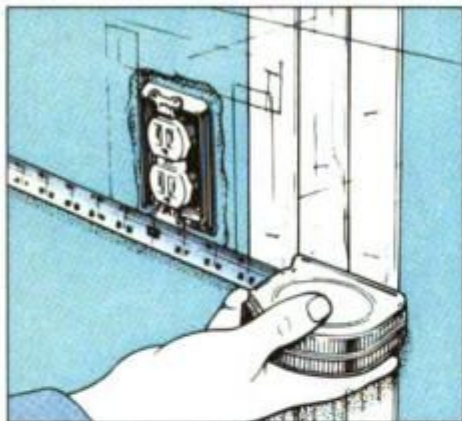
Begin at the top of the walls—this will yield the tightest joint along the ceiling, minimizing the possibility of cracks developing later. The simplest way to temporarily support the panels



**19** Use a cutout tool for window and door openings. Install the whole panel, then rout around the interior perimeter.

is to screw or tack-nail a support block to the studs at both ends of the panel. Position these blocks 48½ in. below the ceiling to allow for some adjustment. We lifted the panel (Fig. 16) and rested it on the blocks. Then we positioned it from side to side, pushed it tight against the ceiling and screwed it into place.

On partition walls, where no insulation was in the way, we found that a couple of C-clamps were just as effective as the support blocks. We simply tightened the clamps at the proper height and set the panel on them (Fig. 17). Both the blocks and clamps worked faster than the lift, but the lift required less effort. To use it, just cut your panel to size, load it on the bracket and

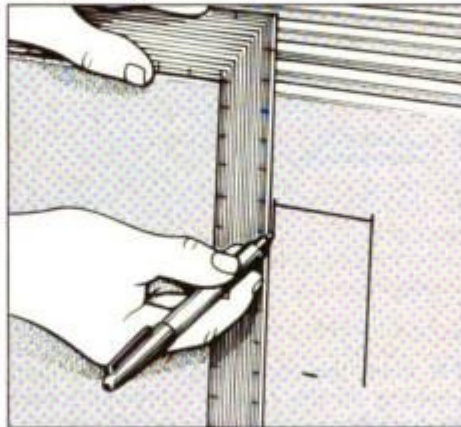


**20** To locate switch and receptacle outlets, always measure from the adjacent panels installed on the side and on the top.

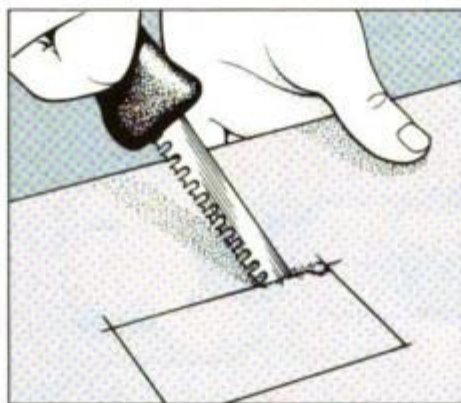
elevate it to within an inch of the ceiling (Fig. 18). Engage the foot brake and tip over the panel until the top edge hits the wall. Make sure the bottom edge is still engaged in both support brackets. Then, crank up the lift wheel until the top of the panel abuts the ceiling. Drive at least six screws along the top edge of the panel. Remove the tension on the lift wheel and let the bottom of the panel swing against the wall. Fasten it into place.

## Cutouts

Walls always have more openings than the ceiling. They contain doorways, windows, receptacles, switches and often some lights. Again, you have some options. You can cut the opening in the panel before or af-



**21** Mark the outlet-opening dimensions on the face of the panel. Then outline the box using a square and a pencil or felt pen.

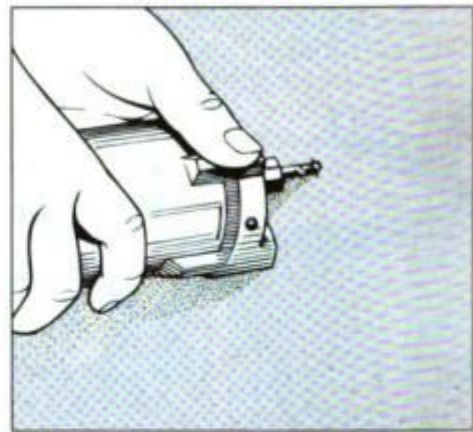


**22** Cut outlet openings with a drywall or keyhole saw. To prevent breakage, be sure to support the underside of the panel.

ter it's installed. Doing it afterward is best accomplished with a cutout tool—a small, portable electric tool similar to a laminate trimmer. When outfitted with a special bit, the tool quickly cuts openings by following the surface of the framing members (Fig. 19). The tool we used was Porter-Cable's model No. 7399, which costs about \$100. You can, however, rent it or a similar tool for just a few dollars a day.

These tools are timesavers, especially for the professional. And they nearly eliminate measuring mistakes. But if you're doing just one room, the traditional method makes more sense. All that's required is measuring the location of the opening from the adjacent panels (Fig. 20), transferring the position to a new panel (Fig. 21) and making the cut with a drywall or keyhole saw (Fig. 22).

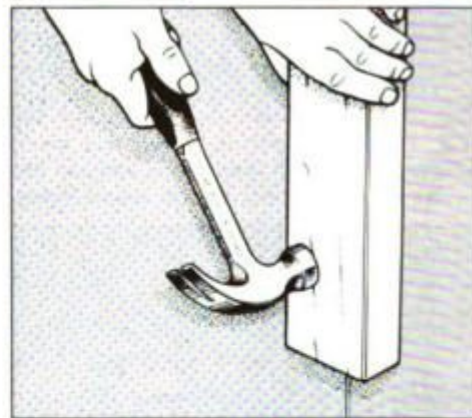
You can also use a cutout tool to



**23** To use a cutout tool for outlets, measure the location, drive the bit through at this point and cut against the box side.

make cuts around electrical outlets (Fig. 23), but the technique requires some practice. First, turn off any electrical service to the outlet, then measure the location of the middle of the box. Push the self-drilling bit into the panel and move it in one direction until it hits the inside wall of the box. Carefully lift the bit over the edge so it bears against the outside wall of the box. Move the tool counterclockwise, and when the cut is complete, pull out the waste. The panel should fit perfectly around the box.

Though it's best to leave a small gap between panels at all the joints,



**24** If the panels fit too tightly to lie flat, use a hammer and a wood block to force the ends together. Tap along the joint.

the fit will occasionally be too tight. Resist the temptation to tap the panels with the face of a hammer—a crack will almost certainly occur. Instead, place a scrap block flat against the joint and tap the block with a hammer (Fig. 24). This will spread the blow across a larger area and reduce the chance of breaking the panel. When you're done hanging the panels, make sure that you've installed enough fasteners. You should use screws about every 6 or 7 in. around the perimeter and every 12 in. on the interior of each panel.

**NEW PRODUCTS**

# Steak Out

*Great new barbecue gear.*

BY ROY BERENDSOHN, Assistant Home Improvement Editor



**Traditionalists**

Cast iron is a traditional cooking material, but we like it for more than that reason alone—it's also durable and thermally efficient. Weber provides two ways to use it: as a retrofit searing grate and as a reversible griddle. Both come with a nickel-plated steel-wire holder that fits 22½-in.-dia. Weber kettles. A neat feature about the griddle (right) is that one side is flat and the other is ridged for cooking fish or vegetables. Each product costs about \$50 at hardware stores and home centers. Contact Weber-Stephens, 200 E. Daniels Rd., Palatine, IL 60067, or call (800) 446-1071.



**Cook Anything**

The red-meat crowd might find it hard to believe, but market research indicates that Americans are cooking more fish, poultry and vegetables on their grills—and that's where this grill comes in. Sunbeam says it's designed to handle the heartiest steak or the most delicate fish filet. How? With a powerful 40,000-BTU porcelainized burner that throws heat on a bed of ceramic briquets. To cook fish, use the grill's built-in, porcelainized grid. To steam or smoke, add water or wood chips to the smoker/steamer compartment. Sunbeam says the tight-fitting lid helps seal in the smoke or steam. Furthermore, because heat is supplied indirectly, flare-ups are unlikely—even when using the built-in rotisserie. The Model 4799V shown has a 15,000 BTU side burner. It costs between \$280 and \$350 at department and hardware stores. Write Sunbeam Outdoor Products, Customer Service, 4101 Howard Bush Dr., Neosho, MO 64850.



**Gliding Along**

Using a lawn swing is an old-fashioned way to relax, and this one—called the WhisperGlide—incorporates modern materials that require very little maintenance. It's built out of structural aluminum that's finished with a baked-on enamel. The glide itself rides on ½-in.-dia. nickel-plated steel shafts in self-lubricated bronze bushings. The vinyl canopy is secured to the frame with fiberglass rods and Velcro fasteners. The few fasteners that are used throughout are made of stainless steel. The swing is delivered by UPS and it costs about \$2000, plus shipping. For more information, contact WhisperGlide, 10051 Kerry Ct., Hugo, MN 55038, or call (800) 944-7737.

**Light House**

If you want to throw a little low-voltage light on the subject, give this product a look. It's neat because it gives you two lights in one: a tier light that simply converts to a floodlight. Called the Convertible, this product, sold alone, costs about \$9—but you might find it for as little as \$6, according to its manufacturer. For a 12-light set with a power pack and 100 ft. of cable, the cost is about \$110, but it can often be found on sale for as little as \$70 at hardware stores and home centers. For additional information, contact Malibu c/o Intermatic Inc., Intermatic Plaza, Spring Grove, IL 60081.





### Don't Worry About It

Here's a good, rugged knife sharpener that you can take outside without worrying about it. The sharpener is made out of plastic with diamond-abrasive inserts, and it's light enough to float for pool-area, dock or boat-side use. We tried it and found that it's easy to use because it sets the sharpening angle for you. This product puts a quick, clean edge on even difficult-to-sharpen stainless-steel blades. Draw the blade through in one direction to apply an edge of medium sharpness. Draw it through from the other side to finish the edge. The manufacturer says it works on any kind of knife—from kitchen cutlery to hunting knives. The sharpener costs about \$25 through mail-order catalogs, cookware stores and cutlery stores. Contact Edgecraft Corp., 825 Southwood Rd., Avondale, PA 19311, or call (800) 342-3255.

### Problem Solver

If you've had a bad experience with a gas grill—catching fire, ruining expensive meat or just being cranky—you might consider the Ducane 5004SS. Its manufacturer makes no bones about it being expensive—equipped with the 16,000-BTU side burner, it costs about \$1287—but we'll say this: It has received careful development and sound engineering. For example, its two bottom burners are top-ported. Having seen side-ported burners get clogged with grease, we asked how this was feasible. The answer: It's almost impossible for grease to get to the burner because it must first make it past a sear grid, then a layer of ceramic briquets and finally a double-layered grate. Compared to other designs, Ducane says the top-ported burner is subject to fewer thermal stresses and produces a more evenly shaped, fuel-efficient flame.

The grill has a long list of attributes: a separate vertical burner for rotisserie cooking, a chrome-nickel glow coil and an observation port that lets you verify when the grill is lit (even on a bright, sunny day), lots of stainless-steel and cast-aluminum components, and a UL-listed quick-disconnect tank apparatus. The grill is sold at propane distributors and hardware stores. For more information, contact The Ducane Co., 800 Dutch Square Blvd., Columbia, SC 29210.



### The Bare Necessities

If your idea of grilling is to keep it simple, you might consider this well-designed portable appliance (shown below) from Kingsford (about \$40). The vented base is removable, and it fits inside the upper section. To start the grill, set it on the ground, mount the top on the base and light the charcoal with a crumpled sheet of paper tucked into the base. The manufacturer says it will ignite without charcoal lighter fluid. The grill has a 155-sq.-in. cooking surface.

If you want a grill that's portable within the confines of your yard, the wheeled Grill Gourmet Series may be right for you. It has a nickel-plated steel



cooking grate, a hinged warming rack, a condiment rack and high-temperature plastic side shelves. The lid slides back and rests in a cradle, affording full access to the cooking surface. Also, its side and lid vents provide reliable airflow because, according to the company, they can't get plugged up with ashes. Furthermore, these vents allow the grill to maintain a precise temperature setting, the company claims. The grill costs about \$250. Both products are sold at specialty stores and home centers. For more information, contact Porcelain Metals Corp., 1400 S. 13th St., Louisville, KY 40210, or call (800) 585-4745.



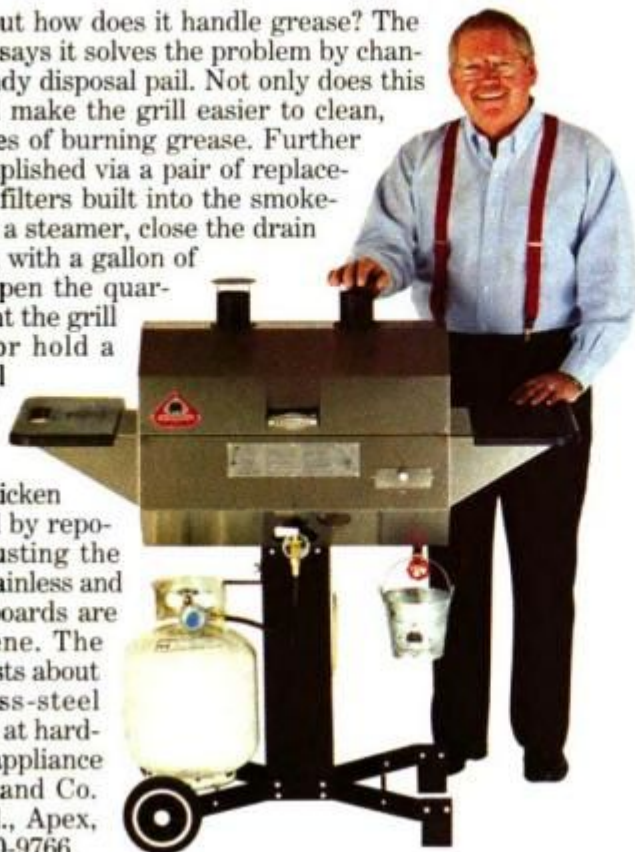
### Parabolic Hanging Around

It looks like an ordinary hammock—perfect for a lazy swing in the shade. But what caught our attention is what the manufacturer says about the design. Most obviously, it's a combination cloth and net hammock. This is supposed to provide good support for your upper body while also allowing grass clippings to fall off your feet and through the net. Viewed from above, the hammock sides curve inward in an hourglass shape. When combined with the fabric and knot design, this creates a parabolically shaped pocket that also resists tipping. The hammock comes in two sizes: 48 in. wide x 80 in. long, and 56 in. wide x 84 in. long (about \$120 and \$150, respectively). The stands for the hammocks cost \$70 to \$95. Other comforting features include hardwood spreader bars, weather-resistant fabric, welded steel clew rings and all-cotton rope. Both are sold at home centers and through home-product catalogs. For more information, write Algoma Net Co., 1525 Mueller St., Algoma, WI 54201.



## Problem Solver

Any grill can cook food, but how does it handle grease? The manufacturer of this grill says it solves the problem by channeling the grease to a handy disposal pail. Not only does this reduce excess smoke and make the grill easier to clean, but it also eliminates flares of burning grease. Further smoke reduction is accomplished via a pair of replaceable, self-cleaning smoke filters built into the smokestacks. To use the grill as a steamer, close the drain valve and fill the drip pan with a gallon of water. To operate, just open the quarter-turn gas valve and light the grill with a butane lighter, or hold a match in the stainless-steel alligator clip that comes with the appliance. Once warmed up, the grill operates at 400°F. You can quicken or slow the cooking speed by repositioning the food or adjusting the lid. The grill is made of stainless and cold-rolled steel; the sideboards are high-density polyethylene. The Premiere model shown costs about \$800, and a non-stainless-steel model costs \$400. It's sold at hardware stores and propane appliance stores. Contact The Holland Co. Inc., 2501-B Ten-Ten Rd., Apex, NC 27502, or call (800) 880-9766.



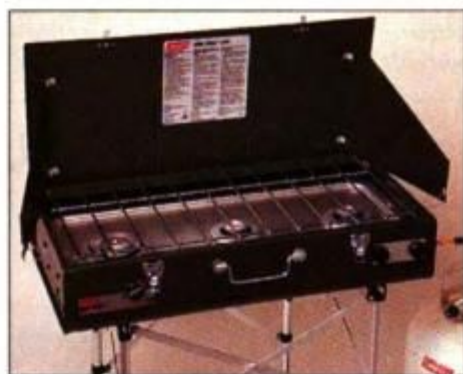
## Built To Take It

This isn't just some cute Adirondack chair. The sample we saw at a trade show looked like it was built to take it. Its arms and seat frame are 1½-in.-thick pressure-treated No. 1 Grade or Better Southern Pine. The lumber is then redried to reduce excess water. Both the seat and back slats are ¾ in. thick and are of the same material. All the lumber is finish-sanded and has rounded edges. It's treated with Wolman water repellent and a sealant, and all the hardware is stainless steel—a handy feature where it's humid or salty. The chair costs \$120 to \$130 at home centers and lumberyards. To find a distributor, contact Palmetto Mfg., P.O. Box 1124, Orangeburg, SC 29116.



## Where Charcoal Is King

If charcoal grilling is what you like, this combination rotisserie grill and oven should provide all the cooking area you need. Its four rotisserie shelves turn by an electric motor and hold 10 pounds of meat apiece. (Circulating the food in this manner allows the meat above to baste the meat below.) The long firebox takes up to 12 pounds of charcoal. Excess grease runs out through the side, where it's collected in an exterior drip pan. Made of 18-ga. steel, the appliance's assembled weight is about 120 pounds—but it can still be delivered by UPS. It costs about \$400, plus shipping. Write to Swisher Mower and Machine, 333 E. Gay St., Warrensburg, MO 64093, or call (800) 222-8183.



## Go Outside

This portable propane stove gives new meaning to the phrase: "If you can't stand the heat, get out of the kitchen." Its three burners provide a startling 35,000 BTUs—the left burner is 15,000 BTUs, while the other two are 10,000 BTUs each. Also note that the burners are in line, with 9 in. separating them. This allows you to use big pots on each burner, or position a griddle over the center and righthand burner while cooking something else on the left. Other features include a recessed aluminum steel top and stainless-steel burners. This is a lot of cooking appliance for about \$100. The stand shown in the photo is a \$30 accessory that's made out of anodized aircraft-grade aluminum tubing. Both products are sold at sporting-goods stores and department stores. Contact The Coleman Co., Consumer Services, P.O. Box 2931, Wichita, KS 67201, or call (800) 835-3278.

PM

## Lasting Impression

Lazy Man's approach to building gas grills is to make them simple and to make them last. Consider the MG25, an \$1150 appliance. What do you get for your money? The grill body and removable cover, cart, fasteners, burner, cooking grates and drip pan—all Type 304 stainless steel. The drip pan covers the entire grill bottom. To keep the design simple (there's no pushbutton piezoelectric ignitor), all you need is a fireplace match or a butane barbecue lighter. The company doesn't want homeowners or even stores assembling its gas grills, so it assembles them at the factory. The grill is fired with propane, but a natural-gas model is also available. It has 358 sq. in. of cooking area and two 11,500-BTU burners, and is sold at appliance stores, wood-stove dealers and propane distributors. For more information, contact Lazy Man Inc., P.O. Box 327, 616 Hardwick St., Belvidere, NJ 07823, or call (800) 475-1950.



# Homeowners Clinic

BY NORMAN BECKER, P.E., Contributing Editor  
 PM Illustrations by George Retseck

## GFCI, Ground & Neutral

I'm a do-it-yourselfer, and I'd like to know more about GFCI protection and the relationship it has with ground and neutral wires. If I use a small 1/4-watt electrical circuit tester, I can use the metal junction box or the ground slot as a neutral. However, when doing the same test with a 25-w incandescent bulb, the GFCI will trip. Can you explain this?

JIM DISPONZIO  
 SOUTH FLORIDA

*The neutral wire is grounded, but it isn't the grounding wire. The neutral wire is needed to close the circuit. This allows the current in the branch circuit to flow from the electrical service panel through the appliance and back to the grounding bar in the panel.*

*The grounding wire is a safety feature. It connects to ground components that don't normally carry a*

*current, such as a metal appliance case. If an electrical short develops and the case becomes electrified, the grounding wire directs the current safely to ground rather than shocking the person touching the metal.*

*The GFCI (ground fault circuit interrupter) is a safety refinement. Under normal conditions, the current is equal in the hot and neutral lines of the branch circuit. The GFCI breaker or GFCI outlet receptacle has a sensing element that monitors the current in both of these lines. If the GFCI senses a current difference between the hot and neutral line as small as 5 milliamps (<sup>5</sup>/<sub>1000</sub> of an amp), it automatically trips. The circuit is now opened, and current will stop flowing within a fraction of a second.*

*Testing the circuit with the hot leg and the grounded junction box or ground slot in the outlet alters the*

*current flow between the hot and neutral legs of the circuit. The GFCI doesn't trip with the 1/4-w tester because it draws only 2.1 ma, which is less than the GFCI's 5-ma threshold. The GFCI is tripped when using the 25-w bulb because that test draws 208 ma. Based on the test you conducted, the GFCI is working properly.*

## Gold-Plated Fixtures

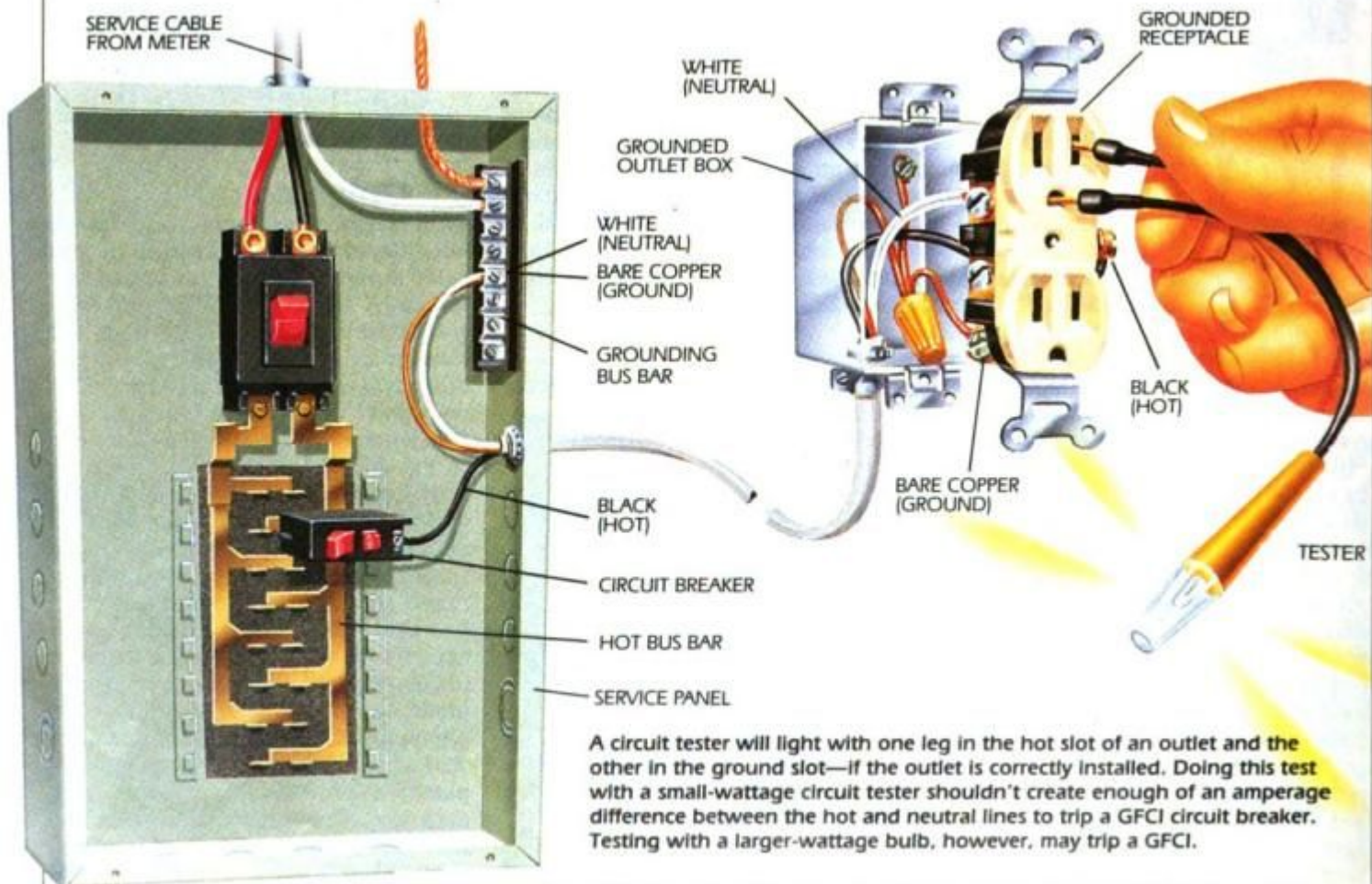
We recently moved to a home that has Kohler gold-plated bathroom fixtures. Evidently, they had been cleaned with an abrasive solution because all the finish is gone. Is there anything we can do to restore their gold luster?

NOREEN GLEN  
 SPARTA, NJ

*The finish on Kohler faucets resists soap and hard water. However, it won't withstand an abrasive cleaner. Unfortunately, there's nothing you can do to restore the finish other than replating the parts, and I doubt that the cost would be justified. Unless the finish on the entire*

*(Please turn to page 86)*

## GFCI, GROUND AND NEUTRAL





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Age \_\_\_\_\_

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faucet has been abraded, you might consider replacing just the affected parts rather than the entire faucet. Contact your local plumbing-supply store for assistance.

### Wood Floor Care

We're living in a home that was built in 1934. The floors have always been cleaned and waxed with an electric polisher. However, wax buildup makes the floors look as though they need to be cleaned. What solvent safely removes wax buildup?

ADRIENNE GAREAU  
NORTHBRIDGE, MA

*Paint thinner (also known as mineral spirits) is sometimes used to remove wax buildup from floors. It's flammable, however, so it must be handled with care. Open windows and doors to keep the area well ventilated. You should also wear rubber gloves and put on a respirator that's equipped with filter cartridges for organic vapors. Paint thinner, the respirator and the gloves are all commonly available at hardware stores, paint stores and home centers.*

For more information on cleaning wood floors, contact the Oak Flooring Institute, P.O. Box 3009, Memphis, TN 38173, and request a copy of the Wood Floor Care Guide. This brochure is free, but you must send a self-addressed No. 10 envelope with a 32-cent stamp.

### Service Tip

In our June 1994 Homeowners Clinic, we discussed painting over water stains on a ceiling with store-bought stain blockers and primers. Greg Fernandez, of Albuquerque, New Mexico, wrote in to tell us he uses a home-made solution of water and bleach.

He recommends the following: "Water-stain blockers and sealers work well, but a 50/50 solution of water and chlorine bleach (Clorox) works as well as the commercially prepared products. Sponge the solution over the stain (don't scrub) and let it dry naturally. As the solution dries, the stain will disappear. A stubborn stain may require a second application. The surface is ready for painting without further washing, rinsing or preparation. This trick was taught to me by a professional house painter." **PM**

### DO YOU HAVE A HOME-MAINTENANCE OR REPAIR PROBLEM?

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

## SUMMER PROJECT DIRECTORY

### Paint, Stains, Sealers, Coatings:

Summer is the time when most of us do home-improvement projects, especially those that require working outside, such as painting and building a deck. The right information can make the job go more smoothly—and make the end results last longer. Here are some sources of information. The code next to each manufacturer's name corresponds with the numbers below.

1. Locate a dealer.
2. Get technical assistance.
3. Request free or low-cost literature.



#### Benjamin Moore & Co. (1)

(800) 826-2623  
Dept. CC  
51 Chestnut Ridge Rd.  
Montvale, NJ 07645

#### Cabot Stain (1, 2, 3)

(800) 782-4681  
100 Hale St.  
Newburyport, MA 01950

#### Colony Paint (1, 2, 3)

(800) 458-0047  
1191 S. Wheeling Rd.  
Wheeling, IL 60090

#### Cuprinol (1, 2)

(800) 424-5837  
P.O. Box 6709  
101 Prospect Ave.  
Cleveland, OH 44115

#### Deft Inc. (2, 3)

(800) 544-3338  
P.O. Box 19507  
Irvine, CA 92713

#### Drylok/UGL (3)

(800) 272-3235  
P.O. Box 70  
Scranton, PA 18501

#### Dutch Boy (1, 2)

(800) 828-5669  
P.O. Box 6709  
101 Prospect Ave.  
Cleveland, OH 44115

#### Enterprise/Magicolor (1, 2, 3)

(800) 323-6326  
1191 S. Wheeling Rd.  
Wheeling, IL 60090

#### Flecto-Varathane (1, 2, 3)

(800) 635-3286  
1000 45th St.  
Oakland, CA 94608

#### Flood Co. (1, 2, 3)

(800) 321-3444  
Technical Service  
P.O. Box 2535  
1212 Barlow Rd.  
Hudson, OH 44236

#### Formby's (1, 2)

(800) 367-6297  
Thompson's Booklets  
3500 Maple, 4th Floor  
Dallas, TX 75219

#### Glidden (1, 2)

(800) 663-8589  
For literature write:  
Glidden  
P.O. Box 1172  
Cleveland, OH 44115

#### H. Behlen & Bros. (1)

(518) 843-1380  
Dept. PM  
4715 State Hwy. 30  
Amsterdam, NY 12010

#### M.A.B. Paints and Wallcoverings (1, 2, 3)

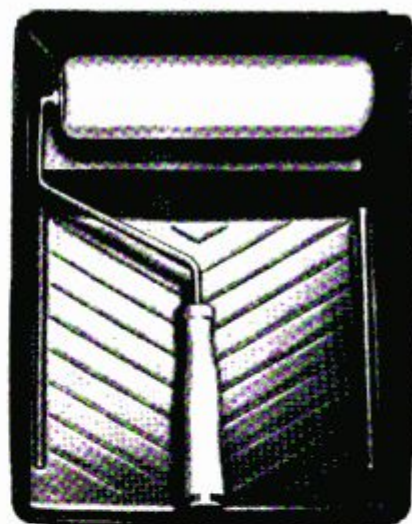
(800) 622-1899  
600 Reed Rd.  
Broomall, PA 19008

#### Martin-Senour Paint (1, 2)

(800) 542-8468  
P.O. Box 6709  
101 Prospect Ave.  
Cleveland, OH 44115

#### McCloskey (1, 2, 3)

(800) 345-4530  
1191 S. Wheeling Rd.  
Wheeling, IL 60090



#### Minwax (2)

(800) 523-9299  
For literature write:  
P.O. Box 438  
Montvale, NJ 07645

#### Mr. Mac (1, 2, 3)

(800) 348-3571  
P.O. Box 25188  
Oklahoma City, OK 73125

#### Osmose Wood Preserving (1, 2, 3)

(800) 522-9663  
P.O. Drawer O  
Griffin, GA 30224

# FROM FRONT...

# TO REAR...

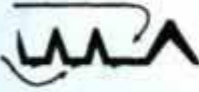


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- Lincoln Mazda • Mercedes • Mercury • Mitsubishi • Nissan
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**WE GUARANTEE YOUR SATISFACTION.**  
If you are not happy with your order, return your unused mats or cargo liner within 30 days for a complete refund, less shipping.

\*We pay shipping within the 48 contiguous states on orders of a front & back set, two or more sets, or a combination of mats and cargo liner. Extra shipping charge may apply outside the 48 states. If paying by check send checks payable to MacNeil Automotive Products Ltd. IL residents add 6 3/4% sales tax.

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Gr. Voyager • MPV • Odyssey • Previa • T & C • Voyager/Quest • Windstar
- AUTOMOBILE TRUNK LINER APPLICATIONS:**  
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## HOME & SHOP JOURNAL

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Fall River, MA 02720

**PDI Inc.** (1, 2, 3)  
(800) 969-5432  
P.O. Box 130  
Circle Pines, MN 55014

**Pittsburgh Paint** (2, 3)  
(no phone inquiries)  
(Olympic Stain, Lucite)  
PPG Industries  
1 PPG Place

Pittsburgh, PA 15272  
Attn: Technical Service  
**Plasti-Kote Co. Inc.** (1, 2, 3)  
(800) 431-5928  
1000 Lake Rd.  
Medina, OH 44256

**Pratt & Lambert** (1, 2)  
(800) 289-7728  
P.O. Box 22  
Buffalo, NY 14240

**Roof Pro** (1, 2, 3)  
(800) 348-3571  
P.O. Box 25188  
Oklahoma City, OK 73125

**Rust-Oleum Corp.** (1, 2, 3)  
(800) 323-0851  
11 Hawthorn Pkwy.  
Vernon Hills, IL 60061

**Thoro System Products** (1, 2, 3)  
(800) 327-1570  
8570 Phillips Hwy.  
Suite 108  
Jacksonville, FL 32256

**Valspar** (1, 2, 3)  
(800) 323-8418  
1191 S. Wheeling Rd.

Wheeling, IL 60090

**Waterlox Chemicals and Coatings** (1, 2, 3)  
(800) 321-0377  
9808 Meech Ave.  
Cleveland, OH 44105

**Weatherbeater** (2, 3)  
(800) 972-4687  
Sears, Roebuck and Co.  
D2-172A  
3333 Beverly Rd.  
Hoffman Estates, IL 60179

**Wm. Zinsser & Co.** (1, 2, 3)  
(908) 469-4367  
173 Belmont Dr.  
Somerset, NJ 08875

**Wolman Wood Care Products** (1, 2, 3)  
(800) 556-7737  
1850 Koppers Bldg.  
436 Seventh Ave.  
Pittsburgh, PA 15219

**Zar/UGL** (3)  
(800) 272-3235  
P.O. Box 70  
Scranton, PA 18501

## SUMMER PROJECT DIRECTORY

### Power Tool Manufacturers:

Power tool manufacturers offer the following services through their toll-free or standard phone numbers:

1. Locate a dealer.
2. Locate a service center.
3. Get answers to technical questions about power tool use.
4. Request a tool catalog.

**Black & Decker** (1, 2, 3, 4)  
(800) 762-6672  
Customer Services  
P.O. Box 618  
Hampstead, MD 21074

**Bosch** (3, 4)  
3: (312) 794-7495  
4: (312) 481-3831  
4300 W. Peterson Ave.

Dept. PM  
Chicago, IL 60646

### Chicago Pneumatic Electric Tools Division

(Formerly AEG) (1, 2, 3, 4)  
(800) 243-0870  
2220 Bleecker St.  
Utica, NY 13501

**DeWalt** (1, 2, 3, 4)  
(800) 433-9258  
Fulfillment Supervisor  
P.O. Box 158  
Hampstead, MD 21074

### A true statement by Paul B<sup>†</sup> of San Pedro, California



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| <input type="checkbox"/> Small Engine- 52560          | <input type="checkbox"/> Gunsmithing- 92158         |
| <input type="checkbox"/> Upholstery- 81110            | <input type="checkbox"/> PC Programming- 35673      |
| <input type="checkbox"/> Woodworking- 43443           | <input type="checkbox"/> Vinyl Repair- 71048        |
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H.H., Denver, CO

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R.B., Bakersfield, CA



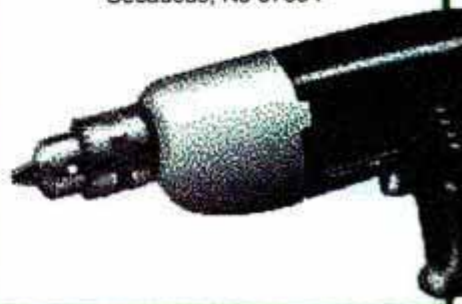
**Dremel** (2, 3, 4)  
(800) 437-3635  
P.O. Box 1468  
Racine, WI 53401

**Hitachi Power Tools USA** (1, 2)  
Electric Tools:  
(800) 362-7297  
Pneumatic Tools:  
(800) 546-1666  
3950 Steve Reynolds Blvd.  
Norcross, GA 30093

**Makita USA** (2, 4)  
(714) 522-8088  
14930 Northam St.  
La Mirada, CA 90638

**Milwaukee** (1, 2, 3, 4)  
1, 2, 4: (414) 783-8311  
3: (414) 783-8408  
13135 W. Lisbon Rd.  
Brookfield, WI 53005

**Panasonic Cordless Power Tools** (1, 2, 4)  
(800) 338-0552  
1 Panasonic Way, 4A-3  
Secaucus, NJ 07094



## SUMMER PROJECT DIRECTORY

**Porter-Cable** (1, 2, 3, 4)  
(Also Rockwell Tools)  
(800) 487-8665  
4825 Highway 45 N.  
P.O. Box 2468  
Jackson, TN 38302

**Ryobi** (1, 2, 4)  
(800) 525-2579  
5201 Pearman Dairy Rd.  
Anderson, SC 29625



**Sears, Roebuck and Co.** (4)  
(800) 948-8800  
D2-172A  
3333 Beverly Rd.  
Hoffman Estates, IL 60179

**Skil** (3, 4)  
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4: (312) 481-3831  
4300 W. Peterson Ave.  
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Chicago, IL 60646

**WEN Products** (1, 2, 3, 4)  
(800) 462-3630  
1240 Diehl Rd.  
Suite 100  
Naperville, IL 60563

### Lumber Trade Associations:

These trade associations are the best sources of information on all aspects of lumber as it pertains to house construction. You name it, these associations can provide it—from span tables for framing lumber to installation guidelines. They also offer plans and design guidance for a variety of other structures, such as decks, gazebos and fences. Contact the associations below and ask them for their indexes or literature lists.

**AMERICAN  
FOREST &  
PAPER  
ASSOCIATION**

**American  
Forest &  
Paper  
Association**  
111 19th St. N.W.  
Suite 800  
Washington, DC 20036  
Phone: (202) 463-2700  
Fax: (202) 463-2791

**A P A**  
*The Engineered Wood Association*  
**APA—The Engineered Wood Assn.**  
(Formerly the American Plywood Assn.)  
P.O. Box 11700  
Tacoma, WA 98411  
Phone: (206) 565-6600  
Fax: (206) 565-7265

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City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Credit Card:  Mastercard  Visa Number: \_\_\_\_\_ Exp: \_\_\_\_\_

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**CEDAR SHAKE & SHINGLE BUREAU**

### Cedar Shake & Shingle Bureau

515 116th Ave. N.E.  
Suite 275  
Bellevue, WA 98004  
Phone: (206) 453-1323  
Fax: (206) 455-1314

No literature list is currently available. However, the bureau can provide information regarding the installation and care of cedar shakes and shingles as they're used in roofing and siding.



### Southern Pine Council

P.O. Box 641700  
Kenner, LA 70064  
Phone: (504) 443-4464  
Fax: (504) 443-6612



### Western Red Cedar Lumber Association

P.O. Box 2888  
Naperville, IL 60567  
Phone: (708) 369-2828  
Fax: (708) 369-8651



### Western Wood Products Association

Department PM-795  
522 S.W. Fifth Ave., 4th Floor  
Portland, OR 97204  
Phone: (503) 224-3930  
Fax: (503) 224-3934

## HOME&SHOP JOURNAL

## SUMMER PROJECT DIRECTORY



### California Redwood Association

405 Enfronte Dr.  
Suite 200  
Novato, CA 94949  
Phone: (415) 382-0662  
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Passport 5000's Total Picture™ technology uses an LCD panel to provide continual updates on radar, laser, detector status modes and driving conditions in your area.

You are receiving more than one X-band signal.

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The alert audio has been automatically muted.

You are reminded that "City" mode is selected.

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An emergency vehicle is near.

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X-band radar is being used nearby.

Total Picture™ technology uses 1120 pixels to visually display information in easy-to-understand terms. Other detectors can typically devote only 11 LEDs to information display.

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# ONLY PASSPORT 5000 GIVES YOU THE TOTAL PICTURE™

Passport 5000's Total Picture™ technology, available only from Escort, is a new innovation for radar/laser detection. Like a CD player, Passport 5000's LCD screen visually displays information, eliminating the guesswork common with LED-style panels.

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Passport 5000's unique SafetyPilot™ technology alerts you to the presence of emergency vehicles and road hazards (highway construction, accidents, dangerous intersections, unmarked railroad crossings) in those cities using the new safety technology. Drive with peace-of-mind knowing Passport 5000 is protecting you and your passengers.



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for the total driving picture, call toll-free:

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**new price!**

Passport® 5000 \$169.<sup>95</sup>

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The Innovative Edge™



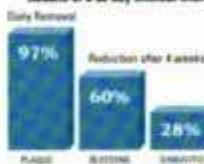


## Fight plaque and gum disease with the world's only ultrasonic toothbrush!

UltraSonex<sup>®</sup> is the world's only ultrasonic toothbrush. Accepted by the American Dental Association as an effective cleansing device, the UltraSonex removes plaque, fights gum disease and is recommended by dentists. *UltraSonex is not an electric toothbrush. It has no moving parts, does not vibrate and is absolutely silent.* It works by transmitting 1.6 million cycles per second of ultrasonic waves directly to the teeth and



Results of a 30 day clinical trial.



Clinical testing proves that using UltraSonex can reduce bacterial plaque by 97% daily and bleeding gums by 60% and gingivitis by 28% - in just 4 weeks - and UltraSonex can reverse the progression of gingivitis, which can lead to periodontal disease.

Results of a 30 day clinical trial conducted at a leading university teaching hospital. Subjects were instructed to brush twice daily for 2 minutes.

gums. No other product approved for home use offers ultrasound technology. And clinical testing proves that using UltraSonex can also reverse the progression of gingivitis and gum disease. It is extremely gentle, yet you'll quickly notice dramatic results. Just brush normally using your favorite toothpaste. Shuts off automatically and recharges in its own base. Try UltraSonex. You and your dentist will both be amazed at the results. **\$99.95** (\$10.95) #3100. UltraSonex and 6 Replacement Heads (Yr.'s Supply) **\$129.95** (\$12.95) #3325. Now available, the Twin UltraSonex - two UltraSonex toothbrushes that recharge in one space saving base. **\$169.95** (\$13.95) #3400. Twin UltraSonex and 6 Replacement heads (6 Month Supply) **\$159.95** (\$14.95) #3425.

New! Twin UltraSonex



## Power clean your laundry without harsh detergents.



Not only are these revolutionary laundry discs from Japan as effective as detergents, but they clean without any chemicals whatsoever. *Clean Power Plus<sup>™</sup>* is a trio of discs that use activated ceramic particles to produce ionized oxygen in the water, thereby enhancing water's natural ability to penetrate clothing fibers and lift away dirt. Test results certified by a USDA accredited laboratory confirm that these anti-bacterial discs kill, without harsh chemicals, the toxic E. coli and Staphylococcus aureus bacteria. These hi-tech wonders are hypo-allergenic, environmentally correct and simply better for your health. Pure water is added to the washing

machine and pure water, plus the dirt from the clothes, is released. Your clothes come out clean, fresh, unscented and chemical free with no fiber deterioration, color-fading, or skin irritants common with most laundry products. Three discs will clean your clothes for two years (that's 700 loads!) and cost just pennies a load to use. With the average family spending about \$150/year on detergents, bleaches and fabric softeners, this is one product you can't afford to be without! Satisfaction guaranteed or your money back. **\$69.95** (\$6.95) #4300.



## Fresher, healthier air in minutes!



The HEPA-CLEAR<sup>™</sup> Air Purifier with Ionizer from Slant/Fin<sup>®</sup> is a true HEPA (High Efficiency Particulate Air) filtration system. *It operates at an astonishing 99.97% efficiency. Literally scrubbing the air clean in a 10'x14' room of billions of pollutants and allergens every 15 minutes - pollen, dust, dangerous bacteria, mold spores, animal dander, even tobacco smoke. And the Hepa Clear is 166 times more effective than purifiers that operate at 95% efficiency.* Other filter systems blow purified air out of the bottom or sides of the machine, re-contaminating it with dirt and dust from rugs and

floors. Slant/Fin's patented air passageway design discharges only pure, clean, filtered air from the top of the unit back into the room. The HEPA-CLEAR can help relieve respiratory ailments and it's the only true HEPA system that is compact (12" diameter x 14" high) and lightweight enough to be placed virtually anywhere - on the floor, a table, even a file cabinet. The Filter Replacement Indicator System lets you know when it's time to service the filter. Healthful negative ions enrich the air, making it fresh, invigorating and odor-free. The HEPA-CLEAR is less than half the price of larger, more cumbersome models. *In fact, in its price range, this is the only complete HEPA filtration system.* We're so sure you'll be completely satisfied with the HEPA-CLEAR, we offer a 100% money-back guarantee. Mfr.'s 2-year limited warranty. **\$129.95** (\$12.95) #4280. Replacement Hepa Filter **\$49.95** (\$5.95) #4290.

Air drawn into the back of the unit is purified as it passes through the pre-filter and then the HEPA filter. Clean air enriched with negative ions is pushed up and away from the front of the unit.



## Amazingly comfortable self-inflating bed.

Aero Bed<sup>®</sup> is the fastest, easiest way to accommodate overnight guests comfortably - better than clumsy cots and rollaways! Plug it in, push a button, and in 45 seconds it inflates to a sturdy, standard-sized mattress - as comfortable as your own bed



Simple push button control.

and that supports up to 600 lbs. Use it for kids or adults - anyone up to 6'1" tall. Then unplug it and place it anywhere. Has its own machine-washable mattress pad. Standard-sized sheets fit perfectly. Adjust firmness at the touch of a button. Rolls up like a sleeping bag to store in its own tote. Great for unexpected guests, slumber parties, the dorm, vacation homes. Weighs under 15 lbs. Made in USA. Twin **\$119.95** (\$13.95) #2280, Full **\$149.95** (\$14.95) #2290. Travel/Camper Aero Bed is identical, but the built-in inflator pump is cordless. Rechargeable battery lasts for 10 uses before recharging. Use it indoors or outdoors. Twin **\$119.95** (\$13.95) #2300, Full **\$149.95** (\$14.95) #2310.

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# CAR CARE

## CAR CLINIC

BY MIKE ALLEN,  
Associate Automotive Editor

### Puddle Jumping

A puddle of something shows up under my car if I don't move it for a few days. My mechanic can't find the problem, and I'm getting tired of scrubbing my garage floor so the kids don't track it onto the carpet. How can I find what's leaking?

JOHN STAFFINGTON  
PERTH AMBOY, NJ

First, you've got to identify the offensive fluid. Here's how, clockwise from the bottom:

- Engine coolant is a slimy-feeling, thin, green-tinted liquid. You'll generally find it near the front of the car under the radiator, but it may also be near the firewall if it's leaking from the heater rather than the radiator. It's water-soluble, so simply hose it away.

- Windshield-washer solvent is an alcohol/water mix, so it often evaporates before morning. It's usually tinted blue, and it will have a distinct alcohol smell. If it's a steady leak, look to the washer reservoir.

But what you may have is a leak in the lines that lead to the spray nozzles, in which case it will only leak when you're using the washers, and may leak almost anywhere under the hood or cowl, depending on where the hoses run.

- Brake fluid is a clear, slimy-feeling fluid. It's also water-soluble, as brake fluid is basically an alcohol. It will evaporate, although slowly. It should also rinse away with water. Really old brake fluid may have a brownish discoloration from dirt and disintegrating rubber seals. Brake fluid leaks from the calipers or drums in the wheel wells, or from the master cylinder in front of the driver—and occasionally into the driver's footwell.

- Automatic transmission fluid is a thin, red-tinted oil. Older fluid may turn a dark brown color and acquire a slightly toasted smell. Detergent is

needed to lift it from the concrete. It may be leaking anywhere from the transmission or the trans cooler lines that lead up to the radiator. Don't freak out if you find something you identify as ATF dripping from your manual-transmission car—some newer vehicles specify ATF as the manual-trans lubricant because it's thinner than gear lube and provides slightly

better mileage. (Don't use it for this purpose unless your car manufacturer recommends it.)

- Gear lube is a thick, sulfur-smelling brown oil. It's pretty viscous, and may turn a very dark brown after it has been in service for a while.

- You may also see plain old water leaking from under the car. It's coming from the a/c evaporator as it sucks moisture from the vehicle's



## CAR CARE

interior, and it's perfectly normal.

● In the center of the illustration is engine oil, generally found under the center of the engine compartment.

Knowing the origin and kind of liquid on your garage floor should give your mechanic a head start on identifying the source of the leak.

### How Cold Is It?

We have a 1988 Cutlass Calais with a Quad 4 motor. In really cold weather, it has so much condensation in the oil that the moisture freezes on the oil pump pickup, starving the bearings. I've had to heat up the oil pan with a torch to melt the ice in order to change it—and that's after only a few hundred miles. The dealer is no help.

WILLARD LOVE  
BELLVUE, MI

*You're not getting enough crankcase ventilation. I'd check the vent orifice carefully for any restriction.*

*All vehicles have some water in the crankcase. That's normal, and periodically driving the car until the engine is thoroughly warm, and then for another 20 minutes or so, will drive the water out of the system.*

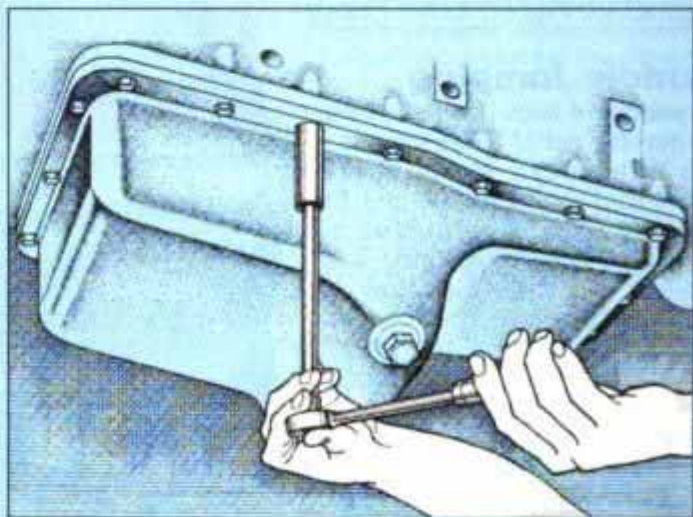
*Check to see if your thermostat is*

### First Things First

● This is pretty basic stuff, but I had to help a pal out last weekend, and I wound up rescuing him from a big problem. He was replacing his oil-pan gasket to fix a leak. Hardly rocket science, as every bolt was in plain view and the pan was easily dropped and reinstalled. There were about a million—well, maybe two dozen, but it seems like a million when you're lying on your back at 0400 and the wife is screaming at you to come to bed—6mm bolts holding the pan on.

He'd put in four of the bolts—at the corners of the pan—and tightened them finger tight. Then he tried to install the other 20. But they were reluctant to go in. In fact, he had almost cross-threaded a couple before I got there.

So I had him loosen the original four bolts two full threads, allowing the pan to float enough to start the remaining bolts no more than three turns. Then we could snug the bunch of them down in the appropriate criss-cross fashion.



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NEVER TO LEAVE YOU FLAT.  
WE GUARANTEE IT.**

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## CAR CARE

working, and that your car is warming up completely. If it doesn't, the oil won't get warm enough to burn off the water. GM has a TSB on this that involves drilling a 1/4-in. hole in the pickup to provide an alternate oil feed. Sounds pretty flaky to me.

### Oil's Well

I purchase my oil at the discount store in case lots and often pay no more than 85 cents per quart. My friend buys oil only from auto dealers and auto parts stores and pays 50 to 80 cents more. He maintains he's getting better oil—more refined and properly graded. "My" oil, on the other hand, is recycled, mixed and not properly graded, and he refers to it as 2nd-grade oil. Am I sacrificing quality for price?

NEIL STEMANN  
RED WING, MN

Any bottle of oil you buy of the same brand, type, viscosity and API rating is as close as the refiner can make it, regardless of whether it was purchased at a discount or for list price over the counter at a dealership.

Look for the API rating and starburst symbol. If they're there, shop price. Your friend is wasting money.

### Lost In The Ozone

If you've been reading Car Clinic regularly, you're aware that R-12 refrigerant, used in most automotive a/c systems until the past year or two, is being forced off the market by the Environmental Protection Agency because R-12 contributes to the hole in the ozone layer.

According to several sources, the government is finding a substantial amount of illegally imported R-12 refrigerant on the market. The EPA has arrested some people and recovered a great deal of R-12 coming in from Mexico. Apparently, the high price of ever-harder-to-find R-12 has attracted the attention of some less-than-scrupulous individuals.

Aside from ethical considerations, we recommend against using this bootleg R-12 in your vehicles. It doesn't meet many quality-control standards, and it can damage your a/c system. Legal R-12, although expensive, is still available. **PM**

### DO YOU HAVE A CAR PROBLEM?

Just ask Mike about it. Mail your question to Car Clinic, Popular Mechanics, 224 W. 57th St., New York, NY 10019. While letters, faxes or phone calls cannot be answered individually, problems of general interest will be discussed in the column.

### SERVICE TIPS

● Does your 1993-94 Acura Vigor's handbrake stick up and leave the BRAKE warning light on? Does the ABS light sometimes come on? The problem may be nothing more than an overtight rivet that fastens the brake lever to the brake rod.

● Squealing noises from under a Suzuki Samurai probably mean that transmission/transfer case seals have dried out. Spray each seal with silicone until the noise stops.

● GM has mirror kits (PN 12524676, right, and 12524677, left) for 1992-94 Chevy Lumina, Olds Silhouette and Pontiac Trans Sport minivans with mirror glass that vibrates.

● If you have a 1985 or newer Toyota, get free seatbelt extenders from your local dealer. The extenders come in 6-, 9-, 12-, 15- and "beer belly" 18-in. lengths.

● On some BMWs (usually with a manual trans), the most likely cause of burned-out starter motors and inoperative power windows is an ignition switch that's jamming up. The lock housing, lock cylinder and electrical switch must be replaced.



# YOUR OLD FLAME HAS MET ITS MATCH.

If you're still using WD-40®, here's something new to try. Liquid Wrench® Super Lubricant with Teflon®.

It protects and lubricates thousands of things all around your home, workshop and garage. Squeaky hinges. Rusted bolts. Hand tools. Power tools. Lawn and garden equipment. Cars. Boats. And machinery.

But, unlike that WD-40 of yours, Liquid Wrench Super Lubricant with Teflon is non-flammable.

So, drop your old flame like a hot potato and pick up a can of Liquid Wrench. It'll do everything your old flame used to do. With one very obvious exception.

**THE ONLY NON-FLAMMABLE AEROSOL LUBRICANT WITH TEFLON®.**



## NEW PRODUCTS

### IMPROVE YOUR CAR

#### Cooler Running

One of life's lesser pleasures is watching your car's temperature gauge soar while you sit in summer traffic.

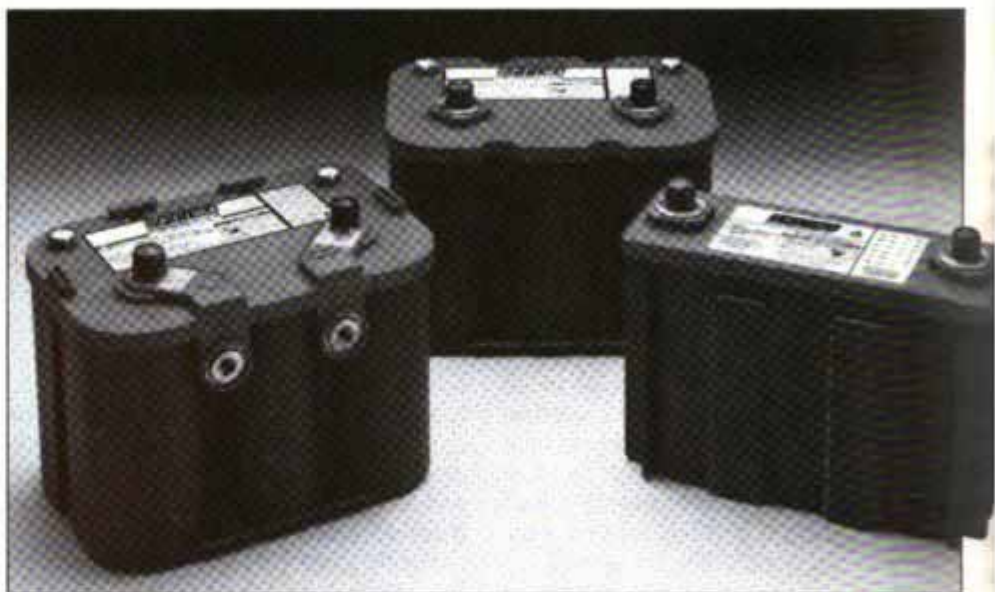
But help is on the way in the form of a coolant additive called 40-Below. The manufacturer says it makes your coolant a better heat conductor, and will reduce water temperature by as much as 40° F when towing, climbing or even sitting in traffic.

The additive

was developed for NASCAR Winston Cup race cars that run under conditions of restricted airflow. Your a/c will blow colder and your heater will blow hotter. 40-Below costs \$24.95, plus \$4 shipping, and comes with a money-back guarantee from Performance Resource, 12 Barbara Dr., Fairfield, NJ 07004; (201) 227-7584.

#### Gas Shock

Owners expect their modern sport/utilities to be tough and rugged, but they also count on those vehicles to coddle them with a near-carlike ride. Gabriel engineered its new Sport Ryder sport/utility gas shock with these seemingly contradictory requirements in mind. Built with stronger components and improved hydraulics, the shocks are precision engineered to be tough in the rough or for towing—but gentle on you. Sport Ryders cost between \$19.99 and \$24.99 and are available at auto parts outlets. Contact Gabriel Ride Control Products Inc., 100 Westwood Place, Brentwood, TN 37027; (615) 221-7433.

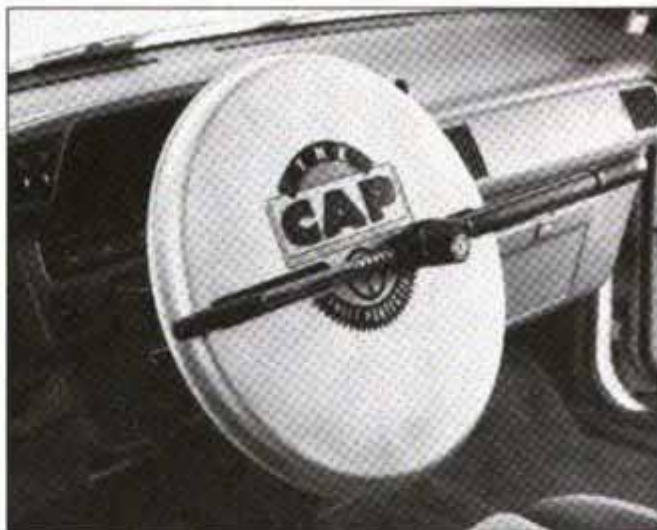


#### Battery With Juice To Spare

If you don't appreciate the game of "starting roulette" each time you turn the key on frosty mornings, it may be time for a new battery. The Optima battery, in 6- and 12-volt versions, delivers up to 850 cold-cranking amps and 120 minutes of reserve capacity. The battery's unique spiral-cell construction provides longer life than conventional batteries. Optima also resists battery-killing vibration and temperature extremes, contains no free acid and is backed by a 2-year free replacement and 72-month limited warranty. The Optima costs \$153 for the 6-volt model and \$182 to \$191 for the 12-volt model. Available through Optima Batteries Inc., 5 E. Mississippi Ave., Denver, CO 80210; (303) 744-5360.

#### Steering-Wheel Cap

Lots of folks rely on steering-wheel cane locks to prevent their cars from being stolen. Unfortunately, an auto thief can slice the steering wheel with a hacksaw in about 10 seconds, then slide off the lock. The Cap makes the thief's job



a little tougher. Made from 18-ga. cold-rolled steel, The Cap locks in place with your existing cane-type lock, completely concealing the wheel so it can't be cut. The Cap, available in 16- and 17-in.-dia. sizes, also protects against another popular crime: airbag theft. The Cap costs \$36.95 and is available from ETC'cessories Inc., 940 Calle Amanecer, Suite D, San Clemente, CA 92673; (714) 492-9915.

#### Super Spark Plug

Hot rodders and racers have known for years that clipping a spark plug's ground electrode produces a stronger spark and better flame front in the combustion chamber. AC Delco's new Rapidfire plug does the rodders a few better. The plug uses a clipped ground electrode for a fatter spark and better fuel economy. A serrated center electrode helps starting and smooths idling.



And erosion-resistant nickel-silver alloy electrodes last almost as long as platinum ones, but aren't as expensive. Rapidfire plugs carry a \$3.99 price tag and are available at auto parts and accessories outlets. Contact AC Delco, toll-free, at (800) ACDELCO.

PM

# Natural Prostate Relief

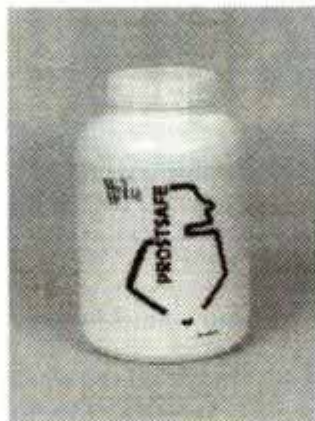
It's a natural fact. If you are a male over 40 and don't already suffer from a prostate gland disorder, the odds are 2 to 1 that you will before you are 59. By the age of 65, most American men have enlarged prostates.

As the years pass, mild discomforts can become disabling. Today, prostate surgery is the second most commonly performed surgery in men over age 65! Surgical complications can include total loss of bladder control and sexual dysfunction.

Prescription drugs may halt the swelling, but rarely ends the suffering. Like many prescription drugs, they have side-effects, like weak erections and low sex drive.

Many doctors feel that prostate disorders can be treated or prevented by giving the prostate gland the nutrition it lacks.

Recent scientific research has shown how to remedy the underlying problems associated with prostate disorders--safely and effectively. These results have been published in the *British Journal of Clinical Pharmacology*, the *American Journal of Gerontology* and papers from the *National Cancer Institute*. They reveal that several vitamins, minerals and natural herbs can dramatically shrink the prostate and improve urinary performance in older men.



Our customers have said  
Prostsafeproduct helps to:

**Halt the endless trips to the bathroom during the night!**

**Stop that burning sensation during or after urination!**

**Prevent uncontrollable wetting!**

**Improve bladder control!**

**Empty bladder completely!**

**Sustain erections and enhance virility!**

**Please a concerned wife!**

The most modern application of these healthy ingredients is found in **Prostsafeproduct** from Whitewing Labs. **Prostsafeproduct** is the nutritional "tool kit" for men with prostate problems, and those who wish to prevent them. It is a mixture of zinc, serenoa serrulata, ginseng, certain amino acids, bee pollen and vitamins A, B-6 and E. Working as a team, these ingredients have been scientifically proven to shrink a swollen prostate.



Dr. Michael Rosenbaum, M.D. says "Prostsafeproduct supplies essential vitamins, minerals and herbs needed to nourish and maintain a healthy prostate."

For as little as a dollar a day, that seems like inexpensive insurance against deadly prostate disorders. If for some reason you are not satisfied, just return the unused portion within 30 days for a full refund.

The reasons why men over 40 use **Prostsafeproduct** are clear. If you are looking for relief, order **Prostsafeproduct** today.

Whitewing Labs, Dept. 129  
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PS1 1 month supply of Prostsafeproduct only \$34.95 plus \$4.50 S&H

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Check enclosed \$ \_\_\_\_\_ CA res. add 8.25% & AZ res. add 5.50%

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*"Now I get a good night's sleep without getting up every two hours to urinate."*

-- Mr. C. Hussy  
Cleburne, TX

*"Prostsafeproduct has stopped the burning after urination."*

-- Mr. C.E. Black  
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*"I empty my bladder and have a good stream of urine with no strain."*

-- Mr. S.J. Hymel  
Houma, LA

*"I previously encountered discomforts such as bladder urgency. These problems are now completely absent."*

-- Mr. B. Doser  
Holland, MI

*"This is a little personal but, how can I say, I am more virile."*

-- Mr. G. Howard  
Cleveland, OH

*"...and in the sex department, my wife thanks you."*

-- Mr. G. Sawin  
Lynwood, WA

## SATURDAY MECHANIC

# KEEPING YOUR WINDSHIELD CLEAR

BY PAUL WEISSLER

● It's a dark and stormy night. Every drop of rain that splatters on your windshield seems to hide another vehicle, camouflaged by the smear of light and haze coating the glass. Even with your windshield wipers set on high, you can't see more than a few feet ahead. Every few blocks you have to stop and wipe the condensation from the inside of the windshield with your hand. It's a dangerous situation.

Your car has several systems that are specifically designed to keep a clear piece of glass—and nothing else—between your eyes and the road. Outside the glass are the wiper

arms, run by an electric motor. Inside is a defogging blower/heater, integral with the heating/air-conditioning system. Keep them at peak effectiveness.

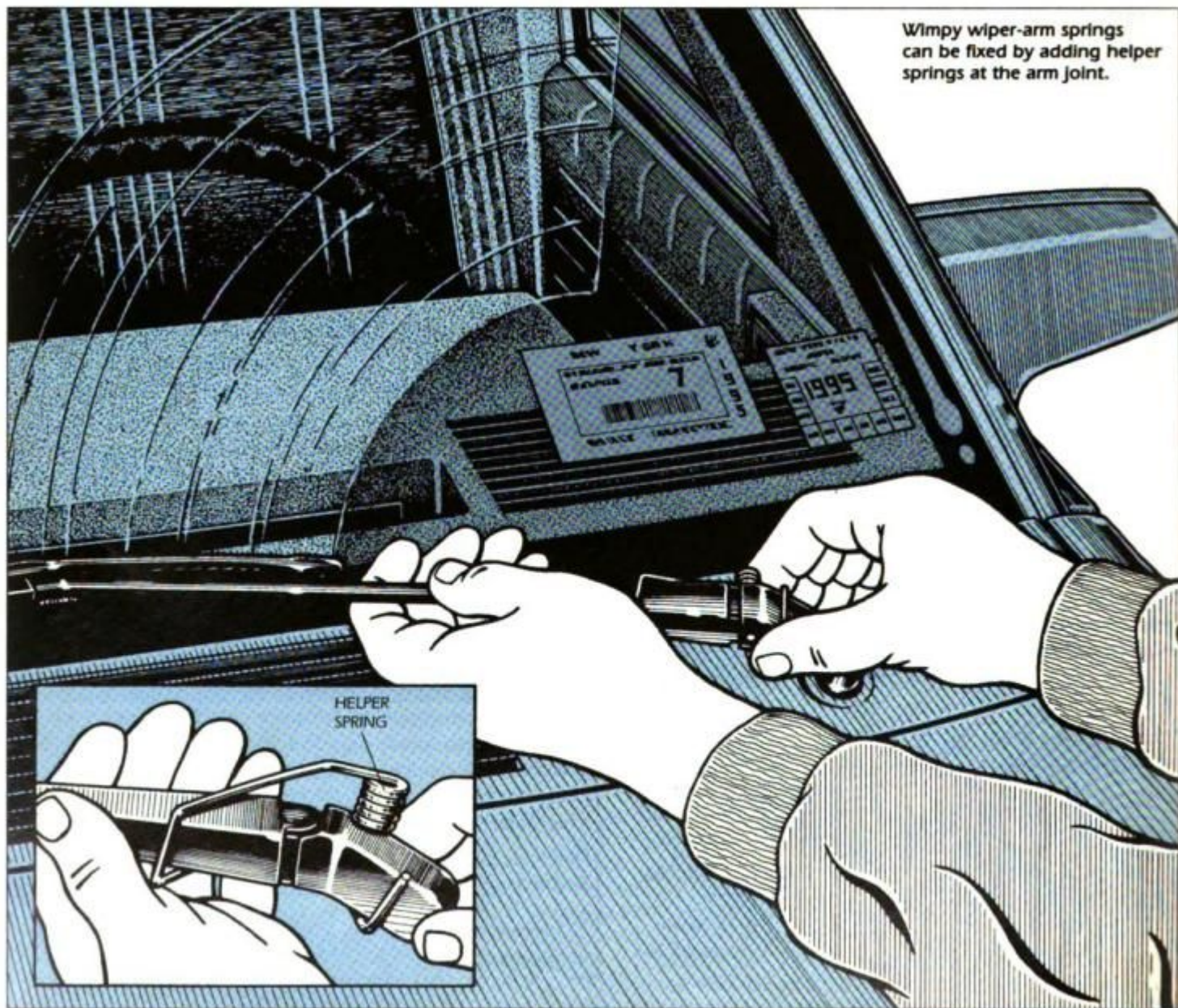
### Slimed

If you get your vehicle washed and waxed regularly, there may be a buildup of silicones on the windshield, layered with the airborne dirt and dust from industrial plants. Even good wipers won't remove this kind of mess. It takes a cleaner with a super-fine abrasive that won't scratch the glass, and, although there are household cleaners in that category, auto

parts stores now carry ones made specifically for windshields. When a windshield is clean, water from a garden hose should "sheet"—flow across it, not bead up.

For winter-freeze protection, fill the washer reservoir with a cleaning solution and antifreeze, not just a mixture of water and alcohol. And never use an abrasive windshield cleaner in the washer reservoir.

Check the spray pattern of the washer nozzle. Although some are nonadjustable, individual tube-type nozzles can be bent slightly to improve the spray position, and the



Wimpy wiper-arm springs can be fixed by adding helper springs at the arm joint.

# WE'LL MAKE THIS AD BRIEF AND TO THE POINT.

The TURBOMAX® drill bit, with the revolutionary JET POINT™ tip. In short, it stays sharp longer, to make even the most challenging jobs go smoothly. Independent tests have shown conclusively that TURBOMAX® bits drill twice as many holes as the leading drill bit.

**PROVEN TO STAY SHARP LONGER EVEN IN 1/4" COLD ROLLED STEEL**



And drill faster.

From the starting point, we set out to design the longest-lasting cutting edge in the industry. We used a computer math model to allow for ultimate control of the point geometry. And we ground the point with a breakthrough superabrasive, CBN, to eliminate the grinding "burn" that can shorten bit life.

Finally, we engineered TURBOMAX® bits to have lower torque values for smoother drilling, and lower thrust values for faster cutting.

That's it. Brief and to the point. So try one today. Once you've used a TURBOMAX® bit, all other bits just seem pointless.

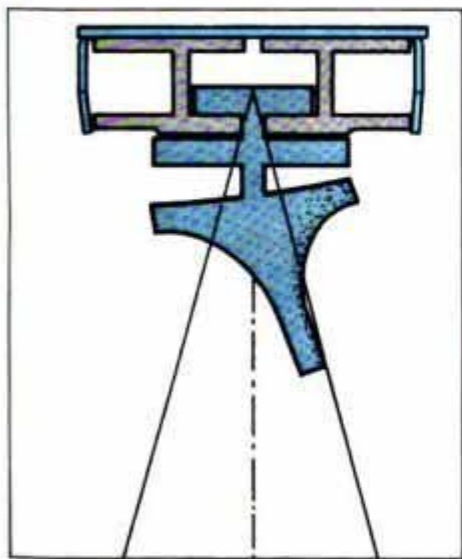
**TURBOMAX**  
STAYS SHARP LONGER



AMERICAN TOOL  
The #1 Brand in every  
franchise of hardware stores

## CAR CARE

base of the nontubular type may be shimmed. The common ball-in-socket variety can be re-aimed, using a straight pin carefully placed in the ball's orifice and used as a lever.



Replace the rubber squeegee in the blade if it's taken a set to one side or the other.

If the wipers chatter and the windshield is really clean, inspect the pivots of the blades. If they're corroded or bent, the blade won't con-

form properly to the glass. Replace it.

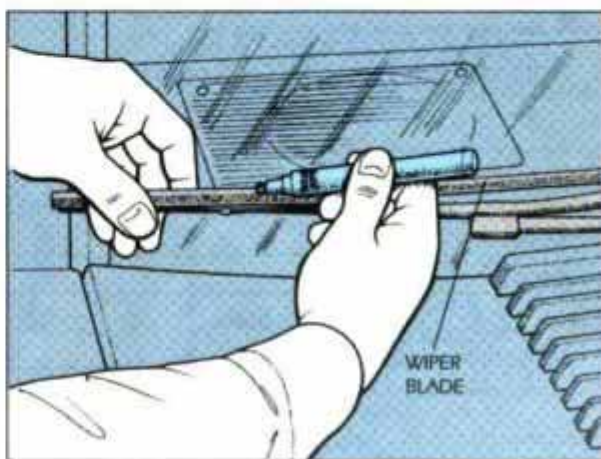
Still chattering? Open the hood and examine the windshield-wiper linkage and mounting. If the motor rocks in its mountings, the blades may chatter. The wiper motor is generally mounted in rubber bushings to reduce noise. Look for broken or deteriorated bushings. Next, check the linkage. Worn bushings and pins can also set up a chatter. If there's anything that can't be tightened, you'll have to begin replacing some parts.

Now check the bushings in the fittings where the wiper arms pivot as they pass through the cowl. Some of these bushings are mounted in rubber, and sometimes it's possible to snug them up. Look for a large-diameter nut below the cowl. The pivot pins themselves can wear, which can also permit chatter to get started. Parts replacement is in order here.

Lift the arm. If it feels weak, compare it with another car, or measure it on a fish scale. The typical

arm, lifted from the blade end, should take about 30 ounces. (Note, however, that fish scales aren't much more accurate than a fisherman's estimate of the length of the big one that got away.) If the arm spring is weak, replacements could set you back more than \$70. Instead, install helper springs—they're sold in auto parts stores for just a few dollars.

Inspect the wiper blades' rubber inserts (the squeegees) for cracks or  
(Please turn to page 101)



A small dab of wiper-blade lubricant can help to keep smearing down and also extend squeegee life.

# Crane Cams Offers the Best & Most Economical Rocker Arms Worldwide!



**Stamped Steel  
Roller Tip  
Rocker Arms  
for  
Chevy Small Blocks  
1.5 or 1.6 Ratio**



**Energizer  
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1.5, 1.6, 1.7 Ratio**



**Stamped Steel  
Roller Tip  
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SB/Chevy 1.6 ratio 7/16"	11747-16	266.72
BB/Chevy 1.7 ratio 7/16"	13744-16	266.72
SB/Ford 1.6 ratio 3/8"	11746-16	266.72
SB/Ford 1.7 ratio	44746-16	266.72 (pedestal mount)

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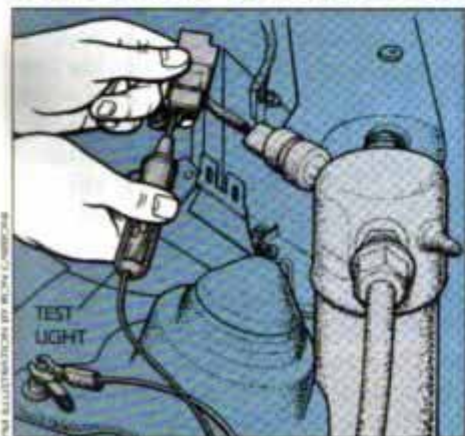


# CAR CARE

other deterioration. It's best to remove the blade, hold it in front of you and see if the rubber squeegee tip is absolutely straight down the center of the blade. If it's wavy or tilted noticeably to one side, replace it. If the blade is good, only the squeegee need be replaced. If the squeegee itself is good, apply a lubricant made for natural rubber to both sides. A quick smear of lube once every week or two should not only extend the squeegee's life, but improve its everyday performance. Again, look in the auto parts store for rubber lubricant. *Don't* use silicone.

## Fogged In

If the inside of the windshield has a permanent "fog," it may be caused by interior air pollution, including tobacco smoke and fumes from



If the blower isn't up to speed, probe the blower-motor relay wiring with a test light.

plastic trim. Vinegar does a good job of removing it, but be sure to wash the glass to help clear away the odor. Another option is to clean the glass with an antifog formula, which leaves an invisible coating that retards interior fogging. Unfortunately, the formulas we've seen are not recommended for tinted windows, so watch where you apply it, or simply stick with vinegar.

When you use the defroster, many cars' ventilation systems automatically turn on the a/c compressor, even in winter (temperatures above 50° F), to condense the interior moisture. If your system has a separate a/c compressor control, you may have to push the a/c button to get the desired effect. And if your control panel has a separate button or lever for outside air versus recirculated air, choose outside air—it'll help purge the interior moisture that you and your passengers release, which is a major cause of the fog that mars a normally clean windshield. This probably sounds counterintuitive—isn't there plenty of moisture coming in with the

fresh air from the cowl vent? Trust us. Fresh air will melt more mist.

Just because you hear the blower fan doesn't mean the air is blowing against the windshield, so put your hand over the defroster outlets. If the airflow is weak, either the ventilation-control system is misbehaving or there's a dashboard duct unplugged, causing the airflow to leak out before it gets to the windshield. If there's strong airflow from another duct when you select DEFROST, the

control panel is probably at fault.

If the blower doesn't seem to come up to speed but *is* turning, there's a fair chance that the high-blower relay used on many cars is faulty. Inspect the area around the blower motor, and if there's a relay wired to it, check the connection. And look around for an inline fuse—wired to the relay—to inspect. It could be blown.

Still have trouble seeing what's ahead on the road? Next time, don't forget your eyeglasses. **FM**

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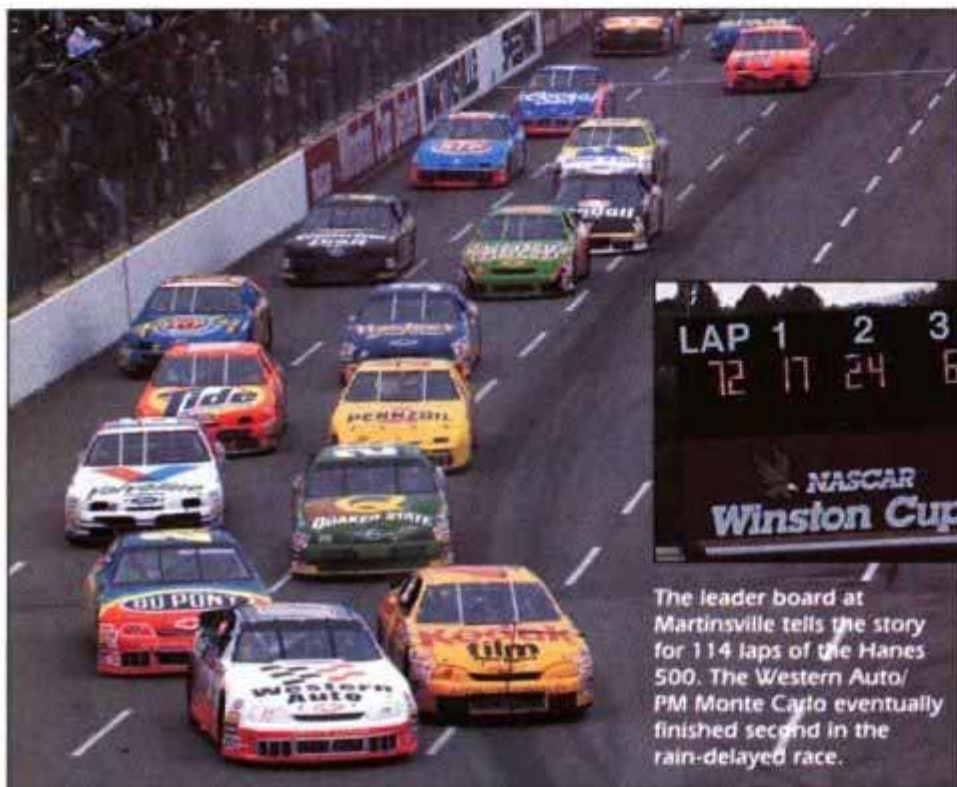


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# SWEET SPRING

The Western Auto/PM team hits its stride.

BY AL PEARCE; PM Photos by Don Hunter



LAP	1	2	3	4	5
	72	17	24	6	43 33

NASCAR  
Winston Cup Series

The leader board at Martinsville tells the story for 114 laps of the Hanes 500. The Western Auto/PM Monte Carlo eventually finished second in the rain-delayed race.

● Darrell Waltrip's eyes light up and his pulse quickens as NASCAR approaches the spring portion of its schedule. And why not? Over the years, he has enjoyed great success at Darlington, South Carolina; Bristol, Tennessee; North Wilkesboro, North Carolina; and Martinsville, Virginia. His five victories at Darlington, 12 at Bristol, 10 at North Wilkesboro and 11 at Martinsville account for 45% of his 84 career victories. In addition, Waltrip has 22 poles and a remarkable 49 top-5 finishes at those tracks.

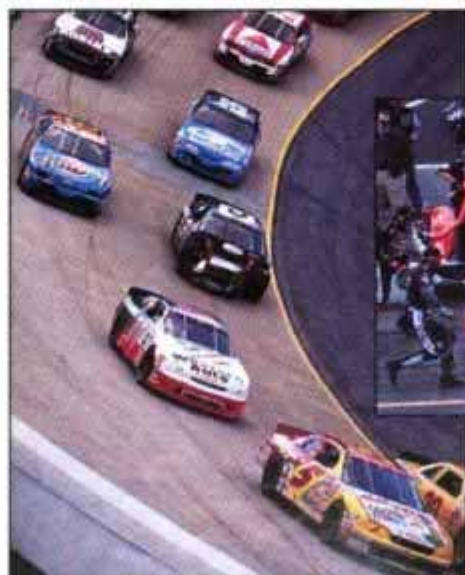
## TranSouth Financial 400

Darlington Raceway is slick, narrow and unforgiving. One end turns abruptly and is steeply banked, while the other end's turn is more gradual and flatter. The pole-winner for its 1950 opener was barely 82 mph. The pole for this year's TranSouth 400 was more than twice that—171 mph.

Darrell and the PM team qualified sixth, then had early race handling problems. The newly repaved asphalt

surface was difficult to read and Waltrip lost two laps before a much-needed chassis adjustment solved most of his problems. But any chance for victory ended, after 190 miles, when his Chevrolet cut a tire and hit the Turn 3 wall.

The team needed 48 laps to patch



the damage. The PM No. 17 Chevrolet finished 21st, 54 laps behind winner Sterling Marlin and runner-up Dale Earnhardt. At the time, it was the fifth consecutive victory for Chevrolet's new Monte Carlo model.

## Food City 500

Things went a whole bunch better at Bristol, a vicious little ½-mile concrete bullring with 36° banked turns. Waltrip started 12th on the 36-car grid, stayed near the front and finished third. "Overall, it was a great day," he said. "The car handled right, it certainly ran well and the crew did a great job. We were good today and we're going to get better."

Outside pole-sitter Jeff Gordon led 199 of the 500 laps to beat the lead-lap top-5 cars of Rusty Wallace, Waltrip, Bobby Hamilton and Ricky Rudd.

Ever the charger, Waltrip reeled in runner-up Wallace toward the end but came up several lengths short. "I did all I could and Rusty did all he could," Darrell noted after the race. "I was catching him, then got hung up in traffic. I wanted to be the second-best Chevrolet, but we had a real good day. Not as good as I would have liked, but okay. We'll be a lot better when we come back in August."



Waltrip (with the help of the pit crew of the Western Auto/PM team) ran flawlessly at Bristol, working his way up through traffic—getting ready to reel in Terry Labonte and brother Michael—from 12th to third before the checkered flag fell.



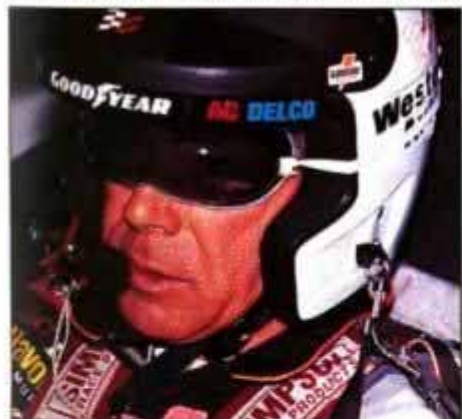
Waltrip ran with Marlin and Earnhardt before losing a tire, earning a Darlington stripe.

### First Union 400

The team continued to show well at North Wilkesboro. Nestled in the foothills of the Blue Ridge Mountains, the track measures  $\frac{1}{2}$  mile and has low-banked turns. Cars run downhill into Turn 1 and uphill along the backstretch into Turn 3.

After qualifying 22nd, Waltrip ran a solid race, earning the Western Auto/PM Monte Carlo a 10th-place finish. After running well in the early stages, his Chevrolet began plowing toward the wall in the turns. With eventual winner Dale Earnhardt in fine form, it wasn't long before Waltrip became an also-ran.

"We got one set of tires that made it push," he explained. "I panicked, and when we fixed the push, it made



Waltrip is psyched up at the start of the First Union 400 at North Wilkesboro.

the car loose. We were excellent, then got messed up. We hung in there pretty good most of the time."

### Hanes 500

The team's best result through Round 8 was at Martinsville, the tour's shortest and slowest track. Since it's barely a  $\frac{1}{2}$ -mile track with low banking, qualifying speeds are in the low 90s, and race speeds, in the high 80s.

Most of the teams dread 500 close-quarter laps at Martinsville. Waltrip is an exception—he welcomes the

track's physical and mental challenges. More than speed and power, Martinsville races are won with finesse and guile—and with strategy and midrace adjustments.

All were factors in the Hanes 500. After preparing in summerlike weather, teams faced cold and damp conditions race-day morning. Crews quickly changed shocks and springs and adjusted carburetor-jetting because the air was cooler and heavier.

Waltrip quickly moved from fourth to first when the race started 2½ hours later. He led for 114 laps, and

was second to eventual winner Rusty Wallace when rain forced a 2-hour 8-minute delay after 183 laps.

During the break, Waltrip and crew chief Pete Peterson agreed not to pit for tires and gas on the restart. They wanted to regain the lead when everyone else pitted, then ride that advantage to victory. It might have happened—if the 500 had ended shortly after halfway.

Instead, the race went to lap 356 and ended in near-darkness. By then, Waltrip had lost a lap with a green-flag pitstop, regained it and charged from ninth in the final 43 laps to reach fourth place at the checker. All told, the PM team led twice for 146 laps—more than it had led in the first seven races combined.

"We had no idea it would go 356 laps," Waltrip said. "We second-guessed NASCAR, thinking it might go to lap 251 or 275 and call it. We would have been in the catbird seat if they had. We gambled and lost, but I don't feel bad because you can't win if you don't try. I would have won if it had gone all the way."

Overall, it was a very sweet spring. The Western Auto/PM team had three of its four top-10s and both of its top-5s in April. After being 30th in points after Round 5, the team stood 16th after Round 8. **PM**

# Mind Power Breakthrough!

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By Dane Spotts



Absolutely mind blowing!!! I popped a French Learning CD into the Learning Machine™. Immediately I was sucked into a deep, dream-like trance. Weird colors and patterns

were created on the insides of my closed eyelids. While in this super-relaxed but hyper-aware state, the special Learning CD began unfolding its magic programming.

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It was as if a movie were playing inside my head. I could see myself in France having lunch at the Eiffel Tower. The music, the sounds, even the fragrance of summer in Paris. A beautiful woman spoke to me. "Bonjour, mon ami," she said. In an almost unconscious way I began following the dialogue. The mental imagery was so intense I not only understood what was going on, it was like I was there.

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Beyond virtual reality, the light-sound matrix stimulates your mind and opens your learning centers. Like magic it pours in new information, skills, mental programming, and launches your imagination.

want to show off its other incredible mind expanding powers.

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Plus in addition to the Language Learning Library, the SuperPhonics, Super Speed Reading, Super Memory, and Super Vocabulary programs, the 3-D Mind Sync Library, and the InnerMind Programming Library (a \$600 combined value), I'm including coupons worth a thousand dollars. These coupons are for hundreds of future Learning CD applications, including software that links your mind directly to a multi-media computer. It's something you absolutely must experience.

Try the Learning Machine for 30 days risk free. Take your mind on an incredible journey. If for any reason you're not totally blown away by the experience, send your kit back to me for a full refund.

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## Oldsmobile Aurora

The Aurora has to be one of the finest driving cars GM has ever produced. Even those of us who have spent lots of seat time in our long-term Aurora still come out of the car raving about its fabulous ride, handling and strong over-the-road character. This is a car BMW owners should drive before quoting the copywriters about that "ultimate driving machine" stuff. The stout 250-hp V8 engine just loves to

### TEST SUMMARY: OLDSMOBILE AURORA

Report number: 3  
Total miles driven: 15,670  
Miles driven since last report: 8674  
Average fuel economy: 19.0 mpg  
Worst observed fuel economy: 14.9 mpg  
Best observed fuel economy: 26.0 mpg  
Maintenance/repair costs: 6000-mile service, \$67.43

run, and the car feels locked to the road at speed. Six degrees of positive caster built into the front end see to it.

We loaned the car to our sister publication, CARSMART, for three weeks to use in a feature article titled "Memphis To Mobile." During that stretch, the car blasted around the South for more than 5000 miles of punishingly hard driving. The car then returned for more general and commuter duty in and around the New York City area. It has been cutting a keen swath along the New Jersey Turnpike since then—and impressing us with an 18.99-mpg rating.

Before the car left for Southern climes, we had a by-the-book service performed, and the right-rear electric window was repaired under warranty. Since then, the car has developed a wind leak around the driver's window.

At 13,990 miles, the dashboard message center began to plead CHANGE OIL NOW. We will. Soon. —J.O.

## Chevrolet Lumina LS

Funny thing about our Lumina. Just after our last report, we were bringing the car to our dealer, though it had less than 4000 miles on it. The dohc V6 was idling roughly, to the point of stalling more than a few times—in rush-hour traffic—and the brake pedal felt as though there was a semi-ripe cantaloupe between it and the calipers.

### TEST SUMMARY: CHEVROLET LUMINA LS

Report number: 3  
Total miles driven: 10,075  
Miles driven since last report: 3947  
Average fuel economy: 20.2 mpg  
Worst observed fuel economy: 14.7 mpg  
Best observed fuel economy: 24.3 mpg  
Maintenance/repair costs: 7500-mile service, \$87.35

Well, after spending the better part of a week at the dealership, our Lumina returned to us. The brake pedal feels firmer, the 24-valve V6 hums rather than lopes off stride, and there's a CD

player in the dash where the cassette player used to be. However, the repair order shows that the technicians found nothing wrong with the engine or the brakes! Oh, but the car was down better than a quart of oil when returned.

The bottom line here is that while the dealership experience may have been less than we—and the folks at Chevrolet—would have hoped, our Lumina is now just hauling. Those on the staff who didn't like the lumbar of the front seats still don't. Those who like all that firmness in the small of the back still appreciate the support. The brakes slow and stop the car when asked. Best of all, the sweet chassis continues to work superbly, straightening out the curves and allowing our black sedan to unceremoniously suck the doors off unsuspecting cars of fancier breeding with more digits after their dollar signs. —D.C.

## GMC Sonoma SLS

With 16,138 on the Sonoma's odometer, we finally made it over to Martin GMC Truck in West Los Angeles for the truck's 12,500-mile service. Because of our tardiness, Pete, our service rep at Martin, recommended that we also have the transmission serviced, which is part of the 15,000-mile scheduled maintenance. We asked them to fix the only problem with the truck to date—a squeak in the right rear of the passenger cabin.

### TEST SUMMARY: GMC SONOMA SLS

Report number: 3  
Total miles driven: 18,374  
Miles driven since last report: 5741  
Average fuel economy: 20.2 mpg  
Worst observed fuel economy: 15.0 mpg  
Best observed fuel economy: 23.6 mpg  
Maintenance/repair costs: 12,500-mile maintenance, \$220.39

When we picked up the truck that afternoon, they had fixed the squeak—a loose right-rear stereo speaker was to blame—but whoever fixed it failed to retighten the plastic panel that covers the speaker and makes up the rear seat—now it squeaks. We're going to have the panel tightened at the next scheduled maintenance.

On top of that, we were handed a bill for \$220.39! On a \$17,000 truck, we think \$220 is steep for a routine service that included the replacement of the transmission oil, filter and gasket, a chassis lube, an engine-oil-and-filter change, a diagnostic inspection and the rotation and balancing of four wheels and tires. The same service on a \$55,000 Lexus LS 400 costs \$280. More importantly, similar service on a Ford Ranger pickup runs \$130.

It's a shame our dealer hasn't proven as solid as the vehicle. The Sonoma defines "bulletproof." Everything about it still feels brand new. —S.O.

## Dodge Ram 1500 Laramie SLT

Sometimes there's no substitute for a full-size pickup truck—like when you're moving to a new home. Pile it higher and deeper, and lash more on top. The Ram carried more than I was willing to load and unload in one day, and it doesn't get tired. What it does get is 16 mpg—amazing for a truck with so much bulk and power. We've been commuting into Manhattan with it, and it's nearly perfect. With plenty of suspension to soak up potholes and lots of scoot to play chicken with taxis, the Ram's high seating position gives you a panoramic view of the congestion.

The truck has been back to the dealer for its 7500-mile service, and the dealer replaced the upholstery on the driver's seat under warranty.

### TEST SUMMARY: DODGE RAM 1500 LARAMIE SLT

Report number: 4  
Total miles driven: 10,518  
Miles driven since last report: 1816  
Average fuel economy: 17.5 mpg  
Worst observed fuel economy: 11.5 mpg  
Best observed fuel economy: 19.2 mpg  
Maintenance/repair costs: 7500-mile service, \$124.75

(A small seam near the hinge had opened up, easily sewed at any trim shop. But the dealer elected to replace the entire cover.) Now, as we begin to gird ourselves for the beginning of the spring landscaping season here in the Northeast, the big blue truck is facing a line of editors, all ready to start hauling every manner of natural growing thing. Unfortunately, they'll have to hurry—as we write this, our test of the Ram is drawing to a close. It's pretty hard to believe that we've hauled ourselves and other stuff around in it for a year already. We're all going to miss this truck when it leaves the fleet. You see, besides all the utility and fun we've gotten out of it, we've had no other problems.

—Mike Allen

## Hyundai Sonata GLS

In the old days, they would call this car loaded. Add up the spiffy stuff like the AM/FM/cassette/CD playing out of a 10-speaker system, dual airbags, a/c, automatic overdrive transmission—and that's just to start. The point is that you get all this in a tidy compact package for well under the average selling price for a new car, which is \$20,000-plus. Our Hyundai Sonata GLS test car is less than \$17,500.

For first-time drivers, the Sonata is one of the easiest cars to step in and drive. Seats, while not plush, are slightly form-fitting. The transmission shifter falls close at hand, the steering wheel adjusts to fit your sightlines, and radio and heater

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### LONG-TERM TEST CARS

controls are easy to read and reach from both driver and passenger sides.

We're continually surprised by the response of the Sonata's V6 engine. At most driving speeds, it purrs with contentment. Tromp on the accelerator and you get a strong surge of power that's unusual in a small sedan.

But there are some rough edges. Want a jolting experience? Just shift the transmission into DRIVE while the car is barely rolling backward—like when you back out of the driveway. You'll feel a solid jerk that pulls you forward without any cushion in the transmission shift. Another is an annoying engine hesitation—for only an instant—that occurs shortly after the cold engine is started.

There are also some teething problems. Taking the car in for its 7500-mile maintenance, we had the dealership check into various trouble spots. And though they were repaired under warranty, the engine ended up with a new oil pump and cam-timing tensioner. Both front-brake rotors were out of round and had to be replaced.

**TEST SUMMARY: HYUNDAI SONATA GLS**  
 Report number: 3  
 Total miles driven: 12,260  
 Miles driven since last report: 4001  
 Average fuel economy: 22.1 mpg  
 Worst observed fuel economy: 16.9 mpg  
 Best observed fuel economy: 32.3 mpg  
 Maintenance/repair costs: 7500-mile service, \$148.48

So, you have to look at the Sonata in two ways. For its size, price and equipment, this is one heck of a deal. However, our Sonata has had more than its share of problems in 12,200 miles of city and highway driving.

As we begin the second half of our first driving year, the Sonata remains wonderfully equipped, perky and fun to drive—it scooted more than 30 miles for each gallon of no-lead during its trip from New York to Detroit. Now that the bugs have been worked out—painlessly and under warranty by Hyundai—we're looking forward to many more miles of luxury and economical fun. We think that's just what we'll get, too. —*Jim Dunne*

### Plymouth Neon Highline

Everyone who drives this car uses the same word to describe its character: zippy. "It's a zippy car." "The Neon zips around traffic." "This is one zippy ride." Driving the Neon makes you feel like driving zippy, too. You find yourself pushing it around, diving for holes in traffic you normally wouldn't even consider and, in general, giving the car a real workout.

The Neon seems to thrive on it. In fact, since our last report, our long-term Neon has been getting its wish.

For the past three months, it has become our around-town beater—meaning traffic-snarled New York City. Manhattan, to be exact. As such, we've added only about 1500 miles to

**TEST SUMMARY: PLYMOUTH NEON HIGHLINE**  
 Report number: 3  
 Total miles driven: 10,195  
 Miles driven since last report: 1746  
 Average fuel economy: 27.3 mpg  
 Worst observed fuel economy: 22.2 mpg  
 Best observed fuel economy: 36.5 mpg  
 Maintenance/repair costs: none

the Neon's odometer—most Manhattan trips consist of a-few-blocks-and-stop, a-few-blocks-and-stop, etc. You don't roll up the miles like you do pounding down interstates at 75 mph. But make no mistake. Stop-and-go driving in an environment like New York City is definitely severe duty.

All this, not to mention potholes the size of small Moon craters, missing manhole covers, Con Edison construction sites, ancient Belgian-block street surfaces and homeless people who punch your fender if you don't give them a dollar. The hazards of city life are many for a Plymouth Neon, and our zippy test car soldiers on, thumbing its nose at it all. —*J.O.*

### Mazda Millenia S

We returned our Millenia S to Mazda with nearly 20,000 miles on the odo—and with some mixed feelings. We loved the sleek exterior, but the interior ergonomics are too offbeat. We appreciated the smooth ride and handling, but the suspension was soft.

We reveled in the way the steering wheel automatically adjusted itself out of the way when the engine was turned off. And the driver's seat offered one of the most comfortable po-

**TEST SUMMARY: MAZDA MILLENIA S**  
 Report number: 4  
 Total miles driven: 19,556  
 Miles driven since last report: 5805  
 Average fuel economy: 21.8 mpg  
 Worst observed fuel economy: 18.1 mpg  
 Best observed fuel economy: 23.9 mpg  
 Maintenance/repair costs: none

sitions we've experienced in a long time. Yet the controls for the stereo system and a/c were annoying and cumbersome. We enjoyed more than enough head- and legroom in the cabin, but the automatic climate control needed constant adjustments. The 6-disc, trunk-mounted CD changer was a luxury, but its location and the small trunklid opening interfered with bulky items that required awkward maneuvering to fit them inside.

All in all, the Millenia has its own distinctive design and some really nice touches. If Mazda can work out the kinks, it offers a truly unusual alternative. —*Deborah Frank*

## TECHNOLOGY UPDATE

# 500 miles from nowhere, it'll give you a cold drink or a warm burger...

NASA space flights inspired this portable fridge that outperforms conventional fridges, replaces the ice chest and alternates as a food warmer.

By Charles Anton

**R**ecognize the ice cooler in this picture? Surprisingly enough, there isn't one. What you see instead is a Koolatron, an invention that replaces the traditional ice cooler, and its many limitations, with a technology even more sophisticated than your home fridge. And far better suited to travel.

What's more, the innocent looking box before you is not only a refrigerator, it's also a food warmer.

## NASA inspired portable refrigerator.

Because of space travel's tough demands, scientists had to find something more dependable and less bulky than traditional refrigeration coils and compressors. Their research led them to discover a miraculous solid state component called the thermo-electric module.

Aside from a small fan, this electronic fridge has no moving parts to wear out or break down. It's not affected by tilting, jarring or vibration (situations that cause home fridges to fail). The governing module, no bigger than a matchbook, actually delivers the cooling power of a 10 pound block of ice.

**From satellites to station wagons.** Thermo-electric temperature control has now been proven with more than 25 years of use in some of the most rigorous space and laboratory applications. And Koolatron is the first manufacturer to make this technology available to families, fishermen, boaters, campers and hunters—in fact anyone on the move.

Home refrigeration has come a long way since the days of the ice box and the block of ice. But when we travel, we go back to the sloppy ice cooler with its soggy and sometimes

spoiled food. No more! Now for the price of a good cooler and one or two seasons of buying ice, (or about five family restaurant meals), all the advantages of home cooling are available for you electronically and conveniently.

**Think about your last trip.** You just got away nicely on your long-awaited vacation.

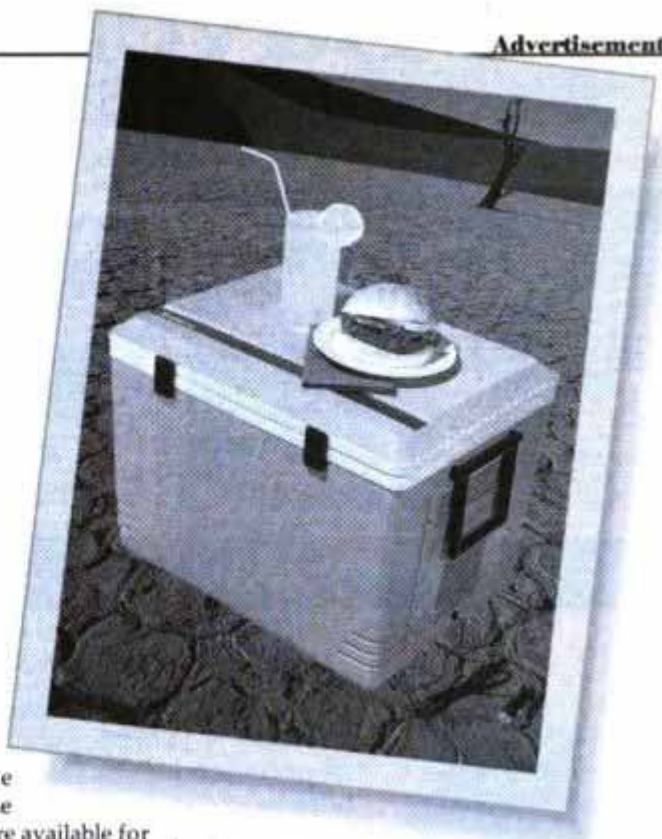
You're cruising comfortably in your car along a busy interstate with only a few rest stops or restaurants. You guessed it... the kids want to stop for a snack. But your Koolatron is stocked with fruit, sandwiches, cold drinks, fried chicken... fresh and cold. Everybody helps themselves and you have saved valuable vacation time and another expensive restaurant bill.

**Hot or cold.** With the switch of a plug, the Koolatron becomes a food warmer for a casserole, burger or baby's bottle. It can go up to 125 degrees.

And because there are no temperamental compressors or gasses, the Koolatron works perfectly under all circumstances, even

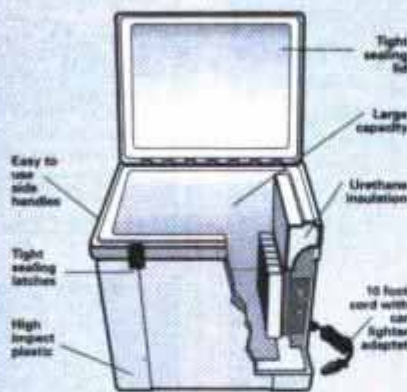
upside down. Empty, the large model weighs only 12 pounds and the smaller one weighs just seven. Full, the large model holds up to 40 12-oz. cans and the smaller one holds six.

**Just load it up and plug it in.** On motor trips, plug your Koolatron into your cigarette lighter; it will use less power than a tail light. If you decide to carry it to a picnic place or a fishing hole, the Koolatron will hold its cooling capacity for 24 hours. If you leave it plugged into your battery with the engine off, it consumes only three amps of power.



## The refrigerator from outer space.

The secret of the Koolatron Cooler/Warmer is a miniature thermo-electric module that effectively replaces bulky piping coils, loud motors and compressors used in conventional refrigeration units. In the cool mode, the Koolatron reduces the outside temperature by 40 degrees F. At the switch of a plug, it becomes a food warmer, going up to 125 degrees.



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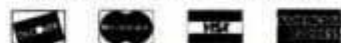
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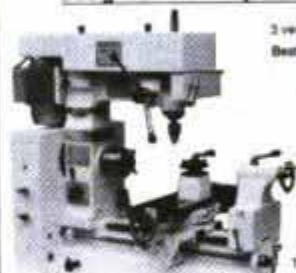
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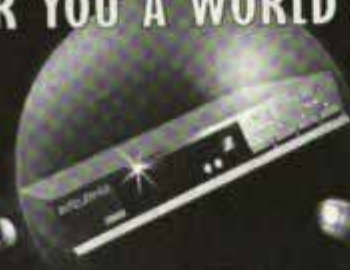
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**TOYOTA T100**  
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©1994 Toyota Motor Sales, U.S.A., Inc. Buckle Up! Do it for those who love you. \*17/20 city/highway EPA estimated mpg for 4x2 Xtracab DX with 5-speed manual transmission. See your Toyota dealer for details. \*\*Performance based on USAC-certified acceleration tests, w/ and w/o 500-lb. payload. T100 Xtracab SR5 versus similarly equipped full-size extended cab standard V8 Chevrolet, Dodge and Ford trucks. \*\*\*Including occupants, equipment and cargo on 4x2 Xtracab DX with 5-speed manual overdrive transmission. \*4x2 V6 models not to exceed GCWR of 9,200 lbs. Requires Class IV-rated towing hitch receiver. \*\*To help avoid serious injury, always wear your seatbelt. Driver air bag is a supplemental restraint only.