

JANUARY 1992 \$1.95

Popular Mechanics



LEARN TO FLY -ON US!

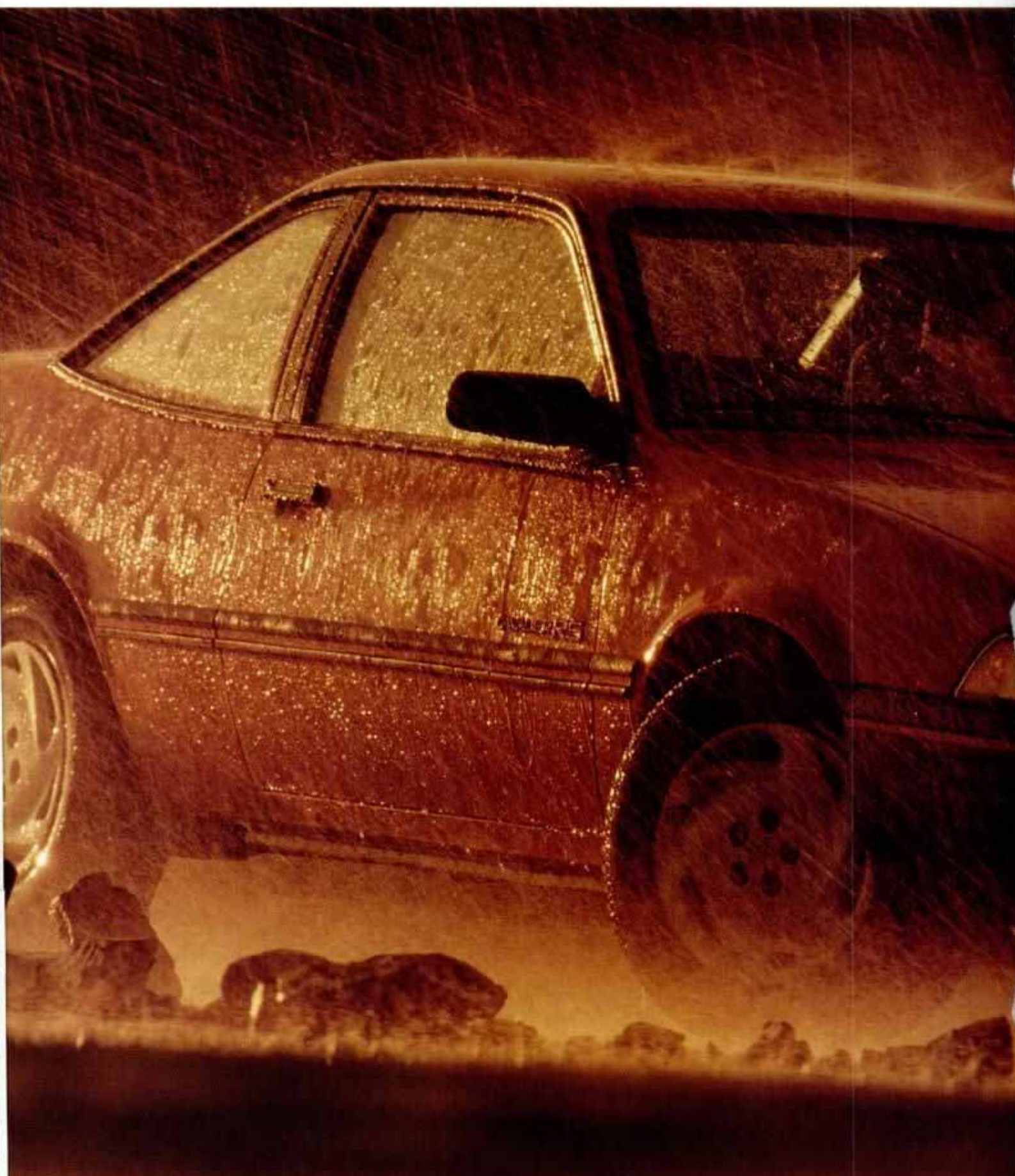
Here's What It Takes
To Get Your Pilot's
License. Win Our
Contest And We'll
Put You In The
Pilot's Seat Free



**1992
DESIGN &
ENGINEERING
AWARD
WINNERS**

MONSTER TRUCK MADNESS
What Makes Bigfoot Tick



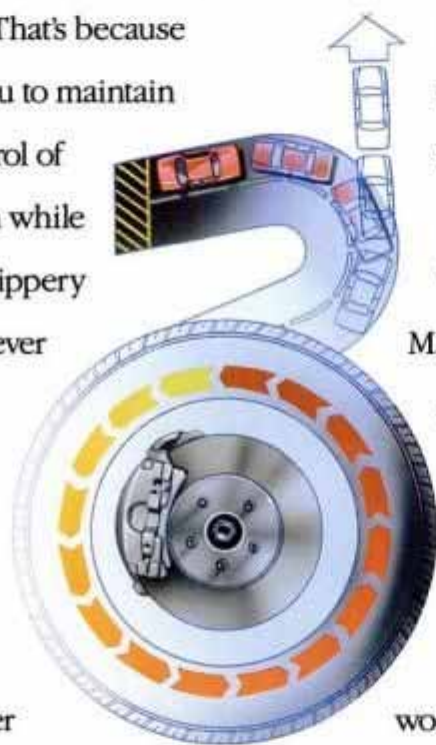


CHEVROLET CAVALIER RS

CHEVY EQUIPS MORE 1992 MODELS WITH STANDARD ANTI-LOCK BRAKES THAN ANYONE.

Anti-lock brakes (ABS) may be one of the most important safety features to come along in a decade. That's because ABS helps you to maintain steering control of your car even while braking on slippery roads. Whenever your wheels begin to lose traction during braking, the ABS computer "pumps" your brakes on and off up to 15 times a second. That's faster than even the most experienced driver could pump them. And the result is both better

control for you and shorter stopping distances. ♦ But anti-lock brakes are only



one part of a total safety system developed for your Chevrolet. We have more M.D.s and Ph.D.s at GM involved in automotive safety than any other car company in the world. At Chevrolet,

we give you even more than you would expect to protect you from the unexpected. ♦ No wonder Chevrolets are the cars more people depend on.



THE 1992 CHEV

IF YOU'RE NOT DRIVING A 1992 CHEVROLET, WHAT'S STOPPING YOU?

CHEVROLET SAFETY

This year, Chevrolet brings the advanced technology of 4-wheel anti-lock brakes (ABS) to more models than any other manufacturer. In fact, we even make them standard on our least expensive 1992 Cavalier. You see, at Chevrolet we believe the best way to protect you in an accident is to help you avoid one in the first place.



THE HEARTBEAT
OF AMERICA IS
WINNING.™



January 1992

Dear Friends of **Popular Mechanics**:

The beginning of a new year is always exciting, it's that time when we think back on the past year and what we've done, and look forward to the upcoming year and what we want to accomplish. Setting resolutions for the New Year and planning the time to follow them through.

For **Popular Mechanics** it's not just another new year, it's our 90th anniversary year. And when we look back on the past years, it seems as though our New Year's resolution remains one and the same year after year: To enlighten our readers with knowledge in the areas of their personal interests. With the same premise as the women's service books, **Popular Mechanics** is the original men's service monthly magazine.

Ninety years ago we began as a magazine that informed men of the latest technological advances relating to the home, transportation, space, defense, electronics. It was this information that men sought after; it effected their daily lives. Today, and throughout the past 90 years, men's interests have remained the same, and so has our editorial focus. Today our reach is rising, our newsstand sales are up. This issue kicks-off our year-long celebration of 90 years with a look at the past 9 decades of technology as reported in the pages of **PM**.

Serving our readers' wide range of personal interests is what **PM** is all about, with articles ranging from new automobiles to in-depth explanations of how our sports heroes of today excel. Even the advertisements serve our readers' interests with products and services they need and desire.

Our commitment to service has lead to the creation of the **Popular Mechanics Design & Engineering Awards**. Recognition is given to a manufacturer for a technological improvement of a product that in some way benefits the consumer. The winners of the *2nd Annual Design & Engineering Awards* are featured in this issue.

We're looking forward to the upcoming year, the celebration of our 90th anniversary, and seeing that once again our New Year's resolution is carried out month after month. We're looking forward to enlightening our readers with the latest advancements, and to bringing to their attention advertisements for the various products and services that enhance their lifestyles.

From the original men's service monthly magazine, **Popular Mechanics** wishes you and yours a happy and healthy New Year.

Sincerely,



USB1-PW9-JL3A

A handwritten signature in black ink that reads "Bob Dillingham". The signature is written in a cursive, flowing style.

Bob Dillingham
Vice President & Publisher

1902-1992



Chevrolet and the Chevrolet emblem are registered trademarks and Chevy and Cavalier are trademarks of the GM Corp. ©1991 GM Corp. All Rights Reserved. Buckle up, America!



Black Velvet® Blended Canadian Whisky, 40% Alc. By Vol. (80 Proof) © 1999, Heublein, Inc., Hartford, CT.

THE VELVET TOUCH

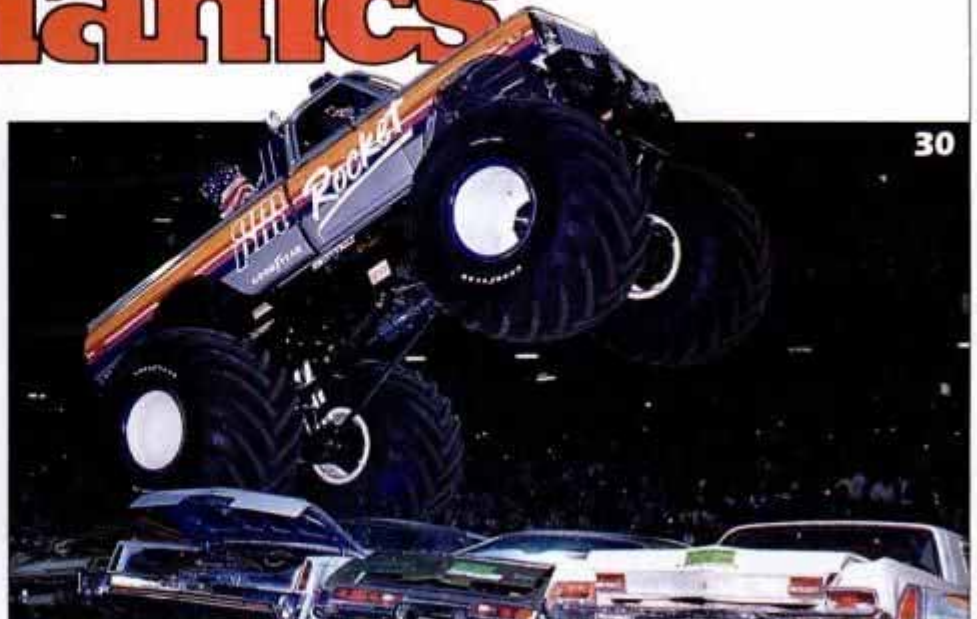


BLACK VELVET.®
SMOOTH. PREMIUM. IMPORTED.

Материал, защищенный авторскими правами

Popular Mechanics®

JANUARY 1992
VOLUME 169
NO. 1



DESIGN & ENGINEERING AWARDS 1992

19 The Best Of The Best

Our recognition of outstanding technological achievement.

AUTOMOBILES

30 Inside Those Wild Monster Trucks

The nuts and bolts of crushing cars for fun and profit.

43 Owners Report: Ford Explorer

Everybody loves this outstanding vehicle.

71 Car Care

- **Maintenance Basics:** Suspensions
- **Saturday Mechanic:** Fixing MacPherson struts
- **Car Clinic:** Car Care Q&A

92 Detroit Spy Report

An all-new Ford Tempo for 1994, the next-generation Pontiac Firebird, more.

HOME IMPROVEMENT

49 Home And Shop Journal

- **Comparison Test:** Belt sanders
- **How It Works:** Humidifiers
- **Home Improvement:** New tools
- **Home Maintenance:** Radiator tuneup

62 Appliance Clinic

Answers to fix-it questions.

68 Homeowners Clinic

Home maintenance Q&A.

SCIENCE/TECHNOLOGY

11 Tech Update

- A personal maglev transporter
- Boeing's Mars lander concept
- 'Caterpillar drive' for ships gets real
- C-17's first flight

13 Learn To Fly, On Us

Win our contest and we'll pay for your lessons.

35 Wings Of Man

Our Science/Technology Editor gets his pilot's license in 21 days.

82 Science

Living for 2 years in a biosphere.

96 Aviation

The Lost Squadron—an update.

ELECTRONICS

46 New TVs

The hottest sets out are flat, not fat.

84 Home Video

Incredible shrinking camcorders.

87 Electronics

Portable data discs know.

89 Photography

Smart cameras do it all.

BOATING/OUTDOORS

24 Comparison Test: Center-Console Boats

Six small tide runners shoot it out.

94 Outdoors

50 years of Ski-Doo.

DEPARTMENTS

4 Editor's Notes 8 Letters

6 Time Machine 114 Coming Next Month

EDITOR'S NOTES

● On January 11, 1902, Henry H. Windsor published the first issue of **POPULAR MECHANICS**, "An Illustrated Weekly Review of the Mechanical Press of the World." Little did Windsor know that he was not only starting a magazine but also laying the cornerstone of a piece of Americana.

Today, on the occasion of our 90th birthday, I can proudly say that **POPULAR MECHANICS** is much more than merely a magazine. In our 90 years of existence, we have chronicled on our pages the technological miracle of the 20th century, and in so doing, we've become somewhat of an institution ourselves.

Think about it. Every important technological invention has come of age in the past 90 years—automobiles, airplanes, computers, television, lasers, space travel, nuclear power, man-made fibers. All of these developments have changed the way we live. And we have been the magazine that explains it all to the world. Or as Henry Windsor said, "Written so you can understand it."

Windsor named the magazine **POPULAR MECHANICS**. He used the word "mechanics" in its broadest sense—i.e. the way things work, as in the mechanics of the solar system or the mechanics of music. The word "popular" came from the Latin root "populi", or the people. So **POPULAR MECHANICS** was a magazine that explained the way things worked to the people. It was needed at the turn of the century, too, as the world was a very rapidly changing place, with inventions coming a mile a minute.

Henry Windsor was something of a genius. Without knowing it, he set up a framework—a format—for our magazine that has lasted 90 years. If you look at the early issues of **POPULAR MECHANICS**, you'll find many elements that will seem familiar to readers of today's **PM**. There was always a recap of the latest innovations in science and technology. Feature articles told about such wonders as the first submarine, electric cars, systems for water purification, high-tech telephone systems, innovative hull shapes that made speedboats faster, X-rays, locomotives to speed one's travel. And there were how-to articles on etching glass, adding a room to one's home, and in general, making one's living environment more pleasant.

In the ensuing years, the subject matter changed but the format—the framework—has remained the same. Today, you'll find our Tech Update section covering all the latest innovations in science and technology. Our feature articles are about cars, boats, planes, trains, electronics, outdoors, science and technology. Then as now, military technology is an area of high interest. In fact, the cover of the first issue shown here depicted the interior of the first submarine which the British Navy had made operational.

POPULAR MECHANICS

An Illustrated Weekly Review of the Mechanical Press of the World



Popular Mechanics

90 YEARS

In the early years, there was a home improvement section called Shop Notes. Today, we call it the Home & Shop Journal.

Yes, Henry Windsor was a genius. His invention, this magazine, has lasted 90 years and is still going strong. Lasting 90 years, whether

you're a human being or a magazine, is an occasion for celebration. And that's what we intend to do all year, with special events, special features and special occasions.

We kick it all off next month with a special 90th anniversary section that will take a look back at some of the highlights of 90 years of publishing a magazine that has explained a rapidly changing world to its readers.

In the March issue, you'll find a very special article that previews an exhibit we're putting together along with the terrific staff of the Henry Ford Museum in Dearborn, Michigan, which is just outside of Detroit. Some of you may remember the ads we ran two years ago asking readers if they knew the whereabouts of some of the milestone machines and artifacts that have graced our pages in the past. Thousands of you responded with information that led to many of the artifacts that will be in our exhibit. Not only will you be able to preview the exhibit, which has taken five years to bring to fruition, but you'll also learn how you can see the exhibit for yourself, in person.

Also in our March issue, you'll find a free bound-in wall poster that commemorates our 90th anniversary. And for all of you woodworkers, March kicks off a project series on building specially designed and dedicated furniture pieces commissioned especially to commemorate our birthday.

This issue is just the first blast in a year-long celebration of our 90th anniversary. It's going to be a great party and you're all invited. Till next time.

Joe Oldham

Popular Mechanics

Editor-In-Chief Joe Oldham

Home Improvement

Editor Steven Willson
Associate Editor Thomas Klenck
Assistant Editor Roy Berendsohn
Contributing Editors Norman Becker
Rosario Capotosto
Steve Toth
Jeff Williams

Boating/Outdoors

Editor Joe Skorupa
Contributing Editor John Wooldridge

Automotive

Editor Tony Swan
Detroit Editor Jim Dunne
Associate Editor Mike Allen
West Coast Editor Rick Titus
Contributing Editors Michael Lamm
Rich Taylor

Science/Technology

Editor Abe Dane

Electronics/Photography

Editor Frank Vizard
Contributing Editor Stephen A. Booth

Art Department

Graphics Director Bryan Canniff
Sr. Assoc. Art Director Alan Andresen
Associate Art Directors Tom Kane
Suzanne McCreight

Editorial Production

Managing Editor/Prod. Deborah Frank
Art Editor John Bostonian Jr.
Production Editor Robin LaSalle
Art Assistant Nancy Coggins
Asst. Production Editor C. Laura Quinn

Editorial Administration

Administrative Asst. Josephine Caronia
Asst. to the Editor Barbara A. Novak

Reader Service Department

Manager Norah I. Golad

Editorial Offices

224 West 57 St.,
New York, NY 10019

We cannot be responsible for loss of unsolicited queries, manuscripts, or photos. For return, they must be accompanied by adequate postage.

SUBSCRIPTION SERVICE: Popular Mechanics Magazine will, upon receipt from its reader of a complete new or renewal subscription order, undertake fulfillment of that order so as to provide the first-copy delivery either to the Postal Service or alternate carriers within six to twelve weeks. If for some reason this cannot be done, you will be promptly notified of the issue date that will begin your subscription, with a request for any further instructions you may have concerning your order. Please address all such orders to us at Popular Mechanics, P.O. Box 7170, Red Oak, IA 51591. • Should you have any problem with your subscription, please write Joan Harris, Customer Service Department, Popular Mechanics, P.O. Box 7170, Red Oak, IA 51591 or call toll-free 1-800-333-4948. Please enclose your mailing label when writing to us or renewing your subscription. • Subscription prices: United States and possessions, \$16.94 for one year; \$29.94 for two years. Canada and all other countries add \$16.00 for each year.

AS A SERVICE TO READERS, Popular Mechanics publishes newsworthy products, techniques and scientific and technological developments. Due to possible variance in the quality and condition of materials and workmanship, Popular Mechanics cannot assume responsibility for proper application of techniques or proper and safe functioning of manufactured products or reader-built projects resulting from information published in this magazine.

POPULAR MECHANICS is published monthly by the Hearst Corporation, 959 Eighth Avenue, New York, NY 10019, U.S.A. Frank A. Betts, Jr., President; Randolph A. Hearst, Chairman; Gilbert C. Maurer, Executive Vice President; Victor F. Gault, Vice President and Secretary; Edwin A. Lewis, Vice President and Treasurer; Hearst Magazines Division: D. Clarys Balzenburg, President; K. Robert Brink, Executive Vice President; Daniel E. Zucchi, Senior Vice President; George J. Green, Executive Vice President; Mark F. Miller, Executive Vice President; General Manager, Raymond J. Peterson, Executive Vice President; Thomas J. Hughes, Vice President & Resident Controller; Robert B. Dillingham, Vice President for Popular Mechanics.



Does Your Garage Door Opener Have A Weak Link?



There's a place for solid steel. At Genie, we believe the only chains in your garage should be on a bicycle. For strength, safety, security and reliability your garage door opener should be screw drive. Ten feet of solid steel that's so strong, so safe, so reliable we can offer the Pro-Tech® ten-year warranty.

A chain drive opener is noisy, greasy and has hundreds of links to break. Genie Screw Drive is smooth, quiet and made the one way that's most reliable. The choice is yours. We've made it easy.

For the name of a nearby Genie dealer, call 1-800-OK-GENIE. In Canada, call 1-800-363-0955.

Genie's dedication to quality and reliability can be found in every product we make. Like wet/dry Genie® Shop Vacuums and Power Blowers, Genie® Gate Openers, the Genie® Beast™ Garage Trash Compactor, and Alliance® TV Antenna Rotators.

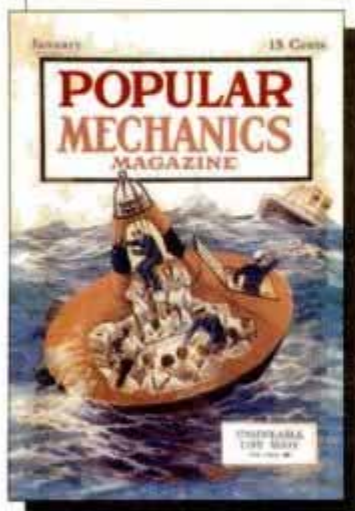


GENIE
Built For A Lifetime.™



TIME MACHINE

75 YEARS AGO: JANUARY 1917



Big Buoy

A Portland, Oregon, inventor proposed replacing lifeboats with steel buoys big enough to shelter 40 people. Resembling a giant top, the watertight vessel featured a conning tower, a ventilation fan, storage space for 10 days' water and provisions, and a telescoping ballast anchor that kept it upright in rough seas. Best of all, there'd be no need to launch the buoy during a disaster. Passengers could just climb in as the ship sank and wait for water to buoy the buoy.

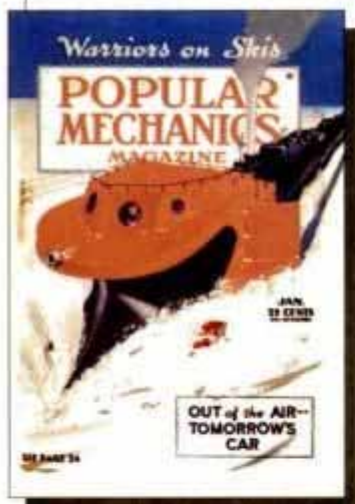


Broadside

Twelve 14-in. guns reared from America's fiercest battleships yet—the USS *Arizona* and USS *Pennsylvania*. They followed the dreadnought tradition of big-caliber firepower, although their guns didn't match the 15-in. brutes on the newest Ger-

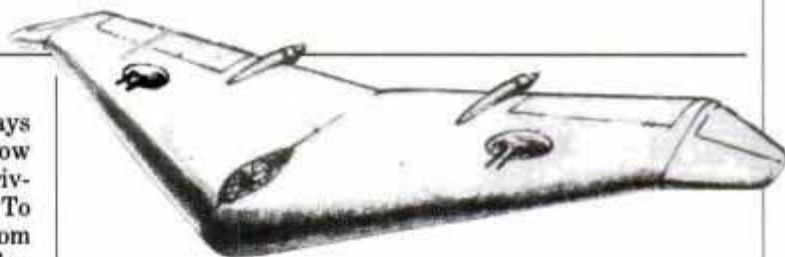
man and British battleships. Neither saw much action during World War I, and both underwent major surgery during the Great Depression. *Arizona*, of course, met a fiery end at Pearl Harbor, but *Pennsylvania* survived the attack and served for six more years.

50 YEARS AGO: JANUARY 1942



Clear The Tracks

Canadian National Railways operated the ultimate snow shovel—a 40-ton wedge driven by a steam locomotive. To prevent the white stuff from drifting back onto the tracks, two massive, pneumatically actuated wings sprouted from the monster plow's sides. An overhanging roof stopped snow from trickling back over the top of the plow. And a rooftop cupola housed the plow's operator, who controlled the wings and conversed with the engineer via whistle blasts.



B-2's Grandpa

How familiar does this sound? "Consisting of a thick triangular wing, with no tail and no fuselage, a revolutionary plane has been completed and test flown in total secrecy by Northrop Aircraft, Inc." John K. Northrop had lofted a flying wing before, but this experimental model

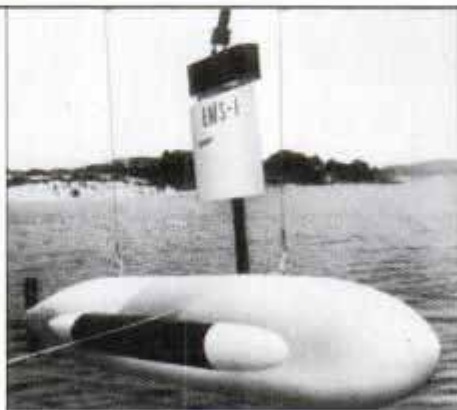
—the N-1M—snared him a contract to build the huge 4-engine XB-35. Drag reduction, not stealth, was the goal back then. The Army Air Forces were impressed enough to consider ordering 200 flying wings as long-range bombers, but the less daring B-29 proved an acceptable alternative.

25 YEARS AGO: JANUARY 1967



Snow Mobile

Blizzards off Lake Erie can freeze traffic, so western New York state seemed the perfect place to research an article on winter driving. Veteran drivers there offered a wealth of tips and tales. One dumped 400 pounds of steel rail into his trunk to add extra weight. Another parked on his lawn's up-slope the night of a snowstorm, guaranteeing momentum the next morning. Most advice was more conventional: Stay out of slush, don't spin your wheels.

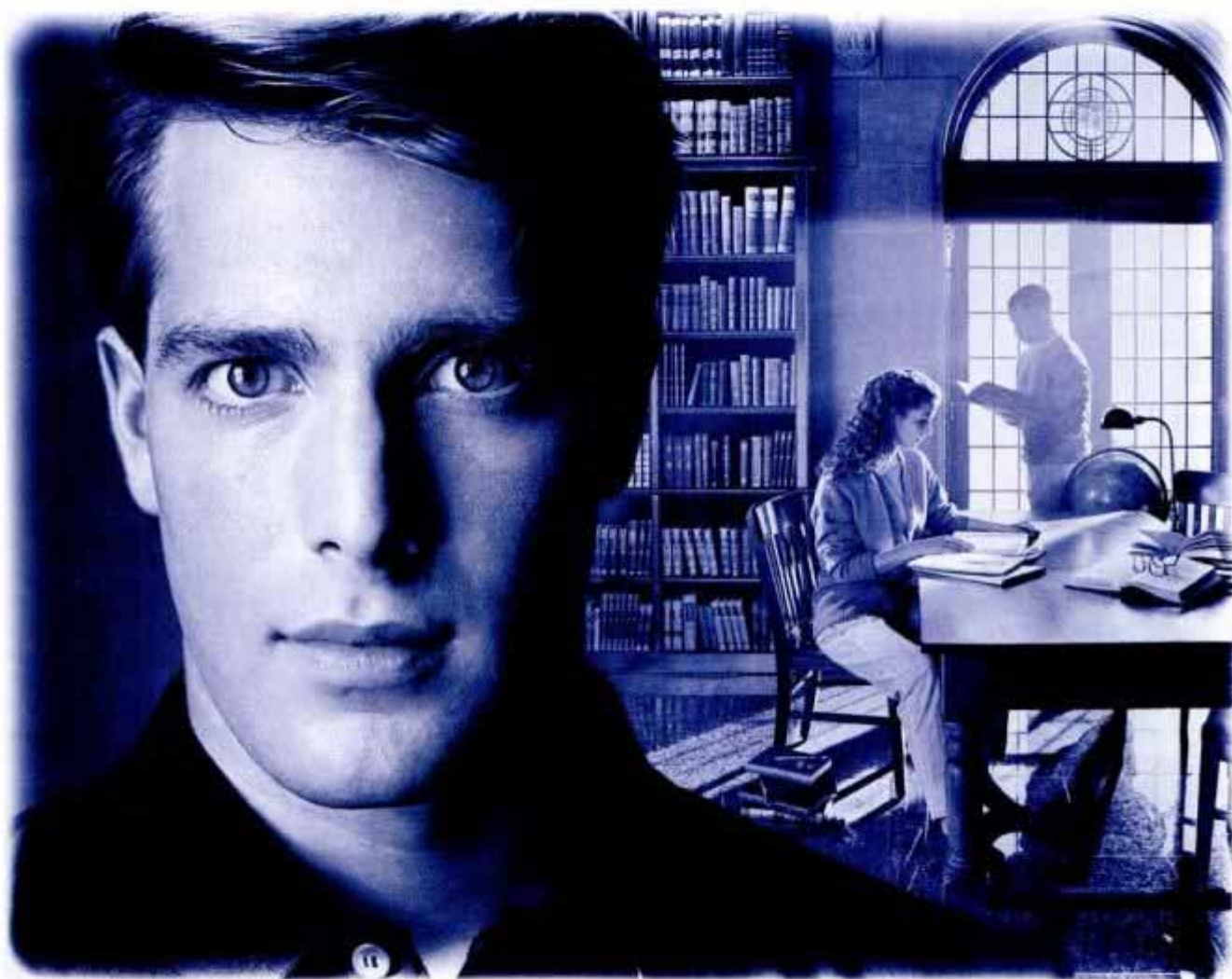


Wet-Jet Sub

Even as far back as the mid-'60s, magnetohydrodynamic submarine propulsion (see

"Jet Ships," page 60, Aug. '90) was considered the wave of the future. University of California engineers demonstrated the principle with a 10-ft. submarine outfitted with batteries and a magnetic coil. The coil created a magnetic field, and the batteries generated electric current perpendicular to the field. The resulting force propelled the craft forward. **PM**

“ In the
Armed Forces,
I earned a lot
more than
stripes... ”



I also earned tuition assistance with the Montgomery GI Bill.

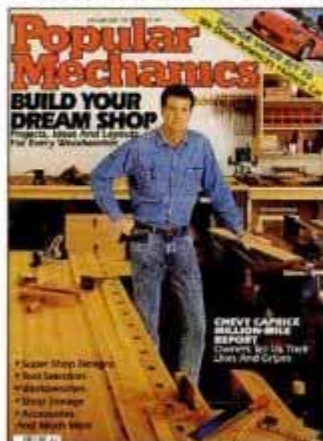
The GI Bill made higher education a reality for me. And it can for you too. By serving full-time in the Armed Forces, or part-time in the National Guard or Selected Reserves, you'll earn thousands of dollars in tuition assistance to help you get an education at an approved college, vocational or technical school.

But that's just part of the education, because in the Armed Forces you'll receive the kinds of skills, training and on-the-job experience that pay off, today and tomorrow. So if you're interested in the Montgomery GI Bill, call your local Armed Forces recruiter today.

U.S. ARMED FORCES

LETTERS

Cover Kudos



What a pleasant cover for the November '91 issue!

No guns, bombs or poison gas, but rather a picture of a woodworking shop. Thanks.

WILLIAM FINNIGAN
CORNWALL-HUDSON, NY

In Control

The letter from David Avery Jr. on the Glock 17 pistol and *more* gun control cannot go unanswered. In reality, criminals do not comply with any new or existing gun control laws. The tragedy in Texas is a good example of how laws *don't* work. Thousands are killed by drunken drivers every year, but I hear no objection to the automotive reviews in each issue.

POPULAR MECHANICS has always done an excellent job of informing its readers on a wide range of products with objective observations and comments. The Glock 17 is indeed state of the art in its very makeup and proven reliability. Its inclusion in the magazine is justified.

I appreciate the objectivity and dedication of the PM staff in their efforts to bring *all* of their readers material

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

that is technically correct regardless of the subject matter. It is, by the way, a free country, and the availability of the Glock 17 guarantees that it stays that way for *all* of us.

JIM PRUCE
NORTH OLMSTED, OH

Thank you for the article on the Glock 17. It was refreshing to read about the mechanical and technological advances without having to read about the pros and cons of gun ownership.

A. RUSSELL
COLUMBUS, OH

Pulling The Plug

About replacing spark plugs (Car Care, page 113, Nov. '91), it is environmentally and economically unsound to get rid of perfectly good plugs because they reach a certain mileage or age. The test for plugs is whether the car is performing up to state standards or there is a loss in gas mileage or performance. I passed the Connecticut state test with flying colors with my Ford Escort. The same was true with my Lincoln Town Car. The Escort has approximately 40,000 miles on the odometer and the Town Car has about 30,000, both with their original plugs. Out of habit, I check and clean the plugs yearly.

The town dump is full of throwaway plugs and filters. Plugs are cheap and the landfills have billions of them, most of which are still good. Let's stop discarding good things because they get old.

WILLIAM JANSEN
NORTH HAVEN, CT

It's good to hear that you've been able to run plugs for 40,000 miles with no loss of

fuel mileage, performance, and no increase in emissions. However, this is virtually unheard of. Most auto manufacturers recommend a plug change every 20,000 to 25,000 miles for a reason. By the way, Connecticut emissions regulations are much less stringent than the federal regulations that govern new car manufacturers. Your car may have experienced a serious degradation of emissions despite passing a local smog test.

—Ed.

To The Limit

On the page right next to the Time Machine article, "Safe At Any Speed," describing the 1966 65-mph speed limit, you put an advertisement for Escort radar detectors. Nearly all accidents are caused by excessive speeds. Shame on you for running an ad for a device created solely to break the law,

GUY RAMSEY
NENANA, AK

Most accidents are caused by excessive speeds? That's not the way we heard it. In our opinion, most accidents are caused by poor drivers who cannot handle their vehicles in emergency situations, some of whom may be drunk. Following

your logic, let's make the national speed limit 10 miles per hour.

—Ed.

Credit Due

The new M/V *Thomas G. Thompson* in Tech Update's "Dream Boat For Science" was built by Halter Marine of Moss Point, Mississippi, not Michigan. This beautiful boat is docked in the Pascagoula River just south of the Highway 90 bridge. Workers at the Mississippi shipyard deserve credit.

ROBERT G. TAYLOR JR.
MOSS POINT, MS

We regret the error.

—Ed.

Replicating History

I enjoy building replicas of vintage aircraft rudders and displaying them as wall mounts. Some of the rudders I have built are in local museums.

A World War II fighter pilot requested a P-51D rudder with his squadron colors and insignia to hang in his home. My newest rudder is Capt. Eddie Rickenbacker's World War I Spad XIII. The next will be *The Spirit Of St. Louis*, which will be hung in the main concourse of our local airport terminal.

W. KENNY GUILLOT
BATON ROUGE, LA



Reader Kenny Guillot shows off his hand-built replica of Capt. Eddie Rickenbacker's Spad XIII rudder.



On September 14, 1990, a modified GMC Truck set a new F.I.A. authenticated record of 204.145 miles per hour, two-way average, in the flying mile. Yes, you read that right. A GMC Truck. The street-legal truck inspired by these explorations was a

IF YOU HAVE SETTLED IDEAS OF LUXURY, SAFETY AND PERFORMANCE, A TYPHOON WILL BLOW THEM AWAY.

compact pickup called Syclone. Performance cognoscenti still speak of how *Car and Driver* pitted Syclone against a \$122,000 Ferrari 348ts. "In a blink, the Ferrari is looking at tailgate," they wrote.

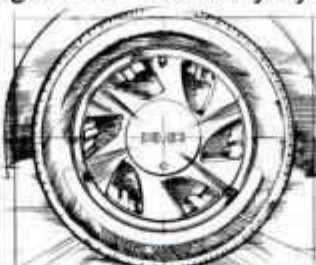
Now we've taken this experience in power, handling and braking to a new, astonishing level. In Typhoon. The sports coupe of sport utilities.

Brace yourself: Typhoon is riding on the kind of technology you wouldn't expect in a utility vehicle: *the same safety and performance technology as Syclone*. A 4.3L V6, turbocharged and liquid-intercooled, that yields 280 horse-power. A four-speed automatic transmission with over-drive top gear. All-wheel drive. And four-wheel anti-lock braking.

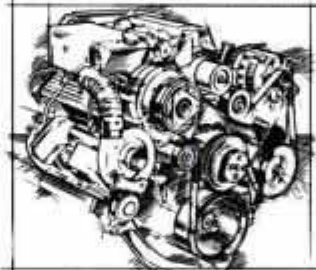
Typhoon's luxury appointments will be comforts to you, too. Body styling that's easy on the eyes. A leather-trimmed seating area with front bucket seats. Adjustable lumbar supports and side bolsters in the buckets. A Delco AM/FM compact disc stereo system.

Did we mention 67.3 cubic feet of luggage space (with the rear seat folded down)? Typhoon is still, after all, a utility vehicle.

Only from a truck company with over 80 years of truck experience could a utility vehicle so wholly unexpected seem so wholly fitting. Put yourself in the eye of the storm: Typhoon, from GMC Truck.



245/50 VR-16 SPEED-RATED TIRES. RIPPING SHOES FOR THE PASSING LANE.



4.3L V6, TURBOCHARGED. A PRACTICAL APPROACH TO SHEER EXUBERANCE.



THE STRENGTH OF EXPERIENCE

It's not too late
to order for
Christmas*



*PASSPORT® by ESCORT:
The Classic of Radar Warning*

Classic Radar Warning ...At A Classic Price

This holiday season, overwhelm the driver in your life with a gift guaranteed to surprise and delight; put a PASSPORT radar detector under the Christmas tree. And, for a limited time (until December 31, 1991), you can indulge your favorite driver at a price which is easy on your wallet. PASSPORT is on sale for only \$149 (25% off the regular selling price!)

PASSPORT is a proven winner.

It's the most popular radar

detector ever made with over one million drivers currently using one. In fact, PASSPORT has won five independent comparison tests by leading automotive

magazines (such as *Car and Driver* and *BMW Roundel*). *Car and Driver* said it best when they claimed PASSPORT is "worth every nickel in roadgoing peace of mind."

PASSPORT is a complete radar protection system and comes with all

the features and accessories needed for worry-free driving:

- Long-range detection
- Anti-falsing circuitry
- Pulse and instant-on radar detection
- Pocket-sized
- Durable construction

PASSPORT is backed with a 30-day money back guarantee and one-year limited warranty.

Order today and make your favorite driver's wish come true.

To order, call toll-free:

1-800-433-3487

Fax: 513-247-4820

Customer Service: 1-800-545-1608

* Overnight shipping available

Major credit cards accepted

PASSPORT \$149 (reg. \$199) + \$4.95 shipping

Ohio residents add 5.5% sales tax. Prices higher in Canada.

ESCORT

► Department 206812
One Microwave Plaza
Cincinnati, Ohio 45249

ESCORT®

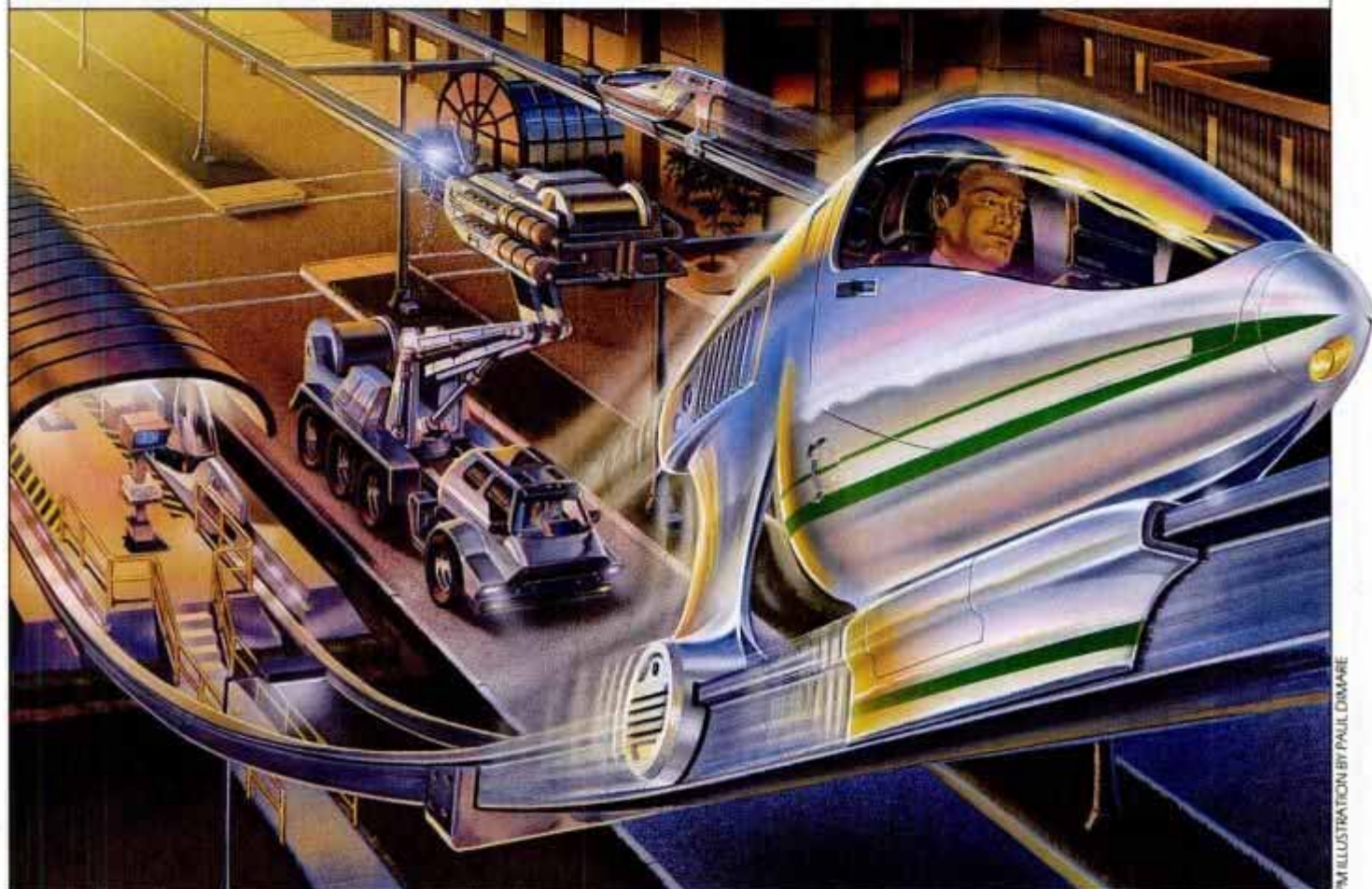
The world's most advanced radar detectors.

25% Off!

ONLY SOLD DIRECT FROM OUR FACTORY TO YOU

TECH UPDATE

News Of Tomorrow's Technology Today



PM ILLUSTRATION BY PAUL DIMARE

Personal Maglev, Public Transportation

IRVINE, CA—How do you get Southern Californians out of their cars and into mass transit? It may take an ingenious marriage of convenience and efficiency. Prolific inventor Doug Malewicki has a solution: individual magnetic-levitation cars that run on a grid of monorails.

Each teardrop-shaped vehicle, called a People Pod, would carry one or two passengers and operate under the supervision of a master traffic-control computer. The rider would hop in a Pod at a drop-down station, key in the destination and sit back for the ride. An on-board computer ushers the vehicle around the 1-sq.-mile grid for a nonstop 100-mph

ride. Meanwhile, the master computer routes idle Pods to high-traffic areas and controls Pod-spacing density.

Built of aerospace composites, a Pod would weigh only 200 pounds, including superconducting magnet. The vehicle could gain power for levitation and propulsion from the track via an induction pickup.

For safety, anticollision radar would activate hydraulic brake pads that squeeze each side of the T-shaped track. A healthy Pod could nose a failed vehicle into a maintenance track to clear congestion.

Editor: Abe Dane
Assistant Editor: Greg Pope
Contributors: Philip Chien, Mike Fillon

Malewicki is currently jockeying for funds to build a 1-mile test track in Orange County, California.

One key to People Pod economics: roll-forming machine, in background, lays steel track across utility poles.

Highlights This Month

- **Fly Me To Mars**—Boeing's excursion vehicle flouts lunar-lander tradition.
- **Jet Packer**—Japan's magnet-drive ship is ready.
- **Weight Lifter**—C-17 takes to the skies in maiden flight.
- **Special Forces' New Horses**—Night choppers emerge from shadows.
- **Fastest Guns In The West**—Bullets fly at 27,000 miles per hour.
- **Six Of A Kind**—A half-dozen drones vie for close-range role.

Night Stalker

FORT BRAGG, NC—The ubiquitous Black Hawk assault chopper has received a major facelift for its new role—sneaking Army Special Operations forces in behind enemy lines.

The MH-60K, built on the basic UH-60 frame, will handle the missions that helicopter pilots enjoy the least: low-level night runs through unfamiliar topography, in bad weather. But the new chopper's terrain-avoidance radar and forward-looking infrared sensors will make these missions easier, as will the cockpit displays that channel information into four screens.

The most visible changes, however, are the two 230-gallon external fuel tanks, allowing a 750-mile range, and a midair refueling probe for even longer-range action.

For defense, the MH-60K has sensors that warn of laser, radar and missile tracking. Two .50-caliber machine guns provide the offense.



Sikorsky recently delivered the first prototype MH-60K, and will deliver the first production model this summer.

Twin external fuel tanks and refueling probe lend menace to visage of MH-60K, Special Operations' new assault chopper.

SIKORSKY PHOTO

Gas Guns Push Outer Limits Of Speed

HUNTSVILLE, AL—Silent for two years, the world's biggest gun is again blazing away in its new home, the Army's Redstone Arsenal. Longer than three football fields, it's not some titanic howitzer, but a 254mm light-gas gun—one of several such machines now pumping projectiles to hypersonic speeds.

At the breech end of a typical 2-stage gas gun, a charge of gunpowder fires a lead piston down a tube filled with hydrogen.

University of Alabama's giant gas gun (right) peppers missile nose cone with high-speed particles (below).



Squashed to tremendous pressure, the gas bursts through a diaphragm and whisks a sabot-shrouded test article to more than 10 times the speed of a bullet from an M16 rifle. After the sabot falls away, the test article passes into a long experiment tube studded with sensors.

The huge Redstone gun, centerpiece of the University of Alabama's new Aerophysics Research Center, arrived last year. It's one of four guns donated by General Motors' Delco Electronics Division and refurbished with new data-acquisition hardware.

Under a contract with the Army's Strategic Defense Command, physicists will run experiments to identify missile reentry signatures—the wakes of ionized gases, heat, light and debris that trail a warhead as it dives through the atmosphere. Nose-cone ero-

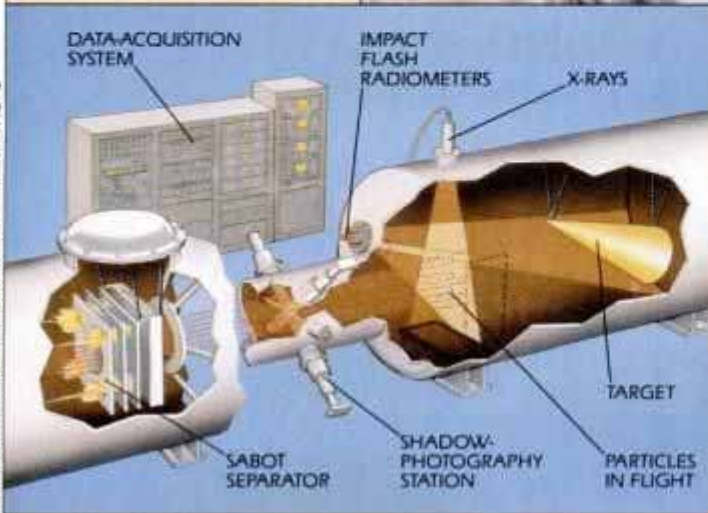
sion will also be a focus.

Meanwhile, at Sandia National Labs in Albuquerque, engineers have recently beefed up their Hypervelocity Launcher, adding a third stage that kicks projectile speeds above 27,000 mph. The key is momentum transfer: The heavy weight boosted by compressed gas slams into a much lighter weight and sends it flying. Sandia researchers will study space-debris impacts, and the new capability allows duplication of orbital-speed collisions.



Sandia researchers add third stage to their gun, boosting projectile velocities to orbital speeds.

SANDIA PHOTO



GM-DELCO ILLUSTRATION; UNIVERSITY OF ALABAMA PHOTO

LEARN TO FLY, ON US

PM PHOTO BY RICH COX



● A monk in the 13th century straps on a pair of "wings" and jumps off a castle parapet. A primitive tribe in New Guinea worships an airplane. A young boy in Iowa stands at the gate of a local airport and watches light airplanes take off and land.

The fascination with flying and flying machines is timeless and universal. Since the first caveman looked up and envied the birds, people have yearned to take to the air.

Our cover story on page 35 tells you everything you ever wanted to know about learning to fly, except one thing—how to pay for it. Here's your answer to that one:

Win our new contest and it's on us. That's right. POPULAR MECHANICS, in combination with the member com-

panies of the General Aviation Market Expansion Plan, is going to make it easy for some lucky PM readers to take up flying through the POPULAR MECHANICS Learn To Fly Contest.

It's simple to enter: In 50 words or less, say why you'd like to learn to fly. Entries will be judged by a panel of aviation experts. Final judges will be POPULAR MECHANICS editors, who will pick 111 winners.

The First Prize Winner will receive complete flight training at a participating GAME Plan flight school in his or her area. It will include all expenses for flight instruction, airplane rental and training materials leading to an FAA Private Pilot license.

Ten Second Prize Winners will receive an introductory 1-hour flight at

a local participating GAME Plan school and the King Video Private Pilot Course, itself a \$169 retail value.

The remaining 100 winners will receive King Video's "Let's Go Flying" introductory video which retails for \$29.95.

The coupon below must accompany your entry, which should be typed on a separate piece of paper. Only entries accompanied by original coupons will be judged. No photocopies of the coupon will be allowed. You can enter more than once if you like. But each entry must be accompanied by an original coupon.

If you always wanted to fly, here's your shot. Read the rules, get out your thinking cap and enter our contest now.

PM

PM LEARN TO FLY CONTEST OFFICIAL RULES

1. On a separate piece of paper, tell us why you would want to learn to fly. Entries must be written in 50 words or less. All words count. Entrant's name and address must appear on the essay.
2. Each entry must be accompanied by an official printed coupon, such as the one on this page. No copies or facsimiles of the entry form will be accepted, except for entries from Maryland and Vermont.
3. You may enter more than once, but each entry must be accompanied by an original, printed official coupon.
4. All entries become the property of POPULAR MECHANICS and will not be returned. Entry into the contest constitutes permission for The Hearst Corp. to use entrant's name, photograph or other likeness, biographical information and essay for any advertising or promotional purpose without further compensation. Winners further agree to be photographed with various members of the POPULAR MECHANICS staff and with members of GAME Plan, and consent to their names and photographs being used in a future issue of POPULAR MECHANICS.
5. Entries will be judged on originality, imagination and sincerity. Preliminary judging will be done by a panel of aviation experts. From initial selections, the final winners will be selected by POPULAR MECHANICS' Editor-In-Chief, Joe Oldham.
6. The decision of the judges is final. No correspondence or telephone calls regarding the contest will be accepted or entered into.
7. The First Prize Winner will receive complete flight training at a participating General Aviation Market Expansion Plan flight school in his or her area. All taxes, licenses, insurance, transportation to and from the school, food, lodging and all other fees not

8. Ten (10) Second Prize Winners will receive an introductory 1-hour flight at a participating GAME Plan flight school in his or her area. Maximum training time is one year from date of first flying lesson and/or 75 hours of training, whichever comes first. All taxes, licenses, insurance, transportation to and from the school, food, lodging and all other fees not specified here are the prize winners' responsibilities.
9. One Hundred (100) Third Prize Winners will receive a VHS videotape copy of King Video's "Let's Go Flying."
10. First Prize and Second Prize Winners assume all risk associated with attendance of flight lessons at the flight school in his or her area.
11. No cash payment will be made in place of the prizes.
12. The contest is open to anyone residing in any of the 50 United States, except employees of The

13. Entries should be mailed to: Learn To Fly Contest, POPULAR MECHANICS, 224 West 57th St., New York, NY 10019. Entries must be postmarked before June 1, 1992, and received by June 7, 1992. Incomplete, late, illegible or misdirected entries will not be considered.
14. The winner will be notified by January 30, 1993, and will be asked to execute and return an affidavit of eligibility and release within thirty (30) days of attempted delivery of same. Noncompliance within that time period will result in disqualification and an alternate winner will be selected.
15. After the winner is notified, POPULAR MECHANICS will provide the winner's name to anyone who wishes it and who sends us a stamped, self-addressed envelope with the request.
16. This contest is void where prohibited by law. All federal, state and local regulations apply.

Mail To: Learn To Fly Contest
 Popular Mechanics
 224 West 57th St.
 New York, NY 10019

Here is my official entry to the Popular Mechanics Learn To Fly Contest.
 I promise to abide by all official rules.

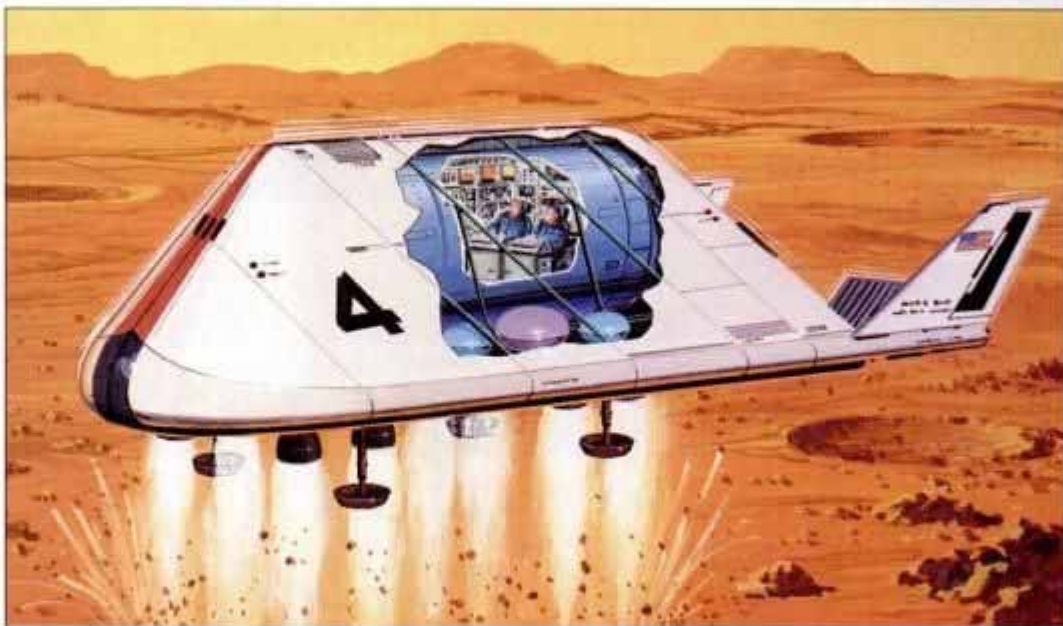
Name _____
 Street _____
 City _____ State _____ Zip _____

Wings Of Mars

HUNTSVILLE, AL—A new Boeing concept for a Mars excursion vehicle draws more from today's flying-wing stealth aircraft, and less from the lunar landers that have shaped previous studies.

The high-lift-to-drag vehicle comprises a 65-ft.-long payload bay shielded by a curved, winglike thermal shroud. With body flaps and control surfaces on winglets, a pilot can steer during ascent and descent. The payload bay could contain 40,000 pounds of cargo or house a crew.

Boeing engineers conceived the craft to enable repeated takeoffs and landings during a mission, and to handle any heat buildup during



descent through the Martian atmosphere.

The concept was born of a now-completed study con-

tract with NASA's Marshall Space Flight Center. President Bush wants the mission flown by 2019.

Boeing's Mars vehicle fires eight rockets to cushion landing. Winglike shroud and control surfaces lend maneuverability.

Japan's Magnetic Ship

KOBE, JAPAN—The world's premier magnetohydrodynamic ship, YAMATO-1, (see "Jet Ships," page 60, Aug. '90) is complete.

Engineers from Mitsubishi Heavy Industries and Toshiba Corp. have finished testing the superconducting magnet assemblies that will help propel seawater through the ship's twin thruster ducts.

Launching the 97-ft., 185-ton craft is a complex affair. While the ship lies on a dry-dock cradle, technicians pump liquid helium into the magnets' cryostats. Once the magnets have chilled to 4° F

above absolute zero, they are energized to 4000 amperes of current from an outside gen-

erator. A persistent-current switch locks in the magnet current. Then helium refrigerators on the ship whir to life, technicians cut the line from the external helium source, and the ship is ready to go.

Sea trials of the 8-knot vessel are scheduled to continue through 1992.



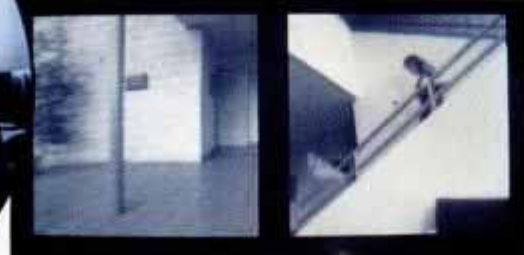
Looking Around

KNOXVILLE, TN—Can you scan a remote camera across 180° without moving parts? A NASA contractor has answered

the question with a system that shunts digital pictures from a fisheye lens through an image processor.

In the Omniview system, developed by TeleRobotics International, a single printed-circuit board flattens distortions out of the fisheye imagery. The remote operator uses a joystick to crop out the area that will undergo correction. The system can simulate panning, tilting and even zooming. And because a fisheye lens has infinite depth of field, everything is in focus.

Possible applications include target acquisition, telerobotic activity and surveillance.



Omniview camera uses image processor to correct distortions in fisheye image.



TELEROBOTICS INTERNATIONAL PHOTOS

PH ILLUSTRATION BY ED VAUGHRAN

SHIP AND OCEAN FOUNDATION PHOTOS

Six-Pack Of Drones

WASHINGTON, D.C.—A half-dozen 200-pound drones are competing for the Pentagon's Close-Range Unmanned Aerial Vehicle (UAV) award. The winner will work for the Army, Navy and Marine Corps, carrying out

reconnaissance and target-spotting missions within 30 miles of launch point.

The contract presents some challenging parameters. The UAV must take off and land within a 93 × 186-ft. area, clearing a 46-ft. obstacle. In addition, the vehicle must stay aloft for 3 hours, totting a 50-pound forward-looking infrared sensor (for which four contractors are competing separately).

These demands have spawned a motley sextet of competing airframes, some quite radical.

General Atomics'

Six unmanned air vehicles will show off unusual airframes at Fort Huachuca, Arizona, this year.

Prowler flies on an oblique wing and an inverted V-tail. IAT's sleek, highly aerodynamic MK-106 HIT features strakes, canards and delta wings. AAI offers the Shadow, resembling a smaller version of the company's Pioneer (of Desert Storm renown) with one notable exception—its lightweight lambda-tail.

The simple delta-wing Huntair from Westinghouse takes modular quick-disconnect payloads in a nose receptacle. From Daealus Research comes the slaved tandem freewing, which has wings that pivot freely to different angles of attack—helpful in handling gusty winds, say the developers. Meanwhile, McDonnell Douglas's tailsitter takes off

and hovers vertically, then transitions to horizontal flight.

Demonstrations of all six airframes will begin early this year, but they won't constitute a true fly-off: competitors won't be allowed to scope out the performances of their rivals.

DAEDALUS RESEARCH STF-9



WESTINGHOUSE HUNTAIR

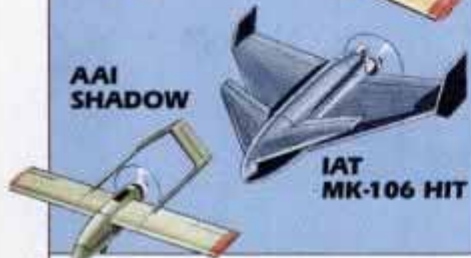


MCDONNELL DOUGLAS TAILSITTER

GENERAL ATOMICS PROWLER



AAI SHADOW



IAT MK-106 HIT

Eye On Extreme UV Rays

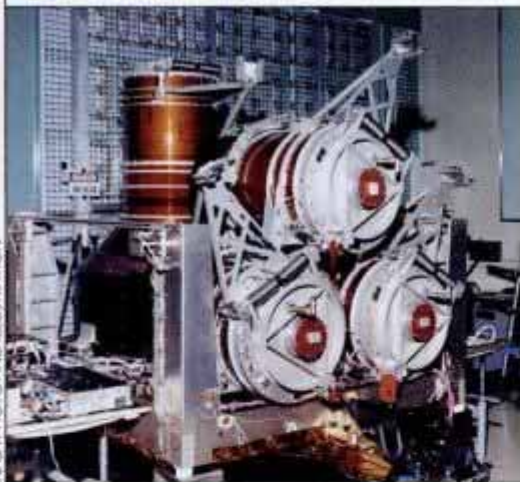
GREENBELT, MD—The extreme ultraviolet part of the spectrum falls between X-rays and ultraviolet light.

Till now, NASA hasn't lofted a spacecraft to study this high-energy radiation. But the Extreme Ultraviolet Explorer will close that gap.

The University of California at Berkeley developed the four telescopes, which are mounted on NASA's Multimission Modular Spacecraft. This platform allows astronauts to swap payloads in and out during servicing missions, although NASA hasn't planned any such activity.

Three of the telescopes will focus on objects closer than 300 light years from Earth, while the fourth will gaze into deep space.

Delta-rocket launch of the probe was scheduled for late January.



Four telescopes will image near and deep-space objects in extreme ultraviolet radiation.



SWIFT Takes Wing

SANTA ROSA, CA—Neither sailplane nor hang glider but a combination of the two, the SWIFT (see [Tech Update, page 20, May '88](#)) is now flying.

Short for Swept Wing with Inboard Flap for Trim, the 120-pound vehicle is the product of Bright Star Hang Gliders, working with Stanford University engineers.



Foot-launched sailplane SWIFT blends convenience of hang glider with sailplane performance.

Three models have flown, traveling up to 140 miles in only moderate soaring condi-



tions. Most hang gliders are lucky to cover 100 miles.

Bright Star is working on a

fourth prototype, and hopes to get certification by the end of this year.

Ford built today's with something important



**Ford Trucks.
The Best Never Rest.™**

The 1992 Club Wagon. All new. Altogether different.

Everything you want in tomorrow's passenger van is easy to find.

Just look at today's New Club Wagon from Ford.

The new shape is bold, aerodynamic. And, it's been protected with a hard new chip-resistant primer.



1992 Motor Trend
Truck of the Year
Club Wagon
Chateau

The spacious new interior holds everything from a new instrument panel to available Ford JBL audio systems. "Out Front" engine placement means more room up front. An available high-capacity climate-control system circulates 50% more air.

Club Wagon's Twin-I-Beam suspension provides a smoother ride, while its body-on-frame construction enhances

Club Wagon in mind: Tomorrow.



The new more ergonomic instrument panel makes everything easier to see and reach.



Full-size comfort for every passenger.

This new optional console may prove indispensable.

Finally, the 1992 Club Wagon is backed by Ford's new warranty—a 36-month/36,000-mile Bumper-to-Bumper

Warranty with no deductible.**

Today's best-selling full-size van really is filled with news.

Tomorrow is looking very good.

trailer-towing capability. This van's maneuverability is better than ever.

Every tomorrow

should be safe. So, Regular Club Wagons now have a driver air bag to supplement safety belts. And, all outer seats have new 3-point safety belts.

Rear anti-lock brakes are standard.

The only full-size van with a driver air bag.*

*Air bag effectiveness depends on wearing your safety belt, so always buckle up.
**Ask your dealer for a copy of this limited warranty.
*Best-Built claim based on an average of consumer-reported problems in a series of surveys of all '81-'91 models designed and built in North America. Sales by Division.



THE BEST-BUILT, BEST-SELLING AMERICAN TRUCKS
ARE BUILT FORD TOUGH.

Liftoff For C-17

EDWARDS AFB, CA—The C-17, the Air Force's first new transport plane since the C-5A, is now roaring through test flights, following its premiere performance last September 15.

Test crews will run the 4-engine airlifter around its flight envelope, with special attention to low-level cargo



First C-17 test aircraft takes to the air at Edwards AFB (above). Flight simulator (left) vetted plane's extensive avionics package.

delivery and short-runway takeoffs and landings. Two of the systems will receive close scrutiny.

One is the blown-flap system, which deflects engine exhaust across oversized rear wing flaps for extra lift. The technique enables operation in and out of small 3000-ft. runways. C-17s must show that they can land at an approach angle of 5°, nearly double that of conventional transport aircraft.

The other feature that will

bear close watching is the engines' thrust reversing, which shortens landing rolls. Because the reversers channel hot exhaust air upward, green C-17 pilots will have to remind themselves not to fire them while leading-edge flaps are down.

Although the C-17 has four test crew members, the aircraft will need only a 3-member crew; pilot, copilot and loadmaster. Four production planes will join the test effort later this year.

Supertorch Lays Waste To Waste

ATLANTA, GA—Yanking asbestos from old buildings only solves half the problem: The cancer-causing material must be rendered harmless for disposal as well. Georgia Tech researchers believe they have the answer, in a plasma arc torch furnace that converts asbestos fibers to molten goo.

Mainstays of the metallurgical industries, plasma arc torches deliver ferocious heat. Like lightning bolts, their electric arcs strip electrons from gas molecules. The result: plasma burning at temperatures between 3000° and 7000° F. Not only do the torches offer handy temperature control and energy efficiency, but they destroy waste in a fraction of



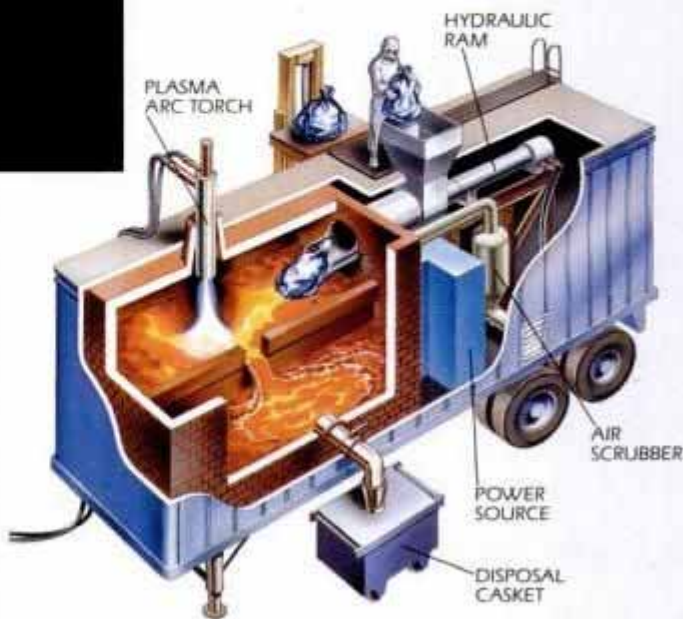
Plasma arc torch, shown in operation at left, could serve as high-efficiency asbestos incinerator in mobile trailer.

the time that conventional incinerators take.

Georgia Tech's experiments reduced harmful asbestos fibers to less than 1% of their original volume. The remains, say the researchers, could serve safely as road aggregate or gravel.

The plasma arc torch may have a bright future in waste disposal technology. Compact and portable, the device could fit into a traveling pyrolysis trailer. The blazing temperatures are hot enough

to neutralize municipal, hazardous or medical waste, and the molten effluent could greatly reduce landfill volume. The Georgia Tech researchers envision plasma arc torches stationed at landfills that are leaching or causing other problems. **TU**



MCDONNELL DOUGLAS PHOTOS

GEORGIA TECH PHOTO

PM ILLUSTRATION BY ADOLPH E. BROTHMAN



1992 DESIGN & ENGINEERING AWARDS

● With current technology pushing hard at frontiers in all fields across the board, it's our mission not only to keep you at the leading edge of what's new and how it works, but also to recognize what we believe to be the most noteworthy of the hundreds of new designs and innovations that come our way each year.

The best ideas, innovations and designs. The cream of the crop in science, technology, automotive, home improvement, boating, outdoors and home electronics. That's the tradition behind the annual POPULAR MECHANICS Design and Engineering Awards.

Award winners are selected by PM editors on the basis of outstanding achievement in their specialty topic area.

We hope you'll join us in congratulating this year's winners and recognize the significance of their contributions.

DESIGN & ENGINEERING AWARDS



DODGE VIPER R/T
Dodge Division
Chrysler Corp.

There's nothing subtle about the Dodge Viper. From its 408-hp V10 engine to its taut 2-seater body, it's a visceral blend of proven racing-chassis technology and brute power in a classic roadster that's capable of running wheel to wheel with anything on the road today.

CADILLAC SEVILLE
Cadillac Motor Division
General Motors Corp.

Lean, clean and agile, the new Seville strikes a distinctively American note in its design. With its understated interior and athletic response, this car rates as a leader in the luxury sport sedan derby.



MERCEDES-BENZ 600SEL
Mercedes Benz of North America

As the flagship of the new Mercedes S-Class Sedan series, the 600SEL represents an unmatched orchestration of cutting-edge technology, understated opulence, flawless road manners and massive power. If this isn't the best sedan on Earth, we'd like to know what is.



SUBARU SVX
Subaru of America

Subaru has always dared to be different, but never so attractively as this. With its fighter-plane cockpit, 230-hp flat-Six engine, all-wheel drive and excellent handling, this high-tech coupe is defiantly individualistic.

**FORD ECONOLINE/
CLUB WAGON VANS**
Ford Motor Co.

Change was a long time coming for Ford's full-size van lineup—17 years, to be precise. But when it finally came, it was sweeping. All-new inside and out, Ford's big vans are thoroughly contemporary in comfort and appearance—which puts them ahead of all the others.





**GOODYEAR
AQUATRED**
Goodyear Tire &
Rubber Co.

Normally, it's hard to get excited about the subtle changes in tread patterns, but this one's really different—particularly in the rain. The deep center groove and lateral channels flush water from under the tread blocks, sharply reducing the danger of aquaplaning. The Aquatred radial dramatically raises the standard for wet-weather tire performance.



FORD SERVICE BAY DIAGNOSTIC SYSTEM
Ford Parts and Service Division
Ford Motor Co.

Ford's new electronic diagnostic system advances the state of this art in an important step with CD-ROM database updates, a broader array of diagnostic functions, more computing power and instant on-line access to the company's latest service manuals and technical bulletins.



SUNBIRD EUROSPORT 190/OMC QUIET RIDER
Sunbird Boat Co./Outboard Marine Corp.

The first fully integrated boat and outboard motor package brings the engine into the boat structure and hides it under a cover. The system uses a unique trim and tilt concept and transom design, and launches a new age of whisper-quiet outboarding.



**BOTTOM LINE STALKER SIDEFINDER
SONAR FISHFINDER**
Computrol Inc.

While other fishfinders peer directly below the boat, the Stalker's sonar looks out horizontally, allowing fishermen to look both down and sideways, and see both images on the same LCD screen. Now anyone can find those "secret" fishing spots.

7.4-LITER HYDRA-DRIVE
Yamaha Corp.

The most unique lower unit in boating is also the smoothest operating. The key is a hydraulic-clutch system instead of the usual dog- or cone-clutch arrangement. The system allows solid hub props, so the engine's horses work harder and you get the most efficient use of those 454 cu. in.



DESIGN & ENGINEERING AWARDS

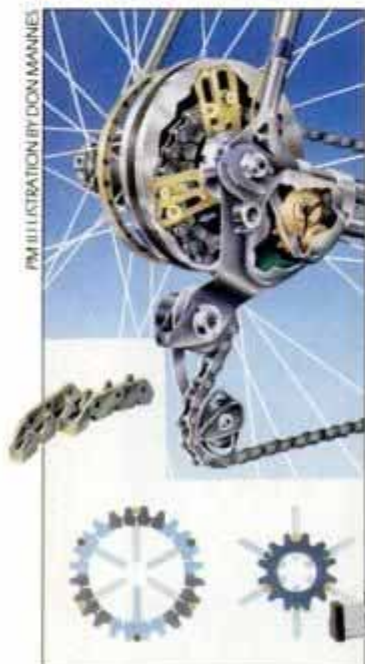
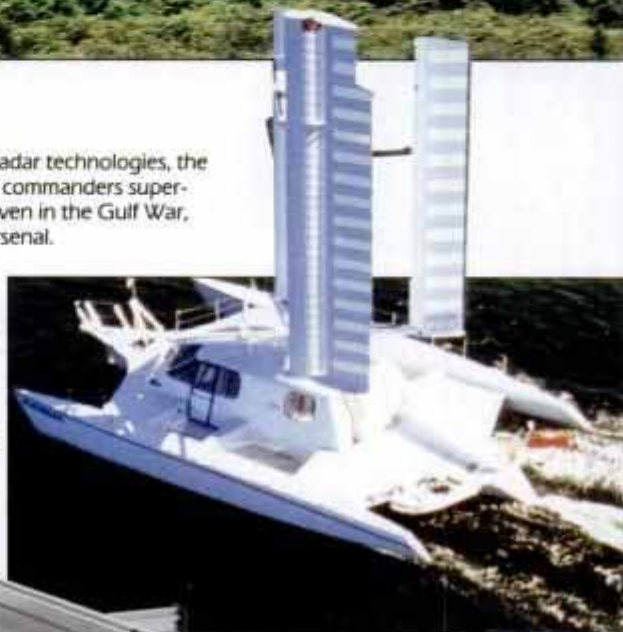


E-8 JOINT-STARS AIRBORNE SURVEILLANCE SYSTEM

Grumman Corp.
Armed with leading-edge computer and radar technologies, the Air Force's J-Stars system gives battlefield commanders super-detailed information on enemy forces. Proven in the Gulf War, it's a new key weapon in our high-tech arsenal.

PLANESAIL YACHT

Walker Wingsail Systems plc.
Computer-controlled wings and tail makes tacking and jibing virtually automatic, and can drive this 54-ft. yacht at 21 knots. The new technology promises to make sailing as easy as powerboating.



BIKE AUTOMATIC TRANS

Autra-Bike, Inc.
A computer, a speed sensor and an adjustable rear sprocket shift bicycle gears automatically. The system adapts to any multispeed bike to make bicycling almost effortless.



RYOBI BT-3000 TABLE SAW

Ryobi America Corp.
Here's a lightweight benchtop 10-in. saw that offers big stationary-tool power and features. Priced comfortably between the two, the BT-3000 will appeal to both pro contractors and amateur hobbyists.



NEW STROKE SNAP-OFF PAINTBRUSHES

3M Company
Snap off a brush, use it, throw it away. That's the beauty of this innovative home-improvement product. The handle is made of recycled paper, and the bristles are plastic film. They're cheap, perform well and take most of the drudgery out of painting cleanup.



TUCKER VISE

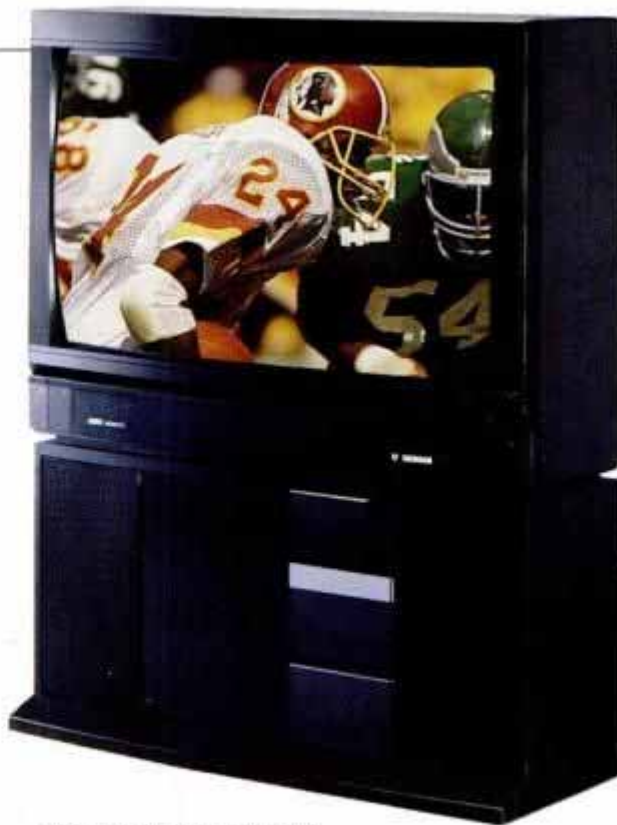
Veritas Tools, Inc.
Virtually a completely adjustable workstation, this vise has a fully rotating and tilting body, plus a foot-activated quick-release feature. Easily clamping any shape stock, the tool will help anyone become a more skilled woodworker.



VCR PLUS

Gemstar Development Corp.

Programming your VCR for unattended recording is an easy one-step process with this handheld remote-control device. Just punch in a series of numbers listed for your program, and date, time, channel and recording time are automatically set. The system will help many more people get the most out of their VCRs.



RCA 16:9 TELEVISION

Thomson Consumer Electronics

Enhanced TV pictures in wide-screen format with a width-to-height ratio of 16:9 debut in this 34-in. screen set. The virtually flat Space System tube uses digital line doubling for improved definition. It's the first salvo in the coming high-definition television revolution.



L1 CAMCORDER

Canon USA

First of the new-age camcorders, the Canon L1 uses an adapter that lets you interchange 35mm SLR film lenses. The camcorder multiplies the lens's focal length up to 5.3 times and opens new worlds of optical creativity. Home videos may never be boring again.



CD-I/CDTV SYSTEM

Philips Consumer Electronics Co., and Consumer Interactive Products Division, Commodore International

Philips and Commodore have each come up with their own format of interactive home entertainment and education. Both systems use audio-size CD programming software and a player that hooks up to your TV and hi-fi system. Programming consists of realistic games for grown-ups, like golf and dogfighting in a jet. The data-packed CDs can even offer a 21-volume encyclopedia on a single disc. The new systems will have a major impact on the way we learn and play.





TIDE RUNNERS

A 6-pack of small, go-anywhere center consoles in a head-to-head shootout.

BY JOHN WOOLDRIDGE, Contributing Editor
PM Photos by Skip Gandy

● When you're talking 17-ft. center-console boats, you're talking fishing versatility. These boats can scoot through skinny water where other boats fear to tread *and* blast offshore to fight deep-water monsters on their own turf.

Putting these qualities to the test, PM brought six 17-ft. center-console boats to Islamorada, in the Florida Keys, for three days of sneaking through shallow back-

water bays and crashing out into the Atlantic to 100-ft.-deep reefs.

All of the boats were powered with Yamaha 115-horse outboards, which are equipped with oil and fuel premixing systems. These potent V4s provide an ideal combination of brisk top-end speed and ideal low-rpm trolling capability. How did the boats stack up? Here's the inside story.



MAKO 171 SPECIAL

Boston Whaler Outrage 17

No boat on the water is more distinctive than a Boston Whaler. Known for an unmistakable shape and unsinkable construction, Whalers command top dollar and high respect. The Outrage 17, the smallest of the Whaler family, is no exception. Its combination of the right stuff made it our overall comparison test champ.

The little Whaler smoked the competition in top-end speed, hole shot and in performance-course times. Configured with the narrowest beam, it didn't rank among the leaders in total stowage, livewell/fishbox space and usable deck area. This, plus narrow and slanted walking surfaces and rod holders that are too short for most saltwater rods, slightly lowered its fishability ranking.

But the Outrage closed out the data chart with a top score in fit and finish, and, here, Whaler takes a back seat to no one. The Outrage comes equipped with stout stainless-steel fittings, creamy glasswork and flawless joinery. The center console is large and well laid out,

with a helm designed to function equally well in a standing or sitting position.

These items are outstanding, and they better be. The Whaler is \$6000 more than its nearest rival. For boaters who want the best and want it to hold its value, there's no better boat—but be ready to pay for the privilege.

Grady-White Spirit 175

The new Spirit 175 is two things we've come to expect from Grady-White—well conceived and solidly built. Its spirited performance, flawless fit and finish, spacious stowage and top marks in fishability produced a balanced package that finished a close second.

The Grady recorded the second-fastest top-end speed and a top-tier score on the performance course, with no misbehavior to note. Hole shot was within a second of the leader.

Features that impressed the test crew are an anchor locker designed to hang the anchor above the chain and

TIDE RUNNERS



**BOSTON WHALER
OUTRAGE 17**

bow rails for support and low-maintenance composite plastic trim that's as beautifully routed and joined as the teak it replaces. Fit and finish, in general, shows a craftsman's hand. It always does in a Mako.

Wellcraft 18 Fish CF

Taking the style of boat seriously, the 18 Fish CF sports the best center console. The large unit has a well-organized dash panel, ideal wheel placement for standing or sitting and good protection behind a tall windscreen.

For fishbox and livewell capacity, this Wellcraft reigns supreme. General stowage space is also among the leaders. With so much volume taken up by compartments, total deck area is comparatively small, but not

rode, a massive 104-quart fishbox, a round livewell beneath the forward bench seat and a sturdy, deck-molded base for the center-console unit.

The tradeoff for the Spirit's fleet-leading stowage space is a bottom-tier score in deck area, although the boat didn't seem cramped.

The high score in fishability is due to the boat's excellent rough-water ride, superb trolling characteristics and numerous fishing features. Fit and finish is outstanding in all areas. Perhaps the stainless-steel hardware is less stout than the Whaler's, but the Grady's price is less steep, too.

Mako 171 Special

To many boaters, Mako is a synonym for fishing machine. So it's no surprise that the 171 Special tied for top honors in the fishability category. Functional, unobstructed deck layout, great rough-water and trolling characteristics, massive forward casting platform and numerous rod holders are sure to please fishermen, even though livewell/fishbox capacity is the smallest in the fleet.

There's tremendous stowage in the

bow, but little elsewhere. Hole shots were impressive and top-end competitive, but the Mako was sluggish on the performance course due to slow recovery from wheel-lock turns.

Features of note include an ice chest beneath a deeply cushioned 2-way bench seat, tall stainless-steel



**WELLCRAFT
18 FISH CF**

AQUASPORT 175 OSPREY

MAKO 171 SPECIAL

BOSTON WHALER OUTRAGE 17

SPECIFICATIONS AND DIMENSIONS						TEST DATA
OVERALL RANKING/ MANUFACTURER/MODEL	BASE PRICE/ AS TESTED	LENGTH/BEAM/ WEIGHT/ FUEL CAPACITY	DRAFT/ COCKPIT DEPTH	MAXIMUM HORSEPOWER RATING	SPACE AROUND CONSOLE	TOP SPEED
1. Boston Whaler Outrage 17 1149 Hingham St., Rockland, MA 02370	\$12,995/ \$24,472	17'3"/6'8" 1350 lb./32 gal.	13 in./ 18.5 in.	120 hp	13.5 in. Adequate	1. 44.5 mph Effortless speed
2. Grady-White Spirit 175 P.O. Box 1527, Greenville, NC 27835	\$9570/ \$18,070	17'5"/7'5" 1880 lb./48 gal.	12 in./ 21 in.	140 hp	14.25 in. Sufficient	2. 44.0 mph Quick in all conditions
3. Mako 171 Special 4355 N.W. 128th St., Miami, FL 33054	\$8249/ \$18,319	17'7"/2' 1580 lb./35 gal.	7 in./ 18 in.	135 hp	17.25 in. Copious	4. 43.0 mph Seemed to plow a bit
4. Wellcraft 18 Fish CF 1651 Whitfield Ave., Sarasota, FL 34243	\$15,995/ \$17,870	17'10"/7'9" 2080 lb./52 gal.	16 in./ 21 in.	150 hp	16.25 in. Generous	5. 41.0 mph Held back by weight
5. Aquasport 175 Osprey 1651 Whitfield Ave., Sarasota, FL 34243	\$14,112/ \$17,252	17'5"/6'10" 1840 lb./35 gal.	7.5 in./ 17 in.	115 hp	10.0 in. Confined	3. 43.5 mph Lively in rough stuff
6. Pro-Line 190 Sportsman P.O. Box 1348, Hwy. 19 S., Crystal River, FL 32623	\$8270/ \$17,222	18'6"/7'6" 2280 lb./69 gal.	12 in./ 22.5 in.	150 hp	11.5 in. Minimal	6. 39.0 mph Seems underpowered

Fishability rankings are a combination of analysis of layout, livewell/fishbox capacities, rough-water ride and trolling characteristics. Bold numbers on each line in the chart indicate ranking.



**PRO-LINE
190 SPORTSMAN**



**AQUASPORT
175 OSPREY**

cramped. Durable hardware and overall glasswork are evidence that Wellcraft has a renewed commitment to fit and finish. Overall fishability is equally sound.

However, the 18 Fish CF is the second heaviest boat in the test and didn't score among the leaders in the performance categories. This may not be a liability to those who notice that

pricing. However, there's no doubt that Aquasport is the econo line of the two. This isn't to say that the 175 Osprey is without appeal, it's just leaner than the top-tier boats.

The Osprey captured solid seconds and thirds in our performance categories, with just a hint of chine hooking in wheel-lock turns. A narrow beam resulted in lower marks in deck area,

eral minor fit-and-finish problems that could have been avoided.

Still, it's good to see Aquasport back on the scene after a few tough years, and we're sure the line will eventually find its niche.

Pro-Line 190 Sportsman

Odd man out in this test of 17-footers is the 190 Sportsman from Pro-Line. We had planned to test the company's 17-ft. model, but the builder showed up with the 190 because it considered it the best package for the 115-hp Yamaha. Despite its large size, and after much debate, we decided to include it in our comparison test.

The Sportsman is the heavyweight of the fleet and nailed down last-place marks in all performance categories. However, its size worked to its advantage in test categories determined by measuring tape. Tilting the balance away from an even trade were lackluster marks in fit and finish and fishability—narrow walkways and lively rough-water ride.

A bigger engine would undoubtedly benefit the Sportsman, but then the price of the boat would begin approaching the Whaler's. Bigger isn't always better. **FM**



**GRADY-WHITE
SPIRIT 175**

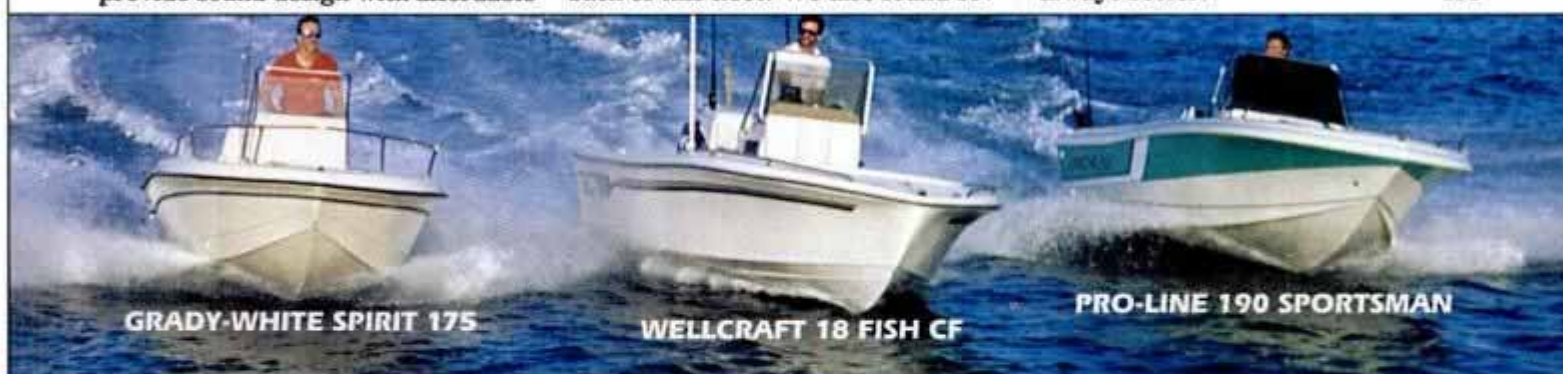
the affordable Wellcraft is a package boat with more standard features than any rig in the fleet.

Aquasport 175 Osprey

Like Wellcraft, Aquasport is a subsidiary of Genmar, and both builders provide sound design with affordable

livewell/baitwell capacity and stowage space.

A large casting platform is a plus for fishability, but narrow perimeter walkways, limited compartment space and a less-than-smooth rough-water ride pushed the Osprey to the back of this fleet. We also found sev-



GRADY-WHITE SPIRIT 175

WELLCRAFT 18 FISH CF

PRO-LINE 190 SPORTSMAN

HOLE SHOT 0-30 MPH	PERFORMANCE COURSE	DECK AREA/ STOWAGE SPACE	TOTAL LIVWELL/ FISHBOX SPACE	FISHABILITY RANKING	FIT & FINISH
1. 6.36 sec. Lightning fast	1. 28.39 sec. In a class by itself	3. 58.25 sq. ft./ 4. 14.64 cu. ft.	4. 4.64 cu. ft. Only in bow	2. Needs longer rod holders	1. (tied) Lavish quality in every detail
4. 7.27 sec. In the top tier	3. 31.43 sec. Corners like a champ	6. 55.07 sq. ft./ 1. 16.45 cu. ft.	3. 5.77 cu. ft. Fully rounded livewell	1. (tied) Functional layout, soft ride	1. (tied) Second to no one throughout
2. 7.14 sec. Leaps up on plane	4. 34.22 sec. Prop ventilates in turns	1. 69.45 sq. ft./ 5. 10.88 cu. ft.	6. 4.22 cu. ft. Needs more for offshore	1. (tied) Better for bays, but sound overall	2. (tied) Great joinery, good overall
5. 7.98 sec. Not far from top group	5. 34.5 sec. No misbehavior	5. 55.27 sq. ft./ 3. 14.8 cu. ft.	1. 8.03 cu. ft. Room for monsters	1. (tied) Best for bays, offshore due to draft	2. (tied) Excellent latches, good glasswork
3. 7.19 sec. Sprightly performer	2. 30.83 sec. Nimble with practice	4. 55.74 sq. ft./ 6. 8.96 cu. ft.	5. 4.60 cu. ft. Adequate but no more	4. Best for protected bays and calmer days	3. Minor installation details need attention
6. 8.41 sec. Sluggish but adequate	6. 35.86 sec. Slides wide through corners	2. 58.43 sq. ft./ 2. 15.55 cu. ft.	2. 6.93 cu. ft. Good for bait and fish	3. Lively in chop, otherwise fine	4. Low rails, toe clearances tight

Chevrolet. The Trucks You Can Depend On.



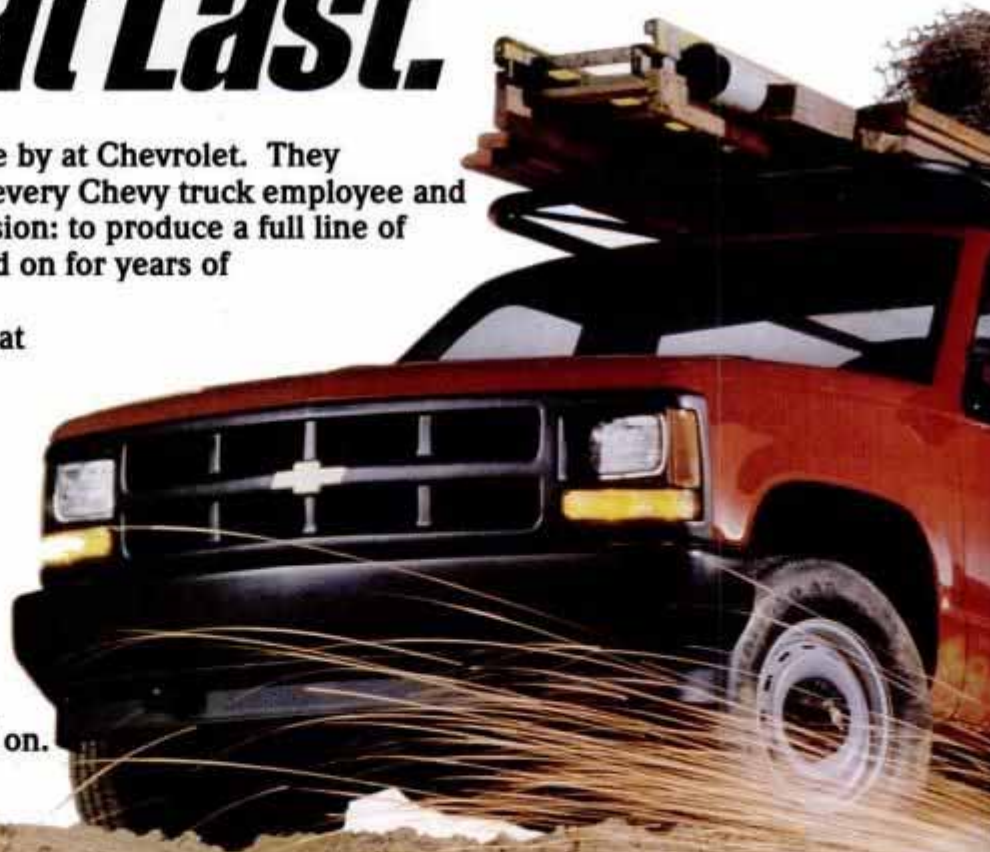
The Trucks That Last.

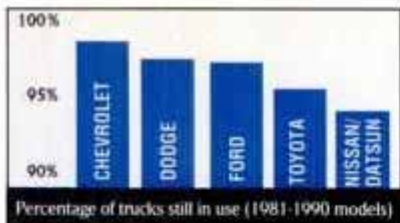
Those are the words we live by at Chevrolet. They represent a vision shared by every Chevy truck employee and dealer in the country. The vision: to produce a full line of trucks that people can depend on for years of hardworking use.

Each year we've realized that vision with products that provide greater value and quality. And, perhaps most important of all, with products that last.

Now we're ready to do it again. With a full line of trucks that is the finest in Chevrolet's 80-year history. The 1992 Chevrolets.

The trucks you can depend on.
The trucks that last.





• Traditionally, Chevys last longer, on average, than any other full line of trucks. These registration figures from the past 10 years prove it.*

Over 98% of all Chevys sold in the past 10 years are still on the job.* That's the highest percentage of any full-line truck company.

And as a Chevy gets older, the news gets better: Chevy full-size pickups bring top dollar at resale time. In fact, independent research shows they have the best resale value in the business.



• Chevy Astro is the only mid-size van with standard 4-wheel anti-lock brakes, a 6000-pound towing capacity,† available 200-horsepower engine and available seating for eight.

Chevy also has the biggest selection of trucks available—over 100 models to choose from.

And all of them are backed by one of the best warranties in the business. A 3-year/36,000-mile Bumper to Bumper Plus Warranty. With no deductible.**



• Chevy S-10 pickup has the biggest V6 you can get in a compact pickup—a 4.3 Liter V6.

In addition, every Chevy pickup, Blazer, Astro and Suburban comes equipped with standard rear-wheel or 4-wheel anti-lock brakes.†† That's a degree of dependability unmatched in our industry. And a powerful example of Chevrolet's commitment to your safety.

Here's one more cold, hard fact any truck owner will appreciate: Chevy trucks have the most two-side-galvanized steel of any full-size pickup. Plus a protective layer of standard base-coat/clear-coat paint.

Dependability is a key factor in the popularity of Chevy's

patented Insta-Trac™ system, too. In fact, so many people have come to depend on Insta-Trac, it's now the most relied-upon 4x4 system in America.



The result is the best rust protection in the business.

• Chevy S-10 Blazer is the only sport utility vehicle in its class with standard 4-wheel anti-lock brakes. Now available with push-button Insta-Trac 4-wheel drive.

And here's something else you can count on: Insta-Trac is standard on all Chevy 4x4s, from Blazers to pickups. More proof that wherever you go on this planet, Chevy trucks are the trucks you can depend on.

Something Chevy owners have come to depend on through years of hardworking use. No wonder Chevy full-size pickup is America's best-selling truck.***

• Chevy full-size pickup has the best rust protection in the business. One more reason why it's America's best-selling truck.

See your Chevy dealer. And see for yourself. These are the trucks you can depend on. The trucks that last.



**The Heartbeat of America
Is Winning™**

Buckle up, America! Chevrolet, the Chevrolet emblem, S-10, Blazer, Astro and Suburban are registered trademarks and Chevy is a trademark of the GM Corp. ©1991 GM Corp. All Rights Reserved. *Based on registration data, 1981-1990. †When properly equipped. Includes trailer, equipment, passengers and cargo. **See your Chevrolet dealer for terms of this limited warranty. ††Rear-wheel anti-lock brakes operate in 2WD only. ***Based on truck registration data model year to date.

MONSTER TRUCKS



DUANE ELLIOTT/GETTY IMAGES

BY CLIFF GROMER

● A firestorm of exploding glass fractures the light in a blaze of brilliant sparkles. The shattering blast of a berserk behemoth smashing the roof of a forlorn family Dodge is sucked up in the roar and squeal of the crowd. This is car abuse at its most spectacular—monster trucks dive-bombing a squad of sacrificial automobiles, pouncing and bouncing crazily over roofs and hoods, and bashing them pancake-flat. It's the "Monster Mash," and it's a box-office smash.

Just what kind of beasties are capable of meting out—as well as taking—this kind of punishment every weekend? Bulldozer brawn is just the beginning. The big-wheelers also have to accelerate, handle and brake. That's because the paying public eventually tired of a pack of single-purpose monsters whose whole act was simply pounding cars into scrap. So the event's promoters had to come up with new forms of monster truck madness—such as mud racing, sand drags,

hill climbs and side-by-side motocross-style stadium racing.

And as the madness evolved, so did the trucks. What started out as a 4-wheel super-sledgehammer has evolved into a very specialized competition machine.

Today's monster trucks are faster, absorb more stress and require more control. They have to stay in their lanes over bouncy, twisting obstacle courses, where the obstacles are junk cars. That's no small feat when you're bounding along on four huge tires that ride like beach balls. It's a combination off-road race and demolition derby, seasoned with the fascinating sounds of smashing sheetmetal.

Driving techniques also have evolved to keep pace with changes in events. Take mud racing, for example. The older mud pits were thick and gooey and deep enough to almost swallow an entire truck. So slogging through the stuff was the only way to go. Now the mud pits are only about 2 ft. deep and real soupy. The fast way home here is to skim across the top. To do that you need speed, lots of speed. The new trucks are capable of covering 70 ft. in just 2 seconds.

Crushing cars—the forté of the

CRUSHING CARS FOR FUN AND PROFIT

Nuts and bolts of monster trucks—America's wildest motorsport.



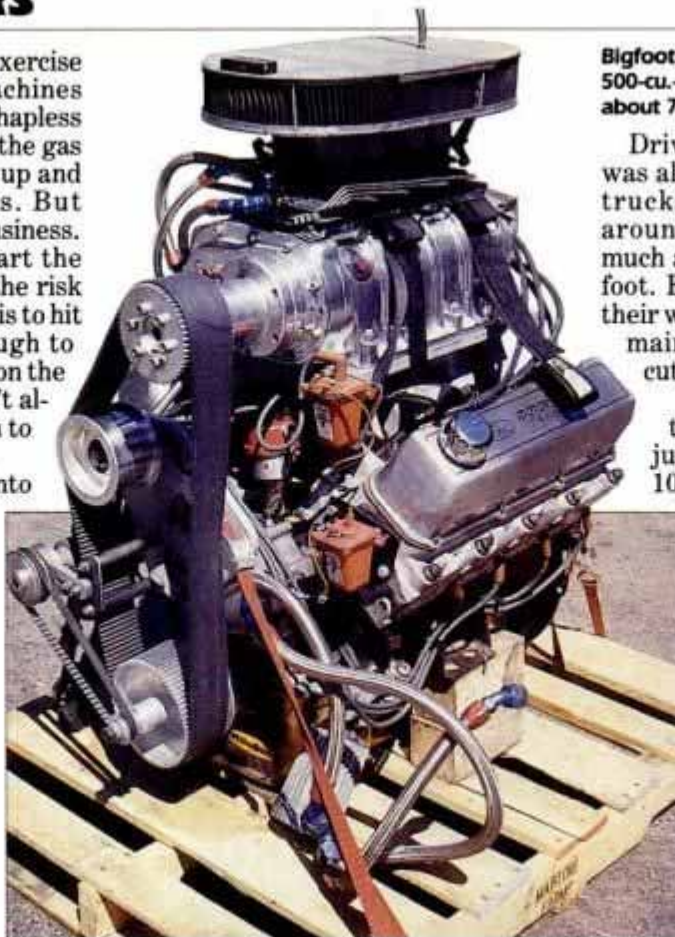
CRUSHING CARS

monster truck, used to be an exercise in slow motion. The huge machines would amble up to the line of hapless autos, the driver would goose the gas and the monsters would rear up and slam down on their victims. But crushing cars can be a tricky business. Cars don't always smash apart the same way, so there's always the risk of flipping over. The trick now is to hit the approach ramp fast enough to clear the pack of cars and land on the exit ramp. Of course, it doesn't always work out that way, much to the delight of the crowd.

To get an idea of what goes into a modern monster masher, we went to St. Louis, Missouri, home of the most famous big-wheeler of them all—Bigfoot. All told, there are no fewer than 12 Bigfoots, representing three generations of development.

Peeking under the skin of one of the newest versions, the first thing you notice is the skin itself. The entire Ford pickup body—cab, bed and fenders—is all fiberglass, with door handles and headlights painted on. It seems that the metal cabs were wearing out too quickly, with welds and body structure breaking and cracking from the constant pounding.

Weight saving is a second reason for the fiberglass body. It's part of the overall trend toward size reduc-



Bigfoot's supercharged and fuel-injected 500-cu.-in. Ford Motorsport engine puts out about 700 horsepower.

Driver comfort, believe it or not, was also a major concern. The older trucks were bashing the drivers around inside their cabs almost as much as they bashed the cars underfoot. Easing the shock loads finding their way into the cab helps the driver maintain better control, and also cuts down on the medical bills.

Extra-generous suspension travel is the key to going faster, jumping higher and keeping the 10,000-pound truck on an even keel. You won't find any springs on the newest Bigfoots. The 24-in. suspension travel (front and rear) is achieved by using a 4-link setup. Four bars extend from the pivot point at the center of the frame to pivot points on the axles. Two huge nitrogen-charged shocks at each corner help maintain ride height, and jounce and rebound characteristics.

Custom-built, the shocks are similar in concept to off-road racing shocks, but larger, and use a 3-stage damping system. Discs inside the shocks are changed to fine-tune the damping characteristics of each stage. Damping is progressive. Initially, the shocks move 2 in. for every inch of wheel movement. But as the shocks compress into their last stage, the damping ratio stiffens to 1:1. Videos of the truck in action on Bigfoot's own test track and a telltale tape that indicates how far the shocks are traveling, show what's happening during each stage of damping. Ride height is also adjustable by varying the pressure of the nitrogen in the shocks.

While many of Bigfoot's parts—such as driveshafts and tie rods—are handmade, some are adapted from agricultural and industrial applications. It's just a matter of finding something that works—usually by trial and error.

Take the axles, for example. The new trucks run Rockwell F106 axle

tion—the Incredible Shrinking Monster Truck—for better handling and performance.

Finally, fiberglass is easier to repair than steel in case of rollovers, which are not uncommon. Just cut out the damaged panel and bond in a new one. Of course, fiberglass isn't as strong as steel, so the entire cab structure uses a full roll cage that's an integral part of the chassis.

The frame itself uses chromoly steel tubing, similar to the frames used in stadium race trucks. The final design—including suspension layout, shock location and engine setback—was worked out by computer, putting the new Bigfoot car-compactors into the high-tech category.



Fuel cell and engine radiator are mounted behind cab for protection.



Dual nitrogen-charged shocks at each corner are fully adjustable.



Braking system consists of a 12-in. disc on each differential yoke.

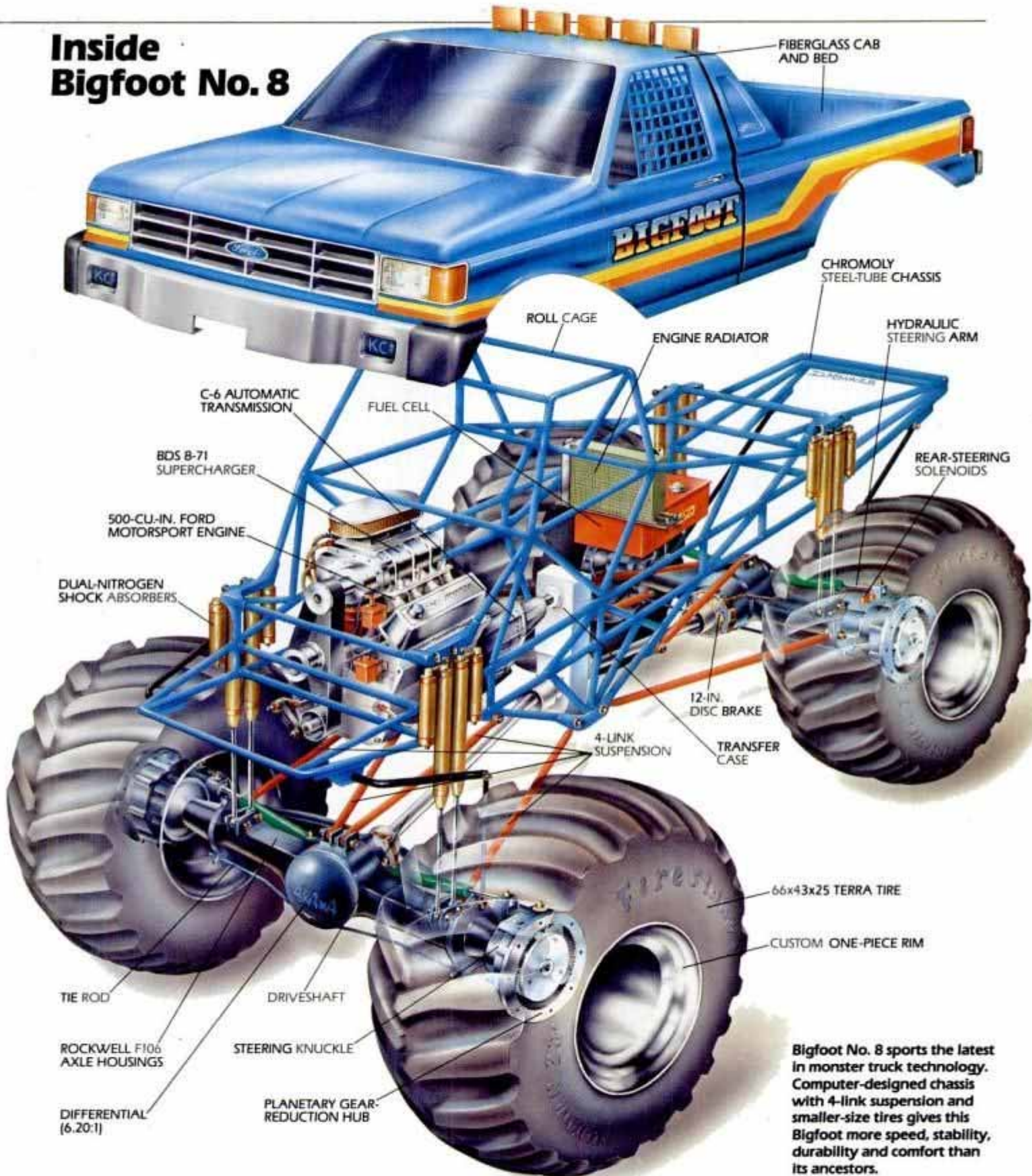


Rear steering is controlled by electric solenoids that control hydraulic pistons.



Interior is gutted. Plexiglas firewall allows driver to see into engine compartment.

Inside Bigfoot No. 8



Bigfoot No. 8 sports the latest in monster truck technology. Computer-designed chassis with 4-link suspension and smaller-size tires gives this Bigfoot more speed, stability, durability and comfort than its ancestors.

housings (normally used in school buses), replacing 5-ton military axles as the hot setup. Bigfoot mechanics cut the ends off the housings and weld on special flanges. The axle itself (an industrial application), comes with a planetary gear reduction on the end of the shaft.

This setup allows additional 3.56:1

gear reduction to ease the torque load on the axle. The shafts are cut down and resplined to fit the F106 carrier. The conventional axle-mounted drum brakes were sent to the trash bin to cut unsprung weight. So Bigfoot's mad progress is controlled by a 12-in. disc brake mounted on the differential pinion shafts.

Custom-made one-piece rims (safer and lighter than 2-piece rims) carry 66x43x25 Firestone Terra tires. In the real world, these tires have the dubious distinction of supporting 30-mph liquid fertilizer spreaders. On Bigfoot, they're pushed to speeds of 70-plus mph. Inflated to between 5 and 11 psi, the tires, about \$2000

CRUSHING CARS



apiece, compress right to the rims on the jumps. Shaving the tread on new tires cuts another 200 pounds—per tire—off the truck's weight.

It takes some big ponies to get those big feet high enough to perform a crowd-pleasing aerial act, and superchargers are virtually the norm in today's monster truck world. The fine-tuning and speed secrets that go into these engines rival the fierce mechanical one-upmanship that takes place behind the scenes in dragstrip and superspeedway duels.

Pumping big power to Bigfoot's big feet starts off with a Ford Motorsport high-nickel-content, cast-iron 460 cylinder block that's bored and stroked to 500 cu. in. The Ford big-block can take even more in the way of overbore, up to as much as 640 cu. in. if needed. But 500 in. of engine fed by Crower fuel injection and boosted by a 30% overdriven Blower Drive Service 8-71 supercharger seems to provide more than enough muscle.

Bigfoot's supercharged engine is far from unique—just about all the trucks that perform their wild antics in the monster circuit are blown. A combination of Ford Motorsport and aftermarket performance sources account for the aluminum heads with oversize valves, camshaft, 10.5:1 pistons, rods and crankshaft.

Mounted in hard neoprene bushings, the engine is set low and well

back from the front of the chassis for a better center of gravity. It's also designed to help the truck land with its rear wheels first, for better control on the jumps.

Drivers have enough to worry about without shifting gears, so monster trucks rely on automatic transmissions. Bigfoot uses a heavily beefed Ford C-6 transmission with a manual valve body, hardened input shaft and a TCI converter designed



for tractor pullers. Additional torque multiplication is provided by a Profab transfer case before the power is delivered to the double-reduction 6.20:1 differentials. The transfer case also offers a fast and easy way to change gearing to suit a particular racecourse.

In case you're wondering what the third 4 is in Bigfoot 4x4x4, it's for 4-wheel steering. Hydraulics, borrowed from various agricultural and industrial jobs, turn the steering

Car abuse doesn't get much better than this as a monster truck makes short work of squishing roofs and scrunching sheetmetal.

knuckles on front and rear axles. The front system uses a conventional belt-driven power-steering pump. Rear steering uses electric-driven hydraulic pumps controlled by a switch mounted on the shifter.

The system has a self-centering feature, so releasing the switch returns the rear wheels to the straight-ahead position. Tie rods, front and rear, connect the steering knuckles to keep the wheels parallel in case the truck comes off a jump on one wheel. They prevent the pressure from forcing the hydraulics on one side from turning the wheel in.

The front steering hydraulic system uses a relief valve to blow off excess pressure. Without the valve, a one-point front-wheel landing could generate enough back-force in the hydraulics to whip the steering wheel with such violence that it could break a driver's fingers and wrists.

While monster trucks stretch (literally) automotive technology in new directions, some of the hardware is filtering down to enthusiasts who are building their own custom big-wheel pickups. After an evening of watching pro monsters mash every car in the stadium, it's amazing that these guys can resist the temptation of riding over the parking lot traffic jam. **FM**

BIGFOOT 4x4, INC., PHOTO

FM PHOTO BY CLIFF GROWER



WINGS OF MAN

A PM Editor becomes a licensed pilot in just 21 days.

BY ABE DANE, Science/Technology Editor; PM Photos by Chris Sorensen

● I was just getting the hang of steering the plane with my feet, when Dave Weitz, my instructor, told me to do what seemed like a very reckless thing. He told me to gun the throttle. So I did. The little Cessna snarled and leapt forward, gathering speed quickly as we weaved back and forth across the runway centerline. Through the haze of distractions, my mind clung to one fact retained from my first preflight briefing: Pull back on the control yoke when your airspeed gets to 55 knots. Simple enough. Now...if I could just find the airspeed indicator. Damn! I used to know that one.

By the time I found the elusive gauge, we were doing 60. I pulled back gingerly and the plane reared up off its nose gear, but the main wheels stayed firmly on the pavement. Then, as if tugged upward by a

giant bungee cord, we wobbled into the sky.

So began my pell-mell rush to pilothood.

Actually, the *very* beginning came a little more than a week before, when Editor-in-Chief Joe Oldham called me into his office. As usual, his orders were succinct: Get your pilot's license as fast as you can, then get back here and write a story about it.

Within a week, I was setting up camp in Leesburg, Virginia, a burgeoning suburb northwest of Washington, D.C. After checking into a motel, I headed over to Janelle Aviation, the fixed base operator at Leesburg Municipal Airport. Like FBOs at many small airports, Janelle is a sort of hy-

WINGS OF MAN

brid business that pilots rely on for fuel, repairs and whatever else they need to sustain their habit.

Soon I am sitting in a tidy office across the desk from Weitz. With a businesslike manner, and an impish smile, he displays the sort of good-natured mercilessness that often marks an effective teacher.

"We're attempting the impossible," he says matter of factly, as he slaps a pile of books, charts and inscrutable paraphernalia down in front of me. He gives me a cursory outline of what we're about to embark on, and sends me back to the motel with a stern directive to study. We'll take our first flight tomorrow morning.

For most people, getting a Private Pilot Certificate is a relatively drawn-out affair, a labor of love pursued in free time and on weekends over a period of three months to a year. While regulations say you need only 40 hours of flying time (35 hours at FAA-approved schools like Janelle's), most people spend 60 to 70, primarily because they forget so much between lessons. There would be none of that for me. There wasn't time.

Private pilot training centers around preparation for two tests: the written and the practical. The written covers topics ranging from navigation, to radio communications, to meteorology. It's a lot of material, but if you cram, you can eke out a passing score of 70% with a few days' study. The real challenge is putting that knowledge into practice.

Your success in doing this is determined in the practical test, or check ride—the last hurdle between you and your license. A representative of the FAA goes up in the plane with you, and puts you through your paces, while interrogating you on the full range of the textbook material.

The next day, after a night of feverish study, Weitz introduced me to my mount, a 1981 Cessna 172 Skyhawk. Although no longer in production, this



little 4-seater is the most numerous aircraft type in the world. Its popularity is due in large part to simple design and docile handling, which make it an excellent trainer.

My first impression was that it was—well, functional. Particularly on the inside, a complete disregard for aesthetics is manifest. The upholstery is dowdy, the instrument panel is an ergonomic nightmare of seemingly randomly placed dials, rows of identically shaped rocker switches and primitive-looking push/pull knobs. Accustomed to the fly-by-wire flight control systems, glass cockpits and ring laser gyros regularly written about in Tech Update, I was a little disappointed.

Weitz showed me a checklist, a stalwart mental crutch which I would soon learn was integral to many aviation tasks. In this case, it outlined the steps of the preflight inspection, a ritual performed every time you start the plane with the intent to fly. It begins in the cockpit with a quick check of the fuel gauges and a few other items, then takes you on a choreographed saunter around the plane—wiggling control surfaces, feeling for popped rivets and skin irregular-



ities, checking fuel samples, and the like.

With practice, the preflight takes about 10 minutes. Then it's on to the prestart and start checklists. To actually crank up the motor, you pump the priming knob in and out a couple of times, set the carburetor heat to cold, open the throttle a crack, set the mixture control to rich, yell: "Clear prop!" out the window, turn the master switch on and turn the ignition key to the START position. It's enough to make you appreciate what engine management electronics have done for car powerplants over the years.

The engine, an air-cooled Avco-Lycoming O-320-D2J, catches and blasts out a raw, unmuffled exhaust note. With 319-cu.-in. displacement, 160 horsepower, and a horizontally opposed flat-Four layout, it's not unlike a giant, low-revving Volkswagen Beetle engine.

We check the oil pressure, flip the avionics switch on, check the two communications radios and ask for the active runway. Runways are designated by the first two digits of their magnetic compass heading. "Cessna 365, Leesburg's advising 17, right



Dave and I do the preflight, checking prop condition, oil and fuel levels, and taking fuel samples to spot water or sediment.



Cramped inside, ungainly outside, the 172 nonetheless has a mammoth following.

traffic," comes the reply.

A blip of the throttle gets us rolling. Steering on the ground is through the rudder pedals, which move the nose wheel via an elastic linkage. For tight turns, you rock one pedal forward, engaging the main-wheel brake on that side only.

Just before the entrance to Runway 17, we pull off the taxiway into the runup area. Then out comes the pre-takeoff checklist. After making sure everything's secure in the cabin, we test the controls and set the flight instruments. Then, with feet planted on the brakes, we throttle up to 1700 rpm, bringing a stiff gust of propwash in through the open windows. The engine's two ignition systems, carburetor heater and instruments are checked while revved up.

I should note that when I say "we" did all this, I really mean that Weitz talked me through every move and stepped in when I was too clueless to follow instructions. Overall, however, I was amazed, and a little worried, at how much leeway he gave me. Wherever possible, his approach was to let me learn from my own mistakes.

A few more checks and we're ready to go. We pull up to a yellow hold-short line just off the runway, look around for other planes, key the radio mike and say: "Leesburg traffic, Cessna 365, departing Runway 17 Leesburg." Then we roll out

onto the runway, pulling windows shut, and flipping on the transponder and wingtip strobes. From here on out, any mechanical glitches are going to be a lot harder to deal with than if we'd found them on the ground.

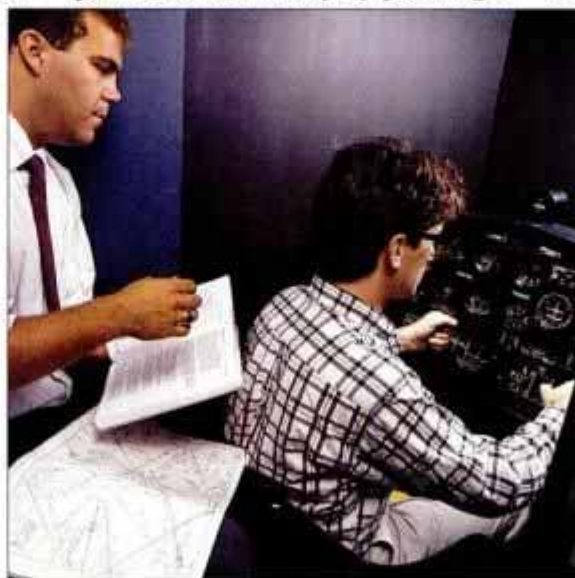
Once airborne, I immediately begin to shed preconceptions about what it's like to fly a plane. To those of us accustomed to the behavior of vehicles in contact with the ground, the air seems like a spongy and unpredictable medium to travel through. Swirls of turbulence buffet us, and I can't blink without finding myself 200 ft. from the altitude I'm trying to hold. I wrestle with the yoke as if it's part of some infernal exercise machine.

Perhaps the hardest thing for a new student pilot to get accustomed to is the fact that you can't just drive a plane around the sky by pointing it

where you want to go. If, for example, you want to go down, lowering the nose will start you in the right direction, but you'll quickly gain airspeed as you descend. That increases lift, so that when you try to level out, you'll tend to climb right back up again. In order to descend more than 100 ft. or so, you have to pull the throttle back, and keep a close eye on airspeed.

Airspeed is even more critical in climbs. Since the slightest nose-up will promptly slow you down, you have to find the combination of airspeed and climb angle that will give you the most lift. This is done by applying full throttle and nosing up to an angle that will slow you to one of two precalculated airspeeds. Known as V_x and V_y , these are part of a whole series of V speeds that must be memorized for whatever type of plane you're flying. V_y takes you up at the maximum number of feet per minute. V_x produces the steepest angle of climb—good for getting over obstacles.

Turning is tricky too. Kicking the rudder pedals will swing the nose sickeningly from one side to the other, but does little to change the direction of flight. To do that, you have to bank, which means that a certain amount of the lift that was holding you up is now pulling you sideways. It also means that you've lost some vertical lift and will tend to descend unless you nose up, which, if you don't add power, will reduce your airspeed. Meanwhile, your feet are busy working the rudder pedals to keep the back of the plane



Simulators cut the cost of instrument training.

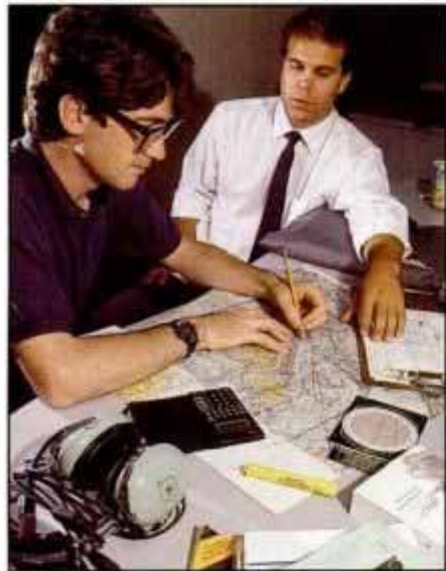
WINGS OF MAN

trailing neatly behind the front.

The bottom line was that every time I got out of the plane after the first few flights, I wanted nothing more than a cold beer and a full-body massage. Instead, I got a postflight critique and more homework.

For the first week, we flew every day. Progress came quickly, and within two days, I took the first of five stage checks. A written quiz and a ride with Janelle's chief flight instructor, Dr. Donald Robb, confirmed that I was moving along satisfactorily.

From the beginning, Weitz had told me he wanted me to solo in a week. That *really* seemed like a bad idea. But as the week wore on, I was starting to feel a little more comfortable in the airplane. In fact, flying around and around the airport traffic pattern, practicing takeoffs and landings, was beginning to have an almost mesmerizing appeal. A few times, I even



Getting through the cross-country planning quickly was one of the toughest challenges.

caught myself trying to steer my car home with my feet.

On the sixth day, as we taxied back for another takeoff, Weitz told me to stop the plane. He scribbled something in my logbook, opened the door and said, "Your logbook's signed off for solo. Make three takeoffs and three landings. Full stop."

Then he got out and closed the door.

On one level, what happened next was perfectly mundane. I flew the traffic pattern just as I had with Weitz sitting next to me. The pattern is no more than the aerial equivalent of driving around the block. I'd done it time and time again.

But it was different. At first, I was a little relieved that Weitz was gone. The way he pointed out my mistakes was starting to wear on me. I changed my mind shortly after lifting off. Things were happening faster than I remembered. I made the first turn a little late, and didn't stop climbing until I was higher than I was supposed to be. At 1200 ft., with the world spread out below on this warm summer day, it struck me that three days before, I wouldn't have had a prayer of putting this machine back on the ground in one piece.

As it was, I was a little unsure. But I did as I'd been taught, and soon Leesburg's long, wide runway rose to meet me. Ground effect cushioned my descent about 10 ft. up, and wafted me over the runway like an air-hockey puck. The excess airspeed bled off, and I dropped to the tarmac with a graceless bang and a chirp of the tires.

Two more times around, and it was over. I shut the plane down and walked slowly back to the office to rejoin the ground-pounding human race. Weitz was waiting outside with his friend and fellow instructor Jim



Friendly AFSS supervisor Cliff Brooks explains obscure weather terminology.

Odenwaldt. "Climbs like a bandit without him, doesn't it?" said Odenwaldt.

With the basics of getting off the ground and back down again covered, we began spending more time outside the pattern. There, we practiced a variety of maneuvers, primarily designed to help in recognizing and getting out of dangerous situations.

Chief among these were stalls. When these occur, the smooth, lift-giving sheet of air flowing over the wing suddenly degenerates into useless turbulence. As a result, you stop flying and start falling. It doesn't happen in a properly loaded, properly flown plane, but it happens nonetheless. And if it happens close to the ground, you'd better be ready with the appropriate recovery techniques. These, in a nutshell, consist of applying full throttle and pushing the nose *down* to raise airspeed—not the first thing you'd naturally think of with the ground rushing up to meet you.

How To Get Yours

● People come to the United States from all over the world because it's easier and cheaper to learn to fly here than just about anywhere else. So even if you don't win our contest, you can probably swing it.

All told, costs usually range between \$3000 and \$8000. Ways to hold the price down include training in a small, simple plane like a Cessna 152, and doing your homework, so you don't pay for unnecessary instructor time. I got a good jump on the homework by watching King Video's Private Pilot Written Exam Course over a weekend before I began.

More than anything else, quality of instruction will determine whether you end up feeling your money's been well spent. Assuming you can't spare a month for a full-time program, look in the Yellow

Pages under "Aircraft" for a nearby flight school. You can also dial (800) I CAN FLY, a national information line run by Sporty's Pilot Shop.

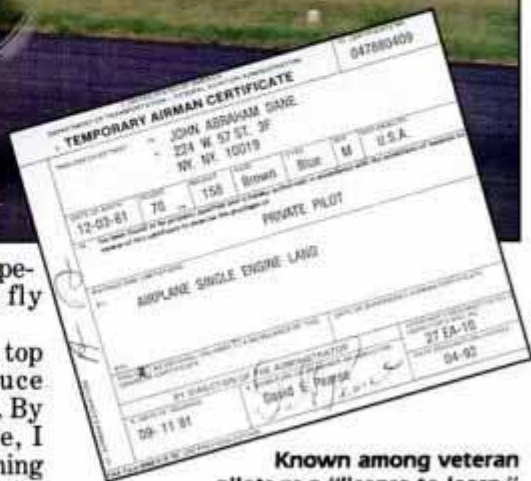
Next, visit schools, looking for an instructor you're comfortable with and a well-maintained fleet of planes. Make sure also that the school has enough aircraft to ensure you won't have to reserve them too far in advance, and will not have your training interrupted by breakdowns. Once you select a school, have them set you up with a doctor to get your medical certificate. Do it *before* you invest a lot of time and money in training.

Now comes the fun part—flight training. In the process, you'll probably become intimate with one of the four aircraft at right, or the 172 I flew.

—A.D.



Piper Cadet is back in production, despite manufacturer's fiscal woes.



Known among veteran pilots as a "license to learn," the Private Pilot Certificate is the first of several milestones in an aviator's career.

My precarious grip on control had its severest test when Weitz had me put on the foggles. Resembling a pair of bifocals with all but the little reading lenses frosted over, these blocked my view of everything but the instrument panel. Only the twitching needles and indicators of the six flight instruments stood between me and total disorientation.

Arranged in two rows of three, these are the airspeed indicator attitude gyro, altimeter, turn-and-bank indicator, vertical speed indicator and directional gyro. To a trained pilot, they provide a complete picture of how the plane is flying. To me, they looked like a child's busy board.

The trick to instrument flying is keeping your eyes dancing over all the instruments in a pattern called a scan, which enables you to synthesize an overall sense of orientation. We practiced it for a few hours, but private pilot training is intended to give only enough proficiency to save you in an emergency. Without an instrument rating, which comes only with ex-

tensive additional training and experience, you're only allowed to fly when visibility is good anyway.

Every time I started to feel on top of things, Weitz would introduce some new maneuver or procedure. By about two weeks into the course, I was at least familiar with everything that I might be asked to do on the practical. Thus, the time was fast approaching when I would have to leave the confines of our practice area and find my way over unfamiliar terrain.

My ability in this regard would be developed and tested in three solo cross-country flights. The last of these, stretching over three legs and 300 miles, would be the final task before Robb gave his approval for the check ride.

The most basic method for finding your way from place to place in an airplane is a combination of pilotage and dead reckoning. That means you look at a map, determine the course from point to point, correct that course for wind and magnetic variation, then steer it with a magnetic compass.

Along the way, you note your time of arrival at checkpoints to make sure you're progressing as planned.

For a student pilot, exhaustive pre-flight planning is essential to stave off later confusion in the cockpit. I'd start the process with a walk to the FAA Automated Flight Service Station (AFSS) next door for a weather briefing on my intended route. After establishing that it was safe to fly, I'd take the wind, temperature and barometric pressure information from the briefing and plug it into my navigation log. Then, using tables from the 172's manual and a simple arrangement of

(Please turn to page 98)

PIA PHOTOS BY RUSSELL MUNSON



American General Aircraft Tiger revives and updates an old favorite.



Aerospatiale Tampico Club is the only all-new trainer design on the market.



Although out of production, the compact Cessna 152 flies on in huge numbers.



Buckle up — together we can save lives.

HAVE YOU
EVER GIVEN
YOURSELF A
PROMOTION?

HAVE YOU
DRIVEN
A FORD
LATELY?

Raising your status means raising your standards, so be prepared to accept some remarkable improvements on the new Crown Victoria: *A sleeker, more aerodynamic design.* A quieter, roomier interior. A redesigned suspension for better handling.

Next comes power, which you'll have on demand, courtesy of a new modular V-8, *the most advanced engine in its class.*

NEWS ABOUT SAFETY.

With power comes responsibility: An available anti-lock braking system with Traction Assist, speed-sensitive power steering and a standard driver-side air bag supplemental restraint system to be used with your safety belt. A passenger-side air bag is also available.

THE Nth DEGREE.

For an even more serious trip to the top, consider *the new Crown Victoria Touring Sedan.* It boasts added horsepower, an exclusive interior and standard anti-lock brakes with Traction Assist.

Whichever route you take, you'll be calling the shots. From a very impressive office.

NEW BUMPER-TO-BUMPER WARRANTY.

New 36-month/36,000-mile limited warranty requires *no deductible.* See your dealer for a copy.

**NEW
CROWN VICTORIA**



Why settle for a cheap imitation when the real thing is now so affordable.

Achieve your
New Year's
resolution with
NordicTrack!

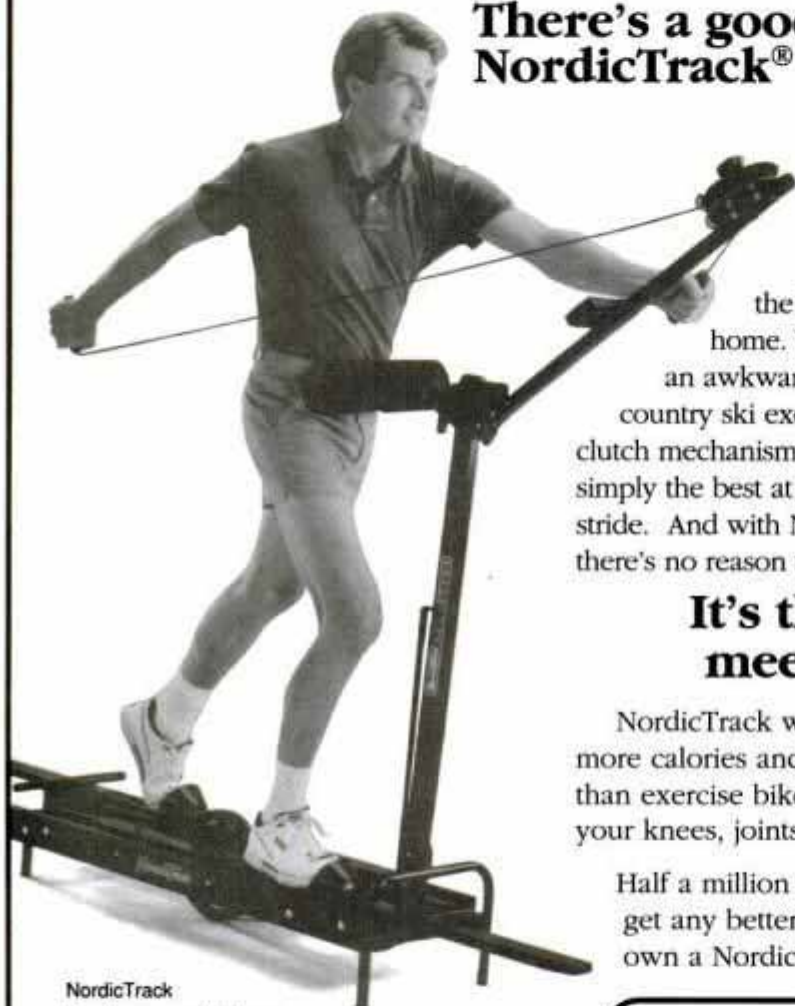
There's a good reason why the NordicTrack® cross-country ski exerciser is known as "The World's Best Aerobic Exerciser"™.

For over 15 years NordicTrack has been the leader at bringing cross-country skiing into the home. While lesser cross-country ski exercisers provide an awkward "shuffling" motion, the NordicTrack® cross-country ski exerciser uses a patented flywheel and one-way clutch mechanism that no other ski machine can match. It's simply the best at simulating the natural cross-country skiing stride. And with NordicTrack models priced as low as \$299, there's no reason to own anything but the best!

It's the affordable way to meet your fitness goals.

NordicTrack works all the major muscle groups, burning more calories and providing a better cardiovascular workout than exercise bikes, treadmills and stairclimbers. It's gentle on your knees, joints and back. And it's easy to use.

Half a million owners already know that exercise just doesn't get any better than NordicTrack. At these prices you can own a NordicTrack:



NordicTrack
Challenger model shown.

**Order today.
And get a \$69.00
electronics package
for FREE.**

Order today, and you'll get more than "The World's Best Aerobic Exerciser"™ — you'll get a free \$69.00 electronics package! We just improved our Challenger, Sequoia and Excel models to accept the BC 887 Electronic Speedometer/Chronometer, which helps you accurately track your distance, time and speed. It adds value to every workout...and it's yours for free if you order a Challenger, Sequoia or Excel before January 31, 1991. This offer not valid with any other offer.



NordicTrack Excel only \$499!

NordicTrack Sequoia only \$399!

NordicTrack Challenger only \$299!

Models priced from \$299 to \$1299

NordicTrack

A CML Company

Call today for a 30-day in-home trial!

1-800-328-5888 Ext. 275A2

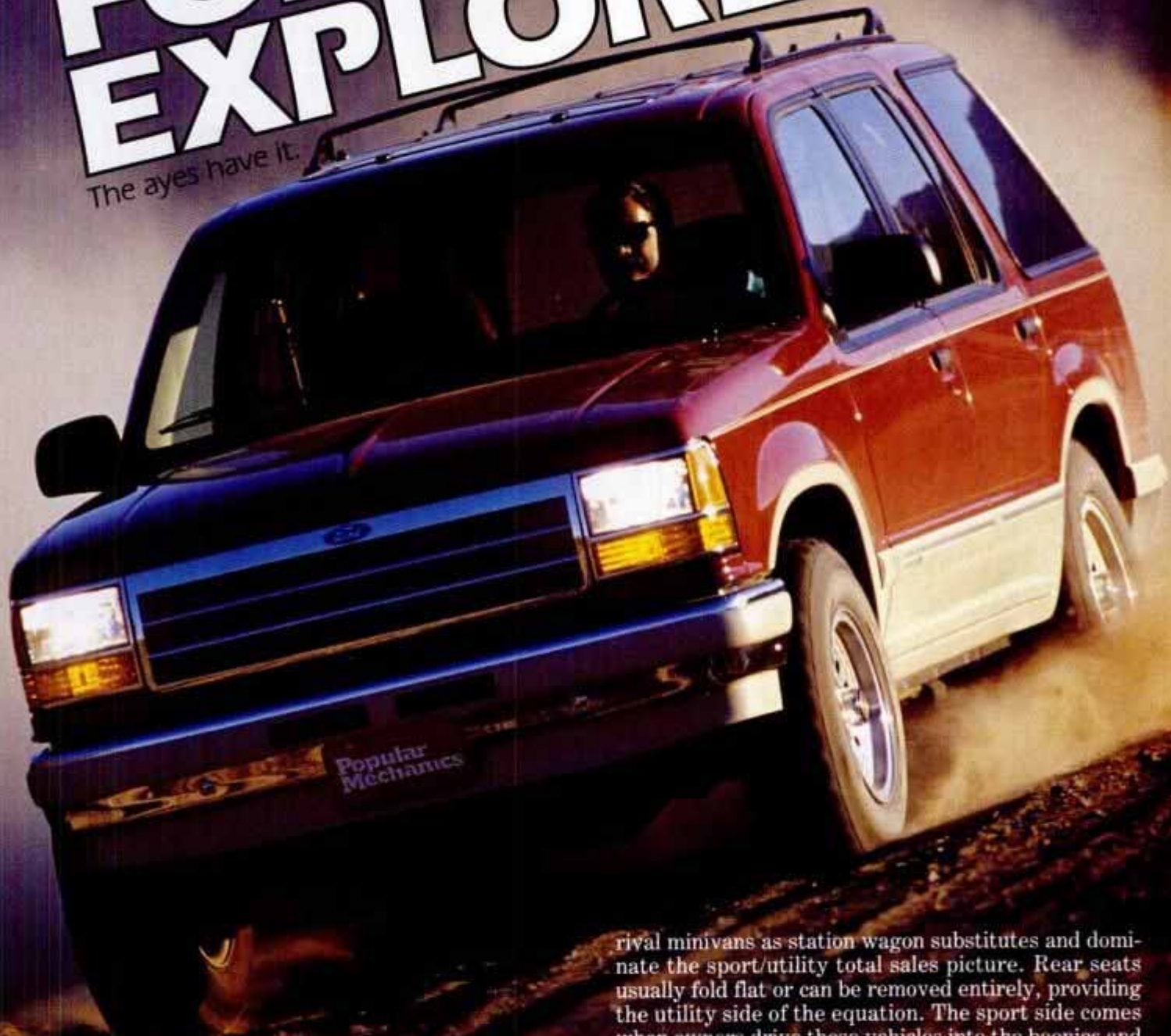
NordicTrack, Dept. #275A2, 141 Jonathan Blvd. N., Chaska, MN 55318

©1991 NordicTrack, Inc., A CML Company

All rights reserved.

FORD EXPLORER

The eyes have it.



Popular
Mechanics

BY MICHAEL LAMM, Contributing Editor
PM Photos by Rich Cox

● Sport/utility vehicles have come a long way since the Jeep Wagoneer blazed a bumpy trail across the gullies and washes of North America on its way to the country club. But once accepted in suburbia, the Wagoneer and the smaller Jeep Cherokee legitimized the sport/utility vehicle as something suitable for all-around driving.

People buy these vehicles for any number of uses. Most manufacturers now offer 4-door versions, which

rival minivans as station wagon substitutes and dominate the sport/utility total sales picture. Rear seats usually fold flat or can be removed entirely, providing the utility side of the equation. The sport side comes when owners drive these vehicles into the boonies and put on their hunting caps or fishing waders.

Beyond that, many owners value 4-wheel drive to help pull them through snow, mud and over the rough stuff in bad weather. Sport/utilities are crossbreeds: part truck, part sedan—engineered for all seasons and unmistakably styled for the great outdoors, with their own kind of macho panache that's easily adapted to a wide variety of tastes and purposes.

As one of the newest—and most popular—representatives of its breed, the Ford Explorer is a natural Owners Report subject. We mailed questionnaires to 1000 owners of 1991 Explorers and asked how they're get-

FORD EXPLORER



Detailing and appointments of Explorer interior scored well with most owners, as did its roominess. Power of 4.0-liter V6 engine was one of the outstanding features.



ting along with their vehicles. And the overall reply seems to be: "Just great!" An impressive 57% rated the Explorer's fit, finish and overall quality excellent, while another 41% called it good. Both percentages are well above average.

Very few questionnaires reflected any type of mechanical trouble. The

most common non-mechanical problem had to do with leaky windshield seals. Ford quickly came up with a fix and offered free repairs in the field.

We noted a large number of positive comments about the Explorer's performance, both on and off the road. The 4.0-liter 155-hp V6 got lots of praise for its smooth, quiet opera-

tion and also for its wide torque band. Most of the buyers surveyed—86.9%—chose the optional 4-speed overdrive automatic transmission over the manual 5-speed.

It was also interesting to note that there was very little difference in overall fuel mileage between the automatic and the manual in 2wd or 4wd.

SUMMARY OF 1991 FORD EXPLORER OWNERS REPORTS*

Total miles driven:	2,625,854	4wd/2wd	87.4/13.1	Excellent	57.0%	Dealer repairs satisfactory?	
Average miles driven:	6436	Specific likes:		Good	41.0	Yes	75.0%
Purchase price:		Styling	42.9%	Average	2.0	No	25.0
Average	\$20,248	Ride quality	34.8	Comfort opinion, front seats:		Dealer service opinion:	
Range	\$15,000-\$25,500	Interior/roominess	34.0	Excellent	69.1%	Excellent	46.6%
Why did you choose the Explorer?		Seating comfort	34.0	Good	28.0	Good	42.3
4-door convenience	33.8%	Handling	28.8	Average	1.7	Average	9.7
Styling	32.7	4wd	22.3	Poor	1.2	Poor	1.4
4-wheel drive	32.7	4-door convenience	21.5	Comfort opinion, rear seats:		Number of vehicles owned:	
Roominess	20.2	Engine power/performance	21.2	Excellent	46.3%	This vehicle only	12.2%
Comfort	11.2	Specific dislikes:		Good	44.6	Two vehicles	44.9
Price	10.1	No complaints	16.4%	Average	7.8	Three or more	42.8
Model choice:		Low mpg	13.1	Poor	1.3	Principal driver:	
XLT	66.2%	Stiff ride	9.8	Mechanical trouble?		Male	50.9%
Eddie Bauer	23.3	Price	6.6	No	82.1%	Female	42.3
XL	23.3	Seating comfort	5.9	Yes	17.9	Equal	6.8
Sport (2-door)	1.3	Seatbelts chafe neck	4.6	What type of trouble?		Age distribution of owners:	
Avg. mpg, city/hwy.:		Suggested changes:		Noisy brakes	13.9%	Under 29	10.0%
5-speed manual	17.6/21.8	No changes	26.8%	Wheel alignment	12.5	30-49 years	58.7
4-speed automatic	16.8/21.2	Improved mpg	8.0	Fuel gauge	6.9	50-plus	31.4
2wd	17.7/21.7	More comfortable seats	5.9	Transmission	6.9	Based on your experience, would you buy an Explorer again?	
4wd	16.9/21.2	Improve rear-seat airflow	5.0	Accelerator	5.6	Yes	84.0%
Transmission choice:		More comfortable seatbelts	4.7	Did you repair it yourself?		Maybe	14.0
4-speed automatic	86.9%	Better dash layout	4.4	No	95.8%	No	2.0
5-speed manual	13.1	Workmanship opinion:		Yes	4.2		

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

The Explorer's 4x4 drive has a pushbutton-operated shift-on-the-fly feature. Owners appreciated its ease of operation and instant response. A second soft-touch button is provided to engage or disengage low range, but the vehicle must be stopped to do so.

So far, Ford provides antilock brakes on the rear axle only, but Dearborn insiders say that 4-wheel ABS is on the near horizon.

Explorer buyers don't seem to hold back when they get to the option list. Among the owners we surveyed, most chose the upmarket XLT series, and then proceeded to add several thousand dollars worth of extras. They wound up paying \$20,248 on average.

The least expensive Explorer 2x2 lists for \$14,451, but our owners made it clear that even with the heavy option invoice they felt they'd gotten their money's worth. To emphasize the Explorer's value, one in 10 respondents listed price as an important sales incentive. The three prime reasons for purchase, though, were the availability of four doors, styling and 4wd, in that order.

Subtle touches

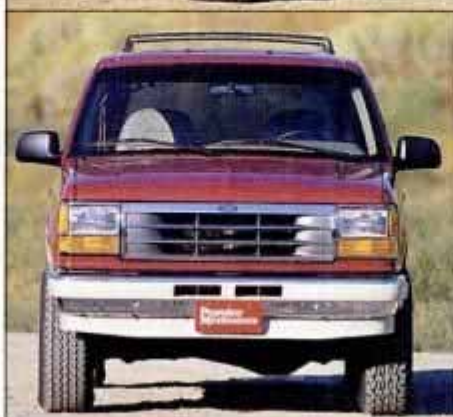
A lot of subtle touches were simultaneously pointed out by owners. Many appreciated the full-size spare tire that stows under the cargo floor. They also liked the opening window in the rear liftgate and the cargo net that keeps groceries from sliding around. The 40/60 split rear bench seat folds flat to give 81.6 cu. ft. of cargo space—a lot more than any sedan. And the Eddie Bauer edition comes with two fitted pieces of luggage, a thoughtful extra that wins friends for Ford.

Ford launched the Explorer as a successor to the 2-door-only Bronco II. Although a few mechanical parts were carried over, the Explorer is a lot more than just a mere replacement. Many of our respondents had owned Bronco IIs, and virtually all agreed that there's no comparison between that vehicle and this one.

High satisfaction

If they had it to do all over again, would they still choose an Explorer? Based on their experiences, 84% of our Explorer owners said yes. Perhaps even more significant, only 2% said no. That's an extremely high approval rate, particularly for so specialized a vehicle.

It also says something for the appeal of sport/utility vehicles in general. This type of vehicle is winning converts daily. And the Ford Explorer seems to stand out as one of the most satisfying. **FM**



Reflecting practical appeal of sport/utes, 4-door convenience outranked styling as primary reason for buying among Explorer owners. Styling still ranked tops as best-liked feature.

EDITORS REPORT

All-Around Excellence

● Like the majority of owners in this survey, our experiences with the Ford Explorer have been positive. Unlike the majority of the owners, these experiences span a broad range of environments, from urban stop-and-go to wide-open interstates to wide-open spaces.

It's this last part that sets our experiences apart. Most sport/utilities rarely leave the pavement, but we've done some pretty rough stuff with an Explorer ("Death Valley To Pikes Peak," page 38, Sept. '90), a job it handled in style.

That experience taught us a lot about the Explorer's off-road capabilities. Its 4-wheel-drive system is flexible, user-friendly and tough. The 4.0-liter V6 has plenty of low-end grunt for bog-slogging, and there's enough leftover torque for towing.

Competent as it is off-road, though, the Explorer does have one weakness when it comes to the paths less traveled. Its minimum ground clearance is just 6.3 in., which isn't much when you're out there rock-hopping. In fact, it's the smallest ground clearance in the compact sport/utility field, a statistic to keep in mind if there are a lot of rocky roads on your horizon.

However, when it comes to the environment where most Explorers spend most of their time, it's hard to

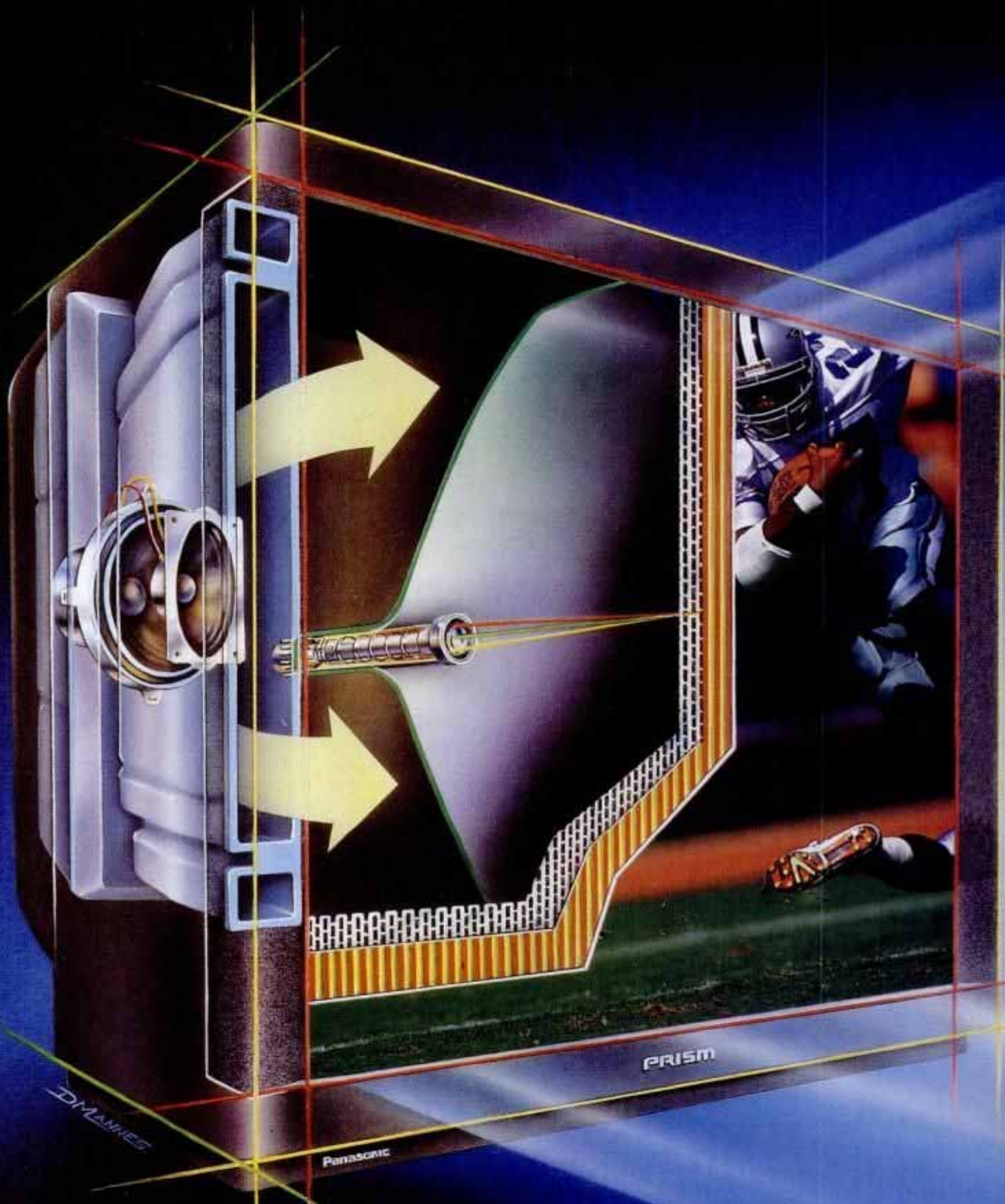
think of another sport/ute that does a better job. The 4-door Explorer, which accounts for 86% of Explorer sales, serves mostly as an all-weather go-anywhere station wagon. Whether you're schlepping Superbowl eats for 24 or mushing through slush en route to the ski area, the Explorer gets it done with minimal fuss.

It has the roomiest interior in its class—a genuine 5-passenger vehicle. And even though it's essentially a truck, its longest-in-class wheelbase helps keep ride quality carlike.

Handling is more truckish, though favorably comparable to the other players in this class. Our only complaint is the power steering, which is typically Ford—overassisted and numb on center. And like the owners, we wish the ABS function extended to all four wheels.

But there is nothing else that sticks out as a weak spot. Interior appointments range from tasteful in the basic XL to almost luxurious in the Eddie Bauer edition, instrumentation is clean, controls well located and small-object storage plentiful.

The Explorer is an enticing combination of thoughtful design, solid engineering and attractive pricing. Many of our owners think it's the best in its class. We're inclined to agree with them. —Tony Swan



The electron gun inside a picture tube is precisely aimed through a perforated grille and a light-absorbing grid to excite individual color phosphors. In Panasonic's new Prism "SuperFlat" TV, a flatter screen reduces distortion while a better electron gun produces sharper images. Stereo sound shoots out from each side of the TV.

ELECTRONICS

FLAT NOT FAT

New TV pictures are flatter, viewing angles are wider, and the image is clearer.

BY STEPHEN A. BOOTH, Contributing Editor

● Call it the Battle of the Bulge. Television makers are trimming the beer-belly contours of the boob tube to provide you with a better picture. The idea is to make a rounded picture flat, thereby eliminating the curvature in the screen that creates distortion. Less noticeable than the flatter screens are other elements within the picture tube that are also being improved to produce sharper images and truer colors.

Like many dieters striving for flat tummies, however, television manufacturers have succeeded in making a flat screen to varying degrees. And, again like many dieters, manufacturers have a tendency to overstate their successes. While this new crop of TVs is ballyhooed as flat, there is still a slight bulge in the profile. Nonetheless, the bulge is significantly smaller.

The first of these flatter TVs on the American market is the Prism CTP-3196SF made by Panasonic. Listing for \$1800, this 31-in. deluxe TV boasts a "SuperFlat" tag but actually has a screen curvature of 21mm, 30% flatter than the company's conventional models. To the naked eye, the screen is virtually flat.

Panasonic will not be alone in offering flatter TV screens. Sony is already selling a Super Trinitron with flatter screens in Japan. Likewise, Hitachi and Toshiba are currently selling flatter screen models in their domestic markets. Thomson Consumer Electronics, which owns the RCA brand in the U.S., has flatter screen models in Europe. All these companies are likely to make their flatter screen models available in the United States soon.

Why is there a new emphasis on TVs with flatter screens? It's a fact of life and geometry that you can't see around a curve. It's also been a necessary evil of TV manufacturing that display tubes have a convex screen surface. This curvature in the viewing area has several

drawbacks, all of them having to do with picture distortion. It is this distortion that TV makers are trying to correct by eliminating the bulge.

To begin understanding why TV screens are curved, it's important to remember that, like a light bulb, a TV tube is a vacuum tube. This vacuum exerts great stresses on the glass, and any flaw or weakness could cause the tube to implode.

It's easier, and more cost-efficient, to blow spherical (and cylindrical) pieces of glass that can withstand the force of a vacuum than it is to make flat plates with the same stability. As TV tubes come in bigger screen sizes, the stresses increase. To withstand them, a perfectly flat plate of glass would have to be impossibly thick, creating new viewing distortions, and heavy.

Manufacturing practicalities aside, the curvature of tube displays also has a lot to do with reproducing color images.

The inside surface of a TV tube's faceplate is etched with tiny dots of color phosphors—red, green and blue. These are the primary colors from which all other colors are derived. The phosphors glow, creating a color picture when they are struck by electrons fired at high velocity from the electron gun in the neck of the tube.

This process isn't as simple as it seems. Magnetic lenses in the gun focus the electrons, but to make sure they hit the correct phosphors and thereby create the correct image, two other elements are needed.

The first is a barrier between the electron gun and the screen. This barrier is a thin metal sheet with perforations, similar to a window screen, and it's called the shadow mask or aperture grille. There's a perforation for each phosphor, and its purpose is to guide the electron beam to exactly that target while the solid area masks the adjacent phosphors.

FLAT, NOT FAT

As a backup to the mask or grille, the phosphor dots on the screen are separated from one another by a black grid that does not transmit light. This barrier is akin to the grout between tiles, and further reduces the chance of a stray electron exciting the wrong phosphor. If you look at your TV picture closely, you'll see it's made up in a screenlike mosaic pattern. The closer the phosphors are spaced, and the finer the grille, the more photographic-looking the picture.

Ironically, the shadow mask itself provides another reason for giving the tube's faceplate a convex shape. Most of the electrons fired at the viewing surface never get near the target, because they strike the solid area of the grille. The mask takes a hell of a shelling, and the heat from constant electron bombardment causes the grille to expand and deform. This problem is compounded by the American public's demand for ever-brighter TVs, which entails "driving" the tube with heat-increasing higher wattages.

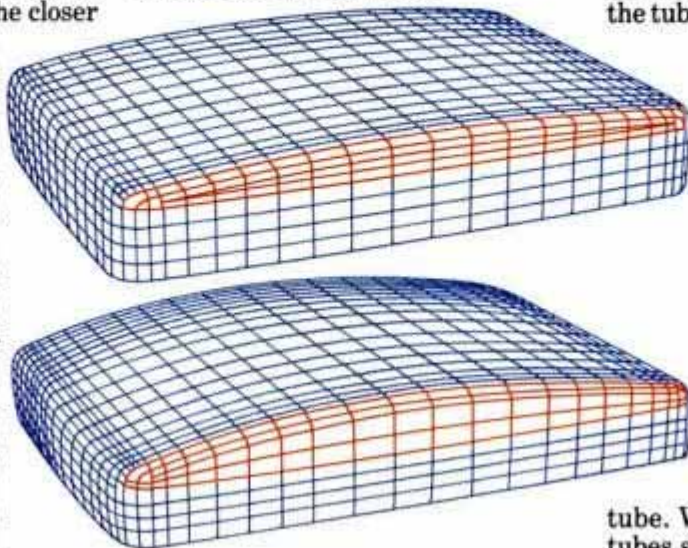
Because the mask is suspended by springs, it tends to buckle outward from the center when it deforms—a process called "doming." If the tube's faceplate were flat, you'd have a really weird-looking picture once the deformed mask began misguiding electrons to the wrong phosphors. Happily, the curvature of the tube's faceplate takes into account the doming of the shadow mask, and the black guardbands between the phosphors minimize any residual misfocusing of electrons.

Given all of the conflicting demands on the innards of a TV, it's easy to appreciate what an elegant compromise the curved tube represents. But much the way the curvature of the Earth prevents you from seeing over the horizon, a convex faceplate prevents you from seeing the entire picture when you're seated at an extreme off-side angle to the screen. Also, a curved surface is prone to pick up reflections from light sources all over the place. The resulting glare negates the brightness the tube produces, thereby reducing contrast.

Until now, these viewing inconveniences have been a fair tradeoff for the benefits of large, bright, color displays. But as TV moves toward wide-screen tubes and high-definition programming, the shortcomings of the curved screen will become more objectionable.

For example, the soon-to-arrive

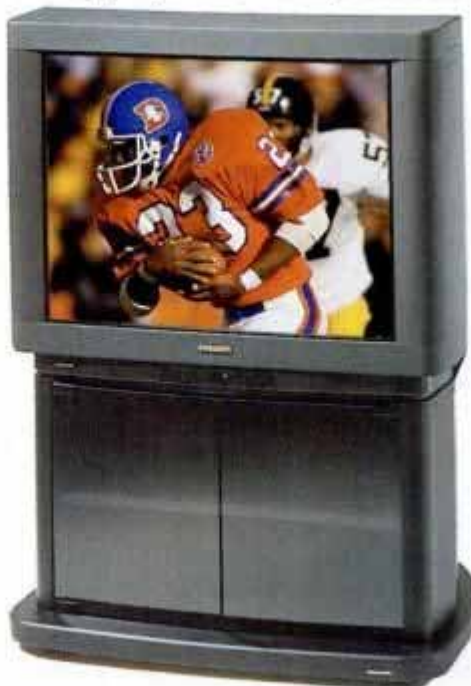
wide-screen sets (now available in Europe) have a 5.33:1 width-to-height ratio—one-third wider than the 4:3 proportions of today's TVs. Given this girth, the bulge in a screen would be quite evident if it had the same degree of curvature as today's sets. Also, off-angle viewing would become nearly impossible.



The highlighted area in the top diagram shows the slim screen curvature of Sony's new Super Trinitron TV. Above is the screen curvature of a conventional Trinitron.

With an eye to the future, for some years now manufacturers have been introducing improved materials and new technology to alter the TV tube's physique.

One remedy has been antiglare coatings on the faceplate. Although this reduces unwanted reflections and thereby improves contrast, it doesn't



Panasonic's 31-in. "SuperFlat" Prism—as it would appear in your living room.

address the geometry of the tube.

Better shadow masks do, and some manufacturers have begun to use masks made of an alloy called Invar in their higher-priced television sets. This alloy resists heat deformation better than the metals used previously. Because the mask doesn't deform as much, less curvature is required in the tube's faceplate.

So far so good, but the stresses of the vacuum tube still exist. To address these, manufacturers applied computer-assisted design techniques to shape flatter tubes that could resist internal stress. RCA's Square Planar Tube from 1986 was an early example. Though it was a pleasure to view, TVs using this tube never succeeded in the U.S. because the picture wasn't bright enough to satisfy American tastes.

Sony too was in the forefront of redesigning the tube. Whereas other so-called "flat" tubes still have a slight potbelly profile, the Trinitron faceplate has been cylindrical—curved from side to side but flat from top to bottom. This fall, Sony announced an improvement called Super Trinitron. Though still cylindrical, the protrusion at center screen has been reduced by about half, to 16.9mm from 34.3mm in a 32-in. diagonal tube.

There are many other improvements in the SuperFlat tube and tubes from other companies, such as a more accurately focused electron gun that permits a finer aperture grille and, therefore, more closely spaced phosphors for a higher-resolution picture. The electron gun in Sony's Super Trinitron tube, for example, can focus a beam that's 30% smaller than those in conventional tubes.

The fact remains, though, that flat is flat. And Chicago-based Zenith has the only truly flat television tube, although it's used only in computer monitors and is not yet available for TV receivers.

The perfect flatness of the Zenith tube owes its existence to the company's patented Flat Tension Mask (FTM). This shadow mask is stretched on frame from all sides, and held rigid under great tension. Because the mask doesn't deform and buckle when it's heated, the tube's faceplate needn't be curved.

Last summer, Zenith developed the initial machinery for automated manufacturing of large FTM tubes. The perfectly flat TV tube might appear in American homes sometime within the next few years.

PHOTOGRAPH BY HANK KEN

FOCUS ON SPORTS PHOTO

JOURNAL

COMPARISON TEST

BELT SANDERS

For sheer sanding power, nothing beats a belt sander. Here's how nine of the best stack up.

BY THOMAS KLENCK, Associate
Home Improvement Editor
PM Photos by Stan Silver



● You've just finished gluing up boards for a tabletop. The glue is dry, and it's time to remove the clamps. And, whether you've done this job a hundred times or this is your first effort, the next steps are to inspect the joints and check the panel for flatness. Don't be surprised if there's a ridge at every seam due to misaligned boards. Even the best lamination requires some surfacing before the panel is ready for final sanding and finishing.

Woodworkers have two solutions to the problem. You can either get a hand plane and shave the surface flat, or you can plug in your belt sander and

wear away the imperfections. While a sharp plane—lubricated with a little elbow grease—will handle the job, many folks opt for the belt sander. Not only does it remove stock quickly and with little effort, it produces a uniform surface regardless of changes in grain direction. And, controlling the degree of smoothness is simply a matter of installing the appropriate belt. There's no blade sharpening, and adjustments are minimal. If this sounds too good to be true, in a way it is. The belt sander's voracious appetite makes it one of the more difficult power tools to control. If it's not han-

dled with skill, it can turn a flat board into an undulating surface of gouges, bumps and depressions.

Many of today's belt sanders come with features and accessories to help tame this tool's over-eager sense of purpose and to increase its versatility. Variable-speed or 2-speed models allow you to tailor stock-removal speed to your job. This is handy for light-duty surfacing, as well as removing finishes. Many belt sanders can be mounted upside down, turning them into stationary benchtop tools that handle small work. In this mode, they're also useful for tool sharpen-



PORTER-CABLE 352



FREUD LC75



SEARS 11715



MAKITA 9900B

ing. Fences are available to help hold the work at the correct angle, and wraparound sanding frames help eliminate surface gouging much like the base on a plane.

Belt sanders are classified by belt size, and most major manufacturers offer a range of models to handle belts from 3 in. wide × 21 in. long to 4 in. wide × 24 in. long. Our comparison test concentrates on the 3 × 21-in. sanders. Unless you're doing a lot of large-scale belt sanding, it's likely that one of these will fit the bill. For a look at a few of the other belt sanders available, see "Belt Sanders—Large And Small" on page 53.

All of the sanders we tested come with a dustbag. Although the bag won't collect all the dust, it's definitely better than doing without. The 3 × 21-in. sanders come in two styles. The first has its motor mounted at a right angle to the length of the tool. This transverse type is also the standard model for the larger, heavy-duty versions. In the second configuration, the motor is placed parallel to the length of the tool. Called inline belt sanders, they're more compact, can be flipped over for use on the bench and, as we found, they're easier to handle.

In addition to a motor-and-drive system, all belt sanders have a spring-loaded belt-tensioning mechanism to keep the belt taut. A belt release lever backs off belt tension for remov-

ing the belt, and a tracking knob adjusts the position of the front roller to keep the belt from shifting too far on either side (see bottom illustration on page 51).

In addition to belt sander features, you probably want to know how fast each tool removes material. Although our comments reflect our impressions after putting each tool through a series of tests on hard and soft woods and plywood, you can get an idea how effective they are by comparing each belt sander's maximum belt speed, weight, platen area and motor size (see Specifications Chart on page 52). All things being equal, a heavier sander will remove stock more quickly with less effort, and a higher speed produces the same result. Given a consistent belt width, a larger platen area will also contribute to faster sanding. However, in all cases, you need a motor powerful enough to maintain belt speed once the tool is set on the wood. More subjectively, a comfortable, quiet vibration-free tool with well-designed handles and controls may feel more effective simply because it's easier to handle.

Note that the prices shown for all tools are manufacturer's suggested retail prices. In order to be competitive, most dealers and mail-order distributors sell for less, and it pays to comparison shop so that you'll get the most sander for your money.

AEG HBSE 75S

We feel that the ability to use a belt sander in the stationary, benchtop mode is important. That's one reason why we're impressed by this tool—it's the only one that comes complete with the stand accessory. Even without this thoughtfulness on AEG's part, however, the HBSE 75S would be a strong competitor.

Power supply is through a hefty, 16-gauge rubber-sheathed cord, versus the 18-gauge wire found on most other models. A 7.8-amp motor in combination with a large sanding contact area (15¼ sq. in.) means this tool does its job fast. Our tests have it coming in just behind the more powerful Freud unit. The sander is loud, but not quite as annoying as the Freud. Because this tool is a variable-speed model with a low speed of 490 fpm (feet per minute), you can harness and control the power for careful work as well. A chart on the tool's side helps in selecting the right speed for the job.

The AEG sander has a comfortable handle and a well-designed trigger-lock button. The large belt tracking knob works smoothly, and the belt release mechanism is one of the best. Its zippered dustbag is easy to empty and attaches through a secure bayonet-mount connection. Where most others have a steel platen, the AEG uses a graphite-impregnated platen that



HITACHI SB-75

AEG HBSE 75S



RYOBI BE 321

BOSCH 3270D

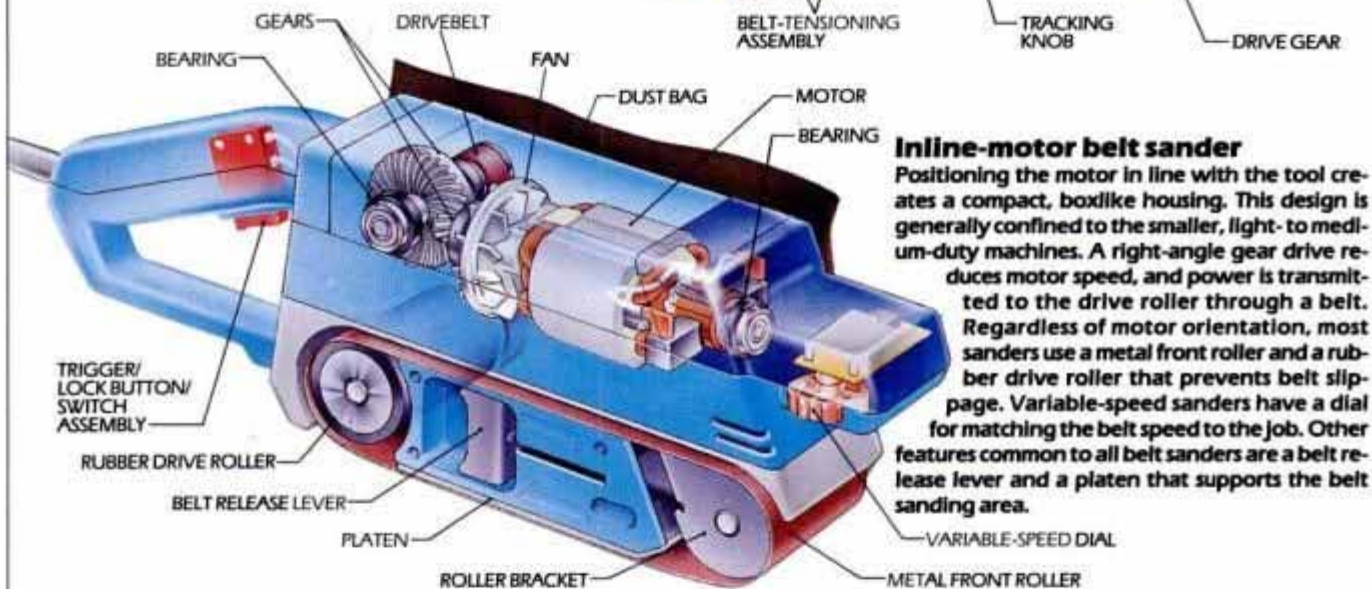
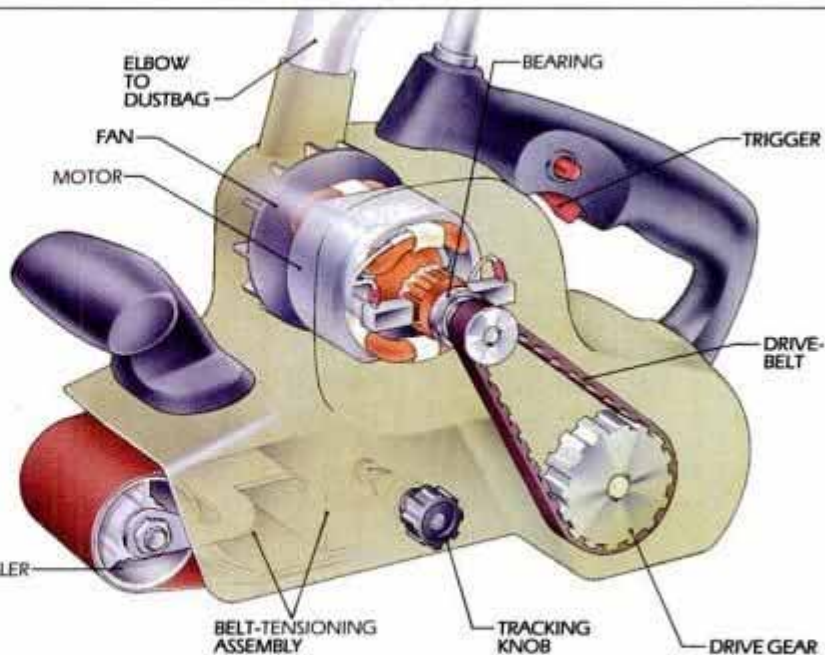


ELU 4024

BELT SANDERS

Transverse-motor belt sander

The most common belt sander design has a motor that's positioned across the length of the tool. This places the motor axis parallel to the rollers so power can be transmitted through a simple toothed drivebelt. Reduction gears behind the drive gear further reduce the motor's speed to an rpm suitable for driving the belt. The fan behind the motor creates an airflow that carries dust from the sanding area to the dust-bag. A tracking knob and belt-tensioning mechanism keep the belt tightly aligned on rollers. In addition to a trigger switch, belt sanders have a button to lock the tool on during continued use.

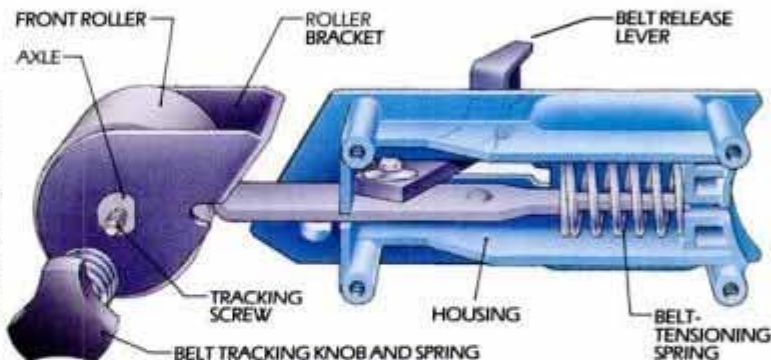


Inline-motor belt sander

Positioning the motor in line with the tool creates a compact, boxlike housing. This design is generally confined to the smaller, light- to medium-duty machines. A right-angle gear drive reduces motor speed, and power is transmitted to the drive roller through a belt. Regardless of motor orientation, most sanders use a metal front roller and a rubber drive roller that prevents belt slippage. Variable-speed sanders have a dial for matching the belt speed to the job. Other features common to all belt sanders are a belt release lever and a platen that supports the belt sanding area.

Belt-tensioning mechanism

Although the design varies from one manufacturer to the next, most belt-tensioning mechanisms share similar features. The belt-tensioning spring forces the front roller away from the drive roller to keep the belt tight. When the belt release lever is opened, a cam on the inner end of the lever bears against the mechanism housing to compress the spring and draw the front roller toward the drive roller. The tracking knob adjusts the position of the front roller so that the belt will stay centered over the platen.



reduces friction and heat buildup.

We did notice that the front roller and platen are slightly out of line with the rear roller, although this didn't seem to affect the tool's ability to sand flush against the tool side. Sanding up to a wall at the tool front will leave about 3½ in. unsanded. In addition to the stand accessory that comes with

this tool, AEG offers a sanding frame to help prevent gouging broad, flat surfaces.

Bosch 3270D

If you're looking for a medium-duty 3 × 21-in. belt sander with thoughtful design and construction, refined manners and performance in keeping with

this category, then chances are you'll be happy with the Bosch 3270D.

While it's about average in sanding power, this tool is a joy to use. It's one of the quietest in our test, and relatively vibration-free. Along with a comfortable grip, it has a large, easy-to-use trigger-lock button. It's very light, and belt switching is a snap.

We felt that the dust-collection bag on this belt sander collected more dust than the other tools we tested. Unfortunately, the bag is held closed with an annoying clip rather than a zipper. While the tool has only one speed, its less-than-aggressive sanding power combined with light weight make it easy to control. If you're looking to remove material in a hurry, though, you'd probably be better off with another model. The Bosch tool flush sands on the side, but only as close as about 5½ in. at the front. For accessories, you can buy a sanding frame, a stand for stationary work and an adjustable fence to hold stock accurately when the tool is mounted in the stand or to guide the sander when it's handheld.

There is one thing Bosch should fix, however—the power cord. At 6½ ft., it's simply too short for a tool that's likely to be moved around as much as a belt sander.

Elu 4024

Similar to the Bosch, the Elu 4024 is clearly not designed to compete in any way with the larger, heavy-duty machines. However, it's a comfortable, well-balanced and lightweight tool suited to typical careful cabinet- and furniture-making work. The Elu is also the quietest tool we looked at, and its variable speed goes as slow as 475 fpm for delicate sanding operations. The platen has a cork backing pad to cushion the sanding area.

On the down side, the tool doesn't flush sand into a corner (although Elu claims it does), and the tiny dustbag is difficult to remove and empty, although it does pick up a relatively large percentage of dust. Most annoying is the belt release procedure. Unlike other tools, the Elu's lever doesn't lock in the open position—you

have to hold it open with one hand, while installing the belt with the other. And, although its light weight makes it an easy tool to handle, it may also be responsible for a tendency to chatter with a coarse, 50-grit sanding belt.

Elu offers a unique stand for this tool that permits mounting the tool vertically or horizontally. Also available is an adjustable fence and a sanding frame.

Freud LC75

If you're hungry for power, you might as well stop here. With a single speed, large contact area and a 9.6-amp motor, the Freud LC75 is going to remove material—whether you like it or not. You can also get this tool as the LC110. The only difference is a longer, 3 × 24-in., sanding belt.

In appearance, the Freud sander is very similar to AEG's entry—with a little less attention paid to fit and finish. It also has the same easy-to-use belt release mechanism, a hefty, 16-gauge power cord and a graphite platen. Its dustbag mounts by way of a spring clip that works well, and the bag has a zipper for easy emptying. The sanding belt tracks very well, and excellent roller/platen alignment assures flush sanding on the side. Like the AEG HBSE 75S, the Freud's housing has two threaded holes on the top for installing legs when using the sander as a stationary tool. Freud doesn't offer the legs, however, but suggests that you move the front knob to either of these holes to suit different sanding situations.

Unfortunately, the tool has one serious drawback—it's loud to the point of being painful. If Freud would fix the noise, and perhaps throw in variable speed, they'd have a very attractive tool.

Hitachi SB-75

In contrast to the variable- and single-speed tools already considered, Hitachi offers a 2-speed model as an answer to sander flexibility. Although variable speed may be better at handling a wider variety of situations appropriately, in practice, the simplified 2-speed solution may be nearly as effective—and, a lot less complicated.

Like most transverse-motor sanders, the Hitachi SB-75 feels a little bulky after using the inline designs. However, the tool's ample 8.7-amp motor provides good sanding power, and this tool is very comfortable to handle.

The tool's most unusual feature is its platen. It's far wider than the 3 × 21-in. belt, and almost appears as if it were meant for a 4-in.-wide sander. While this has little effect on typical surfacing, it makes flush sanding to one side difficult. It's possible to adjust the tracking knob so that the belt shifts to the outer edge of the platen, but then it's about one-third of the way off the rollers.

The front of the sander has no overhang so you can sand relatively close up to a wall or obstruction. However, be careful—the exposed roller and belt can easily gouge the adjoining surface. Dustbag removal and emptying is easy and all the controls work well—except for an excessively stiff belt release lever. In terms of sanding power, we place this tool slightly slower than the Freud, AEG and Porter-Cable tools, but faster than the rest. Hitachi offers a belt sander stand for using the tool as a stationary sander.

Makita 9900B

If nothing else, Makita has equipped this tool with one feature that all manufacturers would do well to notice—

3 x 21-IN. BELT SANDER WITH DUSTBAG SPECIFICATIONS

MANUFACTURER	MODEL	AMPS ¹	PRICE ²	STYLE	SPEED(S) ³ (fpm)	SANDING AREA (sq. in.)	FLUSH ⁴ SANDING	NOISE ⁵ (dbA)	CORD LENGTH	WEIGHT (lb.)
AEG	HBSE 75S	7.8	\$279	inline	490 to 1040	15.75	YES	99	10'	8.4
Bosch	3270D	5	\$260	inline	1080	14.25	YES	90	6'6"	7.9
Elu	4024	5.2	\$307	trans	475 to 1100	15	NO	87	9'4"	6.2
Freud	LC75	9.6	\$306	inline	1475	15.75	YES	100	7'8"	10.8
Hitachi	SB-75	8.7	\$255	trans	1180 and 1470	14.25	YES*	96	8'	9.7
Makita	9900B	7.8	\$283	trans	1180	14.25	YES*	96	17'	10
Porter-Cable	352	7	\$255	trans	1300	14.25	YES	95	7'	10.8
Ryobi	BE 321	5.4	\$272	inline	775 to 1148	15	YES	97	6'6"	7.9
Sears	11715	7.5	\$85	trans	1300	13.8	YES**	94	6'	9

1. Amperage at maximum speed of multispeed tools. 2. Suggested retail price, dealers may sell for less. 3. Fpm stands for feet per minute—multispeed tools show maximum and minimum speeds. 4. As tested. 5. Noise level measured at maximum speed.

* Belt must be shifted for flush sanding. ** Bag must be removed for flush sanding.

a 17-ft. power cord. It's about twice as long as the average, and nearly three times as long as the skimpy Bosch, Ryobi and Sears cords.

Other than that, however, we simply have a basic, single-speed, transverse-motor belt sander. It has a good, large tracking knob, but we noticed that tracking seems to vary in use depending on pressure applied to the tool. Like the Hitachi sander, the platen on this tool seems to have an identity problem in that it's far wider than the belt. The trick we used with the Hitachi—shifting the belt to one side for flush sanding—didn't work well with this tool as the belt wouldn't stay in place. The Makita also has the same zero-clearance front roller that

can gouge a corner wall if you're not attentive. And, the belt release lever is very stiff.

This is a slower sander than the Hitachi, but just as noisy. The dustbag is attached by a ring clip and is very difficult to remove. Like most other models, you can use this tool in a stationary mode with a stand and fence accessory.

Porter-Cable 352

Porter-Cable's entry is a well-designed, no-frills, single-speed, transverse-motor sander. We liked the feel of the tool and the operation of the trigger and trigger-lock button. Although our sound-level meter placed this model below several other tools,

the 352 produces a noise that we find whiny and irritating.

The zipper-equipped dustbag is large, and the bag fits on an elbow pipe that attaches to the housing. This system allows you to rotate the bag if necessary to shift it out of the way. The P-C's dustbag is the easiest to remove and empty. This is important since the tool ranks close to the AEG and Freud models for aggressive sanding. Belt tracking is very good, and the sander easily sands flush to one side. We did notice, though, that the rollers and platen are not well aligned. The platen is cushioned by a cork backing pad.

In the needs-improvement area, we have to list the power cord. It's a

Belt Sanders—Large And Small

● Because belt sanders are such job-specific tools, manufacturers offer a wide variety of models in terms of both power and belt size. It pays to analyze your needs before you get out your checkbook. Unlike circular saws or drills, where extra power doesn't mean you can't handle a light-duty job, using a belt sander too big for the work can be frustrating, if not ruinous.

And, where many power tools are designed to produce accurate work far more easily than if the job had been handled manually, belt sanders are simply designed for speed and power. Even with a sanding frame or fence accessory to help guide the tool, getting a true, smooth surface is as much a result of operator skill, if not more, as it is if you did the job by hand. In addition to getting a sander of the right size and power, keep in mind that there's no need to pay top dollar if you're only going to use the tool occasionally and the finished work isn't that critical.

Although Black & Decker builds heavy-duty belt sanders that handle the larger belt sizes, B&D's 3 × 21-in. offering is strictly a consumer-level tool. The Black & Deck-

er 7447 (bottom right, about \$89) is a transverse-motor tool designed for budget-conscious do-it-yourselfers. While it has the same features as its more-expensive, single-speed cousins, its small 3.4-amp motor and 600-fpm belt speed keeps stock removal to a minimum.

At the other end of the belt-sander spectrum are the **Bosch 1273 DVS** (bottom middle, about \$370) and the **Milwaukee 5936** (bottom left, about \$419). These are both top-of-the-line, 4 × 24-in. sanders. The Bosch tool features variable speed (1150 to 1550 fpm) and has a powerful 10.5-amp motor. Optional accessories include a stand for stationary work and an adjustable fence. If you're looking for a basic workhorse that may just outlast you, the 10-amp, single-speed (1400-fpm) Milwaukee may be what you need. Both the Bosch and Milwaukee models shown are serious professional tools.

Sometimes you need the aggressive sanding power of a belt sander, but without the massive bulk and weight of typical models. The **Makita 9030** (top right, about \$279) is designed to handle awkward situations and confined spaces. It

has a 1½ × 21-in. belt that runs at 3280 fpm, an adjustable or removable front handle and an open front pulley to get into tight areas.

Somewhere in between the Makita and typical belt sanders lies the unique **Skil 7102 Sand Cat** (middle right, about \$70). This 2.8-amp, 600-fpm tool is designed for light-duty smoothing and shaping. And, at 4½ pounds, it's easily used with one hand on those jobs no ordinary belt sander will reach.



MILWAUKEE 5936



BOSCH 1273 DVS



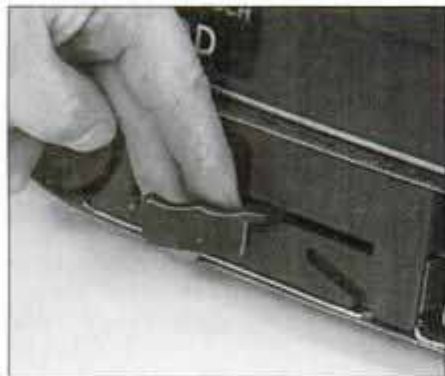
MAKITA 9030



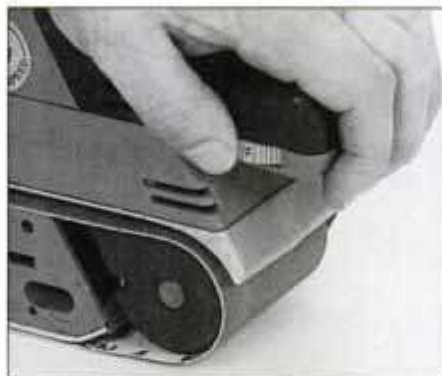
SKIL 7102



BLACK & DECKER 7447



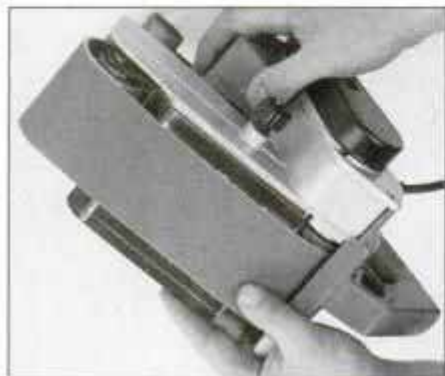
Belt release lever is typically found between rollers on right side of tool. Pull out lever to release tension and remove belt.



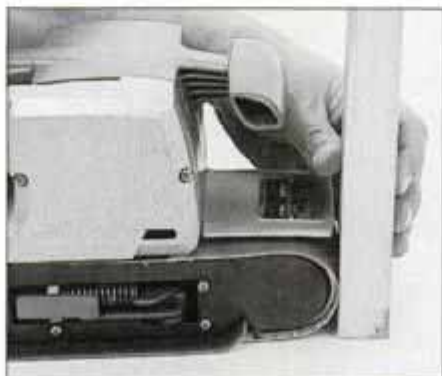
Models with variable speed (Ryobi BE 321 shown) have a numbered speed dial. Chart on this tool helps to select speed.



Platen supports belt over sanding area and handles friction of moving belt. P-C model has cork backing pad to cushion platen.



Hitachi (shown) and Makita 3 x 21-in. sanders have oversized platens. Flush sanding means belt must be shifted to one side.



Makita belt sander has no guard overhang at front roller, and belt can gouge adjoining surface. Hitachi model is similar.



Belt sanders with stand accessories can be used as stationary sanders. Adjustable fences are also available for guiding work.

kinky, plastic-sheathed cord that's not up to the standard set by the rest of the tool. And, it terminates in a 3-prong plug.

Ryobi BE 321

Like most inline tools, we found the Ryobi compact and easy to handle. The grips are comfortable and the controls are all in the right places. Unlike the other inline models, the top of the Ryobi unit is perfectly flat so it can easily be flipped over and used for light-duty stationary work on your benchtop. For heavier stationary jobs, Ryobi offers clamps to secure the tool to your workbench. You can also get a sanding frame and fence for this model.

This is a variable-speed sander. Like the AEG model, it also has a speed-selection chart mounted on the housing to take the guesswork out of dialing the right speed. The dustbag has a zipper and attaches to the housing via a bayonet mount. Belt changing is almost as smooth as the Bosch tool, and the Ryobi tracks well. While flush sanding against the side, we noticed that the belt favored the center of the platen slightly more than the edge, and sanding power is slightly below that of the Bosch. Unfortunately,

ly, the power cord is the same length as the Bosch—too short.

All in all, this is an attractive and versatile medium- to light-duty sander. If you're interested in it, you'll do just as well with the Skil 7621 (about \$235). As far as we can see, they're identical.

Sears 11715

It's no wonder that Sears is also in the business of selling extension cords. Like the Bosch and Ryobi models that we tested, this Sears tool has an unacceptably short link to the wall outlet—6 ft. Its appearance, in general, is not quite up to the standard set by the other tools, and its performance tends to match its looks. Not only is sanding on the slow side, but the tool feels unstable and inadvertent gouges are far too easy to accomplish. This Sears sander does have flush-sanding capabilities, but you have to remove the dustbag to get the job done. That's fine, however, as we found the dust-collection system is the least effective in our test group.

However, you can remove the bag easily—only Porter-Cable is better—and it's equipped with a convenient zipper. The belt release lever is clearly the stiffest and hardest to operate

of all we tried. This sander is comfortable to hold, has an easy-to-use trigger, and you can buy a stand for stationary benchtop sanding. At less than one-third the suggested list price of the other tools in the test, the Sears 11715 belt sander should have a niche in the marketplace.

Summing up sanders

Perhaps more than any other portable power tool, your belt sander should be matched to the work you're doing. If you simply want to remove stock fast, all you need is a basic single-speed machine with power such as the Freud or Porter-Cable model. The Makita would be our next choice in this category, followed by the Sears belt sander. However, if you know that your work will be confined to more critical operations in furniture- and cabinetmaking, a tool like the Bosch, Ryobi or Elu should be able to handle the job.

If you're looking for the most versatility, go for a variable- or dual-speed range sander with good sanding power such as the AEG or Hitachi models. Of these, our favorite is the AEG HBSE 75S because it embodies all the important features and performance in a compact, inline package. **PM**

HOW IT WORKS

HUMIDIFIER

BY STEVE TOTH, Contributing Editor; PM Illustrations by George Retseck

● For most of us, the changing seasons mean more than just switching from baseball to football. As the Earth moves around the Sun, our physical environment changes in a dramatic, although fortunately predictable, way. And we in turn do our best to control our own personal environments—our homes—to provide continuous, year-round comfort.

In winter, of course, this means activating the home heating system. However, as we turn up the thermostat, we need to return moisture to the air that the heating system has dried out. Warm, dry air is like a giant sponge that soaks up moisture from everything it touches. The results range from loose, wobbly chairs and peeling wallpaper to dry skin, chapped lips and clogged sinuses.

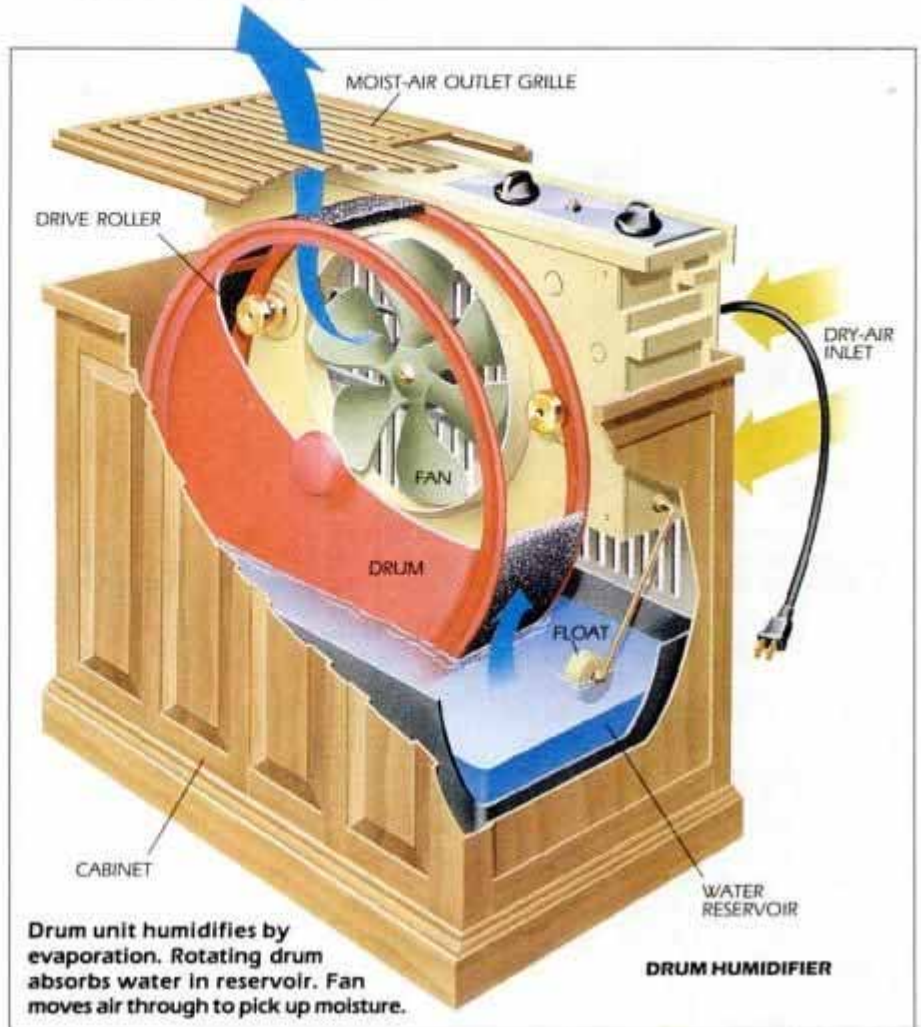
Dry air also makes you feel colder than your thermostat setting suggests because the evaporating moisture on your skin causes a cooling effect. When this happens, you turn up the heat—and end up paying more in energy bills. Ideally, the humidity level in your house should be from 30% to 50%. The most convenient way to return moisture to your home is with a humidifier. These are available in a range of sizes, and utilize one of six methods for reintroducing moisture into the air.

Drum-type humidifier

One common type of humidifier for handling relatively large areas in the home is this floor-model unit. It utilizes a fan to move air through a water-saturated filter. When the air passes through the filter, it picks up moisture through evaporation.

The drum-type evaporative unit has a foam filter that's wrapped around a large drum. A portion of the drum rests in a water reservoir—many models have a reservoir capacity of more than 5 gallons. To keep the foam filter saturated with water, the drum rotates slowly through the water. An electric motor drives the drum, as well as powers the fan.

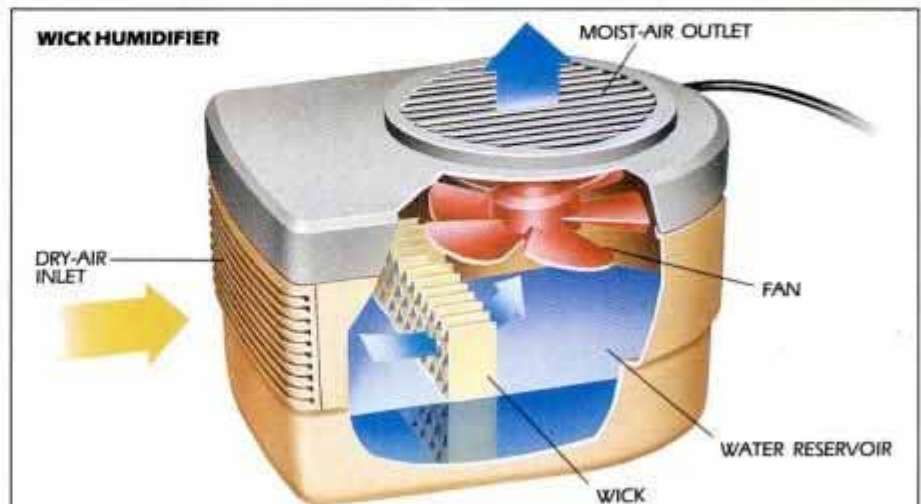
Instead of a slow-turning drum, some models use a continuous-rotating belt that's mounted between two

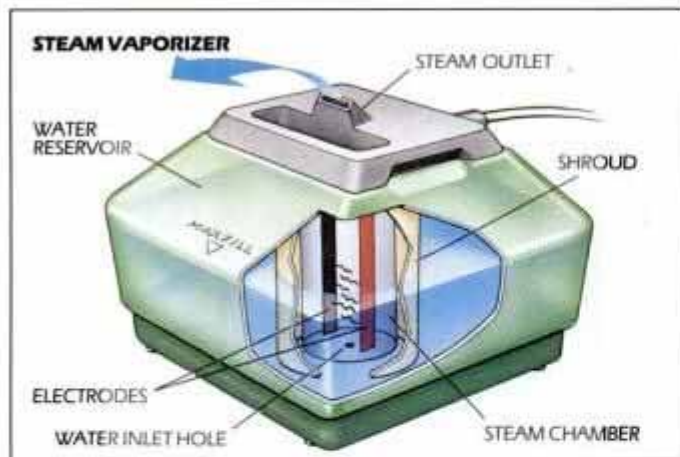


rollers. Both the drum- and belt-type humidifiers are equipped with a fan speed control to adjust the rate of evaporation. They also have a float switch that shuts off the unit when the water gets low. Other common features are a water-level indicator and a humidistat that senses relative humidity so the unit can start and stop automatically.

Wick-type humidifier

These are generally smaller tabletop evaporative humidifiers, although floor models are available. They operate by water's ability to move up and through a filter pad, or wick. You can see the principle in action by placing one end of a cloth in water. Eventually, the water spreads through and saturates the cloth. To transfer the





A vaporizer humidifies air by creating steam. Two electrodes in the steam chamber send electrical current through the water, which heats the water to the boiling point. Resultant steam humidifies air.

moisture to the air, a fan blows dry air across the wick causing the water to evaporate.

These units usually have a capacity of as much as 5 gallons. Most models have a multispeed fan, a humidistat and an indicator light to let you know when the unit is operating.

Steam vaporizer

These small, portable units humidify by boiling water and creating steam. Inside, you'll find a steam chamber that contains two electrodes. When the unit is turned on, current passes through the water from one electrode to the other. This heats the water to create steam that exits through an outlet at the top. The vaporizer shuts off automatically when the water level falls below the electrodes.

Because mineral content affects the water's ability to carry current, it also affects the amount of steam produced. Distilled water produces no steam, and water with a mineral content that's too

high produces too much steam, which can shorten the life of the unit.

Warm-mist humidifier

This type of humidifier is available in both portable and floor-type console models. Like the steam vaporizer, it creates a warm mist by heating water. The water flows from a reservoir tank into a valved chamber and then into a heating tray where the water is heated by an electric heating element. The water vapors formed by the heat are blown out of the moist-air outlet port by a small electric fan. Like other humidifiers, warm-mist models are usually equipped with a humidistat, a fan speed control and a water-level indicator.

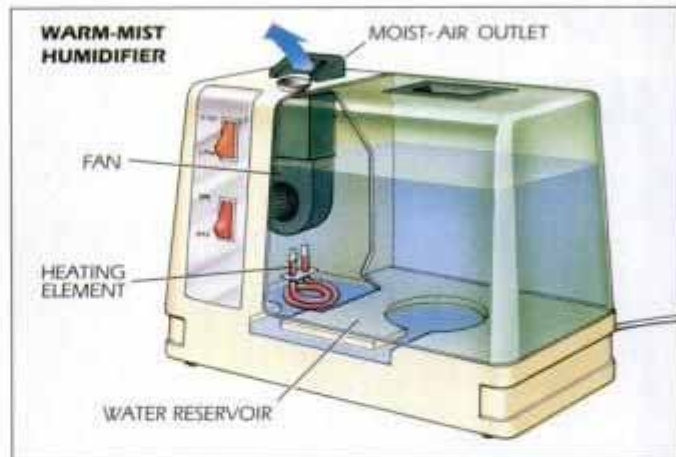
Impeller-type humidifier

In contrast to the passive evaporative humidifiers and the heat-produced vapors of the warm-mist and vaporizer models, this design creates a cool mist by mechanical means. Inside the

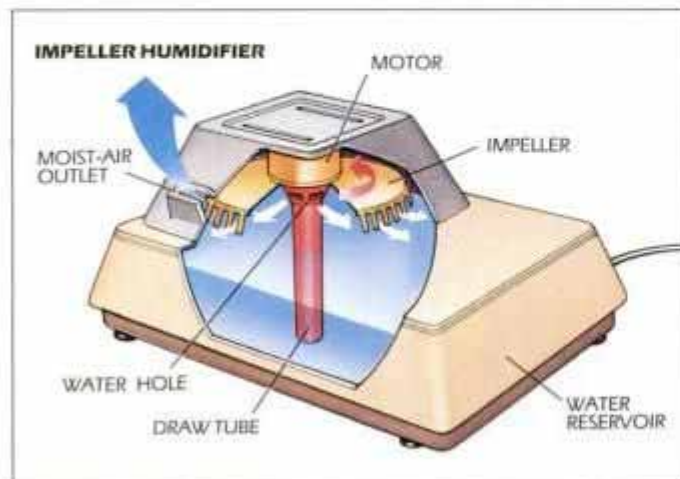
unit there's a motor-driven disc, or impeller, attached to a tube that extends into the reservoir. When the impeller spins rapidly, water is drawn up from the reservoir and dispersed on the impeller. Then, centrifugal action pulls the water out across the impeller to a fanlike edge where the water is atomized and dispersed through the moist-air outlet port.

Ultrasonic humidifier

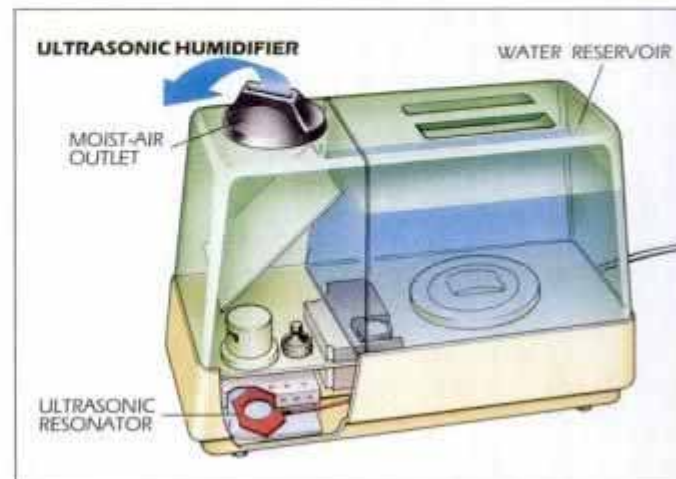
Like the impeller humidifier, the ultrasonic type generates a moist vapor through mechanical action on the water. However, in this case, the water is agitated through ultrasonic vibration. The water moves from the reservoir through a valve channel to a small chamber where an ultrasonic resonator called a transducer is located. This disc vibrates at up to 1 million times a second. The high-speed vibration causes the water to break up into very fine droplets which then move out through the moist-air outlet. **PM**



This warm-mist humidifier also heats water to create vapor. Here though, water is heated by an electrical-resistance heating element, and vapor is dispersed through outlet port by a small fan.



Impeller humidifier uses centrifugal force to moisten air. Motor-driven impeller draws water up tube and across impeller surface. As impeller spins, water droplets are thrown out and dispersed into air.



Ultrasonic humidifier utilizes an electronic resonator, or transducer, that vibrates up to 1 million times a second. Atomized water creates a mist that's dispersed through outlet to humidify air.

HOME IMPROVEMENT NEW TOOLS

Great tools for any job around the house.

BY ROY BERENDSOHN, Assistant Home Improvement Editor



Super Saw

Ryobi powered its new 10-in. table saw with a 13-amp, 2-hp motor, and gave it a sliding table and adjustable miter fence for precision. To make it durable but lightweight (75 pounds), the saw's tables are aluminum die castings and its fences, aluminum extrusions. At 90°, the saw's 36-tooth carbide blade cuts to 3⁹/₁₆ in. deep, and at 45°, 2½ in. deep. The saw comes with a port in the saw table to accept a router, and a router and sabre saw mounting kit costs \$70. Other options are an extra-long miter fence (\$70), a sheet-steel stand minus casters (\$90) and an extra-wide table kit (\$150). The saw costs about \$1100 at hardware stores and home centers. For more information, contact Ryobi America Corp., P.O. Box 1207, Anderson, SC 29625.



Sorta Neat

Keep your tools and hardware straight with this novel toolbox molded from copolymer polypropylene plastic. The box has four tilting drawers with three removable dividers in each, for maximum flexibility in storing hardware. A push latch at the top of the cabinet secures the drawers. It has an open top storage compartment and a deeper tool well on the side opposite the drawers. It measures 8¼ in. deep × 13¼ in. wide × 19½ in. high. A drill bit gauge is built in to the top of the cabinet, and an inch-to-metric conversion chart is next to it. The box costs about \$18 at hardware stores and home centers. For more information, write Plano Molding Co., P.O. Box 189, Plano, IL 60545.



Looks Unusual

If this ⅜-in. cordless drill looks unusual to you, it's because of its D-handle that positions your hand behind the tool. This allows you to apply pressure directly behind a bit or screw, instead of under it, as you would when using a conventional pistol-grip drill. The reversible drill has a high and a low speed, six torque settings and a battery recharging time of 1 hour. Its keyless chuck speeds changing the bit, and the drill has an electric brake for fast chuck stoppage. It comes with a recharger and a plastic carrying case, and costs about \$275 at hardware stores and home centers. For more information, write Makita, 14930 Northam St., La Mirada, CA 90638.

Hold It Right There

This new clamp quickly and firmly holds a workpiece securely to a benchtop. The clamp inserts through a hole bored in the benchtop. A retaining ring and flange are fastened under the top, and the flange is held in place with a clevis pin and clip. To use it, press the lever in front of the pistol grip to slide the moving jaw up to the workpiece, then tighten by squeezing the grip. The workpiece is clamped firmly between the moving jaw and the benchtop. The 5-in. clamp costs about \$30 at hardware stores and home centers. Write American Tool, 301 S. 13th St., Suite 600, Lincoln, NE 68508.

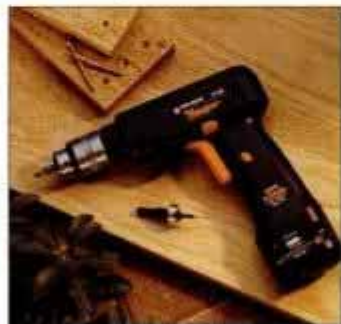


Tornado Alley

According to Black & Decker, the new Super Cyclone cordless 3/8-in. drill has more power than its competitors. This 12-volt drill also has "Versa-Clutch" adjustable torque control that automatically adjusts the torque, overriding the manual torque setting, when boring or driving in inconsistent materials. Also, a shifter lets you quickly switch between driv-

ing and drilling. The Super Cyclone comes with one battery and a recharger. It costs about \$215 at hardware stores and industrial suppliers.

Black & Decker says that another recent addition to their line, the new 6-volt Ranger drill, runs for 6 hours on a single charge and recharges in 3 hours. The 2-speed drill, 225 and 550 rpm, is reversible and comes with a pair of double-ended hex-shank screwdriver bits. It costs \$60 at hardware stores and home centers. For more information, write to Black & Decker, U.S. Power Tools Group, 10 N. Park Dr., P.O. Box 798, Hunt Valley, MD 21030.



High-Tech Wire Brush

Empire's new wire brush differs from conventional designs in that it keeps your hand clear of the worksurface while allowing you to apply as much pressure as you can. The 9-in.-long brush has steel wires set in a molded plastic handle, which has a hole in it for hanging up the brush. It costs about \$4, and is available at hardware stores and home centers. For more information, contact Empire Brushes, Inc., P.O. Box 1606, U.S. 13 North, Greenville, NC 27835.

Speed Zone

Dremel has improved its 16-in. scroll saw by adding a variable-speed control and a digital display that tells you the blade speed at a glance. Set the saw speed from 200 to 2000 strokes per minute using the dial on the saw's front. The 12-in.-dia. aluminum table tilts 45°, and accommodates 2-in.-thick stock at 90° and 1-in.-thick stock at 45°. To reduce vibration, the saw's base is cast iron. The saw can be mounted on a bench or an optional sheet-steel stand, which is \$45. A magnifying light is also available for \$40. The Dremel Model 1695 scroll



saw costs about \$250 at hardware stores and home centers. For more information, write to Dremel, 4915 21st St., Racine, WI 53406.

Propane Paint Stripper

This propane-fired paint stripping tool is designed to make heat stripping faster and easier. Its pistol grip has a piezoelectric pushbutton ignition. It produces a 1200° F flame, and using a 14.1-ounce cylinder, it burns for 8 hours. Its other features include automatic shutoff when the handle is released, a perforated heat shield and a belt clip for the tank. It costs about \$45 at hardware and paint stores. For more information, write to BernzOmatic, 1 BernzOmatic Dr., Medina, NY 14103.

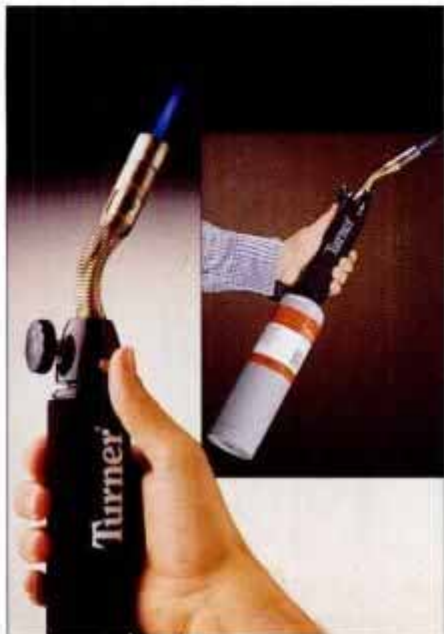


Get The Plug Out

If you've ever tried to pry the wood plug from a holesaw, you'll appreciate the way this tool works. It removes the plug for you. Cut the plug out as usual, then reverse the drill. The holesaw's arbor is threaded and fitted with a stop collar, so it pushes the plug out. The saw's teeth are high-speed steel welded to a carbon-steel saw body. It comes in sizes from 3/8 in. to 2 1/2 in. dia., and costs from \$20 to \$25 at hardware stores and home centers. For more information, write to Vermont American Tool Co., P.O. Box 340, Lincolnton, NC 28093.

Torch With A Twist

Turner's mini propane torch burns on its own for 30 minutes, screws into the top of a standard propane cylinder for extended reach and hooks via an adapter hose to a bulk tank for extended burn time. The torch has a piezoelectric ignition and comes with a nonslip fire-retardant handle and a stand for stationary work. It costs about \$55 at hardware stores and home centers. For more information, write to Cooper Tools, P.O. Box 728, Apex, NC 27502.



Professional Pickup

Genie has introduced a line of professional-duty shop vacuums, including a 3-hp, 20-gallon model (about \$180). Also included in the lineup are three 2.5-hp models in 12-, 16- and 20-gallon sizes (about \$145, \$150 and \$165, respectively). All four have an overflow shutoff switch, an impact-resistant plastic tank and handles molded into the motor housing. The accessories that the vacuums come with are a 1 1/4-in.-dia. flexible plastic hose, two floor extension wands, a crevice tool, utility and floor nozzles, and a removable squeegee plate for picking up liquids. They're sold at hardware stores and home centers. For more information, contact The Genie Co., 2850 Gilchrist Rd., Akron, OH 44305.



Safety First

These German electrical tools meet the newly enacted federal safety standards for electrical tools, their manufacturer says. Each tool is supposedly insulated against 1000 volts, and the insulation itself is inflammable and highly impact resistant. The 8-piece screwdriver kit shown costs about \$48, and consists of a current tester, four slotted-tip drivers and three Phillips-tip drivers. Other kits, with socket wrench sets, crescent wrenches, pliers and wire strippers are also available. The tools are sold through industrial supply houses or through CIP, 17 Brenne-man Circle, Unit E, Mechanicsburg, PA 17055; (800) 443-1196.



Around The Bend

If you have a bent for metalworking, so to speak, you may want to look into this benchtop bender. It can be used to form mild steel up to 5/16 in. thick x 2 in. wide, solid round or square stock up to 3/8 in. and tubing up to 3/8 in. dia. The bender comes with eight dies for bending solid round or flat stock, and other accessory dies are available for bending tubing and making scrolls. It costs about \$270 postpaid from Lock-down Securities, Inc., 4376 Pinos Altos Rd., P.O. Box 2576, Silver City, NM 88062.



Light 'Em Up

Push a button and built-in light-emitting diodes illuminate the three vials on Stanley's new torpedo level. The diodes turn off automatically after about 2 minutes, or are operated with the manual on/off switch. It's built with a rugged double aluminum I-beam frame. One edge of the level has a magnet, and the other edge is grooved so it can be used on pipe. The 9-in.-long level costs about \$25 at hardware stores and home centers. For more information, write to Stanley Tools, New Britain, CT 06050.

Keep It Straight

Blade Runner II is a versatile and lightweight (12-pound) guide that accepts most 7 1/4-in. and 8 3/4-in. circular saws. Use it to rip and crosscut lumber up to 2 in. thick, and to cut miters and compound miters. Positive stops lock the saw at common miter angles. With accessories, Blade Runner converts into a panel saw and a router guide. Made of glass-filled styrene and polypropylene plastic, aluminum and steel, Blade Runner II costs about \$130 at home centers and woodworking supply houses. Write to Professional Tools, Inc., P.O. Box 672525, Houston, TX 77267.



Tough Handle

Marshalltown designed its new trowel to have a mushroom-proof handle. The trowel is equipped with a cushioned PVC handgrip and a plastic bumper at the handle's butt. The bumper protects the handle when tapping brick, block and stone into a mortar bed. The trowel has a heavy-gauge steel ferrule and a forged vanadium tool steel blade. It comes in a variety of sizes and patterns, but all cost about \$28 at hardware stores and masonry supply houses. For more information, write to Marshalltown Trowel Co., P.O. Box 738, Marshalltown, IA 50158. **PM**



**HOME
MAINTENANCE**

**RADIATOR
TUNEUP**

BY MERLE HENKENIUS
PM Illustrations by
George Retseck

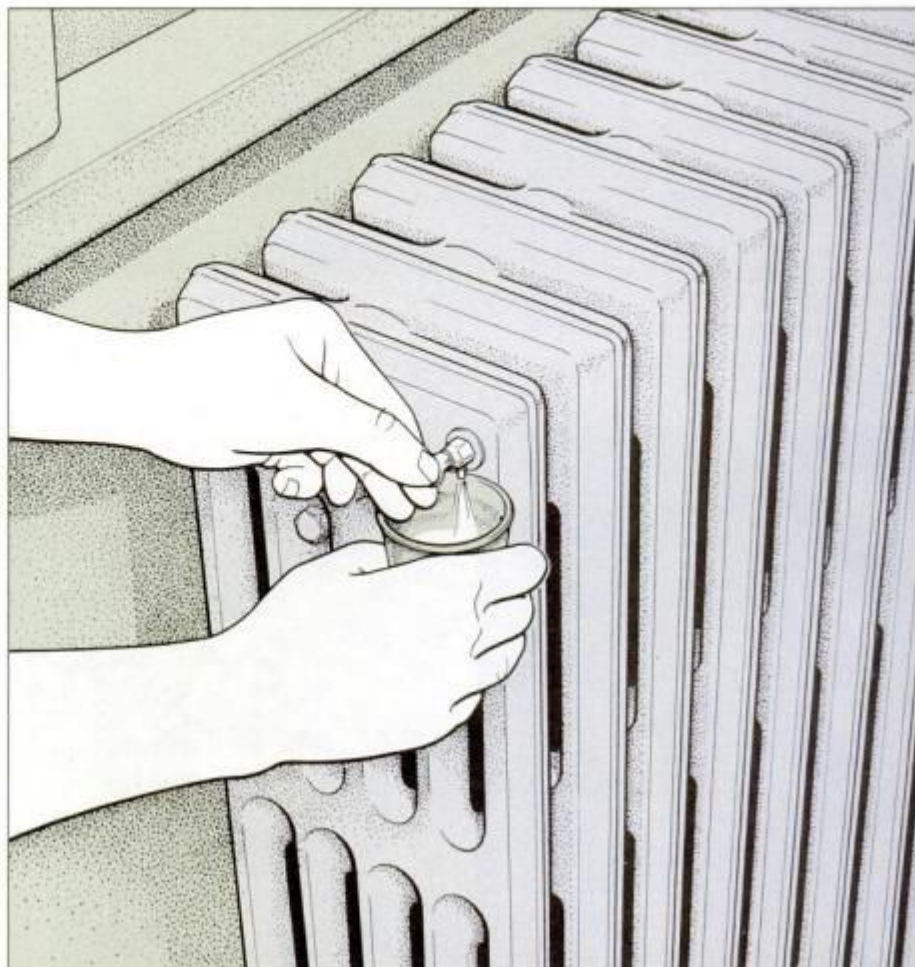
● There are still a good many steam and hot-water radiant-heat systems in service today—and a large number of them still use iron radiators. However, keeping your steam or hot-water system working smoothly can be a challenge. Many installations are more than 50 years old, and yours may be due for minor repairs. While servicing the boiler of a steam or hot-water system should be left to a professional, solving a radiator problem only requires simple tools and is well within the reach of most homeowners. And, these simple procedures could save you money by eliminating an expensive service call.

The degree of difficulty and the amount of service required will depend largely on the type of system your home is equipped with and how well it's been maintained. While the earliest systems utilize steam—and many still do, many others have since been converted to hot water. These conversions to hot-water heating systems make sense as it takes fewer BTUs, and consequently less energy and lower fuel bills, to create hot water than it does steam.

System variations

Today, you'll find three or four different types of radiant-heat boiler systems in both new and old homes. The most recent installations have compact fin-tube baseboard heaters, and some new homes have modern, in-floor radiant piping. The systems are often controlled by several zone valves located throughout the home. These allow you to maintain independent heat levels in different areas of your home, and can therefore help reduce energy costs. The radiating parts of these newer systems are generally maintenance-free.

With older systems that utilize iron radiators, you'll find several variations. You might see a steam-heat radiator system, a hot-water radiator system or a steam system that's been converted to hot water. The last two are the most common. Although re-



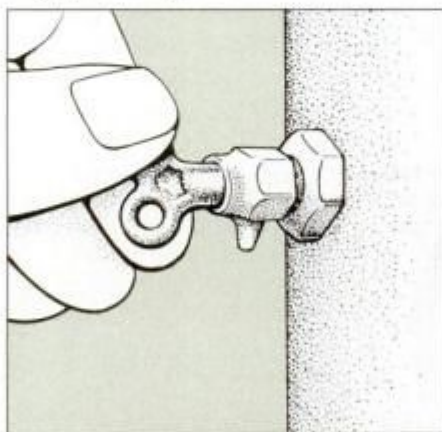
quiring more frequent attention than the newer designs, the simple components on iron radiators are relatively easy to troubleshoot and replace.

Servicing hot-water systems

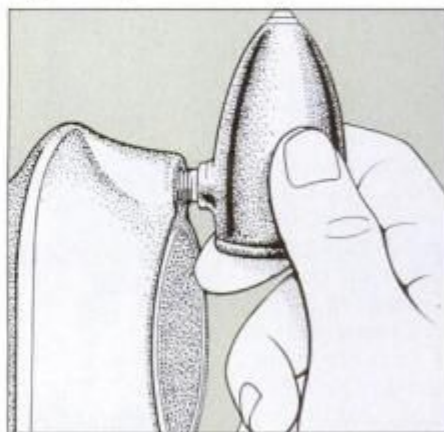
Hot-water heating systems, both original and those converted from steam heat, are less troublesome and easier to service than those that use steam. In fact, air lock is about the only problem you'll find in hot-water

radiators. If you have a single, cold radiator, you can bet there's air trapped in a few of its cells.

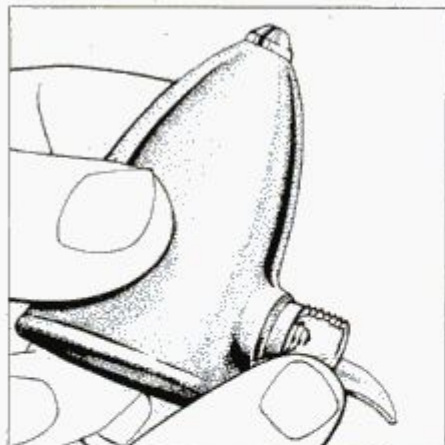
To solve this problem, simply release the air through the brass bleeder valve. You'll find this valve located near the top and on the outlet side of the radiator. These valves vary in configuration, but most can be opened with a hexhead key or screwdriver. Just turn the key or screwdriver counterclockwise until air and water begin to sputter through the bleeder



1 To release any trapped air in a hot-water radiator, open the brass bleeder valve with a hexhead key or screwdriver.



2 To remove a clogged steam vent, first turn off radiator inlet valve to isolate radiator. Then, simply unscrew vent.



3 Before installing new steam vent, coat the threads with antiseize compound. Then, tighten by hand until snug.

valve (Fig. 1). As soon as water alone sprays through, close the valve.

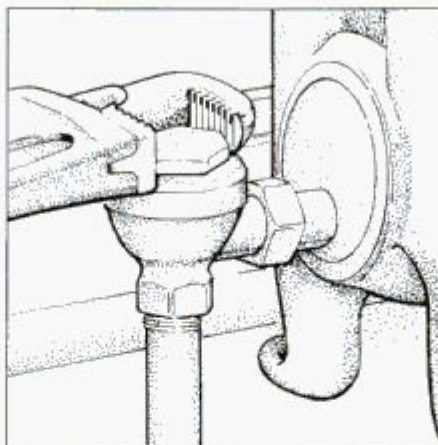
Servicing steam radiators

If you're having trouble with a steam radiator, it's likely caused by one of two common problems—and both have to do with trapped water. First, if the radiator does not heat, chances are the steam vent is clogged. The steam vent is a small valve located high on the last cell of the radiator. Over time, water released through the vent meets room-temperature air and a calcified deposit forms around the vent opening. When enough deposit builds up, the vent becomes clogged and stops working.

Although you could try scraping away this mineral buildup, replacing the vent only costs about \$8 to \$12, and is a better long-term solution. Because the threaded fittings on the vents are made of brass, the vents are usually easy to loosen. In fact, you may not even need a wrench.

To replace the vent, first isolate the radiator from the rest of the system by closing the inlet valve at the opposite end of the radiator. This allows you to work on the radiator without shutting down the boiler. Then, turn the vent counterclockwise and unscrew it from the radiator (Fig. 2). Thread in the new one until it feels snug and the vent opening faces straight up. To facilitate easy removal the next time you do the job, lightly coat the threads with an antiseize compound (Fig. 3). When the new vent is in place, turn the radiator back on by opening the inlet valve.

The second steam radiator problem is characterized by inconsistent heating and a pounding noise. If you notice these symptoms, you can assume that the bellows in the steam trap has



4 Use a pipe wrench to loosen steam trap cap and gain access to trap bellows. If necessary, tap with hammer to loosen threads.

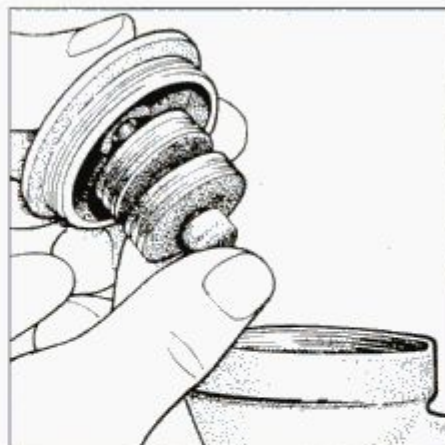


6 To remove the old thermal bellows, use a pair of pliers or small wrench to unthread it from the steam trap cap.

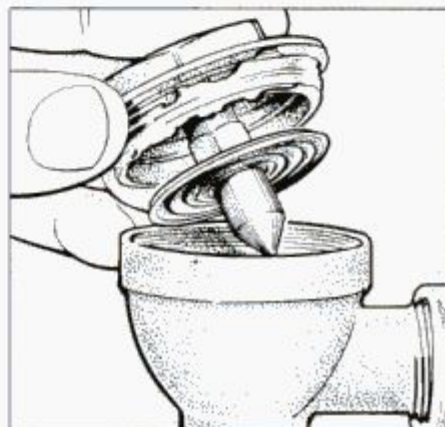
failed. Although a steam trap may take several shapes, you'll find it at floor level between the radiator outlet and the condensate return pipe.

The purpose of a steam trap is to collect water that has condensed from the steam, and then route it to the condensate collection tank near the boiler. Inside the trap is a heat-sensitive, thermal bellows. The bellows acts as a thermal valve that opens to allow relatively cool water to escape, or shuts to keep the hot steam trapped within the radiator.

When a bellows fails, steam moves past it into the condensate return pipe. This drains heat from the radiator cells and produces the pounding noise. The solution to the problem is to open the trap and replace the bellows (about \$12 to \$20). It may also be necessary to replace the trap seat against which the bellows fits when the trap is closed. However, trap seats are often fused in place through years of oxidation and can be difficult to remove. Unless the trap seat is clearly pitted from rust and corrosion,



5 The thermal bellows is flexible, allowing it to expand and contract. Replace bellows even if no defect is visible.



7 After threading the new bellows into the cap, coat the cap threads with compound and tighten the cap in place.

it's best to leave it in place.

To remove the old bellows, first close the inlet valve to the radiator and then remove the trap access cap. If you find that the cap is stuck, tap lightly around the female threads of the trap (located at the top edge of the trap bowl) with a hammer. Then, undo the cap with a 12-in. pipe wrench and steady pressure (Fig. 4).

You'll find the bellows mounted to the underside of the cap (Fig. 5). Use pliers or a small wrench to thread the old bellows from the cap (Fig. 6). Even if no defects are visible on the bellows, it should be replaced. Then, take the bellows to a well-stocked heating service company to find a suitable replacement.

Note that the new bellows may not resemble the old even though it's compatible. Thread the new bellows into the cap. Then, coat the cap threads with antiseize compound and thread the cap back into the trap bowl (Fig. 7). Finally, tighten the cap snugly and open the radiator inlet valve to recharge the radiator.

PM

APPLIANCE CLINIC

BY STEVE TOTH,
Contributing Editor

Dryer Buzzes

We have a Kenmore gas dryer that is model No. 110.87570110, serial No. M41202991, which was purchased in March 1984. Recently it has begun buzzing during the whole drying cycle. How do we stop it from buzzing?

BILL BECK
DES MOINES, IA

The manufacturer for Sears (Whirlpool Corp.) had a problem with a stud in the valve assembly. Apparently, the stud works its way loose, and this causes the valve to buzz.

To check if the noise is coming from the gas valve, you need to open the toe panel at the bottom of the dryer's front. To do this, grip the toe panel on both sides and pull it straight back toward you.

Next, turn the dryer on high heat, and check if the valve buzzes. Also, check the date code stamped on the bracket that holds the two coils on the valve. If the valve has a date code of 8345 through 8416, replace it with Whirlpool part No. 694054 (about \$85). I suggest you have a Whirlpool servicer make the repair.

Bad Igniter Or Short?

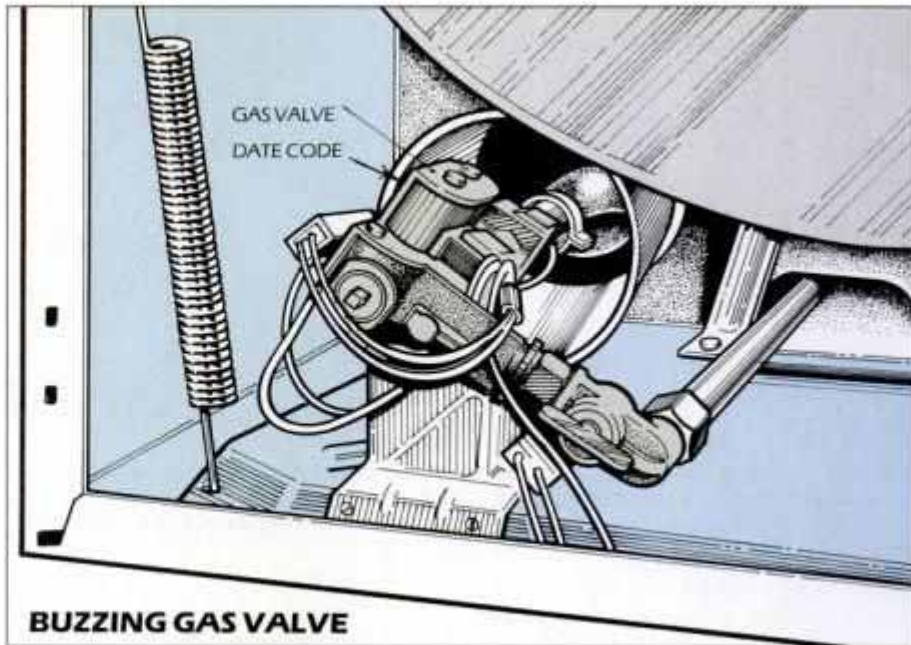
I have a problem with a Crown Range that has been traced to the ignition module. However, I have not been able to locate a supplier for either a replacement or an aftermarket module. The range is model No. 84324KGOE-1, serial No. A3004120. I would appreciate any information you might provide.

GENE HELMERS
CARMEL, NY

The Crown Range Co. went out of business in the early 1980s, and Appliance Parts Distributor bought up its inventory. The company can supply you with the part or parts you need, as well as service literature and technical information. Appliance Parts Distributor, a division of Coin-A-Matic Laundry Products Co., is located at 3900 W. 127th St., Alsip, IL 60658; or call (800) 837-4466.

Fridge Gurgles

I have a Whirlpool refrigerator that has a small freezer compartment on



BUZZING GAS VALVE
Some Sears-Kenmore gas dryers built in 1983 and '84 have a buzzing gas valve. The problem is due to a stud inside the gas valve assembly that works its way loose.

top, model No. ET180PKXSN, serial No. E70319335, bought in 1988. It gurgles while it is running. Technicians installed a factory-recommended kit, but that didn't help. Then some Freon was bled off. That stopped the noise, but the freezer would not get cold enough even when set at the coldest temperature. Freon was put back in and the freezer temperature is normal, but the refrigerator gurgles. How can we correct the problem?

E. BRAUTIGAN
VALLEJO, CA

Since your problem seems to be related to the sealed refrigerant system and Whirlpool guarantees the system for five years, I suggest you contact your area's district office for the Whirlpool Corp. It's located at 38507 Cherry St., Suite I, Newark, CA 94560; (800) 548-1427. This is not a consumer-repairable item, so keep in touch with the company until it is corrected.

Give It A Belt

I need a belt for my Hamilton Beach food processor model No. 707-1. I wrote Hamilton Beach in Washington, North Carolina, but received no answer. Please tell me where I can get one. Thanks.

FRED PRICE
ATHENS, AL

Parts for your discontinued Hamilton Beach food processor are still available from Hamilton Beach and can be purchased from any Hamilton

Beach service center in your area. Call Hamilton Beach toll-free at (800) 334-2785. The drivebelt is part No. 3114797.000. It costs about \$7. For more information, write to Hamilton Beach, P.O. Box 3028, Washington, NC 27889.

Nudge Starts Washer

I have an "Easy Washer" model No. 14-ABM, serial No. 09411862, which until a few weeks ago has performed well. Lately, upon reaching the spin cycle, I have to grip the rim of the tub and turn it to get the washer to spin. Any suggestions?

KARL BURG
CLINTON, IA

There is a Bendix spring inside the transmission that is supposed to lock onto a steel piece called a driver during the spin cycle. What is probably happening is the spring is slipping on the driver. You need to remove the transmission, disassemble it and replace the Bendix spring and driver.

Unfortunately, the Easy Co. went out of business back in 1967, and you may have a problem finding a service technician and a source for parts. Koss Appliance Service Co. (763 Bethlehem Pike, Montgomery, PA 18936; (215) 368-4957) may be able to help.

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

Attention Homeowners!



RECYCLE BRUSH PILES AND YARD DEBRIS INTO FREE MULCH!

Introducing the **TROY-BILT® Junior TOMAHAWK® Chipper/Shredder!**

No more bagging, burning or dumping!

No more hassle of bagging leaves, bundling brush...no more smelly, smoky burning...no more hauling and high dumping fees! The homeowner-sized TROY-BILT® Junior TOMAHAWK® Chipper/Shredder is the fastest and easiest-to-use low-priced chipper/shredder ever!

The Junior quickly and easily gets rid of brush, fallen branches, leaves, prunings and garden residues. It turns them into useful, valuable material for your landscaping and gardens. It's the sensible, practical way to handle your yard debris!



Makes FREE landscaping mulch!

In less than 20 minutes, the Junior can turn an 8' long, 4' wide, 2' high mess of brush, leaves and fallen branches into a compact pile of perfectly-sized chips and finely-shredded mulch.



Spread around flowers and plantings, this shredded material makes a weed-killing, mulch and a "slow-release"

fertilizer to help your plants grow lusher and more beautiful than ever before!

Send for FREE Catalog and Landscaping Tips...

- All the FACTS about the TROY-BILT® TOMAHAWK Chipper/Shredder models — including the new small property Junior TOMAHAWK!

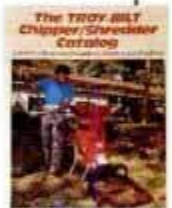
- PLUS valuable FREE tips to improve and beautify your property in the Homeowner's Guide to Chipping and Shredding!

- Mail the Coupon below or...

Call Toll-Free Today
1-800-554-5656
Dept. 3373

TROY-BILT Mfg. Co., Dept. A3373
102nd Street & 9th Avenue
Troy, NY 12180

YES! Please send me your FREE TOMAHAWK® Chipper/Shredder Catalog, with details about all your Models, including the new JUNIOR, plus prices, Special Savings now in effect and our NO-MONEY-DOWN Easy Payment Plan!



PLEASE PRINT

Name _____
Address _____
City _____
State _____ Zip _____

Also available in Canada

TROY-BILT®
An American Legend Caring For The Land.™

PRODUCT REVIEW

SHARK FILE SHARPENING SYSTEM

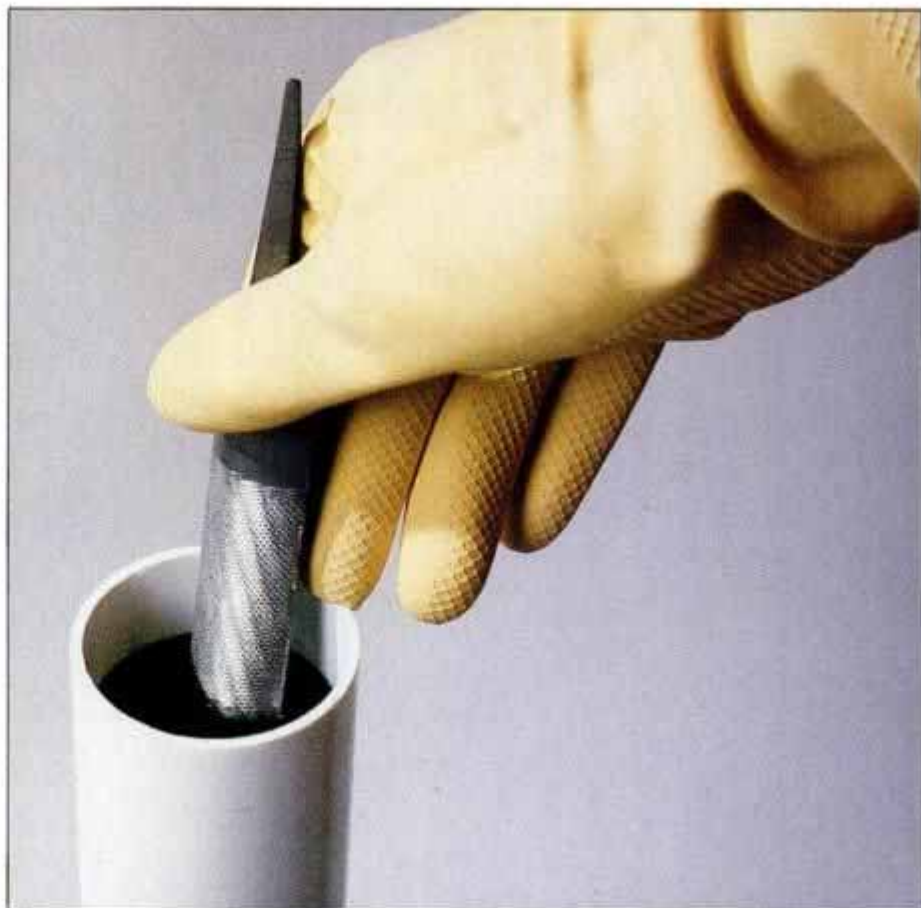
TEXT AND PHOTOS
BY THOMAS KLENCK,
Associate Home
Improvement Editor

● When your old files are simply too worn to cut it, you don't have to throw them away—you can resharpen them instead. Although it sounds impossible, sharpening a file is easier than sharpening just about any other tool in your workshop. At least it is with this product—the Shark File Sharpening System. Although we were skeptical at first, we found that this product restores new-tool performance to all types of files and rasps.

In contrast to typical tool sharpening methods that expose new metal through grinding, honing or filing, this system uses an acidic bath to chemically remove metal on the face of each file tooth. The manufacturer claims that the solution is a benign formula that can be washed off bare skin with soap and water. A file can be resharpened three to five times before it should be discarded.

The system is comprised of three chemical baths. First, a degreaser helps clean the file. Along with a file card, wire brush or wire wheel, this step cleans away grime and imbedded particles that the sharpening solution won't remove. Next, the file is soaked in the sharpening bath for about 35 minutes. After rinsing off the file in water, it's treated with a synthetic-based rust inhibitor.

The model SKQ Shark kit we tried is designed for small- to medium-size shops, and handles files up to 14 in. long. It comes with 1-quart containers of each solution, plastic tubes for treating the files and clips to suspend the files in the tubes. Also included are complete instructions and a chart for monitoring chemical usage. One quart of the sharpening solution will handle about 750 sq. in., or about 40 10-in. files. The SKQ kit costs about \$80. A larger kit, SKT, sharpens up to 6000 sq. in., or 150 14-in. files. For more information, contact O.C.S. Shark File Sharpening, 371 Second St., Chuluota, FL 32766. **PM**



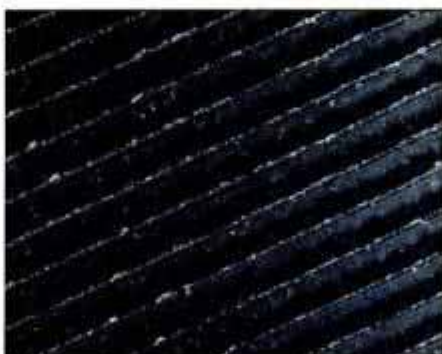
Shark File Sharpening System restores cutting edges on files and rasps through chemical action of acidic bath on steel. Files can be resharpened up to five times.



Shark SKQ File Sharpening kit has 1 quart each of degreaser, sharpener and rust inhibitor. Tubes hold solutions for bathing files.



To prepare file for sharpening, it must be thoroughly cleaned of all imbedded particles. Then it's bathed in the degreaser.



Closeup of a worn 12-in. mill bastard file after it's been cleaned and degreased shows dull, ineffective cutting edges.



After soaking in sharpening solution for about 35 minutes, the same file now has uniformly sharpened cutting edges.

Learn to troubleshoot and service today's computer systems as you build a powerful 386sx/20 MHz computer!

NEW!
386sx/20 MHz
computer, 40 meg
hard drive!

Train the NRI way—and learn to service all computers as you build your own powerful West Coast 386sx/20 MHz computer, now with 1 meg RAM, 40 meg IDE hard drive, and exciting new diagnostic hardware and software!

Jobs for computer service technicians will almost double in the next 10 years according to Department of Labor statistics, making computer service one of the top growth fields in the nation.

Now you can cash in on this exciting opportunity—either as a full-time industry technician or in a computer service business of your own—once you've mastered electronics and computers the NRI way.

Get real-world skills as you train with and keep a powerful 386sx-based computer system plus Microsoft® Works software

Only NRI gives you hands-on training with the finest example of state-of-the-art technology: the powerful new West Coast 386sx/20 MHz computer. As you assemble this fully IBM PC/AT-compatible machine, you actually see for yourself how each section of your computer works.

You assemble and test your computer's "intelligent" keyboard, install the power supply and 5¼" high-density floppy disk drive, then interface the high-resolution monitor.

Your hands-on training continues as you install a powerful 40 meg IDE hard drive—today's most-wanted computer peripheral—now included in your course to dramatically increase your computer's data storage capacity while giving you lightning-quick data access.

Plus you now work with today's most popular integrated software package, Microsoft Works, learning to use its word processing, spreadsheet, database, and communications utilities for your own personal and professional applications.

But that's not all!

NEW! Ultra-X diagnostic hardware and software for fast, accurate troubleshooting

Now you train with and keep the latest in diagnostic hardware and software: the extraordinary R.A.C.E.R. plug-in diagnostic card and QuickTech menu-driven software, both from Ultra-X. Using these state-of-the-art tools, you learn to quickly identify and service virtually any computer problem on XT, AT 80286/80386, and compatible machines.



Only NRI gives you such confidence-building, real-world experience. Only NRI gives you both the knowledge and the professional tools to succeed as today's in-demand computer service technician.

No experience needed...NRI builds it in

With NRI training, you learn at your own convenience in your own home. No classroom pressures, no night school, no need to quit your present job until you're ready to make your move.

NRI starts you with the basics of electronics and computers, building on that foundation step by step until you have the knowledge and skills you need for success.

And all throughout your training you've got the full support of your personal NRI instructor and the entire NRI technical staff, always ready to answer your questions and help you achieve your training goals.

Send for your FREE catalog today!

Send today for NRI's big, free catalog that describes every aspect of NRI's innovative computer training, as well as hands-on training in other growing high-tech career fields.

If the coupon is missing, write to: NRI Schools, McGraw-Hill Continuing Education Center, 4401 Connecticut Avenue, NW, Washington, DC 20008.

IBM and AT are registered trademarks of the IBM Corporation. R.A.C.E.R. and QuickTech are registered trademarks of Ultra-X, Inc. West Coast is a member of the Syntax Group.

SEND CARD TODAY FOR FREE NRI CATALOG

NRI Schools McGraw-Hill Continuing Education Center
4401 Connecticut Avenue, NW, Washington, DC 20008



- Check one FREE catalog only
- | | |
|--|---|
| <input type="checkbox"/> MICROCOMPUTER SERVICING | <input type="checkbox"/> Computer Programming |
| <input type="checkbox"/> TV/Video/Audio Servicing | <input type="checkbox"/> PC Software Engineering Using C |
| <input type="checkbox"/> Telecommunications | <input type="checkbox"/> Desktop Publishing & Design |
| <input type="checkbox"/> Industrial Electronics & Robotics | <input type="checkbox"/> Word Processing Home Business |
| <input type="checkbox"/> Security Electronics | <input type="checkbox"/> Bookkeeping & Accounting |
| <input type="checkbox"/> Electronic Music Technology | <input type="checkbox"/> Air Conditioning, Heating, & Refrigeration |
| <input type="checkbox"/> Basic Electronics | <input type="checkbox"/> Building Construction |
| | <input type="checkbox"/> Small Engine Repair |
| | <input type="checkbox"/> Automotive Servicing |

For career courses approved under GI Bill, check for details.



Name (please print) _____ Age _____

Address _____

City/State/Zip _____ Accredited Member, National Home Study Council 100-012

HOMEOWNERS CLINIC

BY NORMAN BECKER, P.E., Contributing Editor

Drainpipe Backup

We have a drain line around the foundation of our house that runs to the edge of a stream. When it rains and the stream gets full, it covers the end of the drainpipe. Could this cause the water to back up in the drainpipe, or will it continue to drain out?

MRS. HOBERT FURR
COX'S MILLS, WV

It all depends on the elevation of the drain line relative to the stream when the stream is running full. A difference in elevation will create a pressure differential. And as long as there is a greater pressure in the drainpipe, the water will flow out into the stream.

When the end of the drain line is submerged in the stream, water flowing down the drainpipe will flow into the stream. However, a residual amount of water equal to the level of the stream will remain in the drainpipe.

If the level of the stream, when the stream is running full, is above the level of the drain line that runs around the foundation, then water will back up into the drain line to the foundation and cause a water seepage problem.

Rusty Toilet

Is there a way to remove rust and mineral deposits from a toilet?

JOHN BOWER
JACKSONVILLE, FL

The deposits have to be removed chemically. For instance, Sani-Flush, manufactured by Boyle Midway, Inc., and commonly available at grocery stores, is quite effective in removing these stains. I have seen deposits that had accumulated over years removed with one application.

Cracked Insulated Pane

In 1990, we bought a new home with double-pane windows. I accidentally cracked the inner pane on one of the windows. This allowed moisture into the pane, causing fogging. I need to know how to repair it. Two separate glass companies said it will cost several hundred dollars, but I don't buy that. Can you help?

RONALD WALES
MILFORD, CA

Unfortunately, there is no way to fix the pane. It must be replaced. It's not as simple as removing one of the panes, replacing it with a new pane and then sealing it with a caulk gun.

Double- and triple-glazed windows have an airtight seal between the panes. This is achieved under carefully controlled conditions at a factory, where the panes are cleaned and sealed together. It's unlikely that a homeowner can duplicate this.

Gutter Frustration

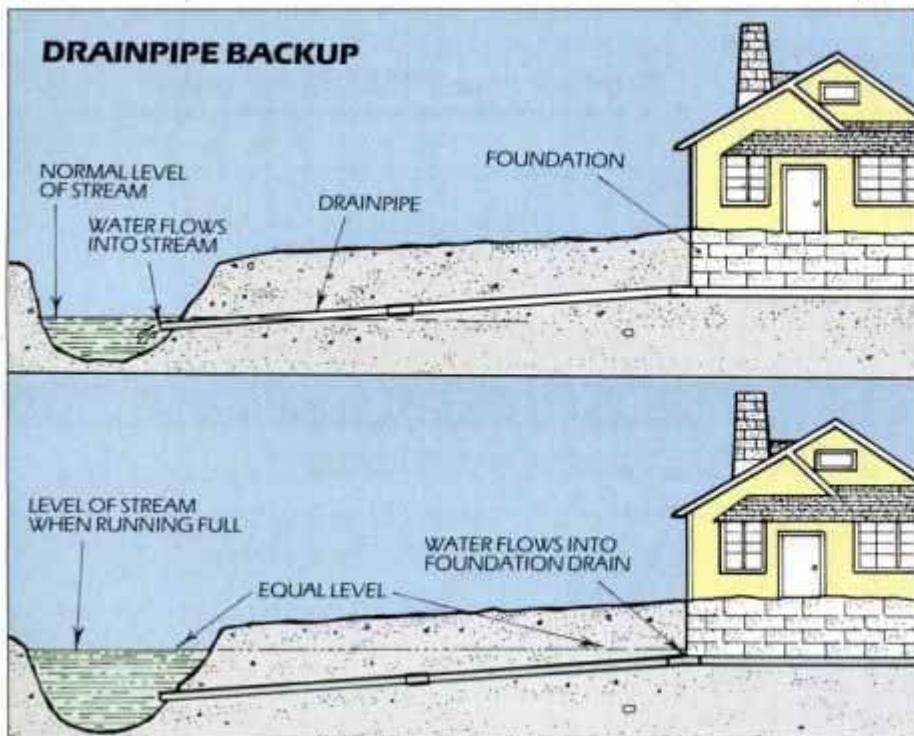
My house has standard aluminum gutters and downspouts. The gutters are constantly getting clogged.

On a recent trip to New Hampshire, I noticed that practically none of the houses had gutters. Instead, they had what looked like sheathing extending up the roof for about 3 ft. Would you know the principle behind this system?

OTTO K. MUELLER
CEDAR GROVE, NJ

What you saw was not the solution to clogged gutters or keeping gutters clean. In the Snow Belt, many houses don't have gutters because they contribute to ice damming or get torn loose by snow sliding off the roof.

The sheetmetal strip is slippery when wet and enables the snow at the lower edge of the roof to slide off easily, rather than build up into an ice dam, which can cause a backup of water under the shingles and into the house. The sheetmetal is generally extended far enough up the roof to cover a point at least 12 in. inside the interior wall line of the building.



Water in a drainpipe that empties into a stream can back up. For instance, if the height of the stream exceeds the height of where the drainpipe starts, backup can occur.

Energy Tip

Owens-Corning Fiberglas Corp. has published a 32-page booklet that is quite useful to homeowners. The booklet is titled, "A Homeowner's Guide To Insulation And Energy Savings."

The booklet explains insulating walls, attics and basements in new construction, and how to install insulation in an attic that is poorly insulated. It also has information on vapor barriers, ventilation and using insulation to deaden sound.

For your free copy of the booklet, call (800) 438-7465 or write to: M. S. U. Meeks, Owens-Corning Fiberglas Corp., Fiberglas Tower, Toledo, OH 43659. **PM**

DO YOU HAVE A HOME-MAINTENANCE OR REPAIR PROBLEM?

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

TOOL TEST

**BOSCH
RANDOM
ORBIT
SANDER**

TEXT AND PHOTOS
BY ROSARIO CAPOTOSTO,
Contributing Editor

● Having tested Bosch's 5-in. random orbit sander, we found it not only praiseworthy but as close to an all-purpose sander as you can get.

The sander's speed control has five settings, from 8000 to 11,000 orbits per minute, which give the sander remarkable range, from rough stock removal and paint stripping (Photo 1) to superfine finishing. Even at top speed, vibration was practically nil.

Each disc has eight holes that channel dust into the collection bag. Coupled with the optional suction hood, sanding is nearly dustless.

The discs are speedily replaced because they attach with Velcro (inset photo). We produced a superb, finish-ready surface on a panel by starting with a 60-grit disc to rid it of irregularities and quickly switching through discs in 80-, 120- and 240-grit sizes. Don't skip grit sizes, though. We found this leaves minute swirl marks.

To back up the discs, the sander comes with a medium-hard pad. Accessory soft and hard backing pads are available for sanding contoured (Photo 2) and flat surfaces.

The sander's random orbit feature makes sanding tricky crossgrain areas a snap. We smoothed a panel with a glued-on edge band that was perpendicular to the panel's grain direction. By sweeping the tool over



The Bosch variable-speed random orbit sander excels at a variety of sanding, finishing and shaping tasks. Its sanding discs are attached with an easy-to-use hook-and-loop system.

the edge band, we obtained smooth, markfree results (Photo 3).

One of the sander's other noteworthy features is a pivoting front handle, which allows exceptional control, especially on delicate work (Photo 4) or in tight spots. The sander is also an effective buffer/polisher (Photo 5).

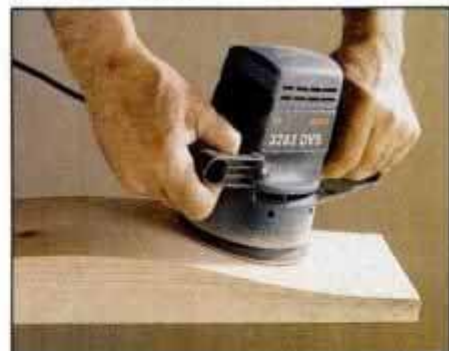
The Model 3283 DVS costs about \$160 at hardware stores and through

woodworking catalogs. Standard equipment includes the dustbag, a sanding disc assortment and an Allen wrench. Accessories include an applicator pad, buffing pad, soft and hard backing pads, dust hose, shop vacuum adapter and a range of disc grit sizes.

Contact Robert Bosch Power Tool Corp., 100 Bosch Blvd., New Bern, NC 28562-4097. **PM**



1 The sander is a clean and effective paint-stripping tool when outfitted with dustbag and a coarse-grit disc.



2 Using the soft backing pad, the sander easily follows slight contours. The flexible dust hood can't be used, however.



3 Sander's random orbit helps you flush off and smooth edge molding, even when it's perpendicular to the panel's grain.



4 Thanks to its pivoting front handle, the sander is easy to control, even in delicate operations such as sanding veneer.



5 Outfit the sander with its optional lambswool bonnet and you can quickly buff a coat of wax onto a piece of furniture.



If You Don't Use Genuine Toyota Parts, You May Not Be Such A Popular Mechanic.

The wife says, "Let a professional fix it." You prefer to do it yourself. And if you don't use Genuine Toyota Parts, you may find yourself in a rather awkward situation.

The truth is, unlike wanna-be aftermarket parts, only Genuine Toyota Parts are made to official Toyota factory specifications and workmanship. So not only

do they fit right, but reliability is built right in.

Take our oil filters, for example. They have an anti-drainback valve that lubricates the engine even after the car's been parked and turned off.

You'll also know exactly where to go for the right part. Right away. For a price that's right on the money. And that's your Toyota dealer.

So insist on Genuine Toyota Parts. It could possibly be the best thing you can do for her Toyota. And your popularity.

**PARTS &
SERVICE**

"I love what you do for me."

 **TOYOTA**

CAR CARE

MAINTENANCE BASICS

SUSPENSIONS

BY DON CHAIKIN

● Severely worn shock absorbers and springs do more than make you seasick as your car wends its way down the road. They can dangerously deteriorate your car's handling, and cause tires and other components to wear prematurely. To prevent such an extreme condition, inspect your rig's suspension at least twice a year.

You must work underneath your car to check the springs, shock absorbers and the various links and rubber mounts that comprise the suspension. To do that safely and easily, you must raise the car and place it on safety stands. Make sure the safety stands are on a stable base—either a concrete garage floor or 2 × 2-ft. pieces of ½-in. plywood.

- To inspect the front suspension, chock the rear tires before raising one front wheel with the jack.
- Place a safety stand under a solid frame member or mounting point. Lower the car onto the safety stand.
- Jack up the front wheel on the other side, and place a stand in a matching spot on that side. Lower that side of the car onto the stand.

For added safety, leave the partially raised jack in contact with the car.

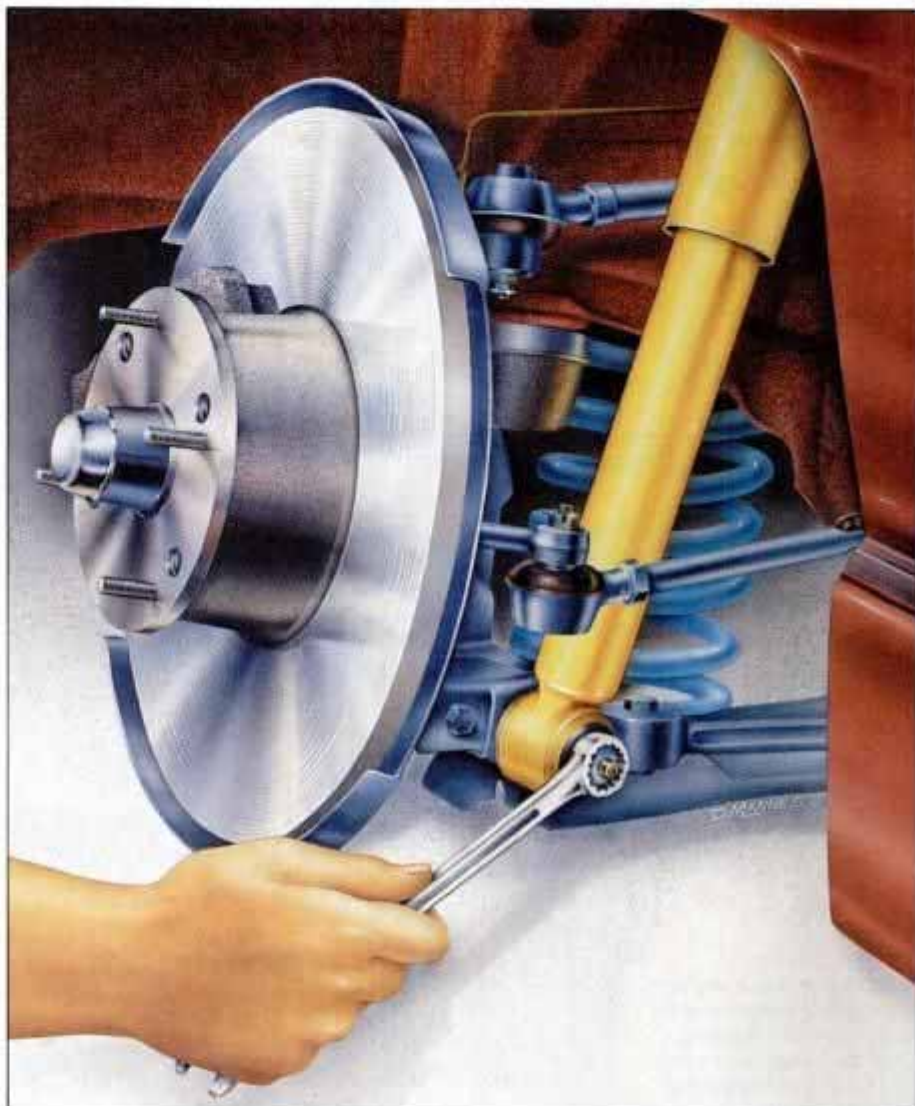
Slide under the car and look at each wheel's spring and shock absorber.

- Check that the spring is properly seated, top and bottom.
- Check for cracks or obvious deformation of the coils.
- Check the shock absorber tubes for dents, dings and cracks.
- Carefully inspect the shock absorber for signs of leaking oil on the tubes.

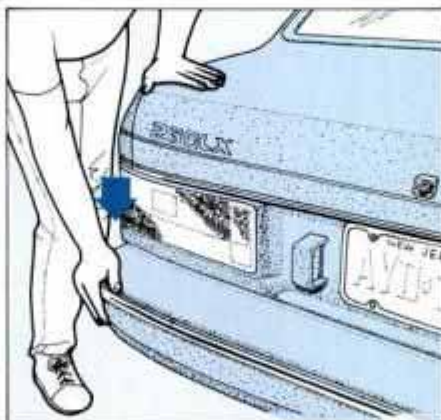
Inspect the upper and lower mounts of the shock absorber for loose or missing mount bolts, and missing or broken rubber bushings.

If mount bolts are loose, tighten them. But if any mounts are broken or if any of the shock absorbers or springs are physically damaged, they must be replaced. In fact, if one front (or rear) shock absorber or spring is bad, both front and rear units should be changed as a pair.

- Check all the rubber bushings that



With the wheels off and the car on stands, you can check the tightness of the suspension bolts.



To check the shocks, push down on one end of each bumper and observe the reaction.

mount the metal suspension components to the chassis as well as to each other.

- Bushings that are more than slight-

ly cracked and dried or are missing chunks of rubber must be replaced.

- Check that the bushing mount bolts are snug.
- Dry, squeaking bushings can be lubricated with some aerosol silicone. Apply the silicone sparingly.
- Inspect all the metal rods, links and arms, including the antiroll bar, for dents, bends and cracks.
- Check that all mount nuts and bolts are secure.

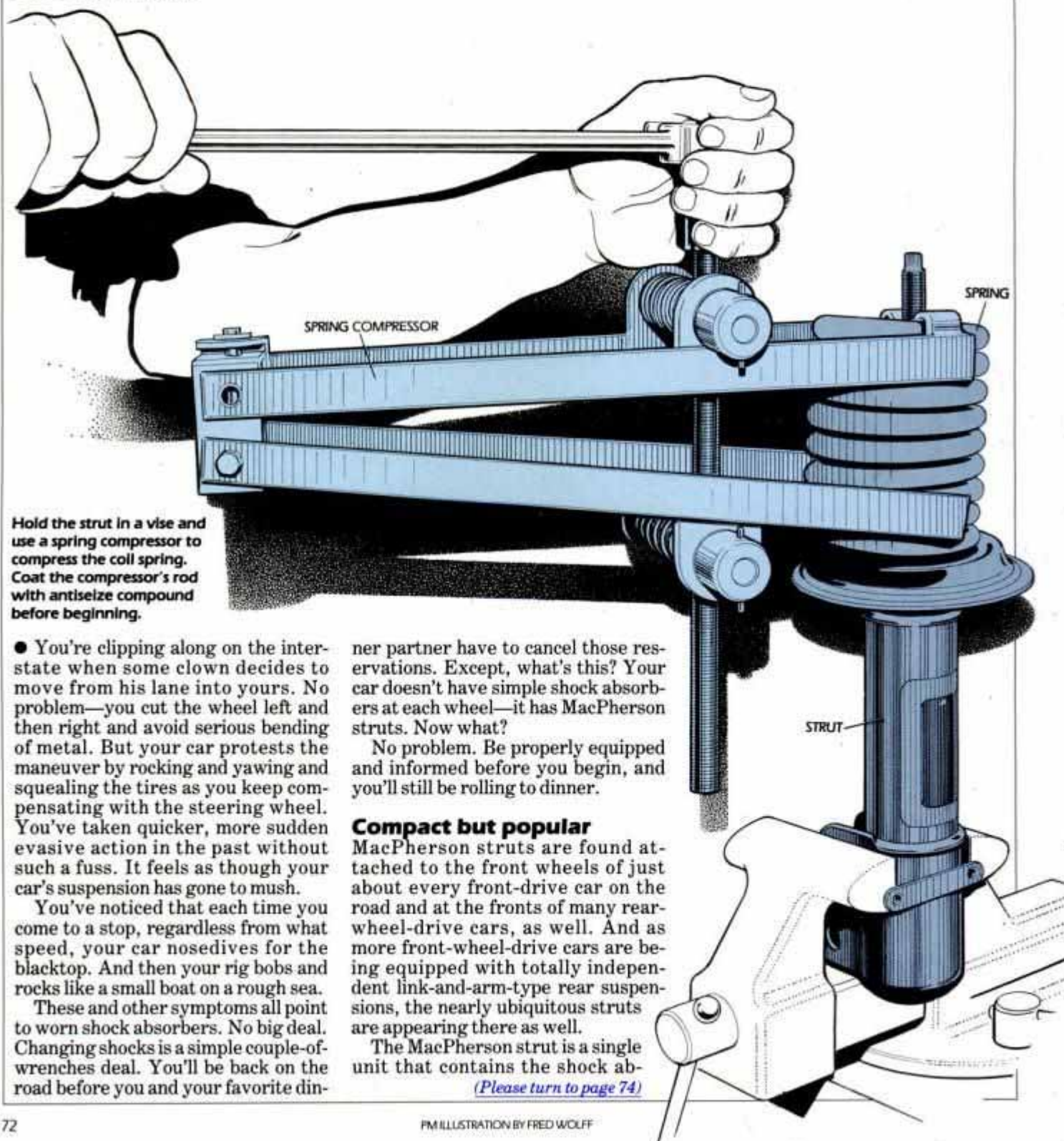
After inspecting the front suspension, lower the car and repeat the process at the rear.

With the car back on the ground, push down on each corner of the car in turn, and let the spring and shock absorber bounce it back up. If any corner of the car bounces more than twice, that shock absorber is due to be replaced.

SATURDAY MECHANIC

REPLACING MACPHERSON STRUTS AND SHOCKS

BY DON CHAIKIN



Hold the strut in a vise and use a spring compressor to compress the coil spring. Coat the compressor's rod with antiseize compound before beginning.

● You're clipping along on the interstate when some clown decides to move from his lane into yours. No problem—you cut the wheel left and then right and avoid serious bending of metal. But your car protests the maneuver by rocking and yawing and squealing the tires as you keep compensating with the steering wheel. You've taken quicker, more sudden evasive action in the past without such a fuss. It feels as though your car's suspension has gone to mush.

You've noticed that each time you come to a stop, regardless from what speed, your car nosedives for the blacktop. And then your rig bobs and rocks like a small boat on a rough sea.

These and other symptoms all point to worn shock absorbers. No big deal. Changing shocks is a simple couple-of-wrenches deal. You'll be back on the road before you and your favorite din-

ner partner have to cancel those reservations. Except, what's this? Your car doesn't have simple shock absorbers at each wheel—it has MacPherson struts. Now what?

No problem. Be properly equipped and informed before you begin, and you'll still be rolling to dinner.

Compact but popular

MacPherson struts are found attached to the front wheels of just about every front-drive car on the road and at the fronts of many rear-wheel-drive cars, as well. And as more front-wheel-drive cars are being equipped with totally independent link-and-arm-type rear suspensions, the nearly ubiquitous struts are appearing there as well.

The MacPherson strut is a single unit that contains the shock ab-

(Please turn to page 74)

COLD REMEDY

Now there's a prescription for helping your car or truck start significantly faster and easier in cold weather: Just add a bottle of Winter Start® to your motor oil.

Last season, thousands of drivers, nationwide, tried this new multi-viscosity oil conditioner and got welcome cold-temperature relief: 27% easier engine turnover, plus 36% better oil flow to engine parts to minimize friction and wear during warm-ups. (Compared to oil without Winter Start)*.

This season, don't get left out in the cold. Try Winter Start... for a cold remedy that'll really get you going.



For more information, ask for your FREE copy of the booklet, "The Cold Facts About Winter Start." Mail this coupon or call our toll-free 800 number.

To order Winter Start directly from Shaler, mail this coupon along with your check or money order. For credit card orders, call our toll-free 800 number. Your order will be shipped promptly. Satisfaction guaranteed or your money back.

Please send FREE "Cold Facts" booklet.

Please send convenient 2-Pack of Winter Start. I'm enclosing \$13.95 (\$9.95 plus \$4.00 postage/handling).

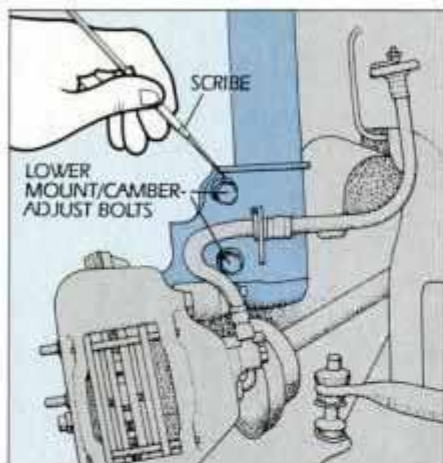
The Shaler Company, 21 E. Jefferson St., Dept. PM
Waupun, WI 53963 • 1-800-845-7348

Name _____

Address _____

City _____ State _____ Zip _____

*Results of independent laboratory tests, available on request.



Mark the position of the lower mount bolt heads to keep alignment close to specs.

sorber and coil spring. In addition, the strut acts as the upper arm in a typical suspension. The strut attaches to the chassis at its top, and to the wheel and lower control arm at its bottom. This simplicity and compactness make for an effective, inexpensive suspension. It also leaves room for other components, like a transverse engine and transmission sitting between the front wheels, or a wide rear seat between the rear wheels.

The strut's top mount consists of the coil spring mount and a swivel bearing which permits the entire strut to turn along with the front wheels as the driver commands via the steering wheel. The lower mount for the coil spring is integral with the strut housing, a metal tube that's heavy enough to support the load of one corner of the car. The bottom end of the strut can either contain the wheel spindle, or bolt to the spindle and hub carrier, or be attached to the steering knuckle, possibly via a ball

joint. Any antiroll bar attaches the left and right struts, either directly or via the lower control arm.

Strutting with intimidation

Since the shock absorber is only one element of the strut assembly, replacing a worn strut-type shock absorber is more complex than replacing a simple shock absorber. But it's nothing to be afraid of either.

While a few older designs—such as the Dodge Colt and Plymouth Champ made by Mitsubishi—had repairable shock absorber units within the strut that had to be drained, disassembled, cleaned and repaired, most cars have far simpler systems. In fact in many cars, replacing the shock absorber means merely replacing the strut unit. With others, the shock absorber is in the form of a cartridge contained in the strut housing's tube and simply slides out once the strut is removed and disassembled.

Begin strut repair or replacement as you would with a non-strut shock absorber, by verifying that the shock absorbers are in fact worn. Push down on each corner of the car and let it rock. The car should come up, go down once and come back to its original height. If it bounces more than twice at any corner, that shock absorber is worn. Also lift the car on its suspension, extending the spring and letting it go. Again, more than two bounces indicates a problem. The car should settle to the same height—within ½ in.—after pushing down on the car and after lifting up on it.

Next, jack up and support the end of the car with the suspect shocks and remove the wheels and tires. Place safety stands under a frame member

to support the car—*do not* work under a car that is sitting only on a jack.

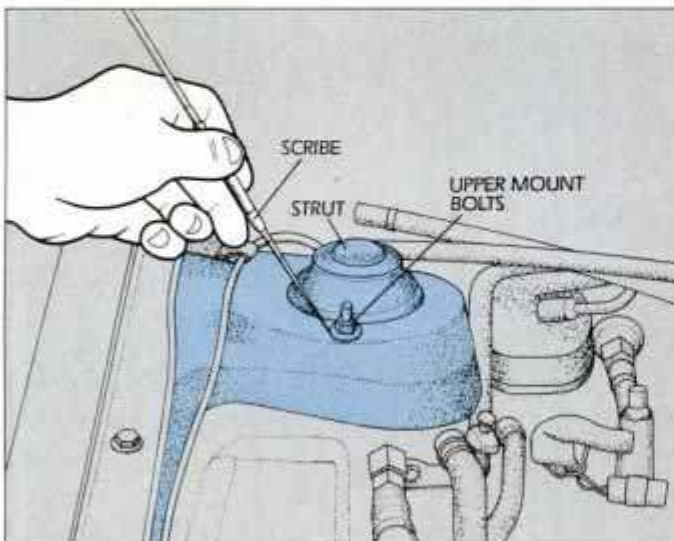
With the wheels off, check the strut for damage—dents, cracks or bends in the housing or spring seat. Look for signs of leaking shock oil on the shock absorber portion of the strut inside the coil spring. More than a trace of oil leaking from the shock is grounds for immediate replacement.

If you determine that any one of the struts is bad, you must replace its mate on the other side of the car. An exception here is if the strut is new or almost brand new and was damaged. Having one strut that's only a few miles younger than the other is not generally a problem. Otherwise, you must repair or replace both struts on the same axle.

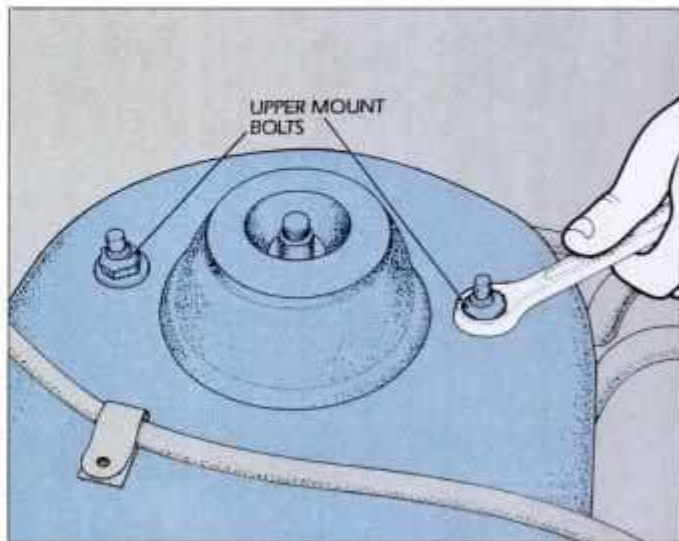
Take it out

To replace the shock absorber cartridge on most MacPherson struts, you must remove the entire strut unit from the car. There are exceptions, however, such as the Buick Regal and its brethren which are designed for cartridge removal without strut removal. If you must remove the strut to repair or replace the shock absorber, first determine how the unit is mounted to the wheel.

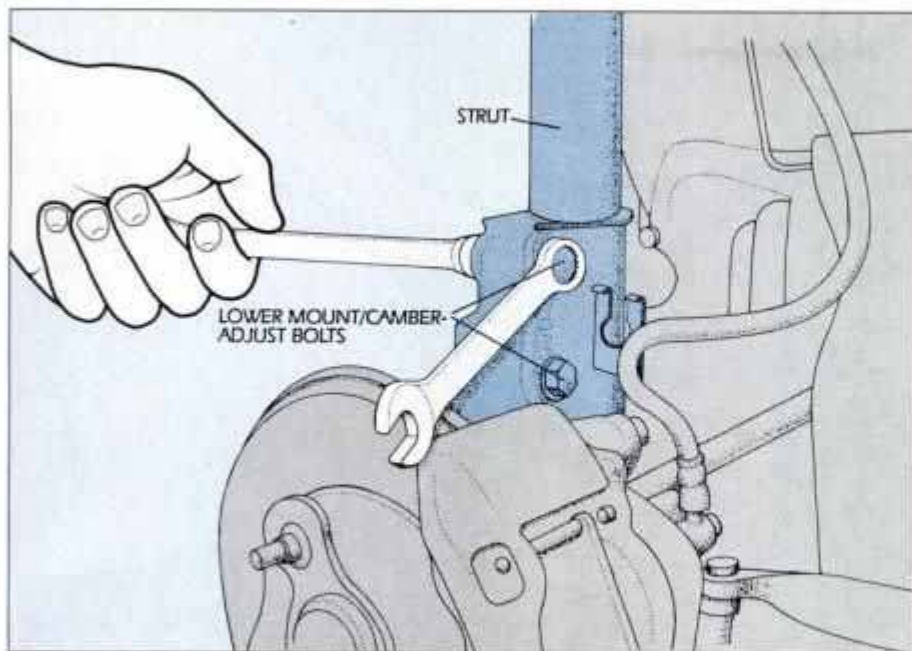
In cases where the strut is attached to the front-wheel spindle and steering knuckle, you must remove the brake caliper and rotor, and disconnect the steering knuckle from the steering tie rod. In most cases you can remove the brake caliper without disconnecting the brake line. Use a piece of heavy wire (wire hanger or welding rod) to tie the caliper to part of the car so the weight of the caliper is not hanging on the brake hose. Discon-



Similarly, mark the position of the upper mount bolts with a sharp tool before removing them.



Remove the upper mount bolts or nuts. Don't loosen the large center nut yet—this nut holds the strut together.



Remove lower mounting hardware. On some cars you'll be taking the ball joint apart instead.

nect any clips that may hold the brake hose to the strut as well.

If the strut is bolted to the steering knuckle or spindle carrier, check the bolts before loosening them. On many cars the lower bolt also serves as the camber adjustment. Before undoing the bolt, scribe matching marks on the head of the bolt and strut mount. Now you can undo the bolts.

In cases where the steering knuckle is integral with the bottom of the strut, you have to remove the steering tie rod end from the knuckle. This usually involves removing a cotter pin and nut. You may need a ball-joint fork to separate the tie rod from the steering knuckle. A sharp blow to the fork with a heavy hammer should do the trick. Take care not to damage the rubber boot on the tie rod end.

With some cars you must also undo the antiroll-bar mount if it is attached to the strut's lower mount or the wheel spindle, so the strut can fall away from the lower control arm.

After you've disconnected the bottom of the strut, go to the top. Front struts are accessible from under the hood, at the tops of the strut towers. The upper mounts for rear struts may be hidden under a parcel shelf, trunk panel or behind the rear seat back.

To remove the strut, undo the two or three nuts that hold the top mount in place. Do not disturb the center nut—it holds the top mount in place on the strut and holds the coil spring compressed. But before loosening the top-mount nuts, ascertain if any of the upper mounting holes are slotted. Slotted holes indicate that moving the

top of the strut along the slots adjusts wheel alignment. If the upper mounting position is part of the alignment procedure, use your scribe to mark the positions of the mounting studs against their spots on the strut tower. Now undo the nuts.

If your car has an electrically controlled suspension that alters the shock absorber valving in the struts, the electric motor and controller are mounted at the top of the strut. You must undo the wiring and remove the motor and controller before disconnecting the strut's top mount. Consult your service manual first.

With both upper and lower mounts disconnected, you should be able to pull down the strut out of the strut tower—if the strut's own weight along with the weight of the lower suspension doesn't cause it to fall. Then lift the strut out of the steering knuckle or wheel spindle carrier.

A strut in the vise

Place the strut in a bench vise, using two pieces of wood in the jaws to protect the strut. To gain access to the shock absorber, you have to remove the coil spring. You must use a coil spring compressor, one designed for use on MacPherson struts. These can be rented or purchased at any auto parts store, as well as many tool rental agencies.

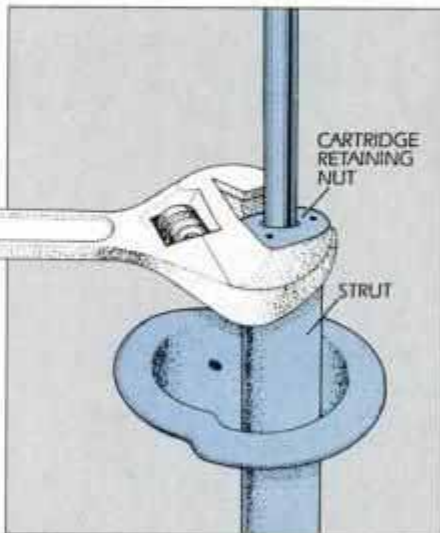
Warning! Do not attempt to backyard-engineer any substitutes for a proper coil spring compressor. There's enough energy trapped in a compressed coil spring to punt your head into the neighbor's backyard

—regardless of whether it's attached to your neck.

Position the compressor over the spring, coat the compressor's threaded rod with antiseize compound and tighten down the rod to compress the spring. Use a long-handled ratchet and socket on the spring compressor so you don't have to struggle with the spring. Work slowly and carefully. If the compressor starts to slip or walk on the spring coils, or if the spring begins distorting instead of compressing evenly, back off and reposition the compressor and start again. All the while you're working, stay out of the line of the spring.

Compress the spring until it is free of the upper mount. Once the spring pressure has been removed from the mount, you can undo the top nut. You may need a deeply offset box wrench to reach the nut, depending on your car. You will also need to hold the shock absorber's piston rod from turning along with the mounting nut. This may require an Allen wrench or a small hex wrench. If you have an air wrench handy, you can probably just spin the nut loose without even holding the rod. Remove the top-mount nut, the upper spring mount and the coil spring/compressor assembly. Set the spring/compressor assembly someplace out of the way where it won't be disturbed.

If there is a rubber jounce stopper and dust cover boot, slide them off the shock absorber's piston rod. Inspect the shock. Check the rod for deep nicks, scratches and cuts. Check to see if the rod is bent. Hold the strut upright and pull the piston rod all the way up, out of the strut housing. If oil spills out along with the rod, the shock



Replaceable cartridges require removing a large-diameter nut at the top of the strut.

CAR CARE

is bad—some very slight seepage is normal, however. While still holding the strut upright, push the rod into the housing and pull it out again. If the rod sticks, pull the rod all the way out and turn the strut upside down and push the rod all the way in. Turn the strut right-side up and pull the rod out again. Turn it over and repeat the process. If the rod still hesitates or sticks, the unit is bad.

If the strut itself is bad—dented, bent, or the lower spring seat is cracked or deformed—or if the shock absorber is not a replaceable cartridge variety, you must replace the strut unit. Simply install the coil spring and upper mount on the new strut, and install it in place of the old.

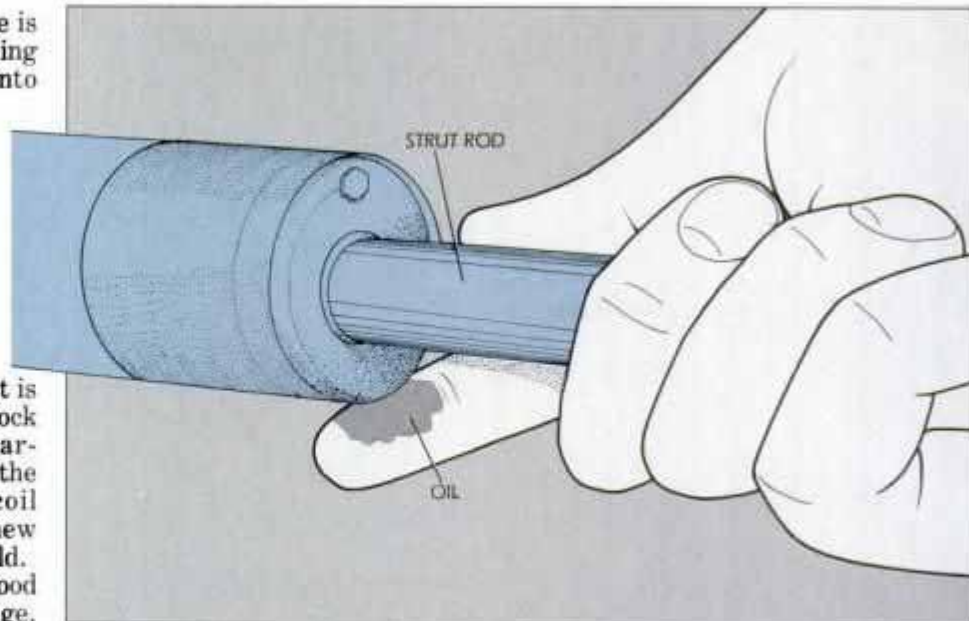
However, if the strut itself is good and the shock absorber is a cartridge, you need only replace the shock absorber. Undo the large nut at the top of the shock absorber tube. This may require a special spanner or simply a large wrench. Unthread the nut and slip it up over the shock's piston rod. Then simply pull the old shock cartridge out of the strut housing. Slip the new shock into the housing in its place. Replace the nut and snug it down. Reinstall the spring and upper mount and reinstall the strut.

Before reinstalling the coil spring, be sure that the coils are intact, with no cracks or deformation. Replace both springs if even one is defective. When reinstalling the coil spring, be sure to place it so the spring end is in the small recess or against the spring stop tab on the mount.

Also inspect the upper bearing plate and jounce rubber before reinstalling them. A new shock probably comes with a new jounce rubber and dust shield—use them. Check that the bearing moves smoothly. The bearings in the top strut mounts on some cars require lubrication upon reassembly—usually in the form of grease—check your factory shop manual. If the bearing sticks or feels rough, replace it. Also inspect the spring seat surface and the mounting studs. If there are cracks or a deformation of the spring seat, replace the mount. Likewise, if any of the mounting studs shows stripped threads.

With the strut reassembled, do not remove the spring compressor until you have tightened the upper mount nut to the correct torque specifications. Check your factory shop manual for the spec—it can run to well over 100 ft.-lb.

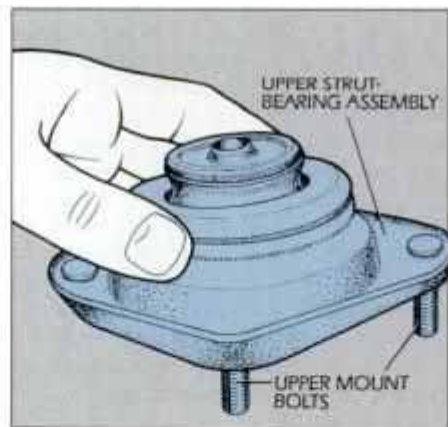
After the strut has been reassem-



An accumulation of oil on the shock absorber rod indicates the shock is worn.

bled, reinstall it in the car, starting at the top. Do not overtighten the nuts on the top mounting studs. Take care to reposition the upper mount as per your scribe marks. Some cars require that new nuts be used.

With the top bearing in place, reassemble the bottom. Again, take care to align any marks you made on the strut's lower mount. And again, some



Inspect the strut's upper mounting plate and bearing before reinstalling it.

carmakers recommend new mounting nuts and bolts. Tighten them to specs. In some cases, you may have to slightly exceed the torque setting to align your scribe marks. Lubricate the threads and washers with oil or anti-seize compound before tightening.

Reassemble the brake and wheel hub assembly and reconnect the steering knuckle to the tie rod. Reinstall the wheel and tire and put the car back on the ground. Despite your care in reassembly, you should have the wheel alignment checked soon.

Easy out, easy in

As carmakers become more comfortable with the nuances of building ease of service into front-drive cars, they have developed ways to replace the shock absorbers in MacPherson struts without the need for removing the strut unit. Besides being easier all around, replacing the shock absorber without removing the strut obviates the need for checking the alignment.

If your car has top-replaceable shocks, there is no need to jack up the car. In fact, the job must be done with the full weight of the car on the suspension, since the car's weight will keep the coil spring compressed between its lower seat on the strut and its upper seat. If the suspension were unloaded—as by having the car sitting on safety stands—the spring would extend, pushing down on the strut and the control arm, displacing itself out of its seats when you removed the upper mounting nut.

Working from under the hood, remove the cover at the top of the strut and undo the mounting nut at the top of the piston rod. With this nut off, you can remove any jounce stopper and then undo the shock cartridge's locking nut. However, to undo these you need special socket wrenches, available from either your dealer or auto parts store. Without the special tools, the job is impossible. Once the cartridge nut is off, you can slip the shock absorber cartridge out through the strut tower and slide in its replacement. Replace any jounce stopper, re-torque the piston rod nut and reinstall the cover. Close the hood, and you're ready to roll.

FM

Precious Metal.



Buckle up, America!

*Excludes other GM products. †Based on truck registration data model year to date. **Rear-wheel anti-lock brakes operate in 2WD only. ††See your Chevrolet dealer for terms of this limited warranty. Chevrolet and the Chevrolet emblem are registered trademarks and Chevy is a trademark of the GM Corp. ©1991 GM Corp. All Rights Reserved.

- Most available 1/2-ton power.
- Standard anti-lock brakes.**
- Two-side-galvanized steel and standard base-coat/clear-coat paint for superior rust protection.
- 3-year/36,000-mile Bumper to Bumper Plus Warranty. No deductible.††

Chevrolet. The best resale value of any full-size pickup.* Let's face it, you get what you pay for. And a Chevy retains more of its original value than any other full-size pickup. So, while you're out there making a buck, America's best-selling truck[†] is working hard to help you keep it. Chevrolet. The trucks you can depend on. The trucks that last.



The Heartbeat Of America Is Winning.™

CAR CLINIC

BY MIKE ALLEN,
Associate Automotive Editor

A Toothy Problem

I've been working on cars for most of my life, and I feel pretty confident about tearing into the engine or the brakes. But I'm about to get into the transmission on my son-in-law's sports car. He got a quote for repairs almost as large as the national debt—and that's without even so much as a test drive.

The service manager says that all of the gearsets have to be replaced, and the parts are what is driving up the price. I don't think a transmission rebuild should cost as much as a new Yugo. My question is, how do you know when a gear is worn out?

TIM ALBETSHAM
POUGHKEEPSIE, NY

Obviously, a gear is history if it's missing any teeth, blackened from excess heat or showing any spalling on the face of the teeth. But generally, the teeth are not the problem.

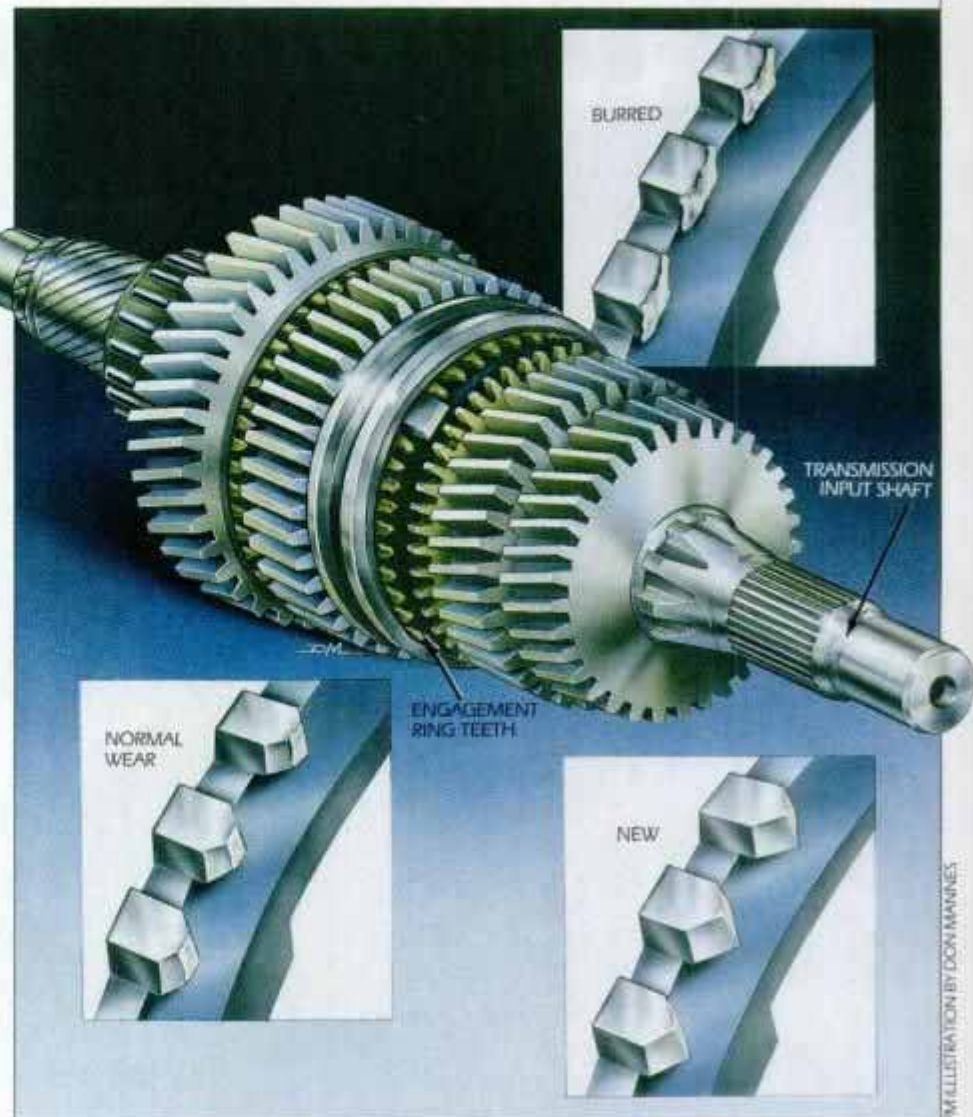
Most transmissions use a sliding gear, called an engagement ring, slider or dog ring. The gear itself rotates freely on the shaft. The engagement ring is indexed to rotate with the shaft, but can slide back and forth a half inch or so. When it slides far enough, small teeth mesh with similar teeth on the gear.

It's usually these teeth that are the big wear points. In every gearshift, these teeth have to mesh when they aren't rotating at exactly the same speed, particularly if the synchros are worn.

Eventually, the points wear down. Ultimately, the ends of the teeth get so burred up and mashed over that the ring won't slide far enough—and you've lost a gear.

How worn is worn? You'll have to decide yourself, but a small amount of flattening of the points of the teeth is normal—until it starts to interfere with shifting, or the teeth wear into a tapered shape that pushes the ring back out of mesh when power is applied. This may well be unnecessary. I've even resorted to stoning the burrs off of gears in emergencies—say at oh-dark-thirty the night before a race—but this is obviously a desperation technique.

Some transmissions even have engagement ring teeth that can be pressed off the gear, allowing them



to be replaced inexpensively. (Good luck finding parts, however.)

I'd plan on replacing all of the bearings, all of the engagement rings and the gearset of the particular gear you're having a problem with. This could save a ton of money—but you should be prepared to spend everything the dealer has suggested.

Transmissions tend to be even more fussy about maintaining wear patterns than engines. Normally, you would be sure to put every rod and piston back into the same cylinder, and the valve lifters back on the same cam lobe. When you disassemble the tranny, mark, tag or separate all of the parts so they go back together in the same place and in the same relationship to their neighbor.

Ohh...The Pressure

Years ago, after a couple of radiator repairs, the radiator shop owner blamed the repeated failures on premature rot and high pressure in the system. He sold me a 7-pound radia-

tor cap to replace my 15-pound cap. I then used the lower-pressure cap only in cooler weather.

I now own a new Buick Grand Prix. In the interest of extending the life of the radiator, should I use a lower-pressure cap?

E. STARSIAK
SCHENECTADY, NY

No. That shop owner was trying to save you a couple of bucks on a re-cored or replacement radiator. He was also making excuses. Any radiator that's not on its last legs ought to be able to take the few extra pounds of pressure from the correct-rated cap.

New cars run hot, in the interest of increased mileage and lowered emissions. The extra pressure buys 20° to 30° F of protection, by increasing the boiling point of the system.

If you flush and fill your cooling system regularly with the correct corrosion-inhibitive coolant, the radiator should last as long as the rest of the car, regardless of the pressure.

(Please turn to page 80)

Kinder? Gentler? No Way.



Buckle up, America!

*Rear-wheel anti-lock brakes operate in 2WD only. †See your Chevrolet dealer for terms of this limited warranty. Chevrolet, the Chevrolet emblem and S-10 are registered trademarks and Chevy is a trademark of the GM Corp. ©1991 GM Corp. All Rights Reserved.

- *Shift-on-the-fly Insta-Trac,™ the most relied-upon 4x4 system in America.*
- *Standard anti-lock brakes.**
- *3-year/36,000-mile Bumper to Bumper Plus Warranty. No deductible.†*

Chevy S-10 Tahoe 4x4. The biggest V6 engine you can get. Take on any mean street or unforgiving back road with Chevy S-10 Tahoe 4x4. Its big, 4.3 Liter Vortec V6 kicks out 160 horses at 4000 RPM. Nail it, and you know it's hammer time. Chevy S-10 Tahoe. Strong. Tall. Proud. Chevrolet. The trucks you can depend on. The trucks that last.



The Heartbeat Of America Is Winning.™

CAR CARE

Blemish Medicine

I purchased a slightly used '91 Bonneville last month. There were some blotches on the hood, trunk and roof, but I assumed that the car simply needed to be washed and waxed after sitting outdoors at the dealer. But the spots remained, so the dealer's body shop concluded it was acid rain damage. They tried a mild rubbing compound, a chemical cleaner and rewaxing—to no avail.

The next step is to repaint, which is in arbitration with the dealer. But many, from the dealer to independent body shops, have told me that the factory paint job is better than any done in the field.

Does GM have a problem with its clearcoat finishes? Will this respray affect the resale value of the car?

VICTOR GAVINSKI
WHITE HAVEN, PA

Clearcoat finishes have taken over the industry, even for solid, nonmetallic colors. Most of the time, there's no problem. But some areas of the country have serious problems with low-pH rainfall. If this slightly acid rain is allowed to dry on the car, the acid is concentrated as the water evaporates—leaving you with some seriously corrosive droplets. This isn't really a paint problem, it's an environmental problem—even though some automotive companies are willing to absorb some of the cost some of the time.

Yes, the factory paint job is probably better, in terms of adhesion, than a body-shop repaint, but a good shop won't necessarily remove all of the paint—depending on how bad the existing paint is.

A good (read expensive) paint job won't have a negative effect on your car's resale value. In fact, it's quite the contrary if the factory finish is damaged.

How good is good? Use a high-quality, catalyzed enamel basecoat/clearcoat system, take the time to prepare the surface properly, and the paint will last the life of the car.

This presumes, of course, that you don't let the acid rain damage it again. Wax regularly so that water beads up and rolls off rather than making puddles, and don't let the car dry in the sun after rainstorms.

A Dim Situation

I have an older tractor with a 6-volt electrical system. I'd like to use 12-volt batteries, which are easier to find. Is there any way I can do this



It's not too late
to order for
Christmas

ESCORT DSP[®]
Radar Warning Receiver

Great timing.

For a limited time, get our best performer at our best price. Until December 31, 1991, you can purchase ESCORT DSP for only \$249 (that's over 15% off the regular price).

ESCORT DSP is a complete radar protection system:

- Longest range available
- Pulse and instant-on radar detection
- Anti-falsing circuitry

ESCORT DSP is also backed with a 30-day money-back guarantee.

Now is the time to order the most advanced radar protection system available.

ESCORT DSP \$249 (reg. \$299)

Add \$4.95 shipping. Ohio residents add 5.5% sales tax.
Prices higher in Canada.

1-800-433-3487

Fax: 513-247-4820 Service: 1-800-543-1608

Major credit cards accepted

ESCORT

► Department 006812
One Microwave Plaza
Cincinnati, Ohio 45249

* Overnight shipping available

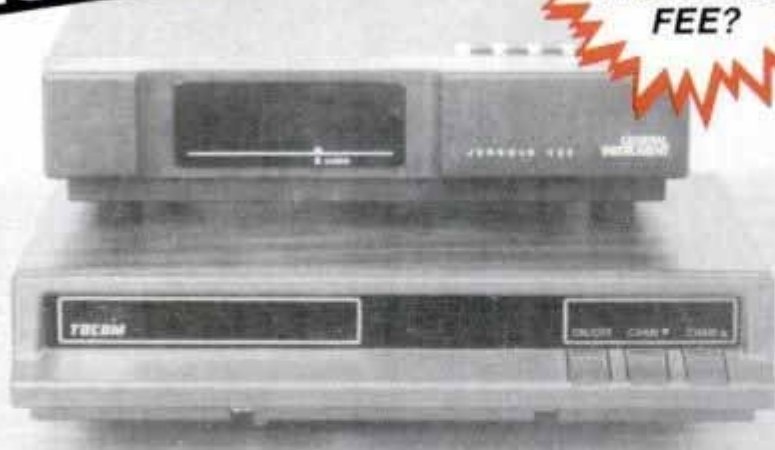
ESCORT

The world's most advanced radar detectors.

\$50 Off!

CABLE T.V. CONVERTERS

WHY
PAY A
HIGH
MONTHLY
FEE?



All JERROLD, OAK, HAMLIN, ZENITH, SCIENTIFIC ATLANTA, PIONEER and all specialized cable equipment available for shipment within 24 hours. 60 Day Guarantee. QUANTITY DISCOUNTS AVAILABLE. MC/VISA or C.O.D. telephone orders accepted.

Send self-addressed stamped envelope (60¢ postage) for FREE CATALOG

**MIDWEST
ELECTRONICS INC.**

P.O. Box 5000
Suite 311 (PM)
Carpentersville,
Illinois 60110

INFORMATION/ORDERS

**1-800
648-3030**

Note: Decoders and Descramblers must not be used without authorization by your local cable operator.

NO ILLINOIS ORDERS ACCEPTED

CAR CARE

From Prying Eyes

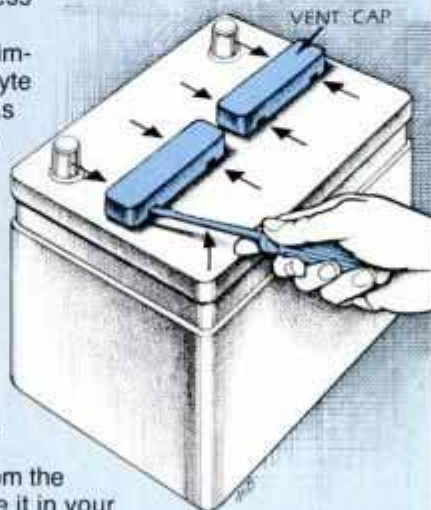
● Maintenance-free batteries are a great marketing ploy. "Never add water" would seem to eliminate yet another annoying task. But this doesn't mean there was some breakthrough in the technology of lead-acid batteries that made topping-up the electrolyte unnecessary. All lead-acid batteries convert a small amount of the water in the cells to hydrogen and oxygen by a process called electrolysis.

So-called maintenance-free batteries simply have an additional amount of electrolyte covering the top of the plates, as well as calcium-alloy rather than antimony-alloy plates, delaying—but not eliminating—the eventual need for adding water to the battery.

Why am I telling you this when there's no battery filler cap on most maintenance-free batteries?

Look again. Often there's a cleverly disguised filler cap, which may require a screwdriver to pry open. Be sure to pry a little bit at a time, in circles around the cap, or you may crack it.

And be sure to wash any electrolyte from the tip of the screwdriver before you replace it in your toolbox or your hip pocket.



PM ILLUSTRATION BY ADOLPHE BROTHMAN

without replacing the starter, generator and points?

HENRY SIDONSKI
RAMSEY, NJ

You'll definitely need to replace the generator. My suggestion is to use one of the new internal regulator alternators from a late-model vehicle. If you scrounge one from a junkyard, it won't cost too much, although you may need to fiddle a little with the mounting bracket to get it to fit.

The starter motor will live for a while on 12 volts. I've converted a number of older 6-volt Volkswagens and Porsches to 12 volts this way—just be sure to avoid cranking the engine for more than a few seconds at a time, or you'll melt the windings. When it finally does expire, have it re-wound for 12 volts at any good electrical shop.

If you have a distributor ignition, the points will be fine, but you'll need to replace the ignition coil and ballast resistor with the appropriate high-voltage parts. If you have a magneto, which used to be fairly common on many pieces of farm equipment, then it will be fine with-

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.

out making any adjustments.

Any headlights, indicator bulbs or the like will probably burn out immediately on 12 volts. Simply replace them with the equivalent parts rated for the higher voltage. **PM**

SERVICE TIPS

- Difficult shifting or gear clashing in '89-'91 V6 Pontiac Firebirds, Sunbirds, Grand Ams and Grand Prix may be the result of loose bolts holding the clutch pressure plate to the flywheel. TSB 91-7-4
- Suzuki TSB 2-06 10260 covers an engine miss/stalling condition on 1991 Side-kicks. The wiring harness between the distributor and the strap on the firewall is too tight, causing broken wiring. Work more slack into that section of the harness, and replace or repair any broken wires.
- Excess current drain, causing a flat battery, may be caused by a bent glovebox light bracket on some 1990 Dodge Dynastys, Chrysler New Yorkers and Imperials. Check for the light's current drain at the battery. You will need to wait 30 minutes after closing the door until the computer has turned off any other electrical devices. Adjustment of the bracket or replacement of the lock assembly is called for in TSB 08-17-90.
- 1989-'90 Nissan 240SX cars may have a problem with sludge buildup in the oil-pressure switch, causing leaks in the switch diaphragm. TSB NTB90-103 suggests adding a 90° adapter where the switch screws into the oil filter adapter to prevent this condition.

Quiet!



Listen to what they're saying!

What a dramatic difference in the car! So much smoother, quieter and better gas mileage. It was indeed a very immediate and noticeable improvement. (A.G. Canada)

Since discovering Tufoil®, I have driven our cars a total of 528,391 miles without ever having replaced any internal part of the engine or having the cylinder heads removed for a valve grind. Your company has saved me lots of money, for which I thank you! (E.L. Utah)

Damned if your stuff doesn't really work! My 85 Chevy (80,000 miles) runs better than new! (H.D. Pa.)

One 8 oz. - \$ 17.75 (ship. incl.)
Two 8 oz. - 29.00 (ship. incl.)
1 Quart - 38.95 (ship. incl.)
1 Gallon - 131.00 (ship. incl.)

1-800-922-0075

ORDER TODAY

Fluoramics, Inc. PM192

18 Industrial Avenue
Mahwah, NJ 07430

My check or money order for \$ _____ is enclosed.

Charge my credit card:

Am. Express Master Card Visa

Card No. _____

Exp. Date _____

Phone No. _____

Name _____

Address _____

City _____

State _____ Zip _____

(N.J. residents please add 7% sales tax.)

SMALL WORLDS

BY ABE DANE, Science/Technology Editor



In tests of NASA's Environmental Control and Life-Support System (left), volunteers worked out in a sealed room (right) to supply water for recycling.

● All a human really needs to live for a year is about 7000 pounds of food, oxygen and water. For millions of years, our world has, with varying degrees of reliability, supplied these vital compounds through a marvelously complex and delicately balanced array of processes. But if we want to explore any distance beyond this planet—or if Earth's natural mechanisms should somehow fail us—we're going to have to find other ways to get what we need.

Several projects now under way around the country are working toward developing what are known as regenerative life-support systems. Attempting to provide their inhabitants with food, water and air by recycling human wastes, these systems amount to tiny replicas of Earth.

The best known, and most controversial, of these is *Biosphere II* (see [Tech Update, page 16, Jan. '91](#)), a \$150-million greenhouse in the Arizona desert. Last September, eight people were sealed inside this tremendous terrarium for a 2-year stay.

Essentially, the idea is that a care-

fully chosen combination of 3800 different plants and animals will survive in symbiotic harmony with the human Biospherians, each organism supplying something that the others cannot provide for themselves.

No one questions that it's a bold undertaking. In fact, many scientists doubt that experimenting on such a grand scale serves much purpose beyond making a big splash with the public. *Biosphere's* unabashedly profit-oriented business practices, refusal to disclose basic scientific and engineering data, and lack of affiliation



Biosphere II mimics Earth's life-support systems in a giant greenhouse.

with reputable scientific institutions have only heightened these concerns.

Overshadowed by all the bickering over *Biosphere* have been a number of less flamboyant, but potentially more illuminating, efforts to create human habitats that are, to varying degrees, self-contained.

Among the most advanced, and also the most likely to see near-term practical use, is the life-support system now being developed for Space Station *Freedom*. *Freedom* differs from all previous spacecraft in that it will recycle all of the water used by its crew. If it did not, approximately 20,000 pounds of water would have to be carried up to the station every three months. With Shuttle launch costs in the area of \$2000 per pound, that's a wildly expensive proposition.

Under the current *Freedom* plan, water will be condensed from cabin air, distilled from urine and collected from hygiene activities. It will then be run through a device called a potable water processor. This elaborate con-

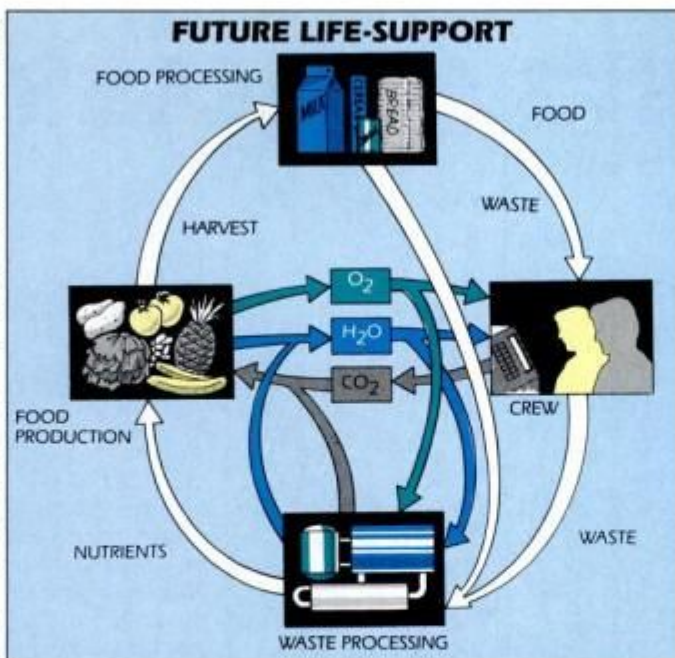
glomeration of systems first filters the water to remove particulate matter, and heats it to kill microbes. Next, the water passes through packed columns containing activated carbon and ion exchange resins, which remove hydrocarbons and metals. Organic materials are removed catalytically, then iodine is added, and water quality is tested.

In tests of the system last summer, volunteers lived and exercised in a sealed room at Marshall Space Flight Center. Water from evaporated perspiration and washing was processed, tasted and found to be acceptable.

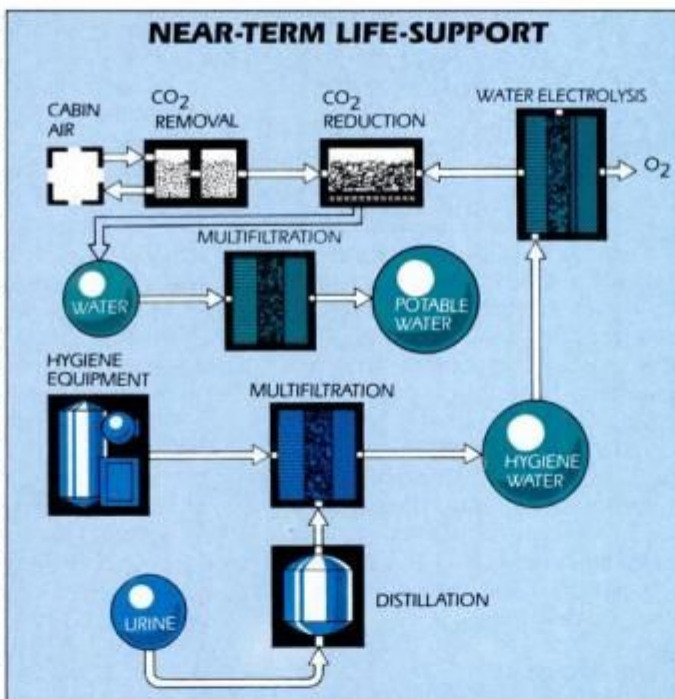
Using the potable water processor, the Space Station should require no water resupplies to support the crew. What little water is wasted by the system will be more than replaced by moisture in the food brought up to the station at regular intervals.

Originally, this nearly perfect, closed-loop system for water was to have been complemented by a similar revitalization system for air. Excess water would have been electrolyzed to replace oxygen consumed by the crew. Although congressional budget cuts necessitated the removal of this system, engineers say it is technically feasible. Current *Freedom* plans make room for a closed air loop, so it can be added later on.

Water is by far the heaviest, and thus the most expensive, requirement of humans in space, but the costs of replenishing food supplies will also become prohibitive as humans venture farther from Earth. That means that future life-support systems will have to be even more complete and



Eventual bioregenerative life-support systems (above) will make space colonies entirely self-sufficient. Early Space Station *Freedom* design would have required only food.



thorough replicas of our home planet.

To that end, scientists at various NASA centers and contractors around the country are working toward bioregenerative systems that produce food as well as water and air. These require the addition of plant, and possibly even animal, life to the overall life-support equation. Current estimates say that somewhere between 220 and 335 sq. ft. of space will be required to grow enough food for one person. A combination of 10 plants supplying all nutritional needs could fit into a plot roughly 16 ft. on a side. Hydroponics and genetically engineered plant varieties could help increase the yield.

PM ILLUSTRATIONS BY HANK KEN



**Dramatic Breakthrough
in Portable MIG Welding!**

MIG-MASTER®

PORTABLE D.C. MIG WELDER

MIGMASTER® has been described by a leading merchandising executive as "the most innovative product I have seen in many years". "Amazing", "Incredible" were some adjectives used by other hardware executives after witnessing a demonstration of MIGMASTER®.

A chart which compares MIGMASTER® with eight of the most popular MIG welders shows MIGMASTER® rated superior over the others. Among the factors considered were amperage, heat control, price, types of metals welded, shipping weight, wire feed speed control and percentage of duty cycle while welding.

MIGMASTER® will weld 3/4" aluminum and steel and stainless to 1/2" thick! Professionals have been adding MIGMASTER® to their shop equipment as a necessary convenience; versatile, easy to use, as well as totally portable.

Farmers, truckers and do-it-yourselfers who have never welded before have been buying MIGMASTER® which they, after a brief learning period, have found to be extremely useful for a variety of metal fusion tasks, especially repairs, building projects and hobby work. Because MIGMASTER® is battery-powered it can be used in the field or on the highway where there is no access to electricity.

SPECIFICATIONS

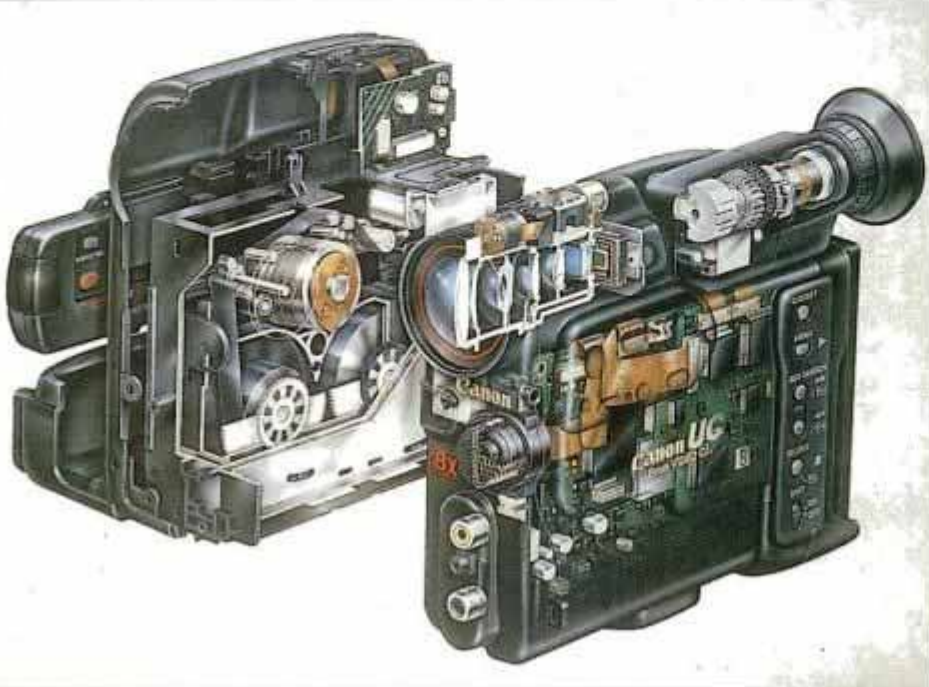
Arc Input Power	24VDC
(Two Storage Batteries in Series)	
Wire Drive Input Power	Customer-Supplied
Electric Hand Drill	
Arc Output Power	30-200 Amps @ 17-21VDC
Maximum Open Circuit Volts	26VDC
Duty Cycle with Inert Gas Cooling	100%
Wire Electrode Types	All 4" Spool Loads
Wire Electrode Sizes	All 4" Spool Loads
Warranty	1 Year

OMNIVERSE RESEARCH, INC.
P.O. Box 33243 Los Gatos, CA 95031
408/354-6611

**To Order, or for the dealer nearest you,
Toll-Free 1(800) 762-7032**

SMALL GETS SMALLER

BY STEPHEN A. BOOTH, Contributing Editor



● Let's open the new year with the latest installment in the tale of the incredible shrinking camcorder. This chapter concerns 8mm video, and how the recent efforts of Canon, Hitachi and Sony are adding momentum to that increasingly popular camcorder format.

Generally speaking, the latest videomakers from this trio of companies continue the trend toward lighter weight and downsized proportions. The newest models also continue to amaze by incorporating a TV studio of editing and special-effects features in a palm-size package. Additionally, the already-excellent sound quality of the 8mm format has been upgraded in these machines.

Meanwhile, two divergent trends are also emerging. Canon is raising point-and-shoot operation to new heights. And the 64X zoom of Hitachi's entry extends hyperfocal ratios to new lengths in what's starting to smell like a horsepower race.

In the realm of miniaturization, Canon's UC1 (\$1499) and Sony's TR-51 (\$1200) vie for the midget-king crown. These leprechauns weigh in just below 1¾ pounds, including battery, tape and remote control. Hitachi's "Twist and Shoot" VM-E25A (\$1300) carries only 2 ounces more.

Fact is, the issue of weight is be-

coming irrelevant in 8mm camcorders, as most current models tip the scales at about a feather's difference above or below 2 pounds. What's at stake is bragging rights for the smallest dimensions (as in Sony's claim: "approximately the size of a 35mm still camera"), but in real life the differences are nearly meaningless. It's interesting, nonetheless, to see how the manufacturers make their camcorders so trim while adding performance features. Canon's UC1 is a good case study.

Slim shooter

The most striking thing about the UC1 (and its upscale cousin, the Hi8 format UCS1) is its slim, vertical configuration. The camcorder measures only 3¼ in. wide, and is 5½ in. tall × 6½ in. long. This arrangement, with the lens/viewfinder assembly on top and the battery in the rear, might be less tiring on your shooting hand than other designs. The handgrip on the camcorder's right side (southpaws take note) detaches for use as a full-function wireless remote control.

According to Canon, three areas of redesign account for the downsizing and weight reduction of the UC1 and UCS1 (\$2099).

One element is the mechanical chassis that transports the videotape

through the camcorder. Primarily, what Canon has done here is shrink the diameter of the rotating-head cylinder that records and retrieves the pictures and sound on the tape.

Also shedding inches and ounces is the lens assembly of the 8X zoom. Focusing is accomplished internally (there are no external moving parts) by a 9-element lens, and because two of these lens elements are aspherical, the total number of parts is reduced with associated savings in dimensions and weight. The UCS1 has a 10X zoom, which ranges from 6 to 60mm using 11 elements, including one aspherical lens. It's at least 20% smaller than comparable 10X zooms.

Finally, both camcorders benefit from extreme consolidation of their electrical components. Circuits are densely packed on their circuit boards, with components stacked atop one another to form smaller circuit patterns. Previously, separate circuits have been combined and integrated on single chips. The size of the CCD (charge-coupled device) sensor alone (the pickup that converts optical information to electrical signals for recording) has been reduced 50%.

Besides the savings in size and weight, all of this consolidation contributes to lower power consumption. This means the supplied NiCd rechargeable battery can weigh only 5 ounces while delivering a maximum of 65 minutes recording time. While we're on the subject of batteries, it's worth noting that the UC1 and UCS1 can also be powered for up to an hour by six AA cells packed in an optional case. This might prove a godsend when you don't have a way to recharge the standard NiCd.



Canon's UC1 and UCS1 (top) vie with Sony's TR-51 for the tiny crown.

In terms of performance and features, Canon's UC models lack nothing. The through-the-lens autofocus stays locked even when the camcorder is panned, and can focus on subjects as close as a half-inch from the lens in the wide-angle setting. There are seven high-speed shutter settings, ranging from $1/100$ to $1/10,000$ second, so you'll get sharp images of active subjects as long as you're recording in sufficient light. The UCS1 uses these shutter speeds in conjunction with automatic-exposure control in a novel point-and-shoot dial. You simply select the scene—for example, sports, sand or snow, portrait, landscape—and the UCS1 picks the optimal setting. A manual option lets you do your own thing.

The UC1 records hi-fi monaural sound and the UCS1 adds stereo, but both boast a wind-detection circuit that automatically filters wind noise to give you quieter outdoor recordings. The UCS1 also has a function that enables the microphone to zoom with the lens, thereby maintaining a close correlation between the image of your subjects and the sounds they make.

Sony's newest and tiniest camcorder, the TR-51, has the familiar mini-football shape of previous TR- (for Travel) series Handycams, while not sacrificing any features.

This new Handycam achieves its size and weight reductions in a manner similar to Canon's entry. These include a downsized transport mechanism and an internal-focusing lens system that uses digital-signal processing to keep images sharp despite fewer lens elements in the 6X zoom.

One nice touch on the TR-51 is an instant-startup button that puts the camcorder into its Record mode without losing precious seconds of footage. Another nice touch is a built-in lens cover. Editing, titling and special-effects features also come built-in.

Twist to start

Hitachi this season brings a new twist to camcorder design—actually, two of them.

The company's VM-E25A borrows the "Twist and Shoot" construction first seen in Hitachi's VM-C1A (a compact-format VHS-C camcorder). In the Power-Off mode, the VM-E25A is flat—similar to the Canon UC machines, but horizontal instead of vertical. To turn on the camcorder, you twist (actually bend) the body so that the lens/viewfinder assembly deploy to the right to become a hand-grip. This is a comfortable shooting arrangement. When you're using the machine to play back your movies,

you can fold it back to the flat configuration. A credit-card-size remote control pops out of the camcorder for VCR-like operation.

The VM-E25A has a host of editing and special-effects functions, but what distinguishes this model from others is its 64X electronic zoom lens.

Actually, the optical focal range of the zoom lens is 8X, but to extend its reach, the camcorder takes one-eighth of the image area from the CCD pickup (what you'd see in the center of the viewfinder) and magnifies this up to eight times.

Now, magnification to this degree

is a bit of a stretch. What begins to happen is the image takes on a mosaic quality as focal length increases, something inherent in the gridlike pattern of the CCD chip. Conveniently, Hitachi displays the zoom ratio (for example, 25X) in the viewfinder, so you can judge for future reference what combination of zoom ratio and image quality is acceptable. The company concedes that superzooms are the result of a silly horsepower race among brands, and even suggests that extreme-zoom ratios be used only for special effects, as for lead-in or exit shots.

FM

NO EXPERIENCE NECESSARY

with...

ARROW[®] STAPLE GUNS

Just load & shoot!

ARROW Staple Gun Tackers turn the difficult into the simple. From the professional to the do-it-yourselfer ARROW makes the job easier, go faster and less expensive. Whether you're building the new, repairing the old or pursuing a hobby in arts and crafts, ARROW has the right tool.

ARROW fastening tools, staples, Xpando fasteners, glue sticks and rivets are available at all leading Hardware, Home Center and Discount Department Stores.



ETC-50 CORDLESS ELECTRIC STAPLE GUN



ARROW FASTENER CO., INC., 271 MAYHILL ST., SADDLE BROOK, N.J. 07662
IN CANADA: JARDEL D&T, INC., 6605 METROPOLITAN BLVD., EAST MONTREAL, H1P 1K9 QUEBEC



WORTH WRITING FOR

475 SMARTLEVEL

SmartLevel reads ALL angles—not just level and plumb—making jobs that involve stairs, roofs and drainage simpler. Digital display provides decimal-point precision and can be recalibrated to factory-perfect accuracy with the touch of a button. Color brochure describes this versatile, professional level. Free

476 RYDER MOVER'S ADVANTAGE GUIDE

Planning a do-it-yourself move. Ryder truck rental can help with their complete home moving guide and planning kit. The free Mover's Advantage Guide is filled with helpful moving tips that will make your move a success.

477 WHY STARTING YOUR ENGINE IS A TERRIBLE THING TO DO

Slick 50 Engine Formula, from Petrolon Inc., treats car and light truck engines with super-slippery PTFE to reduce wear in the engine. A one-quart, one-time application lubricates and protects your gas or diesel engine at start-up, when virtually all motor oil is in the pan and up to 80 percent of all engine wear occurs. It reduces engine wear by 50% for up to 50,000 miles in lab testing. Free brochure

478 SECURITY SYSTEM

Keepsafer, America's #1 Do-it-Yourself security system. Wireless, Reliable. Expandable. Only requires a screwdriver for easy installation. Keep your home and family safe with Schlage. Free information

479 TOWING & HITCH GUIDE

Choosing the right hitch for your tow vehicle is easy with the U-Haul Select-A-Hitch Guide. This pocket guide is filled with helpful information on how to select the correct hitch and towing package for your vehicle and towing needs. Free

480 A BETTER WAY TO BUILD A FLOOR

The Silent Floor system from Trus Joist is a beautiful alternative to bumpy, squeaky floors. Brochure explains how the Silent Floor system is engineered and guaranteed to stay flat, solid and silent for the life of your home. Free

481 LIFETIME FINISH

Liquid Glass Enterprises, Inc. proudly announces 3 new products—Liquid Glass Pre-Cleaner, Connoisseur's Choice Cleaner with Mink Oil, and Wash Concentrate—to complete its line of high tech appearance chemicals for automotive, marine, aircraft, and household uses. 8-page brochure, sample pack kit, and ordering information. \$1.00

482 HOME SECURITY/CCTV SYSTEM

Protect your home with the Panasonic Watchdog Mini CCTV System. It features a camera and monitor and can be expanded to include up to three cameras. Designed for easy of installation, there's no complicated wiring. Just one cable between the camera and monitor. And one easy to install camera mounting bracket. Free brochure

483 SECURITY PROTECTION

For you and your loved ones . . . effective low-cost ways to protect yourself and family. Personal protection anyone can afford. Great gift ideas that show you really care, from Berk International. Information \$1.00

484 HOMEBUILT HELICOPTER CATALOG

Take off from your backyard to open-sky adventure! Exciting, unique catalog from Helicraft, Inc. is filled with photos, specs, prices, and fascinating information on homebuilt helicopter and gyrocopter kits, parts, construction plans, videos, etc. The rotocraft shown are easy to build and affordable. Complete Catalog. \$10.00

485 HOBBYIST CATALOG

Edmund Scientific's 112 page catalog contains over 3,200 products for the hobbyist, gadgeteer, and educator—featuring telescopes, weather instruments, fiber optics, magnifiers, high-tech science toys, plus many items suitable for science-fair projects. Free

486 PROTECT YOUR SMILE

The Dr. Woog® PerioSystem is the 3-in-1 home professional periodontal system that stops bleeding, arrests gum disease, and eliminates 97% of plaque. Developed by the inventor of the Broxodont™, the first electric toothbrush. Free dental information

487 FINISHING TOUCHES

Tips on Wood Finishing 30-page brochure includes details on beautifying and protecting new wood, plus restoration techniques for old wood. Many wood projects are outlined step-by-step with over 50 photographs plus color charts from Minwax Co. Free

488 HOMEBUILT HOT RODS!

Send for a 64 page catalog on how you can build the HOT ROD you have dreamed of since you were a kid. Let Total Performance, the leader in build-it-yourself car kits, show you how easy and affordable it can be to build and drive a 1923 to 1932 Ford Hot Rod. Send today for a catalog filled with photos, specs, and prices. \$5.00

489 WOODWORKERS TOOL CATALOG

Send today for your Free 68 page Discount Woodworking Tools and Supplies Catalog. You'll find the best prices for over 3,000 brand-name products. Included are power tools and accessories, hand tools, screws, hardware, wood components, plans, books, and much more. Free

490 DISTINCTIVE GIFTS

Early Autumn Gallery's beautiful four-color catalog offers many distinctive products and personalized gift ideas for family and friends . . . or for someone special. \$2.00

Popular Mechanics 1/92
Box 1718, Sandusky, Ohio 44871-1718

Please see that I receive the items checked below

- | | | | |
|------------------------------|-------------------------------------|--------------------------------------|-------------------------------------|
| <input type="checkbox"/> 475 | <input type="checkbox"/> 479 | <input type="checkbox"/> 483 \$1.00 | <input type="checkbox"/> 487 |
| <input type="checkbox"/> 476 | <input type="checkbox"/> 480 | <input type="checkbox"/> 484 \$10.00 | <input type="checkbox"/> 488 \$5.00 |
| <input type="checkbox"/> 477 | <input type="checkbox"/> 481 \$1.00 | <input type="checkbox"/> 485 | <input type="checkbox"/> 489 |
| <input type="checkbox"/> 478 | <input type="checkbox"/> 482 | <input type="checkbox"/> 486 | <input type="checkbox"/> 490 \$2.00 |

Total money for priced items \$ _____

Service Charge \$ 1.00

Total money enclosed \$ _____

Total items requested _____

Name (Please Print) _____

Address _____

Town _____ State _____ Zip Code _____

(Please send cash, check or money order made out to POPULAR MECHANICS. No stamps, please)

Note: Popular Mechanics processes your requests for the above information and forwards these inquiries to the organization making the offer. Each company mails the material directly. Your order will be on its way to you within 90 days.

This Coupon Expires March 31, 1992

ELECTRONICS

PORTABLE DATA DISCS

BY FRANK VIZARD, Electronics Editor

● Where in the world is Baker Island? That's the question I asked myself as I pored over the maps contained in the *CIA World Factbook*. In general, I know my geography, but Baker Island was definitely an unfamiliar place.

Baker Island looks like a potato with a bite taken out of it. Deepening the mystery even more was a star on the map designated "Lighthouse." Is this indicating the name of a city, or is it only a building?

No, I didn't turn the page to find the answer. The book I was reading is actually a 3.15-in. compact disc housed in a protective caddy. My "book" actually looks like the 3.5-in. floppy disk familiar to computer users.

How do you read the disc? Simple enough. Just slide the disc into the new Data Discman from Sony. The disc actually fits into a slot underneath the keyboard. The machine itself is about the size of a thick paperback. To read the material, you just pop up the 3.5-in. black-and-white liquid-crystal display screen built into the machine.

Back to the Baker Island mystery. To find out just where Baker Island is, I push a function button that takes me to a search menu. I type in "Baker Island" and push the YES key. There's only one entry for Baker Island. I push the YES key again.

Baker Island, it turns out, is a small, treeless place about halfway between Hawaii and Australia. It's an uninhabited U.S. possession, I learn, abandoned after World War II. To-

day, it's a wildlife sanctuary visited once a year by the U.S. Coast Guard. And the lighthouse is a building, not a city.

There's a lot more information about Baker Island, as well there should be. Each disc made for the Data Discman, which lists for \$550, has a storage capacity of 200 megabytes. This is roughly the equivalent of 100,000 pages of text or 32,000 graphic images.

Consider just one disc, listing for \$40, called "The Library Of The Future." This one disc includes the works of Shakespeare, the complete Sherlock Holmes, the Bible, the Koran, *The Book Of Mormon*, *The Bhagavad-Gita*, *The Word Of Buddha*, *Teachings Of Confucius*, *Robinson Crusoe*, *War And Peace*, *Leaves Of Grass*, *Gulliver's Travels*, *Two Years Before The Mast*, *Tom Jones*, *The Iliad*, *The Odyssey*, some stories and poems by Edgar Allan Poe and copies of 18 famous and important historical documents.

At the same time the Data Discman debuted, 23 titles for the machine were made available from different publishers. It's a broad list that should appeal to many people.

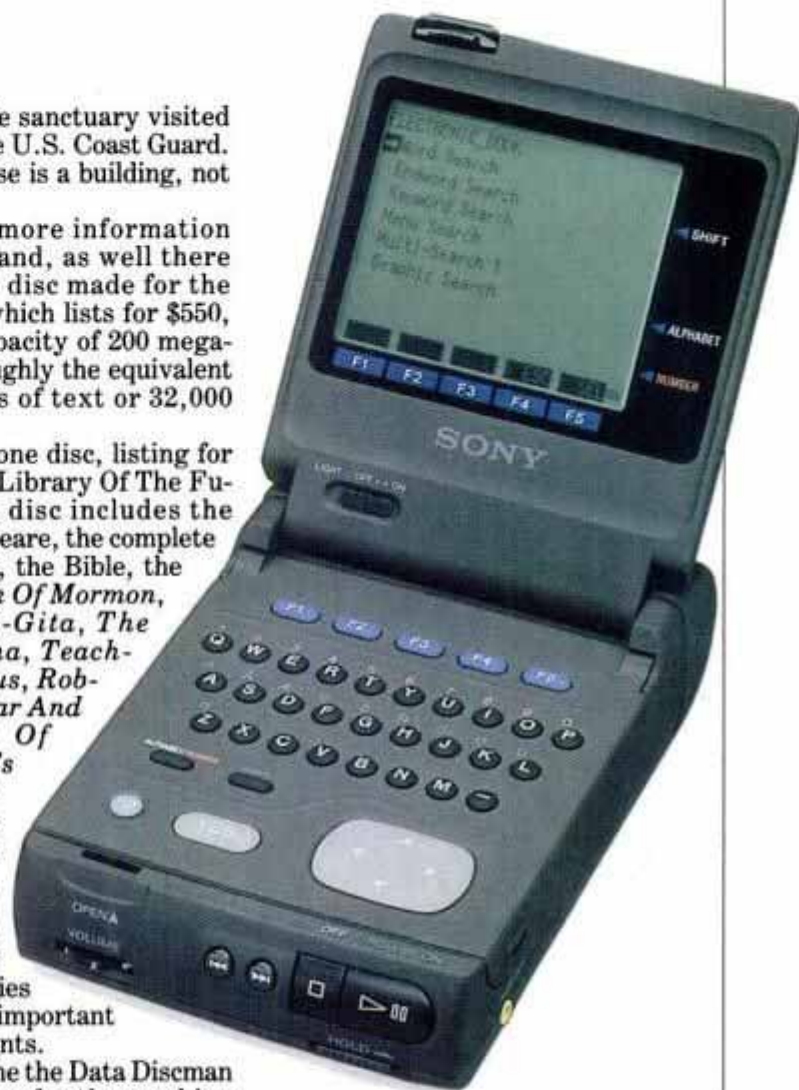
For example, there is a wine guide, a cookbook with more than 1800 recipes, a dictionary, a video guide by noted critic Roger Ebert, a translator, a handbook with corporate profiles, games and an airline travel guide. There's also a general encyclopedia, as well as one each for baseball and medicine.

Basically, the Sony Data Discman is an electronic book. Instead of paper

pages, it uses a portable version of CD-ROM technology developed for use with personal computers. To operate the Data Discman, however, you don't have to be computer literate. Many of the software titles used with personal computers via CD-ROM machines are available for Data Discman. Since the Data Discman uses essentially the same technology that's in computers, it's easy for publishers to reformat their information for the Sony machine.

Retrieving information is easier than using a book's index. As already demonstrated, you can type in a key word and a listing of related topics will appear. You can also just type in the first or last few letters of a word and still get a listing. The machine can also be programmed to ask four questions and your responses function as key words.

(Please turn to page 88)



There are already 23 titles available for Sony's electronic book.

A more general menu and graphics search can also be employed. Lastly, quick links can be made between related text and graphic material.

I carried the Sony Data Discman with me in a briefcase for a few days and was not bothered by its 1½-pound weight. Likewise, the three discs I had—the *CIA World Factbook*, *Compton's Encyclopedia* and *The Timetable Of Business, Politics And Media*—were a lot lighter than their book versions.

During this period, I had no problems as far as power is concerned. The Sony Data Discman comes with a re-

chargeable battery pack that clips onto the back of the machine and is good for about 3 hours. Also available is a AA alkaline power-pack that gives you about 7 hours of extended play time.

There is one flaw in what is otherwise a wonderful product. Once you've accessed all this information, it would be great if you could download portions of the data onto a personal computer. Right now, all the data stays in the machine unless you copy it by hand. A second version of the Data Discman should be available with this feature.

TV By Telephone

Televisions in the future may have a telephone jack built in if the Federal Communications Commission (FCC) has its way. The FCC intends to allow telephone companies into the television business, competing against cable TV companies.

Cable TV costs have risen steeply in recent years. The FCC believes that new competition may help lower prices and break the virtual monopoly cable television companies now enjoy.

Competition, however, won't come overnight. In order to offer a video dial-tone service, phone companies will likely move to first install fiber-optic transmission lines into homes. Fiberoptics could handle several hundred video channels, as opposed to 50 or 60 offered by cable companies using coaxial cable. New video-compression technologies may yet give coaxial cable new capabilities.

Video compression allows a micro-processor to squash a video signal so that it can be sent over phone lines. The image quality at present is not of the highest caliber, however.

The importance of high-capacity wiring cannot be underestimated. Regular conversation travels at a rate of 64,000 bits per second. Video of the quality you get from a videocassette recorder travels between 1.3 and 1.5 megabits per second.

High-definition video might require a transmission capacity as high as 90 megabits per second. One megabit equals 1 million bits.

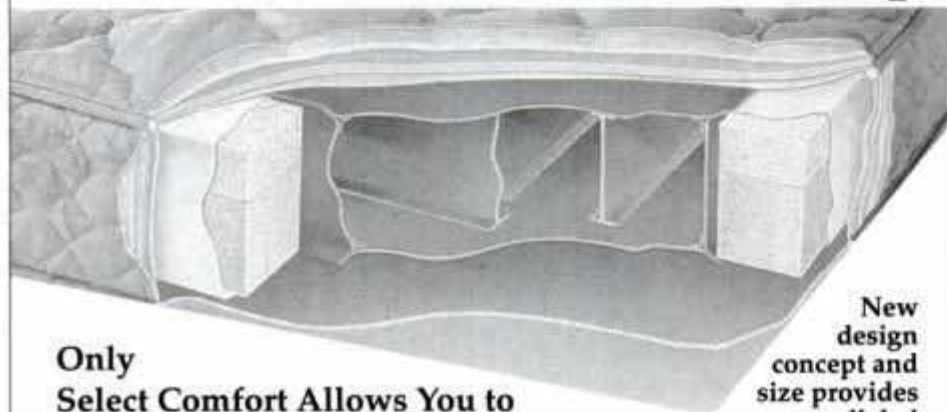
In any event, installing fiberoptic cable will take several years to complete. Some communities, though, are already wired with fiberoptic cable and are experiencing some of the benefits of this new technology at the present time.

Still, a video dial-tone service could revolutionize home entertainment. Imagine, for instance, being able to call a library and have information appear on your television screen. You might also be able to call a video store and ask them to dial you a movie. True full-motion videophones may also be a reality.

Meanwhile, the cable companies are likely to wage a legal battle against the entry of telephone companies into the television business. They are at the same time, however, reportedly researching ways for customers to make telephone calls using the cable TV system. A switcher would allow you to make calls between cable systems or over regular phone lines.

The Federal Communications Commission ruling should be finalized later this year.

Variable Firmness = Great Sleep



Only Select Comfort Allows You to Select Different Firmness and Comfort Levels for Each Side of the Bed.

New design concept and size provides unparalleled support and comfort

Adjust Firmness to Your Exact Needs

Select Comfort's unique air support system lets you control the feel and firmness of your bed—simply by pushing a button. Your mattress can be firmer than the firmest innerspring or softer than the softest featherbed... helping you sleep more comfortably, reducing back pain and muscle aches, and providing true support. Change firmness as often as you like to meet your exact preference.

Dual Chambers Let You Both Sleep Great.

Both you and your sleeping partner can now enjoy relaxing, invigorating sleep because Select Comfort's dual chambers adjust independently. Choose your preferred comfort without affecting your partner's side of the bed. You'll both enjoy total body support and true cradling comfort.

The Back Support You Need — The Comfort You Want.

Your Select Comfort conforms to your body's natural shape so your back muscles don't strain to hold your spine straight. Because air support is the closest thing to floating, you'll wake up rested and ready for the day.

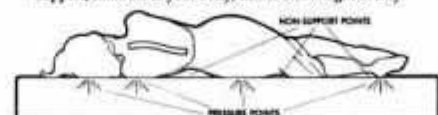
"Thrilled with the comfort"

"We are thrilled with the comfort of this bed. It's wonderful to have one side firm and one soft. Not only is it a great product but it's nice to know you stand behind it the way you do. I'm certainly recommending it to all my friends."

Cindi & Bob Denton
West Bloomfield, MI



Select Comfort's unique air-cushion design provides proper back support, contours to your body, distributes weight evenly.



Innersprings polarize body contours, creating pressure points and uneven support.



Waterbeds rely on displacement and can cause a "hammock effect," bending your spine unnaturally.

Call or Write for a FREE BROCHURE AND VIDEO 1-800-831-1211

YES! Please send me a FREE Information Packet and Videotape.
 VHS BETA

Name _____
 Address _____
 City _____ State _____ Zip _____
 Evening Phone (____) _____

Select Comfort
SLEEP SYSTEMS

11010 89th Ave. N., Maple Grove, MN 55369
1-800-831-1211

© Select Comfort 1991

Dept 236

PHOTOGRAPHY

SMART CAMERAS

BY GEORGE SCHAUB



PHOTO BY GEORGE SCHAUB

● Aiborg, Elan, Stylus, 7Xi and PZ-10. They sound like the reservation list at the bar in "Star Wars", but these are in fact the names of some of the latest 35mm offerings from four major camera manufacturers. The Konica Aiborg and Olympus Stylus are lens/shutter cameras, while the Canon Elan, Minolta 7Xi and Pentax PZ-10 are SLRs. But these simple classifications give little indication of the amazing technology contained in these cameras. Mini coreless motors, joystick focus control, omnidirectional predictive autofocus, and an array of built-in chips and microcomputers are just some of the highlights of this latest crop of 35s. Indeed, as each new camera comes out, manufacturers play technological leapfrog with one another, with each model outdoing the last with some new program, chip or automatic control.

Given that each camera offers the usual array of automatic features—auto advance and rewind, autoexposure, autofocus and autoflash—let's take a look at some of the latest wrinkles of the camera-maker's craft, and see how the computer and the camera are slowly becoming one. We'll start with the SLRs.

Software reigns

You get an indication of the trend in SLRs when you learn about the design teams engaged in their development. For the Minolta 7Xi, half of the 200 engineers involved in the research project for the camera were software engineers. The "Xi" part of the logo means expert intelligence, which refers to the built-in Fuzzy Logic system that Minolta claims matches the picture-taking expertise of a professional photographer. Actually, it's all thanks to the larger and faster 16-bit computerized circuitry and the honeycomb metering pattern.

What's Fuzzy Logic? It's an artificial-intelligence system that gives more than just a "yes/no" answer to a proposition—in a sense, it searches through a number of alternatives and comes up with shades of meaning, and appropriate solutions. Though the term is unfortunate for imaging—be it still or video camera—it has stuck.

The expert-intelli-

Tough pictures are easy with the bar-code programmer that comes with Canon's Elan.

gence system in the Minolta 7Xi comes into play in all facets of operation. In past focusing systems, you chose either single or continuous AF—one for stationary subjects and one for those in motion. The 7Xi removes this step. It selects single AF when it detects a subject at rest, and automatically switches to continuous AF when it senses a subject in motion. In addition, the one real bugaboo of AF systems—keeping track of a subject with erratic motion—is also solved. A system dubbed "omnidirectional predictive AF" tracks both rapidly accelerating subjects as well as those moving across the viewfinder frame. Earlier AF models tested poorly for subjects such as sports, but the 7Xi may become the sports photographers' AF camera of choice.

The same expert-intelligence system is applied to exposure control. For example, if the system senses that the subject is a closeup portrait, it selects a faster shutter speed and smaller aperture. This makes the background go out of focus and helps emphasize the subject. The faster shutter speed is intended to capture changes of expression. If the camera senses quick subject motion, it automatically sets a faster shutter speed. And if it detects a long-distance shot, such as a landscape, it opts for a greater depth of field via a narrow aperture

(Please turn to page 90)



Pentax's PZ-10 is a smart zoomer that remembers a subject's measurements.

selection. Of course, if you feel you're more expert than the camera, you can follow your instincts and override the automation with ease.

Both exposure and focusing response is owed to the unique honeycomb metering pattern. Small changes in the measured brightness, from subject motion and subsequent shifts of contrast between segments of the pattern, cause the computerized brain of the camera to react. So when subject movement becomes obvious to the system, it builds a new pattern of honeycomb cells that deal with subject motion, distance and brightness.

Silent running

While the 7Xi's features could take up this whole column, let's move on to the Canon Elan and see how it has overcome some mechanical hurdles, as well as how it has allied itself with the SLR programming movement. One of the stated intentions of Canon engineers was to create an SLR that was "whisper-quiet" in operation. Place the Elan next to any other Canon SLR, run it through the advance and rewind cycle, and you'll hear the difference. The sound of silence is due to a series of innova-

tions—two coreless micromotors, a sprocketless film-transport mechanism, urethane/rubber belt drives, and rubber and acrylic supports placed in strategic areas within the camera body.

Though all the cameras here have built-in flash, Canon claims that the Elan is the first SLR with a flash that zooms along with the focal length of the lens in use, at least in the 28-to-80mm range. In a happy coincidence, the standard lens for this camera is an EF 28-to-80mm USM model. We've seen the zoom-flash feature in lens/shutter cameras before, but all had considerably lower-powered flash units built in.

The Elan continues the bar-code capability found in the earlier Canon EOS 10-S SLR. This system, which is Canon's answer to Minolta's add-a-chip custom program control, lets you



Konica's AIBORG makes shifting subjects simpler.

select a picture situation from a Canon-supplied booklet, scan the accompanying bar code with a reader and then input the program into the camera. Want to shoot a time exposure at night with second-curtain sync flash as a kicker? Scan it in and press the button.

The wrinkle with the Elan is that you can scan up to five picture situations in at one time and hold them in memory for use later, a decided improvement over the 10-S single-scan capability. In addition, there's a new, expanded bar-code catalog—EOS Bar Codes 101—that has over 100 new sample photos and bar codes. Though some resist the scan-then-shoot scenario, there's no denying that the setup is a great teaching tool.

Remember the automatic switching from single to continuous AF in the Minolta 7Xi? The Elan does the same thing when you're operating in its Green Zone autoexposure mode. This mode also calculates the risk of camera shake, and automatically shifts to a higher shutter speed when necessary. How does it do this? It uses the 1/focal length formula (for example, with a 200mm lens, shakeless handheld shutter speed would be about 1/250 second)—and compares the focal length of the lens in use to the selected shutter speed, then corrects shutter speed upward if necessary. It does this with fixed focal length lenses as well as with a zoom lens, set at any focal length in its range.

Zoom king

Another high-IQ camera is the Pentax PZ-10 which, along with the usual goodies, has added an Intelligent Power Zoom control. The smarts start with a motorized zoom, a feature found previously only in pricey lens/shutter cameras. This power comes in three speeds, including one mode that offers a 0.8-second sweep of an entire

STOP JAMMING ME

IF YOU RENT MOVIES THEY'RE JAMMING YOU TOO!




Rented video tapes usually contain a jamming mechanism called Macrovision. This mechanism is designed to prevent you from copying tapes. However, it also often results in a blurry or streaked picture when viewing a tape.

ClearImage defeats the jamming, leaving you a crystal clear picture. ClearImage is digital, state-of-the-art 100% guaranteed and effective. Comes with a 3 year warranty. For Super-VHS users try our Video Stealth

ClearImage \$59.95 + \$5 S/H



Video Stealth \$99.00 + \$5 S/H

CABLE TV BOXES

General Instruments Oak
Zenith Eagle Jerrold
Stargate Tocom
Scientific Atlanta Starcom

FREE CATALOG

1 year warranty.
30 day money back guarantee.
Low Prices.
7th year in business.
Thank You.



M.D. ELECTRONICS
875 So. 72nd St. Ste. M
Omaha, NE 68114

ORDER TOLL FREE
1-800-624-1150
(402) 554-0417

28-to-80mm range.

Another feature taken from the high-end lens/shutter realm is Image Size Tracking, a programmable option that matches the subject's size and proportion at all focal lengths, regardless of the distance from the camera or subject motion. This allows you to track a moving subject and keep it the same size within the frame. Of course, this capability is limited by the length of the lens and the distance from the camera to the subject.

Another intelligent aspect of the camera/lens interaction is what Pentax calls Zoom Clip. Once set, this mode instantly returns the lens to a predetermined focal length with a single button control. And, as with the Elan and 7Xi, the camera automatically switches from single to continuous AF tracking when it detects subject motion. A wider AF coverage area also ensures that moving subjects are properly tracked. You can also switch to manual control of the PZ-10 if you so desire.

AIBORG enters

Though lens/shutter cameras seem to have solved all of photography's little problems, especially those of less-demanding snapshotters or those who shoot only colorprint film, people still get out-of-focus pictures because they shoot pictures with the main subject sitting outside the focusing detection circle in the center of the viewfinder frame. True, most lens/shutter autofocus cameras have focus lock—center the subject, press halfway down to lock focus, then recompose as you will—but this was either too difficult in a fast-paced shooting situation, or just another feature that was bypassed by failure to read the instruction booklet supplied with supposed "do-everything" cameras.

Konica's AIBORG (AI for artificial intelligence, BORG for a science-fiction twist that smacks of cyborg—a being that's half robot/half man) makes a game of this problem by supplying a roller-ball-type joystick that allows you to swivel onto the main subject at either side of the frame and lock focus before you shoot. Dubbed a "moving-frame autofocus system", the swivel-ball is located on the back of the camera body in the upper-right corner, about where your thumb falls when holding the interestingly shaped camera. Moving the ball side to side shifts focus priority, and moving it up and down zooms the 35mm-to-105mm built-in lens.

The command readout area, which sits in a wide LCD panel atop the camera body and behind the 3D hologram of Horus, the Egyptian Sun god, dis-

plays a wide array of creative options. Select the Night Scene mode and the camera automatically selects a shutter speed (with or without flash) for available-light photography. Choose White Scene and the camera compensates exposure for subjects with a bright, white background, such as snow. Pick what Konica calls the Montage mode and you can get up to 10 exposures on the same frame of film.

With all these magical picture-taking instruments, one camera company, Olympus, has gone in a somewhat opposite direction by creating a small, handsome AF lens/shutter camera

that's a model of elegant simplicity. Called the Stylus, the palm-size camera has a few flash exposure modes, such as red-eye-reducing flash, but doesn't overwhelm you with options.

The so-called clamshell design fits easily in your pocket, yet delivers very sharp pictures with a fast 35mm f/3.5 lens. Slide back the lens-protecting front cover and all systems are go, touch the oversize shutter release button and that's all there is to taking a picture. High-tech? Yes, when you consider what makes the camera work. But it's all tucked away in a sophisticated, lightweight package. **PM**

Get Relief From Back & Neck Pain

The Back Machine™ Massages and Stretches Your Pain Away — Right in Your Own Home!

A Conservative Therapy, Comprehensively Applied

The Back Machine combines the most effective ways to attain relief from back and neck pain into one easy to use, safe unit designed to help you return to a more normal, pain free life. And it feels good, even if you hurt.

How *The Back Machine* Works:

- *Massage* — Soft rollers massage muscles, increasing circulation, reducing muscle spasm, tension and stress.
- *Stretching* — Muscles are passively stretched, increasing flexibility and reducing pain.
- *Traction* — Mild traction restores spine length and pliability, relieving disc pressure.
- *Mobilization* — Restoration of movement occurs and promotes alignment of the spine.

Five Years of Clinical Use

Tested for over five years by doctors, physical therapists, and chiropractors, *The Back Machine* has been proven safe, effective, and comfortable.

60-Day Home Trial

We're so confident you'll experience relief from back and neck pain that we offer *The Back Machine* with an unconditional 60-day money back guarantee.

Call or Write Today For FREE BROCHURE AND VIDEO

1-800-433-5599



YES! I want to relieve my back pain.

Please send me a FREE brochure and Video.

Name VHS BETA _____

Address _____

City _____

State _____ Zip _____

Evening Phone (_) _____

Back Technologies

2525 West Casino Road

Everett, WA. 98204

1-800-433-5599

© 1991 Back Technologies Inc.

Dept 148

AUTOMOBILES

DETROIT SPY REPORT

BY JIM DUNNE, Detroit Editor



Due for 1994 model year, Ford Tempo/Mercury Topaz line gets total redesign.

versions of the new 300-horsepower Corvette LT-1 V8 engine and 6-speed manual transmission.

Saturn Sales

While the Saturn's sales performance is slightly behind the original plan—just over 50,000 cars were delivered for the '92 model year—most Saturn executives are exuberant over the car's market performance so far.

A deliberate production startup at the Spring Hill, Tennessee, plant was the only limiting sales factor, according to Saturn insiders. But in the final month of the 1991 model year, Saturn deliveries topped 8000.

That single-month total was better than comparable sales periods for such established nameplates as Ford Mustang, Pontiac Grand Prix, Olds 98, Camaro/Firebird combined and the entire Chrysler line.

Engine Swaps

GM is instituting a new super warranty program that ought to substantially bolster the General's service image. If an internal engine part fails on a 1992 GM car, the company will replace the entire engine.

At startup, the new program is limited to GM's newer engines—the 3800 V6, the Quad OHC, the 3.4-liter V6, the 5.7-liter LT-1 V8 and the 6.5-liter turbodiesel V8. **PM**

Tempo Tuneup

● Look for a completely redesigned Ford Tempo/Mercury Topaz lineup for 1994. The heavily disguised test mule shown here, snapped at Ford's proving grounds in Romeo, Michigan, is believed to be a final styling prototype for the new family of Ford compact cars.

Aside from wholesale styling updates, the next generation of Tempo/Topaz may be limited to 4-door sedan body styles—no 2-doors.

Ford plans to continue offering both Four and V6 engine options.

Gang Welding

Nissan has come up with a new way of welding body panels at its Tennessee factory that does away with the unwieldy jigs and fixtures ordinarily used in this process.

Instead of clamping the body panels into traditional fixtures, the Nissan process uses a gang of robots to perform the same function. When the panels arrive at the welding station, they're grappled into their proper positions by as many as 35 robots. Once exact tolerances have been checked and double-checked by computer, a gang of welding robots—as many as 16—descends on the job and welds the panels into place.

Besides eliminating jigs and fixtures, the system is more flexible than the conventional assembly line approach. Nissan says the robot gangs can clamp and weld body panels

for as many as eight different vehicles.

The Nissan engineers say the new process is also more precise than the old method.

1993 Firebird

Look for Pontiac to unveil the 1993 version of its sporty Firebird at the 1992 Detroit Auto Show (January 9 through 19).

Although the car won't be ready to go into production until late spring at the earliest, Pontiac wants to whet appetites for the new shape—the Firebird's first overall redesign since 1982.

There will be a number of other changes to go with the new shape. Vertical body panels will be shaped from plastic, à la Saturn. While the platform will continue to be front-engine, rear-drive, live axle, extensive revisions are expected for the suspension system.

Look for surprises under the hood, too. Both the Firebird and Chevy Camaro will offer slightly detuned



Next-generation Firebird will offer new shape, more go-power.

Quality is Job 1.SM

"When I see one of our freshly painted cars, I feel it's a piece of art."

Larry Dickinson, Paint Supervisor,
Ford Employee for 23 years.

Profile in Quality #27: Pride

The finish that Larry Dickinson's team puts on our cars is a true reflection of the quality we build into our cars.

Larry is one of over 366,000 Ford people worldwide who are committed to making quality Job 1.

Our goal is to build the highest quality cars and trucks in the world.



Ford Motor Company

FORD, MERCURY, LINCOLN, FORD TRUCKS

Buckle up—Together we can save lives.

Always insist on genuine Ford Motor Company collision repair parts.

Материал, защищенный авторским правом

OUTDOORS

SKI-DOO: 50 YEARS ON SNOW

BY JOE SKORUPA, Boating/Outdoor Editor

● If it wasn't for a typo in 1958, we'd be Ski-Dogging instead of Ski-Dooing. That's right. The machine that sparked the boom in motorized winter recreation was originally called the Ski-Dog by the inventor, Joseph-Armand Bombardier. The man was obviously more gifted at engineering than marketing. Fortunately for Bombardier (pronounced bom-bar-dee-ay), an early brochure was misspelled and a winter legend was born.

To many people, all snowmobiles are Ski-Doos—not just models made by the company founded by Bombardier in 1942, but all snowmobiles, no matter who makes them. While this isn't accurate, it's understandable. Before Ski-Doo swept the winter-scape and became a household name, only limited-production snow vehicles were available. None featured the advanced technology of Bombardier's mass-produced sled. When Ski-Doo hit the market, the modern sport of snowmobiling was born.

I've been writing in this magazine for too long not to know that the above paragraph will inspire a number of readers to write me letters. That's fine. Go ahead and tell me about snowgoers from the 1920s. But remember that Henry Ford wasn't the only one building cars at the turn of the century and that Columbus wasn't the first to sail to the Americas.

In any event, Bombardier himself was building snow vehicles long before he launched Ski-Doo. His first successful experiment took shape exactly 70 years ago.

The snow man

For some reason, the story of Bombardier's lifelong quest to perfect motorized snow travel reminds me of a



script for an old Hollywood movie. You know, the one that begins on the farm with a precocious boy causing innocent trouble. Then it jumps to his early manhood and the beginning of a budding career. Then, adversity strikes. He enters a dark period, but overcomes it by eventually producing a spectacular triumph. Undreamed-of success and a rewarding life follows. Fade to black.

Bombardier was born in the tiny rural town of Valcourt, Quebec, about 65 miles southeast of Montreal. As a precocious boy of 15, in 1922, he built his first snow vehicle. He started with

a ski-mounted chassis, the kind usually found on a horse-drawn sled, and added a nifty rear-mounted Ford Model-T engine, which was equipped with a wooden propeller. Amazingly, it really worked.

However, Bombardier's father was

less than thrilled with the contraption. He looked at its exposed propeller and pronounced it dangerous. Upon instructions from his father, the young inventor dismantled the vehicle, but a seed was planted.

Four years later, still quite young, Bombardier entered what he thought would be his life's work. Already acknowledged as an accomplished auto mechanic, he opened his own repair shop in 1926. He married and started a family.

Although Bombardier knew that one day he would continue his work on a snow vehicle, a personal tragedy reinforced his determination. In the winter of 1934, his 2-year-old son Yvon was stricken with appendicitis. The nearest hospital was 30 miles away and the roads were snowed in. Before travel could be arranged or help arrived, Yvon died.

Driven by the tragedy, Bombardier decided to modify his design for a small, lightweight sport snowmobile. Instead, he threw himself into creating a multipassenger, multiple-use vehicle. He began adapting old Ford



An early Ski-Doo prototype. It's come a long way.

and Dodge automobiles for snow travel by replacing the front wheels with runners and fitting the rear wheels with steel tracks for traction.

In 1935, Bombardier built a prototype snow vehicle with a sprocket and track assembly and a floating suspension. This significant advance earned him the first of his many patents.

Commercial buyers, such as logging companies, winter resort owners and rural hospitals, began ordering Bombardier's tank-like snow vehicles in such great numbers that he eventually closed his auto repair shop and began making snowmobiles full time. He ultimately founded the company that bears his name in 1942.

Birth of the Ski-Dog

Bombardier, Inc., grew at a rapid rate during the 1940s and 1950s through continual advancement of snow vehicle design and diversification into non-snowmobile business. This was a busy and exciting time for Bombardier, but the inventor continued to work on his dream machine—a small sporty personal snowmobile.

By the late 1950s, Bombardier achieved the basic design he was looking for. However, he held back production for an extensive period of testing. As mentioned earlier, other snowmobiles were being built at this time, but none were setting the world on fire, especially in the areas of smooth performance and reliability. Bombardier wanted his Ski-Dog to be different. It was.

The crucial breakthrough came in 1957 when Bombardier developed a one-piece molded-rubber track with enough durability to provide snow-gripping traction for lightweight vehicles. In 1958, Bombardier incorporated this track into a new snowmobile with a lightweight chassis, frame, cab, seat and suspension. In that first season, 225 Ski-Doos rolled off the assembly line.

In 1964, a few short years after realizing his lifelong dream, Armand Bombardier died of cancer.

But the sport he pioneered continued to flourish. For two decades, the 1960s and 1970s, snowmobiling was a major boom industry. Today, it's a stable and mature industry that annually turns out 150,000 sleds and

attracts more than 10-million riders.

Snow tech

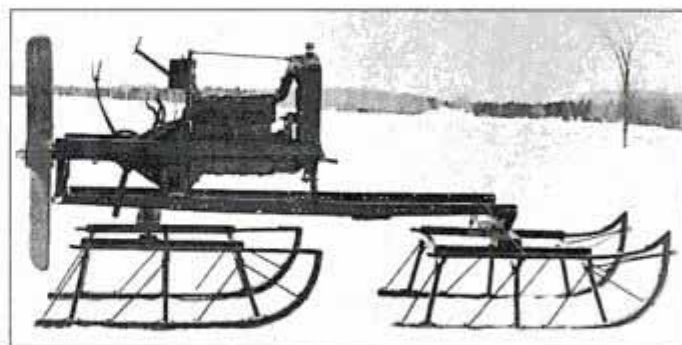
The company Armand Bombardier founded has come a long way in 50 years. Building recreational products, such as Ski-Doos and Sea-Doos, is just a small part of the current multibillion-dollar operation. In addition to making commercial snow vehicles, Bombardier, Inc., is a leader in the transportation and aerospace industries. High-tech aircraft and passenger trains now account for the bulk of the business.

Similarly, in the years following the introduction of the original Ski-Doo, many technological advancements have transformed the snowmobile. Improvements in engine performance, suspension systems and seating comfort were the first to arrive. Then came refinements in durability and dependability. Finally, today's high-tech sleds feature carbide runners, 4-cylinder 700-cc engines, electronic fuel injection, liquid-cooled crankcases, triple carbs, twin-tuned exhaust and wind-tunnel-tested aerodynamics. These rockets can run quietly and efficiently at speeds well beyond 100 mph.

The current top-of-the-line model by Ski-Doo is the 1992 Formula Mach I, which surely eclipses the wildest dreams of Armand Bombardier. This mini-missile is equipped with a 617-cc, liquid-cooled, rotary-valve Rotax engine which packs enough wallop to keep any snow cowboy happy.

In addition to the Formula Mach I, the Ski-Doo line features touring sleds, work sleds, lightweight speedsters and fun econo machines.

Prices and the character of the industry have changed quite a bit, too. By the end of the 1960s, there were more than 100 companies selling snowmobiles, and prices for sleds were in the hundreds of dollars. Today, there are only four companies manufacturing snowmobiles and prices start at \$2000 (with one exception for a child's sled) and go as high as



Bombardier's experimental 1922 prop-driven snow vehicle.

\$8500 for the latest dream machine.

I didn't grow up riding snowmobiles, but I've put quite a few miles in the saddle in the past couple of years. To me, and apparently a growing segment of the population, renting a snowmobile while on a wintertime vacation is about as good as it gets. I've hit the trails in Wyoming, Montana and Colorado and the snow-covered scenery is always spectacular.

But not everyone is as thrilled with my penchant for snowmobiling. To some, a snowmobile is an overpowered, high-speed machine that tears through pristine wilderness and shatters the pleasant solitude of the winter calm.

To these people, I point out that good snowmobile riders follow the principles of Tread Lightly, a non-profit educational group that's developed low-impact methods for enjoying the back-country. In addition to snowmobiles, Tread Lightly has guidelines for off-road vehicles, dirt bikes, ATVs and mountain bikes.

Back-country ethics and methods for low-impact usage are increasingly important today, because there's an ever-growing demand to use a limited amount of land resources. We have to do all we can to make sure these resources aren't damaged and closed off for future usage. Tread Lightly is working to this end. If you want to get more information about Tread Lightly or join as a member, write to Tread Lightly, P.O. Box 149, Ogden, UT 84402. Or call (800) 966-9900.

While the name of the most ubiquitous snowmobile was the result of a printer's error, perhaps it really wasn't a mistake. After all, there is a relationship between dog and doo. Perhaps future historians will dig up the truth. **PM**

AVIATION

LOST SQUADRON FOUND

BY MICHAEL LAMM, Contributing Editor, and GREGORY T. POPE

● July 15, 1942: Two B-17s, six P-38s and 25 unhappy crewmen are stranded on the ice cap of southeast Greenland. The squadron was flying from Canada to Iceland when foul weather and conflicting radio reports turned the planes back. But high winds blew them off course. They ran out of fuel and bellied onto the ice. The men have put out an SOS, but will wait for nine days, bivouacking in the B-17s, before a dog-sled team rescues them. Abandoned, the eight planes will fade from memory.

July 15, 1992: If all goes well, the aircraft of the Lost Squadron will finally emerge from oblivion. This summer, a group of American enthusiasts plans to begin hauling the planes out of their frigid tombs—they lie below more than 250 ft. of ice and snow from 50 Arctic winters. The unprecedented salvage operation will climax a grueling search-and-recover mission that has spanned more than a decade, drawing worldwide interest throughout its ups and downs (see "The Lost Squadron," page 78, May '84).

Back in 1981, tales told by a Lost Squadron pilot riveted two Atlanta men, aviation entrepreneur E. Patrick Epps and architect Richard L. Taylor. They formed the Greenland Expedition Society. Its mission: to find the planes and return them to the U. S.

The group hunted fruitlessly in three expeditions over six years. Finally, they hit pay dirt in 1988 with the aid of the icescope, a side-scanning subsurface radar developed by an Icelandic geophysicist. One by one, the Lost Squadron aircraft were found. Nudged by glacial creep, all eight planes had shifted—in formation—nearly a mile from their original site.

The elated expeditioners let their expectations soar. The planes would be perfectly preserved. In a

triumphant ceremony, Epps and Taylor would fly them off the ice cap.

Full-steam ahead

But icy reality stood between the team and its dream—they still had to blaze trails to the buried treasures. To that end, the team turned to steam. First, one of the salvors converted a car-engine cleaner into a high-pressure steam probe that squirted neatly through the ice. At 260 ft. down, the probe thumped into metal.

Yet not until the following year did the salvors themselves touch the planes. In the summer of '89, the fifth expedition steamed a 4-in.-dia. hole to the B-17 dubbed "Big Stoop." They lined the shaft with plastic pipe and fed a hand-cranked coring drill into the hole. When the bit chewed into metal, they brought it to the surface and pulled a slice of aluminum engine tubing from its teeth.

In addition, 1989 was the first year of the Gopher, a remarkable apparatus that would prove the workhorse of the operation. Resembling a top the size of a trash can, the Gopher muscled through the ice as quickly as 2 ft. per hour. A boiler at the surface circulated hot water through copper tubes that swaddled the burrowing device. The original Gopher melted a 3-ft. shaft 70 ft. down before running askew and getting stuck.

Meltdown

In 1990, the team returned to the ice cap with a new-and-improved model: the Super Gopher. Thirty people and tons of equipment arrived at the site via ski-footed C-130 cargo planes, provided by the New York Air National Guard.

That year the team glowed with ambition. Using the Super Gopher, the team planned to melt a 4-ft. hole down to Big Stoop. Meanwhile, a complex coring machine would open a much bigger shaft to one of the P-38s. This device, modified from a grain-silo auger unloader, swept a scraping



Big Stoop, one of two B-17s, was the first of the Lost Squadron to be reached.

arm in a 16-ft. circle, carving rather than melting a hole and pushing the shredded ice to the center of the shaft. There, a blower spat the ice into a huge nylon bag that was then power-winchd to the surface.

The two devices made steady progress, and the Gopher landed on Big Stoop on June 6. But then the Arctic summer tossed a wet blanket on the operation.

Seventy ft. below the ice cap's surface lies the firn line, where snow compacts into ice. But during summer's thaw, the firn line doubles as a glacial water table. When the Gopher and the silo auger penetrated this line, the shafts filled with water from melted snow and ice.

Pumps pulled the water from the

During 1992 expedition, hot-water hose will erode cave around P-38. Super Gopher, at left, will enlarge hole so that workers can hoist plane parts to the surface.





Super Gopher hangs inside partially completed work tent.



Long Arctic summer days let salvors work nearly around the clock.

Gopher hole, but couldn't handle the flood in the wider shaft opened by the auger, which sputtered to a halt 120 ft. down. Fortunately, a blast of cold weather slowed the melt, and soon Taylor could strap on a harness and rappel down the Gopher hole.

The cold truth

Taylor recalls the bittersweet discovery: "The shaft had landed on the No. 2 engine next to the cockpit. I looked at the engine and it was perfect. The cowl flaps were open and it looked great. I came back up with the great news that the planes were perfect. The crew stayed up there and with a big hose eroded out a cave about 7 or 8 ft. high and 12 ft. wide. There we discovered significant damage to the fuselage."

Taylor's dream, of flying the planes off the ice cap, melted away. The team had assumed that once the planes had sunk past the firn line, they would have filled alternately with water and ice, before becoming permanently embalmed in ice. The ice inside the fuselage would

harden the planes against the pressures inflicted by glacial creep. But the B-17 hadn't completely iced in. Where air pockets had lingered in the fuselage,

the ice had crushed the metal.

"The plane has suffered under the glacier," says Taylor. "It can't be flown—there's too much body and panel distortion. The cockpit roof has been pushed down about 3 ft."

Taylor and his teammates believe the rest of the squadron will show similar damage. Dented but not daunted, they have revised their plans. Starting this May, they expect to bring up each plane in pieces. Once everything's on the surface, they'll assemble the parts into as many good aircraft as possible. To date, team members have stripped Big Stoop of its ball turret and machine guns, some of the seats, the throttle quadrant, instruments, compasses, 200 rounds of .50-caliber ammo, aviator boots and oxygen masks.

"When I came home and told my wife the planes were crushed and we couldn't fly them off the ice cap," Taylor recalls, "her eyes lit up, and she said 'Does that mean it's over?' No such luck, I told her. We're going to keep on until we've gone as far as any-

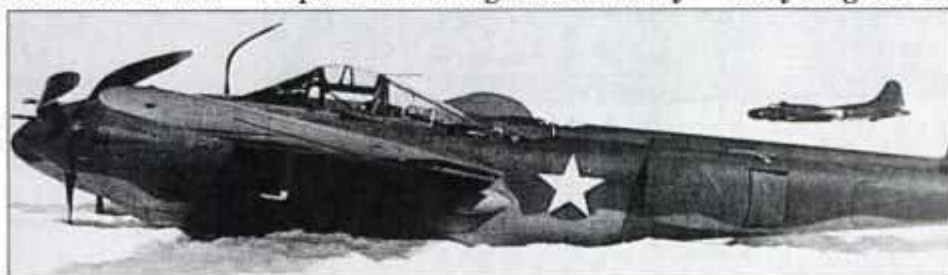
one can go. Maybe further."

This summer, the team plans to deploy four second-generation Super Gophers, operating in pairs, to sink holes next to all eight aircraft. With the holes offset slightly from the planes, sump pumps can drain the meltwater without interfering with the disassembly of the aircraft. At the bottom of each shaft, workers will swing hot-water hoses to hollow out caverns and de-ice the planes. Meanwhile, the Gophers will drill neighboring holes, and hot water will dissolve ice walls between the holes, creating shafts wide enough to accommodate fuselage components.

In addition, Georgia Tech researchers may bring a plasma-arc torch (see [Tech Update, page 18](#)) to the site. If used, the device could blow a 20-ft.-wide hole to the aircraft in a day.

Nashville-based Textron Aerostructures has vowed to reconstruct the aircraft from whatever components the salvors can bring up. Investors in the Greenland Expedition Society have already bought several of the planes, re-

gardless of their condition. The others will go on the block. And if Textron can nurse the planes back to life after 50 years in frozen limbo, the Lost Squadron will fly again. **PM**



Photographed by Lost Squadron crewman in 1942, P-38 "Charlie" lies stranded on the ice cap.

rotating plastic discs quaintly referred to as a flight computer, I'd figure out wind correction angles, fuel use, ground speed and required runway lengths.

Flipping through a book called the *Airport/Facility Directory* gave me radio frequencies, runway lengths, traffic patterns and everything else I needed to know about my destinations. The first time I opened this pale-green paperback, I was amazed at the number of airports there were to choose from. At last count, there were more than 5600 in the United States, of which only about 400 are accessible by commercial airlines. The rest are almost exclusively the domain of the private pilot.

In the air, the problems of navigation join a welter of other, often simultaneous demands. In addition to staying on course, keeping an eye out for other traffic and conversing with air traffic controllers, you have to note the time between checkpoints in your navigation log. Based on this information, you calculate how fast you've been going, and figure out when you'll arrive at the next checkpoint.

None of these tasks is difficult by itself. But taken together, they result in a feeling something like what you'd have if you drove down an unmarked road, while looking at a map, balanc-

ing your checkbook and talking to somebody. And you can't just pull over if it all gets to be too much for you. Generally, what happens is that you get lost. Fortunately, finding yourself again usually involves nothing more painful than a confession to an air traffic controller, who will then vector you back to your course.

My last cross-country, a grueling 5½-hour trek, came off without anything worse than a brief detour. The written test turned out to be a breeze, and the fifth and final stage check went smoothly enough. Twenty days into the program, with 40.9 aircraft hours to my credit, Robb declared my training complete. I pumped him for last-minute tips, then went back to the motel to study my brains out. I'd meet with the examiner the next day.

My biggest worry was the cross-country planning. Official test standards require that you be able to do it from scratch in half an hour, which was better than I'd ever done. I struggled into the night, planning journeys to nowhere, whizzing the wheels of my flight computer around and penciling figures into Nav. logs. By the time I was done, I'd planned more trips than I could have taken in a month, but I still wasn't sure if I'd be able to beat the deadline.

Ready or not, I drove out to the air-

port the next afternoon and met my examiner, a wily old pilot by the name of Dave Pearce. He gave me two destinations, and I set to work on my planning, while he went outside to tinker with his old Piper Cub.

He came back before I was done, looked quickly over my work, and decided he'd seen enough. He grilled me for a few minutes, responding neither negatively nor positively to my answers. Then he said, "You've done your homework," and we walked out to the airplane.

We took off with the Sun low in the sky, and began the cross-country I had planned. After a few minutes of silence, he told me to climb to avoid oncoming traffic. But looming over us was a giant forbidden zone of airspace known as a Terminal Control Area. Enter it without clearance from a controller, and you'd have your license pulled—if you had one in the first place. I checked and rechecked my navigation, and at last mustered the courage to refuse. I'd heard that examiners were not above trickery. He accepted my rebuff without protest.

After we had passed the second checkpoint, we broke off the cross-country, and Pearce began to put me through the hoops—Power-on and power-off stalls, engine-out procedures, go-arounds, constant altitude turns, turns about a point, recoveries from unusual attitudes. By the time we headed back, it was dark.

He had me fly around the pattern a few times, landing without flaps, and demonstrating takeoff and landing procedures for short and soft airfields. Then it was over.

As we taxied to the tiedown area, he said, "That was pretty good," but I didn't dare ask if it was good enough. He kept me hanging all the way back to the office, lecturing me on a disease he called get-there-itis, which he said killed pilots who flew on, despite conditions that were beyond what they or their planes could handle.

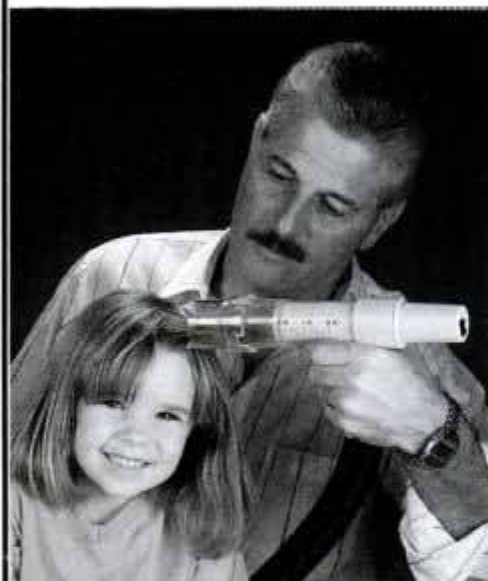
At last, he sat me down, opened my logbook and wrote while announcing: "Private pilot flight test passed and certificate issued."

Looking back, I realize that at that moment the world changed for me. Where once I had been aware only of an environment of roads, fields, forests and towns, I now knew a world crisscrossed with jetways, over-spread by controlled, uncontrolled and restricted airspaces, and marked off by radio beacons. Best of all, I could launch myself into that new dimension and make my way in it, flying along at 130 mph or better with no speed limits or even any roads to hem me in.

I had become a pilot.



SAVE \$\$\$, ENJOY FAMILY FUN with VACUUM HAIRCUTTER



Never need a barber again. Does all styles, all lengths. Tapers, layers, feathers, collects clippings. Great haircuts easy. You get all you need for haircuts, use with any vacuum. Thousands in use from Egypt to Japan.
MADE IN USA.
Robocut, the original since 1985.

As seen on TV, now improved:

- * Easy-to-set dial gives you any length, not 1/2 inch steps and no loose parts.
- * Any length from skin-tight to waist-long
- * Great for straight, curly, even afro-hair.
- * Excellent for pets.
- * Lighter, only 11 oz versus 21 oz.



As seen on TV, now for less.

Full money back guarantee.

Mail today ~~\$149~~ \$99 plus \$5 s&h to:

Robocut Co. POBox 9596, Ft Collins, Co 80525, U.S.A.

call now 1-800-825-0139, VISA/MC/COD

Biggest GNP drop since 1986

Joblessness grows to 6.5 percent

Don't let tough economic times deny your family a better living.

Inflation rises up

DOW unstable

Times are tough. Cutbacks and layoffs are forcing people to scrape and sacrifice. But now there's a way you can ensure tough times won't deny you or your family a good living. Start your own business. For six decades, through good times and bad, Foley-Belsaw has been helping people build profitable companies. Now we can get you into a lucrative field where a shortage of qualified practitioners exists — fields that aren't affected by a rough economy. Our

professional courses give you everything — including tools — to start a full- or part-time business in one of these fields...with absolutely no risk!

You don't need experience. Just a desire to succeed. Earn profits right away while you learn. Make up to \$39.95 an hour. We'll get you going for a start-up investment of as little as \$25.

Choose from these money-makers.

- 1 Small Engine Service and Repair.** There are 65 million small engines in use today — but few people are qualified to service them. This is one of America's fastest growing industries. Foley-Belsaw training lets you cash in on it. People will pay you top dollar to service their lawnmowers, tillers, edgers...the list is endless.
- 2 Locksmithing.** With crime zooming, lucrative regular lock and key business has multiplied a thousandfold. This Foley-Belsaw course gives you everything you need to start your own locksmith business — including a Pro Key machine at no extra cost!
- 3 Professional Woodworking.** Build over \$3,000 worth of valuable furniture and woodworking products while you learn! You get tools, materials and time-tested secrets of master craftsmen. Handle challenging projects ranging from custom-made furniture to construction of the most intricate of jewelry boxes.
- 4 Upholstery.** There are over 401,950,000 pieces of furniture in America — furniture that will need recovering and repair every five to ten years. Take this course and you become one of the few individuals that companies pay cash to restyle and upholster these pieces.
- 5 Professional Saw and Tool Sharpening.** Earn \$200 a day! You get everything you need to master this craft — including your own professional Sharp-All machine. Carpenters, contractors and homeowners all need this important service.

If coupon is missing, write request to: Foley-Belsaw Institute, 6301 Equitable Road / Kansas City, MO 64120

HERE'S WHAT OTHERS ARE SAYING:

"I did \$7,000 part-time...I think I should make about \$20,000 a year the way I have it planned." *Gene Marvin, Shickshinny, PA*

"I'm not going to tell you how much I take in! Let's just say it's a thousand dollars a week. It's more; but use that figure." *M.M. Retrick, Apollo, PA*

If you want to ensure tough economic times won't deny you or your family a better living — find out how we can help you. Send for your **FREE Opportunity Kit** today!

Yes! Send me the following **FREE Opportunity Kit** (One kit per person only)

- Small Engine Service and Repair, Dept. 52061
- Professional Saw and Tool Sharpening, Dept. 21049
- Professional Woodworking, Dept. 43081
- Upholstery, Dept. 80744
- Locksmithing, Dept. 12082

I understand there is no obligation and no salesman will ever call.

Name _____

Street _____

City/State/Zip _____



Complete and return this coupon to:

Foley-Belsaw Institute
6301 Equitable Road / Kansas City, MO 64120

SATELLITE TV SYSTEMS at Wholesale Prices!

VHS Videotape

Explains features of most major brands

\$19.95

plus \$2.00 Shipping and Handling
Refunded with System Order

1-800-447-7775 ext 811
Most Major Credit Cards Accepted

All systems are sold with complete installation and operational instructions on VHS videotape

WESTERN NEVADA SATELLITE
P.O. Box 7528
Incline Village, NV. 89450

YOUR LADY WILL LOVE THIS SURPRISE!

Her Full Name in 3-D

ON BIG LOVECARD THAT SAYS I LOVE YOU

She'll Treasure It As A Memento Of Your Love!

• IT SHOWS HOW SPECIAL YOU THINK SHE IS!
LOOKS EXPENSIVE! - ONLY 3.00 (Limited Time)
VOLK inc., Dept-LM, Box 546083, Miami, FL 33154

STOP FUMBLING IN THE DARK FOR KEYS



Makes Entry Quick and Safe
• Easy Installation
• No Wiring Necessary
• Battery Operated

only **\$19.95**
plus S/H

THE AUTOMATIC DOOR LIGHT

LIGHTS UP DOOR LOCK AND HANDLE FOR SAFE AND EASY ENTRY

Comes ON when screen door opens
Goes OFF when the door closes

- Photocell keeps light off in daylight to maximize battery life
- Equipped with 20 second timer to assure light is turned off
- Works with Right Hand or Left Hand doors
- Mounts between doors on door frame (case size 6" L x 1 1/4" sq.)

Add \$2.00 per Light for shipping and handling
MI residents add 4% sales tax. Send check or money order to:

Four "AA" batteries required NOT included
NJ TECH IND. P.O. Box 3808 Center Line, MI 48015 Mounting instructions included

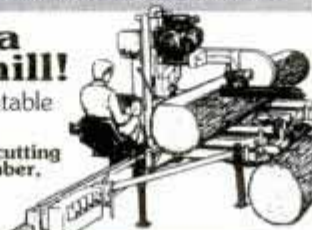
Wood-Mizer

World's Largest Manufacturer of Portable Sawmills

Own a Sawmill!

Start a Profitable Business!

Save money cutting your own lumber, make money cutting for others.



1-800-553-0219

32 Page Full Color Catalog - \$2.00
66-minute demonstration video - \$10.00
MasterCard or Visa accepted
8180 West 10th Street • Dept. D71
Indianapolis, Indiana 46214-2400

Make \$25 to \$100 per hour

with **Badge-A-Minit**

Yes, it's really possible by making and selling bright colorful Badge-A-Minit buttons. Buttons are proven money-makers at fairs, conventions or anywhere people congregate. They're inexpensive, fast and easy to make with Badge-A-Minit!

Send for a FREE color catalog or order a Starter Kit, only \$29.95 plus \$2.95 shipping (IL residents add \$1.87 tax)

Badge-A-Minit, Dept. PM192, 348 North 30th Rd., Box 800, LaSalle, IL 61301, Phone 800-223-4103



SATELLITE TV

Call for FREE Catalog
All Major Brands
Lowest Prices

1-800-845-6664

617 W. Division • Mt. Vernon, WA • 98273

WEST COAST SATELLITE



High School At Home

DIPLOMA AWARDED

Without obligation, get free info on low cost home study method, accreditation, Diploma.

No salesman will call on you.

CALL FREE ANYTIME

American School, Dept. 148
850 E. 58th St.
Chicago, IL 60637

1-800-228-5600

SATELLITE TV

SATELLITE TV BUYING GUIDE

NAME BRANDS AT 50% DISCOUNT
This FREE 24 page Consumer Buying Guide tells all about Satellite TV and lists guaranteed lowest prices.

Satman, Inc.
6310 N. University No. 3798 • Peoria, IL 61612
CALL FOR 1-800-472-8626

TELEPHONE LISTENING DEVICE



Record telephone conversations in your office or home. Connects between any cassette or tape recorder and your telephone line. Starts automatically when phone is answered. Records both sides of conversation. Stops recorder when phone is hung up.

Call 407-725-1000 or send \$19.95 + \$1.00 shipping per item in US Comp. PO Box #12962, Melbourne, FL 32902 CDD * OK.

\$19.95 EACH (by the box)



Super Powerful FM TRANSMITTER
Many times more powerful than other transmitters. Transmits up to 1/2 mile to any FM radio - Easy to Assemble Kit - up to 9V battery (not incl.)
For catalog of Transmitters, Voice Scramblers and other specialty items, enclose \$2.00 to USI Corp.

CABLE TV DESCRAMBLER LIQUIDATION!

FREE CATALOG!
Hamlin Combos \$44, Oak M35B \$60 (min. 5), etc.

WEST COAST ELECTRONICS
For information: 818-709-1758
Catalogs & Orders: 800-628-9656

Don't get **Fight Back!!!**



Beat the racket!!!
Join the men's movement. Lit. on winning! Attorney and organization referrals, your area. Big monthly newsmagazine. Law citations, top writers, networks. Checkmate "Feminism." It's about time! Spread the word!
Information & sample newsmagazine \$3.

DIVORCE! Men's Rights Assoc.
Rte 6M Forest Lake, MN 55025

FREE TO INVENTORS



FREE BOOK filled with facts on how to offer your invention for sale or license. No cost or obligation.
Call 1-800-537-1133, Ext. D-31
Name _____
Address _____
City/State/Zip _____
Kessler, Dept. D-31 Fremont, Ohio 43420

FARMERS • CONTRACTORS • LOGGERS • LANDOWNERS
EARN MONEY! BE INDEPENDENT!

Power Track LT 450

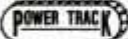
- 100 CUBIC INCH DIESEL ENGINE
- 6 SPEEDS - FORWARD AND REVERSE
- BACKHOE AVAILABLE
- 3 POINT HITCH
- 2 SPEED POWER TAKE OFF
- 6 WAY BLADES
- 700 LBS. OPERATING WEIGHT
- NOT A TOY OR A KIT
- DESIGNED IN THE USA



VIDEO "10"

SAVE THOUSANDS. BUY FACTORY DIRECT

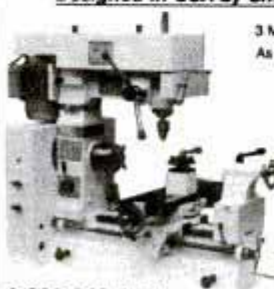
CALL FOR CATALOGUE
1-800-225-7422
P.O. BOX 7531 • TACOMA, WA 98407



SHOP-TASK

MILL • LATHE • DRILL

The Original Home Machine Shop
Designed in USA by Shoptask



3 Models to Choose
As Low As **995.00**
3 Axis Power Feed Available
12 Month Warranty
100% Parts Supply
All Tooling Available
17" Swing
11 x 18 Mill Table

1-800-343-5775
FREE CATALOGUE
DEMAND THE BEST
SHOPTASK P.O. BOX 7531-TACOMA, WA 98407
SINCE 1981

CHRISTMAS SALE!

Save on cable rental fees!
CABLE TV DESCRAMBLERS WE'LL BEAT ANY PRICE

JERROLD-TOCOM-ZENITH
HAMLIN-OAK-PIONEER
SCIENTIFIC ATLANTA
• 24 HOUR SHIPMENTS!
• MONEY BACK GUARANTEE!
• QUANTITY DISCOUNTS!
MASTER CARD / AMEX / VISA / C.O.D.



Have make and model number of equipment used in you area ready.

CALL TOLL-FREE 1-800-284-8432

CABLE WAREHOUSE
10117 West Oakland Park Blvd.,
Suite 515, Sunrise, FL 33351
NO FLORIDA SALES

skoot **MOTORIZED SCOOTER**

Fun! Safe! Easy to ride! 130 mph at motor speed of 18 mph!

SUGGESTED RETAIL FROM **\$4195** Plus Shipping

Optional folding model available. For FREE brochure, call toll free: **1-800-44SKOOT (447-5668)**

Dealer Inquiries Invited. Earth Vision, Inc. P.O. Box 622310, Neaughton, Texas 75862-2310

VOICE CHANGER TELEPHONE



SIXTEEN DIGITAL VOICE CHANGING MODES are built into this standard desktop telephone. Change your voice from male to female, female to male, adult to child, child to adult & "cartoon" voices; works both incoming & outgoing. Use as regular voice phone or switch to Voice Change Mode. Tone/pulse, last number redial, hearing aid compatible. FCC registered, UL & CSA listed, warranty. Precise & realistic voice masking is ideal security for women & children home alone, as a home/business "screening" device, and discourage annoying callers. Money back guarantee. \$89.00 (each add'l \$80.00) + \$4.00 shipping per address. **Order by mail:** DutchGuard, Dept. BJ12, P.O. Box 411687, Kansas City, MO 64141.

Send checks/money orders or MC/Visa & COD order TOLL FREE 1 (800) 821-5157

FLUSH UP TOILET

To Above Floor Drain

Install It Yourself - Anywhere
No Digging Up Floors



Write McPherson, Inc., Dept. 16
Box 15133, Tampa, Florida 33684

CABLE TV DESCRAMBLERS!

CABLE KINGDOM!

JEROLD *OAK* *HAMLIN*
ZENITH *PIONEER*
SCIENTIFIC ATLANTA

IN STOCK

6 MONTH WARRANTY! WE SHIP COD!
ABSOLUTELY LOWEST WHOLESALE/RETAIL PRICES!

*****FREE CATALOG*****

J.P. VIDEO

1470 OLD COUNTRY ROAD
SUITE 315
PLAINVIEW, NY 11803
NO N.Y. SALES
CALL NOW! 1 (800) 950-9145

Help Pay Your X-mas Bills!

STOP Working 40+ hours per week while making someone else rich?

FINANCIAL FIDELITY

proven step by step process for success!

Learn the process that will make you independently wealthy! Join the club of almost 1 million people who have established their own financial independence. Start earning the money you deserve today. Establish financial freedom! Send \$14.95 + \$3.00 S.H. to: **Financial Fidelity, Dept. P96-12, 18 Fox Hunt Dr., Suite 424, Bear, DE 19701. Act Now and Receive the Easy-to-Use Audio Cassettes for an additional \$9.99. Save over 50% off the retail price.**

FULL 1 YEAR MONEY BACK GUARANTEE

SINGERS! REMOVE VOCALS!

Unlimited Backgrounds™

From Standard Records & CD's with the Thompson Vocal Eliminator™ Call for Free Catalog & Demo Record.

Phone: (404) 482-4189 Ext 61
Singer's Supply, Dept. PM-1
7966 Hightower Trail
Lithonia, GA 30058
24 Hour Demo/Info Request
Line (404) 482-2485 Ext 61

Singer's Supply - We Have Anything & Everything For Singers



PRIME TIME CABLE COMPANY

CABLE TV DESCRAMBLERS

Converters, Accessories.

Name Brands • Great Service
Immediate Delivery
Lowest Prices

Call For FREE Catalog: **(800) 777-7731**

Wire Wicklets for Ski Stations

\$69

plus UPS from Richford for **10,000**

Weight: 35 Lbs



FOR FREE SAMPLE, SEND \$1.00 FOR POSTAGE & HANDLING

Wire Racking for Laser Disks

50 for \$17.50

plus \$2.50 for Postage & Handling

Display more cassettes in the same space on perforated cardboard! 12 Laser Disks per sq. ft.

P.O. Box 231, Richford, VT USA 05476



J. D. Fil Inc.

Wire Works Products

Fax: (514) 534-2279, 24 hrs/day

VISA MASTER CARD
CHECK MONEY ORDER

DICKIES WORKWEAR

Send for your **FREE CATALOG**

- 100's of styles & sizes
- Boy's & toddlers
- Work wear, painters wear, casual pants & shirts, jackets, gloves.
- Exceptional quality with 70 years of experience. Satisfaction guaranteed.

Williamson Dickie Mfg. Co.
Box 1779 • Fort Worth, Texas 76101



Call 1-800-DICKIES today!

Subscribe to...

MILITARY VEHICLES

ADS • ARTICLES • NEWS

MILITARY JEEPS, TRUCKS, TANKS & MORE!

Over 8,000 paid subscribers larger circulation than any other magazine for military vehicle enthusiasts...and still growing rapidly! Many more advertisements than any other magazine... Exclusive comprehensive listing of upcoming rallies...and much more!



SUBSCRIBE NOW!

One Year (6 Issues) \$15
Two Years (12 Issues) \$25
Foreign-Canada \$24, other \$26
US Dollars payable by US Bank

P.O. Box 1748-48, Union, NJ 07083

MELT METAL!

Build a low-cost, high-temp furnace! Melt aluminum, brass, iron, more! Pour ingots, machine parts! Set up complete foundry! Discover complete plans, how-to, & secrets! Highest quality! Best selection of books you'll find anywhere! You can do it, too!

POUND IRON!

Blacksmith plans, tools, projects, and much more!

BUILD MACHINES!

Build a metal cutting lathe, shaper, milling machine, sheet metal brake, bandsaw, more! Learn to restore machine tools, spin metal, electroplate, work copper, more! Build one-lung gas engines, steam engines, unusual scientific apparatus, more! Learn secrets of old chemical processes, steam cars, magnets, perpetual motion, moonshine, running three phase motors on single phase, more!



CATALOG!

Send \$1.00 for your personal copy of our giant technical books catalog! Hundreds of quality books! You'll be amazed! Satisfaction guaranteed! Write TODAY!

LINDSAY PUBLICATIONS

Box 538-EMP Bradley IL 60915

Send a Technical Books Catalog! \$1.00 is enclosed!

Name _____
Street _____
City _____ State _____ Zip _____

To get a good idea of what a great idea we have in Image Watches... paste your color logo here.



OR EVEN BETTER

NEW! Water-Resistant Case

Send us your color logo

(Any size letterhead, photo, brochure, artwork which need not be returned)

along with U.S. \$14.50 each*
*(Tax, shipping included.)
(special below-cost introductory offer)

and we'll rush you a personalized working quartz watch sample as our convincer!

Your company logo in full color on the dial of a deluxe, water-resistant wristwatch. 18K Goldplated case, water-resistant leather strap, battery powered quartz movement with a 1-year no-service-charge warranty (battery included). Men's and women's styles. Remarkably inexpensive even in small quantities.

Limit: 2 samples per company @ \$14.50 each

IMAGE WATCHES,™ INC.

Attn: Mr. Mondy

400 S. Atlantic Blvd., Suite 302
Monterey Park, CA 91754 • (213) 726-8050
9am - 5pm Mon. - Fri., Pacific Coast Time

Logo Watch Leader for over 10 Years

Unconditional Money Back Guarantee

Backyard Dream Come True.



A SteelMaster steel building is the perfect place for a home business, from car repair to woodworking to crafts.

Special Savings on these sizes:

24 x 40 42 x 80
35 x 60 50 x 150

The Time is Right -
Build Now!

Call toll-Free:
1 800 341-7007
In Canada call:
1 800 387-2343



Build It Yourself!



1:1 Replica of the 1957 Corvette

**AFFORDABLE • EASY TO BUILD
FUN & REWARDING**



Call Today!
1-800-800-0608

93 NP Ave., Fargo, ND 58102

Ext. 4204

Great money in VCR repair!

Home study. Learn high-profit repairs without investing in high-tech instruments. **FREE BOOKLET: 800-223-4542.**

Name _____
Address _____
City _____ State _____ Zip _____
The School of VCR Repair, 2245 Perimeter
Park, Dept. VA127, Atlanta, Georgia 30341



GO KARTS, ENGINES-KITS-PARTS

72 PAGE CATALOG

\$3.00 REFUNDABLE

Largest Selection.

(216) 357-5569

KW KART WORLD Dept. M

1488 Mentor Ave., Painesville, Ohio 44077



MINICARS MINIBIKES
ATV'S
DISCOUNT
PRICES

Build It Yourself!



1:1 Replica of the '57 T-Bird

**AFFORDABLE • EASY TO BUILD
FUN & REWARDING**



Call Today!
1-800-800-0608

93 NP Ave., Fargo, ND 58102

Ext. 2204

BUILD YOUR OWN HELICOPTER!

From your backyard
to open-sky adventure!

• Simple low-cost assembly • No
license needed • Several helicopter
kits & plans available

Helicopter Plans \$14.95
Heli. Experimenter Book \$11.95
All New Catalog/Kit Info. \$10.00
SPECIAL! All 3 items: Only \$19.95

Add \$2 postage, foreign add \$3 U.S.
Credit card order line: 1-301-681-6368



P.O. Box 50
Riderwood, MD 21159

A Home Even Mother Nature Would Love



AmerLink log homes are made of solid Eastern White Pine or Western Red Cedar logs, produced without chemical surface or pressure treatment. AmerLink Log Homes are a natural way to live!

In fact, our 4-point interlocking log design, and insulated windows even improve on the insulating properties of Mom's own logs. You get virtually the tightest, most energy efficient package available.

Full color Planning
Guide, only \$9.95.
1-800-872-4254.



P.O. Box 669
Battleboro, NC 27809

Franchise Opportunities Available

Please send full color Log Home Planning
Guide. I have enclosed \$9.95. **PM012**

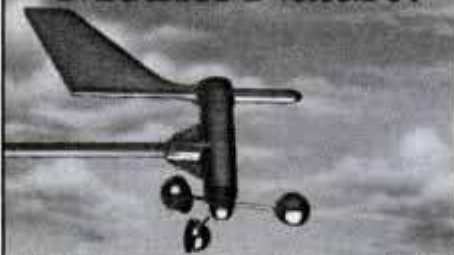
Name _____

Address _____

City _____ State _____ Zip _____

Phone () _____

A direct line to Mother Nature.



Mother Nature may be tricky, but nobody keeps an eye on her better than the Weather Wizard II. Easy to operate and incredibly affordable, it's as miraculous as the weather itself. All for only \$195.

FEATURES INCLUDE:

- Inside & Outside Temps
- Wind Speed & Direction
- Wind Chill
- Time & Date
- Alarms
- Highs & Lows
- Instant Metric Conversions
- Rainfall Option
- Optional PC Interface



WEATHER WIZARD II

THE PROFESSIONAL
HOME WEATHER STATION

Only \$195. Add \$50 for self-emptying rain collector.

Order today: 1-800-678-3669 • **PM013N**

M-F 7 a.m. to 5:30 p.m. Pacific Time • FAX 1-510-670-0589

MC and VISA • Add \$5 for shipping. CA residents add sales tax.

One-year warranty • 30-day money-back guarantee

DAVIS INSTRUMENTS 3465 DAVILD AVE., HAYWARD, CA 94545

CABLE TV "BOXES"

Converters-Descramblers
Remote Controls-Accessories

- ★ Guaranteed Best Prices ★
- ★ 1 Year Warranty - C.O.D.'s ★
- ★ Immediate Shipping ★
- ★ FREE CATALOG ★

Call or Write

NAS/TRANS-WORLD CABLE CO.

3958 North Lake Blvd. • Suite 255

Lake Park, Florida 33403

1-800-442-9333

1-800-848-3997

SMITHY LATHE • MILL • DRILL

NOW YOU CAN FIX
OR MAKE IT
YOURSELF!

- EASY TO USE
- SAVE \$\$\$
- SAVE TIME



OWN A MACHINE SHOP

BUY DIRECT! AS LOW AS \$995

1-800-345-6342

BROCHURE
OR
VIDEO DEMO

OVERLAND CO.
800 E. 7th St.
THE CALLES, OR 97138
FAX 503-296-1023

FREE Satellite TV Buyers Guide/Catalog

ECHOSTAR  **Guaranteed Lowest Price!**
Buy Direct & Save.
10 Years Experience



Complete System
\$1199
 Includes: EchoStar Receiver & Legal Decoder.

1-800-350-0256

(805) 652-0255 FAX: (805) 652-2190

2316 Channel Dr. Ventura CA 93003

The Permanent Gas Cap

Never remove your gas cap again!



only **\$19.95**
 (includes Postage)

No gas odor on hands
 No twisting or broken nails
 Environment friendly. Traps fumes
 Seals itself, automatically!
 Never remove it, never lose it!

Major credit cards, checks & money orders accepted.
 Specify year, make and model of vehicle.

Call NOW 1-800-327-6548

PermaCap • 5000 Oakes Rd. #H, Ft. Laud., FL 33314

SURVEILLANCE

COUNTERSURVEILLANCE Electronic Devices Catalog...\$5.00

Miniature Surveillance Transmitter Kits...\$39.95
 Voice Changers, Phone Scramblers, Vehicle Tracking, Phone Recording Systems, Bug & Phone Tap Detectors, & More!

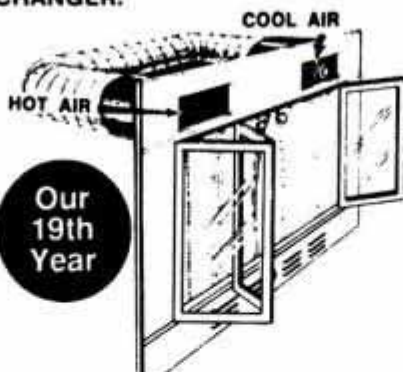
CALL IDENTIFIER displays callers phone number, stores phone number with date & time of call...\$59.95

CALL IDENTIFIER displays callers phone number, stores phone number with date & time of call...\$59.95

P.O. Box 337, Buffalo, NY 14226 (716) 691-3476

Cut Fuel Bills

HEARTH-AID® II AMERICA'S FAVORITE FIREPLACE HEAT EXCHANGER.



Our 19th Year

Increases Heat Output by 500%

- *Custom Fit to any Fireplace.
- *Easy to install. No tools required.
- *Thermostatically controlled, works automatically.
- *Super Efficient stainless steel Heat Exchanger.
- *Best Value No extras to buy
- *No dangerous Creosote Buildup

And best of all you can enjoy your fireplace while saving on your heating bills because with Hearth-Aid II you don't need to sacrifice your fireplace's appearance or the delight of an open fire to be energy efficient.

FOR FREE COLOR BROCHURE

Write: **Hearth Heat & Beauty**
 or **P.O. Box 404**
Abbeville, AL 36310
 Call: **1-800-829-6128**
TOLL FREE PM

New 2,500 lb. 12V DC

- PATENTED TECHNOLOGICAL BREAKTHROUGH
- MOTOR INSIDE DRUM FOR MOST COMPACT 2,500 LB. WINCH
- PULLS OVER 100 TIMES ITS OWN WEIGHT
- FOR THE DEALER NEAREST YOU CALL 1-800-447-4700, OPERATOR 34

Ramsey Winch
 Ramsey Winch Co. • P.O. Box 581510 • Tulsa, OK 74158

LEARN VCR CLEANING/MAINTENANCE/REPAIR

EARN UP TO \$1000 A WEEK, WORKING PART TIME FROM YOUR OWN HOME!



Secrets Revealed!

NO Special Tools or Equipment Needed.

EARN UP TO \$60 AN HOUR AND MORE!

THE MONEY MAKING OPPORTUNITY OF THE 1990'S

IF you are able to work with common small hand tools. . . .

IF you possess average mechanical ability, and have a VCR on which to practice and learn. . . . then we can teach YOU VCR maintenance and repair!

FACT: up to 90% of ALL VCR malfunctions are due to simple MECHANICAL or ELECTRO-MECHANICAL breakdowns!

FACT: Over 77 million VCRs in use today nationwide! Average VCR needs service or repair every 12 to 18 months!

Viejo's **400 PAGE TRAINING MANUAL** (over 500 photos and illustrations) and **AWARD-WINNING VIDEO TRAINING TAPE** reveals the **SECRETS** of VCR maintenance and repair—"real world" information that is **NOT** available elsewhere!

Also includes all the info you'll need regarding the **BUSINESS-SIDE** of running a successful service operation!

FREE INFORMATION
CALL TOLL-FREE 1-800-537-0589

Or write to: Viejo Publications
 5329 Fountain Ave.
 Los Angeles, CA 90029 Dept. PM

CABLE TV 

DESCRAMBLERS

ALL TYPES 800-582-1114
FREE CATALOG
M.K. ELECTRONICS • 7958 Pines Blvd
Suite 276 • Pembroke Pines, FL 33024

BE THE MASTER OF 8 IDENTITIES!

VOICE CHANGER - Electronically Change Your Voice - 4 Robotic/4 Human Sounds.

Great gift for children and adults. \$12.95 each or two for \$23.95 + \$2.00 S/H each. Immediate Delivery.

1-800-531-1150

Hans Corp.
 P.O. Box 711146
 Houston, TX 77271-1146

CABLE TV "BOXES" WHOLESALE PRICES!

CONVERTERS • DESCRAMBLERS
 REMOTE CONTROLS • ACCESSORIES

FROM \$9.95!! CALL NOW!!

- GUARANTEED BEST PRICES -
- BEST WARRANTIES - COD'S
- IMMEDIATE SHIPPING -

LAKE SYLVAN SALES, INC.

1-800-800-4582 PHONE

1-612-895-9454 FAX

FUN TO BUILD - FUN TO DRIVE

Sleek, Lightweight Electric

Build your own electric vehicle now with inexpensive and reliable components. Tops 80 mph and travels up to 60 miles on a 110V charge, costing only 2 to 5 cents per mile. Ideal for quiet, pollution-free commuting.

Sports Performance With Gas

The Subaru flat-4 version does 0-60 in 8 seconds and exceeds 100 mph. Gets 50 mpg on the freeway with excellent handling. Unmatched for sportsness and fun.



Fully Detailed Plans

Plans cover both the electric and gas versions with 96 pages of photos, illustrations and precise construction details. We've also included background information to assist you in building your own design or for converting any car to electric.

DORAN
 MOTOR COMPANY
 1728 Bluehaven Dr., Dept. M
 Sparks, NV 89431 USA

Color brochure, specifications and components catalog - \$5.00, check or M.O. by mail only

Fully Detailed Plans: **\$39.95** plus \$5.00 postage & handling for U.S., Can. & Mex. (Other Foreign: \$10.00 for airmail.)
ORDER BY MAIL OR CALL: 702-359-7336
800-388-8770 for plan orders by credit card. Allow 2-4 weeks for First Class delivery.



THE LANECHANGER II™



THE LANECHANGER™

A unique, easy to install, wide angle mirror that helps eliminate dangerous blind spots, greatly improving your overall field of vision.

- Increases visibility for safer lane changes or backing up
- Provides better view of rear seat occupants
- Works great as a Child Watcher
- Available in two Models:

THE LANECHANGER I™ add-on Wide Angle Auxiliary Rear View Mirror that attaches to your existing rear view mirror Available at **WAL-MART, PEP BOYS, WESTERN AUTO, FRED MEYER and G.I. Joe's.**

THE LANECHANGER II™ replacement combination wide angle & conventional rear view mirror **LANECHANGER II not yet available in stores. Factory Direct Orders only. Call Toll Free 1-800-667-0363. Send \$29.95 plus \$4. Shipping & Handling to The Lanechanger.**



THE LANECHANGER I™

Canadian Industrial Design and U.S. patent pending

THE LANECHANGER INC. • 601 Auguste Mondoux • Aylmer, Quebec, Canada J9H 5E1 • 800-667-0363

1992 Mail Order Calendar of Events

April 1992 issue:
Catalog Mart
1/8 page only
Closing Date: January 10, 1992

May 1992 issue:
PM on Wheels
Minimum: 1/6 page
Closing Date: February 15, 1992

September 1992 issue:
Catalog Mart
1/8 page only
Closing Date: June 10, 1992

October 1992 issue:
PM on Wheels
Minimum: 1/6 page
Closing Date: July 15, 1992

November 1992 issue:
Woodworkers' Mart
Minimum: 1/6 page
Closing Date: August 15, 1992

Popular Mechanics

224 West 57th Street, New York, N.Y. 10019
Classified Advertising Dept. (212) 649-3167

Order
Form
J92

DEADLINE FOR ADS: Copy and payment must be in by the 5th day of the 2nd preceding month for the issue in which the ad is to appear. See Head of Classified Section.

HOW TO COUNT WORDS: Name and address must be included in counting the number of words in your ad. Each initial or number used counts as 1 word: J. J. Smith, 224 West 57th Street, New York, New York 10019: 9 WORDS. Zip codes are not counted. Phone #: 2 WORDS. Symbols used as keys are charged for. City or state count as 1 word each: New Brunswick, New Jersey: 2 WORDS. Abbreviations such as C.O.D., F.O.B., R.P.M., U.S.A., P.O., 5x7, 16mm are counted as 1 word. (P.O. Box 392 counted as 3 words) Webster's International Unabridged Dictionary will be used as our authority for spelling, compound words, hyphenations, abbreviations, etc. Please make checks payable to **POPULAR MECHANICS.**

\$10.20 per word—10 Word Minimum
BOLD FACE CAPS—\$1.00 Per word
(First Word: No charge for Bold Face)
\$50.00—B/F CENTERED HEADLINE
(5 Words or Less)
\$50.00—Screening

Remittance of \$ _____ is enclosed to cover _____ insertion(s) in the _____ issue(s). _____ Classification

NO CHARGE FOR CAPS	2	3	4	5	6	7
8	9	10-\$102.00	11-\$112.20	12-\$122.40	13-\$132.60	14-\$142.80
15-\$153.00	16-\$163.20	17-\$173.40	18-\$183.60	19-\$193.80	20-\$204.00	21-\$214.20
22-\$224.40	23-\$234.60	24-\$244.80	25-\$255.00	26-\$265.20	27-\$275.40	28-\$285.60
29-\$295.80	30-\$306.00	31-\$316.20	32-\$326.40	33-\$336.60	34-\$346.80	35-\$357.00
36-\$367.20	37-\$377.40	38-\$387.60	39-\$397.80	40-\$408.00	41-\$418.20	42-\$428.40
43-\$438.60	44-\$448.80	45-\$459.00	46-\$469.20	47-\$479.40	48-\$489.60	49-\$499.80
50-\$510.00	51-\$520.20	52-\$530.40	53-\$540.60	54-\$550.80	55-\$561.00	56-\$571.20

YOUR NAME _____ (PLEASE PRINT) PHONE: _____

FIRM (NAME IN AD) _____

YOUR ADDRESS _____

CITY _____ STATE _____ ZIP _____

DATE: _____ YOUR SIGNATURE _____

(PLEASE PRINT OR TYPE COPY • FOR ADDITIONAL WORDS ATTACH SEPARATE SHEET)

CLASSIFIED ADVERTISEMENTS

Dorothy Nolan, Classified Manager

Karen O'Rourke, Asst. Classified Manager

Rate: \$10.20 per word payable in advance each insertion. Minimum insertion ten words.

Bold face capitalized words—\$1.00 per word additional (First word set in Bold Face at no extra charge, Zip Code Free.) Centered Headlines (5 Words or Less) in All Bold-Face Letters—\$50.00. Screening—\$50.00. The next available issue to place an advertisement is **MARCH**. The closing is **JANUARY 6TH**. (On sale date is **FEBRUARY 11TH**.) Send remittance payable and order to Popular Mechanics, Classified Department, 224 West 57th Street, New York, New York 10019. Please indicate Heading under which ad is to appear. As a consumer service and in cooperation with our mail-order advertisers who use post office box addresses for their convenience in handling your order, Popular Mechanics maintains a register of such mail-order advertisers containing their complete names and street addresses. Advertisers using P.O. Box number must furnish complete name and street address for our records. To avoid delay in the publication of your ad, please send samples and descriptive materials with your request if your ad does not state clearly what is being offered.

**PLEASE NOTE: WE HAVE 142 CLASSIFICATIONS TO CHOOSE FROM.
FOR OUR LIST WRITE TO ADDRESS ABOVE AND REQUEST OUR ORDER FORM.**

PUBLISHER'S MART BOOKS & PUBLICATIONS

CARD Counting - The easy way. Information for winning at card games \$10.00. Larry Childress, P.O. Box 832014, Dept. C, Richardson, TX 75083-2014

FRANK REPETTO'S TAX BIBLE Beat the IRS! Save now before April 15th, Guaranteed! \$19.95. 191 North Kihel Road PM, Hawaii 96753

TELEPHONE TRADE "SECRETS" EX-PHONEMAN reveals tricks of the trade \$5.00. Oort Cloud Press, Box 5641, Ventura, California 93005

BOOK: BECOME ROACH-FREE. Exterminator Explains: \$20.00. EPE, P.O. Box 74B, Calhoun, Louisiana 71225-0074

"SHARPENERS REPORT" Monthly Newsletter. Valuable Tips—Sources—Buy/Sell Used Equipment. Free Brochure. Skog Company, Dept. PM1, P.O. Box 22559, Minneapolis, MN 55422

SPECIAL REPORT: SECRETS OF AUTO DETAILING. Methods, waxes, chemicals, equipment. Send \$24.95 to: Quaker Ridge Industries, 537 North State Rd., Briarcliff Manor, NY 10510

ALTERNATORS Driving You Crazy? Is it the wiring? The regulator? Check them out - on the car. In seconds, with simple cheap equipment. Test 97% of American Cars. Very easy system. Send \$20. Harris, P.O. Box 7304, Rockford, IL 61126-7304

FUEL FROM WATER Energy independence with hydrogen. Amazing free report. Merit, Box 5363, Louisville, KY 40205.

OPERATE a profitable business at home, new publication shows you how. Send \$18: Edward A., 48 Ward St., Box 4563, Salem, MA 01970.

PROTECT your home and car from intruders. Proven Methods. \$6.00. L.A. Distributors, P.O. Box 352, South Plainfield, N.J. 07080-0352.

AUTOMOBILE DICTIONARY - \$9.95 - Town Crier Publications, 4200 Woodhaven Rd., Suite #214, Philadelphia, PA 19154

"SAVE ON COPIER REPAIRS." Experienced technician tells how. \$9.95. BPC, 2509 Gatepost Circle, Birmingham, AL 35214

"ABRACADABRA For The Nineties" 8800 Acronyms/Abbreviations For Professionals, Students, & Curious. \$15.00 pp. Strong Enterprises, 2600 Cumberland/4200-10, Tehachapi, CA 93561

AVOID TRAFFIC TICKETS - Written by Policeman. Send \$5.95 LSASE: J.K. Publications, Box 3707, Centerline, MI 48015

START YOUR CAREER AS A PROFESSIONAL TRUCK DRIVER. \$4.00. Bailey, 8130 La Mesa Blvd. #201, La Mesa, CA 91941

POKER - Make Money Playing Poker. Win consistently! Learn inside facts on betting, bluffing and common mistakes. \$4.50 Postpaid. Variety House, Box 63-4461C, Margate, FL 33063

WORDS Women Can't Resist: \$10. Gabriel Publications, Box 36100, Decatur, GA 30032

LAWSUIT? Defend yourself or sue without lawyer with "Layman's Litigation Guide". Send \$16.95 (\$3.00 S/H) to: JTI Enterprises, P.O. Box 131, Lihue, HI 96766

INTERESTED IN CLASSIFIED ADVERTISING?
READ POPULAR MECHANICS Latest Edition of "TIPS ON HOW TO MAKE MONEY THROUGH CLASSIFIED ADVERTISING". This Informative 24-Page Booklet Will Show You The Do's And Don'ts of Classified Advertising And How You Can Make It Work For You. So Order Today. Only \$1.00 Plus You'll Receive A \$2.00 Coupon Refundable With Your First Order. Send To: **POPULAR MECHANICS CLASSIFIED**, Dept. SG, 250 W. 55th Street, New York, NY 10019

COBB'S LAW The Profit-ABILITY Guide. Guaranteed Best Management Book You've Ever Read. Free Details. BC Publications, 29 Arapaho, Belleville, IL 62220

MAGAZINES

NATURISM LIFESTYLE: FAMILY RECREATION. Books, magazines, videos. Catalog \$3. Lifestyles-PM, Box 661266, Los Angeles, CA 90066

CATALOGS

HOBBY CATALOG - HUGE SELECTION, OVER 350 PAGES \$9.95 (REFUNDABLE) 1-800-253-6440, HOBBYWORLD

ALUMINUM Brass Stainless 4130 Titanium write for catalog. Shapiro, 1259 Delaware, St. Louis, MO 63133

JEWELRY 14 Karat Chains, Bracelets, etc. Wholesale prices, catalog \$5.00. J M R, P.O. Box 1403, Jupiter, Florida 33468

COLOR catalog. 160 pages of gift ideas great for home, office, or pleasure. Please send \$3.00 to: Barrow Enterprises, 25150 Evergreen Rd., Suite 202, Southfield, MI 48075

GIFT SHOPPING

SPEEDING TICKETS! FIND OUT "HOW TO BEAT" THEM LEGALLY WITH THIS INFORMATIVE VIDEO. SEND \$19.95 TO: KPE DISTRIBUTORS, BOX 148, DEPT. PM, ARDSLEY N.Y. 10502-0148

AUTOMOBILES

\$225 DAILY "CHROME PLATING" Auto Parts, Motorcycles, inexpensive, easy. (Free) information: Chrome Finish, Box 2285, Waldorf, Maryland 20604

DRUG RAID SEIZURES: Buy Dirt Cheap! Cars, Trucks, Boats, Computers. Seizures, Box 4309-AT, West Covina, CA 91791.

GOVERNMENT SEIZED Vehicles from \$100. Fords, Mercedes, Corvettes, Chevys. Surplus. Buyers Guide. (1) 805-962-8000 Ext. S-20024.

RUSTPROOF with two wires! Lifetime warranty! Box 10209-C, Makati 1299, Philippines.

VAPOR Carburetor Triples MPG. Free Information. H&A, R2 PV, Bowling Green, MO 63334

PRACTICAL FUEL SAVING for carburetors and Fuel Injection. Free Details. Eagle Research Inc, 1-800-663-4758, 1-604-424-5402.

PASS EMISSION INSPECTION without costly repairs. Paper tells how. Send \$10.00 money order to: Engine Concepts, 3445 Poplar Ave., Suite 6-265, Memphis, TN 38111

USED CAR BUYERS GUIDE. Helpful Hints and Information Booklet. \$9.95. P.O. Box 2382, Dawson Creek, B.C. V1G 4T9

SHOCK ABSORBING TOWROPE \$30 postpaid. Softstart, P.O. Box 441, Perkasio, PA 18944

SAVE 50%-80% on custom rear spoilers for cars and trucks. Instructions \$7.50. Duradynamics, P.O. Box 2627, Athens, OH 45701-2627.

FUEL Vapor System, Simple Economical. Free Details. 5920W. 10400N., Highland, Utah 84003

GENERIC FUEL ADDITIVES, \$1.00 for list, save \$hundreds. WPPM, 4810A River Vista Lane, Tampa, FL 33617

FANTASTIC ENGINE PERFORMANCE From Water? True! Free Info. Northern Michigan Enterprises, Box 6321, Traverse City, Mich. 49685-6321

NEW PRODUCT PRESSURE BLEED BRAKES. No Special Tools Required. Do It Yourself. Send \$20.00 to: J & J Wholesale, 11835 Carmel Mountain Road, Suite 1304-1A, San Diego, CA 92128

HEADLIGHT REMINDER Avoid battery drain. No-tool installation. \$3.95. Lakefront Distributing, 1898 12 1/2 Ave. #38A, Cameron, WI 54822

GOVERNMENT SEIZED VEHICLES FROM \$100. Cars, Trucks, Vans, Boats, Homes. FREE REPORT. 24hr Message 1-(510) 783-2178. Ext. 315.

FREE MOTOR OIL for life. Guaranteed! Amazing source revealed! Details \$3.00. Discovery, 27 North 3700 East, Rigby, Idaho 83442.

ELECTRIC VEHICLES

CONVERSIONS! New ENGINEERED Systems! 1992's Motors, Controllers, Batteries, Components. Specifications, prices, \$1.00. 3E, Box 19409-CR, San Diego, CA 92159

35 MPH 2 Speed Electric Bike Plans \$12.00. Info. \$1.50. Smiths, 658 W. Willow, Enid, OK 73701

AUTO SUPPLIES & EQUIPMENT

ALTERNATOR/Generator Rebuilding Book. Price: Hedelund Engineering, 7505 Barkentine, Las Vegas, NV 89128

ENGINE OVERHAUL KITS: WHOLESALE CATALOG \$2.00. Engine Service Group, Dept. PM, Box 13053, Lansing, MI 48901.

STOP BRAKE SQUEAL! GUARANTEED! Lubricant and Booklet \$8.00. Hanna Distributing, Box 1423, Fayetteville, AR 72702

AUTOMOTIVE PERFORMANCE IMPROVEMENT PRODUCTS! Increase MPG. Reduce exhaust emissions. Prolong engine life and more. Proven line of treatments-amazing new fuel system device. Great income opportunities! For informative cassettes and brochures rush \$5.00 to: DMR, 2225 West Birch, Bellingham, WA 98226

(Continued on next page)

AUTO SUPPLIES & EQUIPMENT

(Continued from preceding page)

FREE SAMPLE WORLD'S GREATEST HAND CLEANER!
Send \$1.00 (P&H). Delian Enterprise, Box 1292, West Caldwell, NJ 07007

BICYCLES, SUPPLIES

BICYCLE TO TRICYCLE CONVERSION KIT
GUARANTEED to fit any bicycle. Free brochure. Mathews, Box 652, Bradford, PA 16701. 800-525-4444.

MOTORCYCLES, MOTORSCOOTERS & SUPPLIES

GO KARTS, Minibikes, ATV's. Kits, Parts, Engines. Lowest Prices. Largest Selection. 80 Page Catalog \$3.00. Refundable. Kart World, Dept. C., 1488 Mentor Ave., Painesville, Ohio 44077

OUR NEXT AVAILABLE ISSUE:
MARCH 1992
ORDERS MUST BE RECEIVED BY
JANUARY 6TH
ON SALE DATE: FEBRUARY 11TH

AVIATION, HANG GLIDING

AIRBOAT-Hovercraft Supply Catalog. \$3.00. Wind Machines, Multi-bladed propellers. Sportscraft, Meeker, OK 74855

BUILD AND FLY A SCALE REPLICAS OF WWI PLANE!
Ultralight version does not need pilots license! Specify Jenny or Nieuport 11 Info Pak, \$10.00. LEAF Inc., 331 S. 14th St., Dept. PM, Colorado Springs, CO 80904, 800-LEAF-INC.

AIRPLANE, Hang Glider Design Brochure \$1.00. McCoy Aircraft, P.O. Box J, Suite 243, Manhattan Beach, CA 90266

HOVERCRAFT

DEALERSHIP information \$11. Kits, VW plans \$52. Neoteric, Terre-Haute, Indiana, 47807-2394. (812) 234-1120.

HOVERCRAFT Plans All Sizes. Catalog \$1.00 Universal Hovercraft, Box 281, Cordova, Illinois 61242

HOVERCRAFT plans, 3 to 160hp. Information. \$5 (refundable). Sevtec, Box 846, Monroe, WA 98272

BOOMERANGS! ... INCREDIBLE HI-TECH RETURNS. Discovered, Amazing, Illustrated Catalog. FREE! BoomerangMan, 1806-1 N. 3rd., Monroe, LA 71201-4222

LARGEST Hovercraft Catalog \$5.00 Refundable. GPL, 2859 Cormorant, Delray, FL 33444-1068

CB'S, RADIO & HAM EQUIPMENT

POLICE-FIRE SCANNERS. CB's. MARINE ZWAY. ANTENNAS. HPR, BOX 19224PM, DENVER, CO 80219

DIRECTORIES: Secret Scanner Frequencies! Federal Agencies, etc. Big Catalog. CRB, Box 56-PM, Commack, NY 11725.

CB MODIFICATIONS! Frequencies, sliders, FM, amplifiers, books, kits, repairs, high-performance accessories. Catalog \$2. CBCI, Box 31500M, Phoenix, AZ 85046

LAND/General Mobile Radios, CB's, Scanners, Radar Detectors, Marine Transceivers, Auto Alarms Catalog, \$2.00. Rays, Box 14862PM, Ft. Worth, TX 76117-0862

ELECTRONICS

BUGGED? WIRE TAPPED? Find out fast! Countermeasures equipment catalog \$1. Capri Electronics, Box 589P, Bayfield, CO 81122

LOCK PICKING SECRETS, complete instruction. \$4.98 other Titles Available. Tower, P.O. Box 131, Cookeville, TN, 38503

BUGGED? PHONETAPPED? Free Catalog of Fantastic Electronic Devices tells you Fast! 1-800-732-5000

LONG PLAY TAPE RECORDERS, 12 hours per cassette. Free Brochure. Productive Products, Box 930024, Norcross, Georgia 30093

NEW Super Miniature FM Transmitter Kits! Use Surface Mount Technology! Super E-Z Circuit Boards! Free kit catalog. XANDI Electronics, Box 25647, Dept. 28DD, Tempe, AZ 85285-5647.

TALKING 4 language calculator, English, German, French, Spanish, \$24.95 + \$3.00 P/H. Kovacks, Box 2025, Arlington, TX 76004.

TINY MATCHBOOK VIDEOCAMERA, Under \$200! TV Transmitters!! R/C Airborne Microvideo, Surveillance!! Catalog \$3.00. SUPERCIRCUITS, 1403-D Bayview, Hermosa Beach, CA 90254. (310) 372-9166.

COMPUTERS & SOFTWARE

SAVE money on PC maintenance. Free Details. DIAGS, 6541 Oakwood Drive, Falls Church, Virginia 22041, (703) 750-1681.

TIME Traveler DOS calendar (1901-9999), \$9.95. Phadean Engineering, 116 Stiles Road, Boylston, MA 01505-1506.

NEC V20 CHIP improves PC/XT performance 30%! Instructions \$2.00. Chip and instructions \$19.95. PARA Corp., P.O. Box 375, Excelsior, MN 55331.

SATELLITE - TV

FREE Catalog - Lowest prices world wide. SKYVISION, 1022 Frontier, Fergus Falls, MN 56537. (800)334-6455

FREE DETAILS! INSTALL IT YOURSELF! Complete systems, upgrades. Orbitek Satellite Communications, Box 264-M1, Bohemia, New York 11716-0264. (516) 589-1292.

SATELLITE TELEVISION DESCRABLERS Complete detailed plans for home construction by anyone. \$3.00. Jansen Electronics, P.O. Box 25161-A, Seattle, WA 98125

COMPLETE 3 Foot System \$339.00. Thomas, 6307 Homestead, Huntsville, AL 35811

DESCRAMBLER Sales information \$2. Pelham, 327 Chatham Street, Windsor, Canada, N9A 5M8

FREE 24 PAGE SATELLITE BUYING GUIDE. DISCOUNT PRODUCT PRICES. SATMAN (800)-472-8626.

X*PRESS subscribers, tired of having your decryptor go "un-authorized". Call for the Data Defender microcontroller \$99.95 913-221-2455, or include decryptor A/N:# to: Universal Systems, 1925 Sieben Ct., Topeka, KS 66611.

TV, VIDEOS & VIDEO EQUIPMENT

NOTICE: USE OF CERTAIN ITEMS IN THIS CLASSIFICATION REQUIRES STATION AUTHORIZATION.

CABLE TV CONVERTERS. Jerrold, Oak, Scientific, Atlantic, Zenith and Many Others. "New" MTS Stereo Add-On ... Mute and Volume. Ideal for 400 & 450 Owners! Visa, M/C + Amex. 1-800-826-7623. B&B Inc., 4030 Beau-D-Rue Drive, Eagan, MN 55122

DESCRAMBLER KITS. Complete cable kit \$44.95. Complete Satellite kit \$49.95. Add \$5 shipping. Free Brochure. Summit PM, Box 489, Bronx, NY 10465

DESERT STORM EXCLUSIVE. Actual Cockpit Video of F16, F117, F-111 & F15E. Limited Edition 2hrs \$24.95 + \$3 SH. JD Enterprises, 37 Palmer Dr., Sumter, S.C. 29150

CABLE TV EQUIPMENT

CABLE TV SECRETS - the Outlaw Publication the cable companies tried to ban. HBO, Movie Channel, Showtime, Descramblers, Converters, etc. Suppliers list included. \$9.95. Cable Facts, Box 711-PM, Pataskala, Ohio 43062.

SECRET CABLE DESCRAMBLER. Build Your Own Descrambler For LESS Than \$12.00. In Seven EASY Steps. Radio Shack Parts List Included. Also FREE Descrambling Methods That COST NOTHING To Try. Send \$10.00 To: Harrywhite, 2 Marlin, Baytown, TX 77520

TOCOM, Gerrold and Zenith Test Chips. Fully Activates Unit. \$50.00. Orders 1-800-452-7090. Information 1-213-867-0081.

CABLE DESCRABLERS. DISCOUNT CENTER. ABSOLUTELY THE LOWEST PRICES! All Brands-CALL US LAST! Advance Electronics 1-800-659-3018

DESCRAMBLERS, Converters, **LOWEST PRICES**. CNC Concepts Inc., P.O. Box 34503, Minneapolis, MN 55434 1-800-535-1843.

CABLE Descramblers. 'Can't Touch This!' **ROCK BOTTOM PRICES!** All Brands. Wholesale Price Club - Open To All. HITECH ELECTRONICS 1-800-745-5079

CAMPERS & TRAILERS—KITS, PLANS

172 TRAILER PLANS Motorcycle, Utility, Car, Construction - Strong, Streamlined, easily built. Component Kits Catalog \$4.00. (Refundable). Tag-Along, Box 15107, Salem, OR 97309

BUILD YOUR OWN - Travel Trailer - Fifth Wheeler - Motorhome - Campers - Plans - Patterns - Kits - Catalog \$1. Glen-L, 9152 Rosecrans, Box 1804/RV2, Bellflower, CA 90706. 310/630-6258.

NEED HELP Figuring the Cost of your Advertisement?? Call us at 212-648-3167 or send us a FAX (212-586-5562) and we'll FAX Back with a Price Quote.

BOATS, OUTBOARDS, TRAILERS, & KITS

BOAT KITS - PLANS - PATTERNS - AMERICA'S LARGEST COMPLETE LINE - 6'/70' - Powerboats - Sailboats - Trimarans - Dinghies - Houseboats - Hydroplanes - Tunnel-hulls - Duckboats - Canoes/Strippers - Kayaks - Dories - **DISCOVER** no dryrot epoxy boatbuilding - **HUGE ILLUSTRATED CATALOG \$3.00** (Airmail \$5.00), includes Free Epoxy/Fiberglass/Supplies Catalog - Book "Amateur Boatbuilding", \$6.00 - **CLARKCRAFT**, 16-P Aqualane, Tonawanda, NY 14150

EVINRUDES - **NEW 1990** Bargains - Top Brands ... all sizes ... \$2.00 handling ... Scott McCulloch parts ... Electra Marine, 610 Merrick Road, Lynbrook, New York 11563

BOAT PLANS - PATTERNS - KITS - Unsurpassed selection - 7'/55' - Hydroplanes - Canoes - Kayaks - Rowingboats - Duckboats - Dories - Sailboats - Houseboats - Quick/simple Stitchenglue. Tremendous savings! 168-page **DESIGN BOOK - \$4.00 AIRMAIL**. Includes Free "Boatbuilding Supplies" catalog. "Epoxy Manual" \$2. **GLEN-L**, 9152 Rosecrans, Box 1804/PM2, Bellflower, CA 90706. 310/630-6258.

ATHLETIC EQUIPMENT AND BODY BUILDING COURSES

BIGGER, More Powerful Muscles - faster!! Free Booklet! Universal, Box 6694A, Detroit, Michigan 48240

FISHING, TACKLE, LURES

INCREDIBLE Way of Catching Big Fish Even When It's Very Hot \$2.50. J.D. Fil, P.O. Box 231, Richford, 05476

GUNS, DECOYS, HUNTING

OKLAHOMA AMMUNITION COMPANY BUY DIRECT AND SAVE Many popular calibers: rimfire, centerfire-handgun and rifle ammunition. For free price list and ordering information write or call us: 4310 W. Rogers Blvd., Skiatook, OK 74070. (918) 396-3187.

FREE HUNTING AND SHOOTING SUPPLY CATALOG. Our catalog has hundreds of items for the hunter and shooter. Call or write today for your **FREE CATALOG!** **RIVERBEND CATALOG COMPANY**, P.O. Box 22982 **DEPT. PM**, Chattanooga, TN 37422-2982 (615) 892-9119

BEEMAN ADULT AIRGUNS! World's most accurate and most powerful regular, production airguns. Calibers: .177, .20, .22, 25! Largest U.S. sales. Unequaled trigger action, durability, ownership pride, quality. Also: pointed, hollow point, extra heavy, hi-velocity, and match pellets. Free 104 page Guide/Catalog. Add \$3.00 for fast mail. Beeman Precision Arms, 3440-PMC Airway Dr., Santa Rosa, CA 95403. (707) 578-7900 (24 hours).

ELECTRICAL SUPPLIES

"ST-LIGHTING" 1-800-777-3742. Save up to 40% on name brand lighting

TOOLS FOR SALE

BOLTS, SCREWS, TOOLS, WHOLESALE, DIRECT. Guaranteed. Catalog \$2.00 (Refundable). Camelot, Dept. 44, Box 65, Bristol, Wisconsin 53104

MACHINERY, TOOLS & SUPPLIES

WOOD & Metalworking Machinery, Tools, Supplies. Catalog \$1.00. Blue Ridge, P.O. Box 536-V, Hurricane, WV 25526. (304) 562-3538.

STEEL, Aluminum, Brass—Sheet, Bar, Shop Supplies, Plans. Write: CEI, RR1, Box 163, Cameron, IL 61423.

4" METAL Cutting Lathe \$121.70. Taig, 15048 Proctor, Industry, CA 91748

LATHES-INDUSTRIAL/HOBBY FROM \$345.00, METALS, SUPPLIES, LARGE CATALOG \$2.00. **CAMPBELL TOOLS 35TH YEAR, 2100-D SELMA RD., SPRINGFIELD, OHIO 45505**. 1-513-322-8562.

FOUNDRY SETS Supplies, Brochure \$1.00. Pyramid Products, 3736 S. 7th Ave. D-PM, Phoenix, AZ 85041. (602) 276-5365

BANDSAW BLADES, Any Size. Free literature. King Saw, 6541 Tidewater Drive, Norfolk, Virginia 23509

30" SHEET Metal Brake \$159.95. Gingery Tool, P.O. Box 75, Fordland, MO 65652-0075.

(Continued on next page)

MACHINERY, TOOLS & SUPPLIES

(Continued from preceding page)

NEW MAGNETIC LOCKS. "Pick-Proof". Durable, easy to use. Send \$9.95 plus \$1.00 S/H. T.R.P., 912A-1 Union St., San Francisco, CA 94133

ALUMINUM: rounds, flats, shapes, plate. Small orders our specialty. For information write: Short Order Metals, P.O. Box 88753, Dept. M04, Carol Stream, Illinois 60188

SHOP BUILDINGS

QUONSET Style Steel Buildings! Simple Construction! Clearspan Interior! Atlantic Buildings 1-800-942-1234

ENERGY SAVING

FREE ENERGY! Fuel-less Motors and Generators. H&A, REP, Bowling Green, MO 63334

FUEL BILLS 1/2 + Energy \$6.95. Spike's, 320 Ma-Chunk St., Pottsville, PA 17901

DRAFTY windows? Easy instructions, professional results. Saves fuel, stops drafts. \$8.00. Ebenezer's, 6 Old Sturbridge Road, Sturbridge, MA 01566

NEED HELP Figuring the Cost of your Advertisement?? Call us at 212-649-3167 or send us a FAX (212-566-5562) and we'll FAX Back with a Price Quote.

SOLAR & ALTERNATE ENERGY

NEW! BUILD AMAZING LIQUID PISTON ENGINE from pipe fittings. Easy plans. Free information. ABCO, Box 306-M1, Seminary, MS 39479

NEW! Amazingly Efficient Solar Heating Plans \$9.95. Universal Energy, P.O. Box 1514, Emporia, KS 66801

SOLAR Collectors You Construct. Send Stamp. 10909-PML Hayvenhurst, Granada Hills, CA 91344

GIANT SOLAR PANELS \$44.00 EACH! Excellent Prices! Solar Equipment/Accessories. Free Information/S.A.S.E., Catalog \$3.00. Pak Rat Electronics, Box 690073, Houston, TX 77269. (713) 893-0313.

HEATING, FUEL SAVERS

"SPENDING MONEY NEEDLESSLY"

YOU NOW HAVE ACCESS TO THE SAME MONEY SAVING KNOWLEDGE, FACTS & INFORMATION Servicemen use to make "Hundreds of Dollars" on your Heating, Cooling & Appliance Repairs. For information Send (\$3.00) to: **RESOURCE INTERNATIONAL, PM1, P.O. BOX 251, COUNCIL BLUFFS, IOWA 51502.**

HOME CRAFTSMAN

1000 WOODCRAFT PATTERNS! Fun, profitable, shop-tested designs. Catalog + sample pattern \$2.00 - Accents (BP-12), Box 7387, Gonic, NH 03839

IT'S NEW! Shop equipment made from PVC PIPE. Belt sander, scroll saw, and more. 17 projects, 135 page manual \$19.95. **GF MULLINEAUX**, Box 77-M, Otego, NY 13825.

MAKE WOODEN TOYS, whirligigs, door harps, doll-houses, clocks, music boxes, weather instruments, crafts, furniture with our plans, parts, kits, supplies—Catalog \$1.00—(800)-848-4363—Cherry Tree Toys, Belmont, OH 43718-0369

FULL-SIZE PROFESSIONAL PLANS Catalog \$3.00. Over 200 plans for building fine furniture. Furniture Designs, Inc., CP-92, 1827 Elmdale Ave., Glenview, IL 60025.

TURN your LAWNMOWER into a MULCH MAKER. Easily assembled in 2 hrs. \$5.50. **FOLDING SAWHORSE** \$5.50, both plans for \$7.50. Paragon Concepts, 6245 N. 24th Parkway #209, Phoenix, AZ 85016

DOLLHOUSE from matches \$3.00 SASE. Ron, 961 Oakstone, Houston, Texas 77015

"GETTING STARTED WITH PVC PIPE FURNITURE." Casual, Box 208, Tewksbury, MA 01876

DESIGNER metal beds build at home 15 styles, plans \$19.95. IMT International, 2801 Conway Court, Sacramento, CA 95826

PLANS, BLUEPRINTS, PROJECTS

BUILD THE "ROCKIES" CHAIR - comfortable, southwestern design for outdoors. The West's Answer To The Adirondack Chair - plans \$9.95 - Tosto Woodcrafts, Box 88117, Colorado Springs, Colorado 80908-8117

EASY-TO-BUILD PHASE CONVERTER. Starts fully loaded 2hp motor. Plans \$11.95 Money Order. K. Castellano, POB 26, Syracuse, NY 13209

LANDSAILER PLANS - \$15. See Advertisement In Popular Science. American Sand Yacht, 7184 Hwy. 101, Yachats, OR 97496

OUTDOOR FURNITURE PLANS Catalog \$2.00. Woodshed, Box 10822, Lynchburg, VA 24506

EASY-TO-BUILD GEIGER COUNTER. Plans \$10.95 Money Order/ K.Castellano, POB 26, Syracuse, NY 13209

TRUE THREE PHASE POWER From 220V House Current. Plans, Text \$12.95. Centaur, 1602 Foothill, Kalispel, MT 59901

SHED PLANS, 8' x 8' simple, strong & cheap, \$7.50. CSI, P.O. Box 26, Kirkwood, DE 19708-0026

MAKE handy step stool with flex handle from 5 gallon plastic bucket. Instructions \$6.95. Lockwood, 8302D Crenshaw Blvd., Inglewood, CA 90305

15 WOOD Puzzle Plans and solutions. Real mindbenders. Puzzle Man, P.O. Box 2252, Cedar Rapids, Iowa 52406-2252

TRUCK BEDLINER converts easily into gas saving air deflector, tailgate extender (under \$20.00, pays for itself many times over). Liner remains useable. Plans \$14.95. RLB Enterprises, Box 117834, Carrollton, Texas 75011.

KITCHEN REFACING SCHOOL

COMPLETE in-home course on kitchen refacing installations \$195. MC/VISA 1-800-426-6018

DOMES

DOME HOMES, CABINS - Super Efficient, Easily Built Kits. Natural Spaces Domes 1-800-733-7107.

FOR THE HOME

SAFELITER. Black & Decker Emergency Light. **DON'T LET SEVERE WEATHER PLACE YOUR LOVED ONES IN THE DARK EVER AGAIN!** Comes On Automatically When Power Fails. Use As Nightlight Or Flashlight. No Batteries To Replace. Two Year Warranty! Place One In Each Strategic Area Of Your Home. \$19.95 Each. T C Enterprises, 4303 Kerwick Drive, Greensboro, North Carolina 27409

SWIMMING POOL PURIFICATION SYSTEM. Copper/Silver Ionization. 50% savings. \$690.00. Free brochure. Purification Systems, 2320 Treasure Isle Dr., A73, Palm Beach Gardens, FL 33410. (708) 865-2436.

POWERFUL, inexpensive home central vacuum systems and hot tubs. Plans \$5 each. Scientech Enterprises, 35 Poplar St., Newport, R.I. 02840

BUILD YOUR OWN DRINKING WATER PURIFIERS. Complete plans for 5 reverse osmosis systems you assemble from off the shelf components \$12.95. Controlled Filtration Systems, Box 523, Feasterville, PA 19053

CHIMNEY SMOKING PROBLEMS? Write Chimney Components, P.O. Box 1803, Asheboro, NC 27203. Send \$5.00 for chimney troubleshooting guide and technical evaluation.

HOME BUILDING & REMODELING

NEW Booklet: Working Successfully With Architects And Builders. Free Details. SASE to: Paul Gaertner, AIA, 5704 Pine Lane, Crozet, VA 22932

HOMEBUILDER explains step by step method for **ESTIMATING COST** \$5.95. Builder, P.O. Box 791, Rowlett, Texas 75088-0791

PLASTICS

CASTOLITE Liquid Plastics. Crystal clear, colors. For casting, embedding, coating, fiberglassing, repairing and reproducing with our Mold Making Supplies. Catalog \$2.00. **CASTOLITE**, Dept. 92A/PM, 4915 Dean, Woodstock, IL 60098.

RUBBER COMPOUNDS, techniques. Make masks, molds, toys, parts. Catalog, \$1.00: Handmade, Box 16713 (A1), Memphis, TN 38186-0713.

VIDEO SHOWS HOW TO MAKE FIBERGLASS Automotive Body Parts, Boats, Etc. **NO** Experience or Special Equipment needed. VHS \$24.95 S/H \$3.50. **RUSH ORDERS** to: JHM Technologies, 5108 Chipman, Waterford, MI 48327

AIR CONDITIONING & HEATING

HIGH EFFICIENCY low cost air filters. Information \$1.00: Fresh Air Filters, 7491 Bay St. N.E., St. Petersburg, FL 33702

DO IT YOURSELF

BELT BUCKLES for coins, stones, jewelry mountings, cut stones, clock works. Wholesale catalog 25c. Eloxite, Box 729, Wheatland, Wyoming 82201.

ARROWHEAD Making. VHS \$29.95. S/H \$3.50. Commons, Box 5012-M, Central Point, OR 97502.

SAVE MONEY Major Home Appliance Repair Videos. Free Brochure 1-800-256-TAPE.

ELECTROPLATING Textbook. Electroplate Metallics/Non-metals. \$14.95. Details Free. Tropix, Palm Bay, FL 32906-0095

INSTRUCTIONS, EXPORT USA products, worldwide Now! Send \$3.00. Inell Wilcox, Box 20868 Dept. 1, Philadelphia, Penna. 19141

SURVEILLANCE TELEPHONE \$175.00. \$3.00 Catalog. Listen, 603 Elgin, Muskogee, OK 74401. 918-683-9589.

ELECTRIC TOOL MOTOR REPAIR MANUAL \$12.50. Canoles Associates, 20793 Audubon Avenue, Dunnellon, Florida 32630

WOODEN TOYS: Complete plans/instructions for 8 interlocking, shoebox size train cars. All 8 for only \$10.00. Kit #100. "STUCKY" Train Set, Box 30491, Honolulu, HI 96820

DISCOVER BENEFICIAL VCR HARDCOVER DUST PROTECTION, seven drawings only \$5.00, free instructions, supply limited, act now. Crestwood World Marketing, Inc., P.O. Box 35, Joliet, IL 60431.

FLAT ROOFS - SAVE 70%. SOLVE ANY PROBLEM. ANY SIZE ROOF. REVOLUTIONARY REINFORCED ACRYLIC SYSTEM. EASY, SAFE, FOOLPROOF. PROVEN 23 YEARS. WE MANUFACTURE, CONSULT, INSTRUCT. FREE INFORMATION: PML ROOFAGE, P.O. BOX 20784, LEHIGH VALLEY, PA 18002-0784.

FRAME PICTURES like professionals. Step by step manual plus wholesale catalog. \$19.95 plus \$2.50 S&H. Order now! **WAREHOUSE FRAMERS.** 1-800-227-2467.

FLEAS? Housewives new found secret. Rid your home and pet of this pest. Safe and natural. **NO PESTICIDES.** Easy instruction Rush \$3.00. C & L Enterprises, 1642 Ala Lani Street, Honolulu, Hawaii 96819

DOOR JAMMER prevent forced entry, stop burglars cold. Opens from outside for you. Plans \$5.00 and stamped self address envelope to: Door Jammer, P.O. Box 542431, Dallas, TX 75354

FREE information. Flea Control, Wild Animal Repellent. 1-800-336-6037 Proven Results.

EZ 1000% PROFIT! Turn books/household items into hidden compartment storage for valuables. \$5 to: Boots, Box 50072, Dallas, TX 75250

GLASS BLOCK WINDOWS - Beautifies interior and exterior. Increases illumination, privacy and value of homes. Protection against burglars and flooding. Complete instructions - \$6.00. Shed Some Light, P.O. Box 715, Addison, IL 60101

SAVE BIG BUCKS Fix Your Toro Type Paddle Snowblower Yourself. VHS Video \$29.95. Gregies, 472 S. Griggs, St. Paul, MN. 55105

PROJECTION TV ... Convert your TV to project 7 foot picture ... Easy! Results Comparable to \$2,500 Projectors ... **PLANS AND 8" LENS** \$29.95 ... Professional Systems available ... illustrated catalog free ... **MACROCOMA**, 15BE Main Street, Washington Crossing, Pennsylvania 18977 ... Creditcard orders 24HRS. 1-800-955-3979.

PROFESSIONAL REVEALS CARPET STEAM CLEANING SECRETS. Do It Yourself. Get Amazing Results. Valuable Guidebook Tells how. \$5.00 Guaranteed! SHAAK Productions, P.O. Box 7507, Fremont, CA 94537

THREE PHASE POWER Converted From Single Phase. Diagram/Instructions \$12.95. Excel Converters, Box 476, Osceola, IN 46561

MAGNETS

MAGNETS—All types. Discounted prices. Send stamp for brochure. Texan Accessories, Box 23518, Ft. Lauderdale, FL 33307

ARTS, CRAFTS, SUPPLIES

CUSTOMIZE T-shirts. Iron-on Letters, Numbers. Discount T-shirts. 1-800-728-0300.

BUILD clocks for profit (cost under \$8.00 each!). Our videos show you how! Wholesale clock catalog \$3.00 (credited) contains over 1500 items! Steebar, P.O. Box 463-P, Andover, NJ 07821-0463.

(Continued on next page)

ARTS, CRAFTS, SUPPLIES

(Continued from preceding page)

"GETTING Started in Stained Glass." \$1.00. Whittemore, Box 2065T, Hanover, Mass. 02339

CLOCK WORKS, beading supplies, rockhound supplies, belt buckles, cut stones. Wholesale catalog 25c. Eloxite, Box 729, Wheatland Wyoming 82201.

STAINED GLASS, tools, supplies, kits, and more. Catalog \$1.00, USA mail only. AmeriGlas, Department MPM201, Box 27668, Omaha, Nebraska 68127-0668.

GLASSBLOWING FOR BEGINNERS, Book And Video, Hobby Or Business, \$39.95. Wheeler, 2615 West Naranja, Mesa, AZ 85202

MODELS, MODELS SUPPLIES

LIVE STEAM MODELS! 100-KITS, ASSEMBLED, ACCESSORIES, PARTS. LARGE DISCOUNTS. Stunning Colored Catalog \$5.95 Refundable. Diamond Enterprises & Book Publishers, Dept. PMN, Box 537, Alexandria Bay, NY 13607 Phone: (613)-475-1771

MAGIC TRICKS, JOKES, VENTRILOQUISM

PROFESSIONAL MAGIC! Huge Catalog, over 1,000 Tricks and Books \$4.50. Hank Lee's Magic Factory, Dept. PM1, 125 Lincoln Street, Boston, Massachusetts 02111.

VENTRILOQUIST Supplies. Instruction. Information FREE! Dummy Catalog \$2.00. Maher, Box 420-PM, Littleton, Colorado 80160.

FREE! World's Leading Novelty Catalog. 1600 Jokes, Tricks, Science, Sports, Hobbies. Johnson-Smith, F-01, Bradenton, FL 34206-5500

MAGIC, JOKES, NOVELTIES, Super Catalog \$1.50. Huey's House Of Fun, P.O. Box 505, Wallis, TX 77485

MAGIC tricks, books, videos. For catalog send \$2.00 to: **THE MAGIC CAT**, POB 157, Waukegan, IL 60079

THIS IS A SCREENED AD!

LET YOUR Advertisement Achieve The Same Effect! For An Additional \$50.00 Per Advertisement You Can Order Our Screening Process. Same Price Applies To All Advertisements No Matter What Size, Small Or Large. For More Information Call **POPULAR MECHANICS CLASSIFIED—1-212-649-3167**.

FLAGS

FLAG CATALOG - \$1.00. Browse 'n' Buy, Box 504-M1, Bohemia, NY 11716-0504.

DECALS, EMBLEMS, PATCHES

CUSTOM EMBROIDERED EMBLEMS, PINS, DECALS. Free Catalog/Quotes. Rush Sketch, Stadr, 57 Leroy St., N.Y.C. 10014, (212) 929-2293

MY PET bumper sticker. Blue and White. \$1.00, 1313 S. Shiloh, Suite 104P, Garland, Texas 75042

ANTIQUES, RELICS, INDIAN GOODS & CURIOS

FREE List to Serious Collectors. 300,000 Indian Artifacts, Spears, Pots, 50,000 Minerals And Fossils. Caddo Trading, Box 669, Murfreesboro, Arkansas 71958

STAMP COLLECTING

FREE Giant Bargain Stamp Catalog. Full Of All The Latest Offerings On Worldwide Stamps, Accessories And Supplies. Baseball Cards, Postcards And Banknotes. Plus You'll Receive Stamps On Approval. Buy Only What You Like, Return Balance. Satisfaction Guaranteed. Jamestown Stamp Company, Inc., Dep't. E12PM, Jamestown, NY, 14701-0019

1,000 Stamps. \$2.95. Guaranteed worth over \$30 at standard catalog prices! All-Different. 55 countries! Money back if not delighted. Approvals: Kenmore OM-479, Milford, NH 03055.

UNITED STATES 10 Mint Commemoratives 10c. Approvals: Cornetta, POB 1509-M, Lake Placid, Florida, 33852

"INVERTED ERROR" + 100 Different United States. 50c with approvals. Luray, P.O. Box 7088, Silver Spring, MD 20907

FREE sample plus catalog. Jefferies, 3480 Middlebelt, West Bloomfield, MI 48323

50 DIFFERENT Old U.S. between 1861 and 1939 - \$1.00. Ed Roush, Box 3734, Mansfield, Ohio 44907.

OLD U.S. stamps on approval. Sherman, Box 15355E, Philadelphia, PA 19111

ONE! Two! Three! Cent Stamp Approvals. Regardless Catalog. Kloster, 4164 52nd St., San Diego, CA 92105

10 OLD Mint U.S. Commemoratives, 25c! Approvals. Global, Box 7429-P3, Olympia, WA 98507.

INEXPENSIVE complete sets. Approvals. Bode, Box 328W, Markham, ON L3P 5S9

ISRAEL 15 Different 10c Approvals. Sam Chazen, Box 666, Delray Beach, Florida 33447

PHOTOS & PHOTO SUPPLIES

\$3,000 PHOTOGRAPHY COMPETITION! RUSH SASE: UNLIMITED EDITIONS, BOX 4144, GREENSBORO, NC 27404.

PLAYS, SONGS, MANUSCRIPTS

\$1,200.00 Cash Prize. Poems Wanted For New Songs - Recordings - Publishing. Broadway Music Productions, Box 7438-PM, Sarasota, FL 34278.

MUSIC INSTRUCTIONS & INSTRUMENTS

VIOLIN, GUITAR, etc., making materials, accessories, books. Catalog, \$1.00. International Luthiers Supply, Box 580397, Tulsa, OK 74158

ACCORDION Top Brands, Cordovox. Buy Direct Tremendous Discounts. Trades, accepted. Free brochure. PM, Accordion-O-Rama, 16 West 19th Street, New York, NY 10011. Phone 212-675-9089.

ACCORDIONS, CONCERTINAS, Button boxes, new, used, repairs, trades, credit cards. Castiglione, Box 40S, Warren, MI 48090. Catalogs 313-755-6050—800-325-1832

INSTRUMENT Kits! Build Appalachian and hammered dulcimers, banjos, mandolins; even harps, harpischords. Free Catalog. PM Hughes, 4419 West Colfax, Denver, CO 80204

ACCORDION lessons by mail using your camcorder. Send \$5 for VHS demo tape and details. Brian Rude, 610 Oakland, Rapid City, SD 57701

SELF IMPROVEMENT

WIN CONSISTENTLY Poker, Blackjack, Dice, Bingo. Write: Verner, 820 Coriander L, Torrance, CA 90502

EDUCATION & INSTRUCTIONS

BECOME A PARALEGAL. HOME STUDY. FREE CATALOGUE. 800-362-7070 DEPT. LA127.

FREE CAREER GUIDE. Earn more money with Success Proven Correspondence Diploma Courses. Granton Institute, 263A Adelaide Street, West Toronto, Canada, M5H 1Y3

INVESTIGATION CAREER. Quick home study. Become a professional. (800) 272-6680.

NONRESIDENT UNIVERSITY DEGREES. Bachelor's, Master's, Doctorates. Accredited, inexpensive, fast. Credit for life experience. Free sixteen page booklet. Dr. John Bear, P.O. Box 826PM, Benicia, Ca. 94510. 1-800-835-8535.

LOCKSMITHING, Universal School of Master, Correspondence and Shop Training, Box 214652PM, Sacramento, CA 95821

PIANO TUNING PAYS - Piano tuning - Electronic organ servicing. Learned easily at home. Free booklet. Niles Bryant School, P.O. Box 19700, Sacramento, CA 95819

TERMPAPER assistance. 19,278 papers available! 306-page catalog—rush \$2.00. Research, 11322 Idaho, #206MK, Los Angeles, 90025. Toll-Free Hotline: 800-351-0222 (California: 310-477-8226)

PARALEGAL GRADED CURRICULUM. Approved home study. Most affordable and comprehensive. 100 years of legal training. Free catalog (800) 826-9228. **BLACKSTONE SCHOOL OF LAW**, P.O. Box 871449, Department PM, Dallas, TX 75287.

FREE COLLEGE TAPE External Degrees, Business/Public Administration Law, Graduate-Undergraduate Financial Aid. (800) 759-0005 Extension 617. LaSalle University, Mandeville, LA 70470-4000

LEARN Homeopathic Medicine or Naturopathy from Internationally Accredited School, to Professional Diploma standard. Other courses: Dietetics, Radionics. Established 1961. Prospectus Free (airmail 2 Dollars) **BRANTRIDGE FOREST SCHOOL**, Highfield, Danehill, Sussex, England RH177EX. Telex 95246. FAX 0825-790097. Tel 0825-790214.

BECOME A PATENT PROFESSIONAL. Patent inventions before the U.S. PTO. For more information call PPG at 1-800-523-2509

UNIVERSITY DEGREES Without Classes! Accredited Bachelor's, Master's, Doctorates. Free Revealing Facts! Thorson-PM1, Box 470886, Tulsa, OK 74147.

COLLEGE FINANCIAL AID Millions of dollars go unclaimed each year. Get your fair share. Free brochure. Results guaranteed. 1-800-283-8600 Ext. 148

READING Basics. Twenty Charts. Tape. \$20. CTM, Box 568, Pleasant Grove, Utah 84062

BE SAVED And Seeking Salvation. 1127 NE Fifth St., Ocala, Fla. 32670

HIGHSCHOOL Students College Bound. Grants, Scholarships, Loans. Free Info. 1-800-872-1221 Ext. 1674.

FULLY APPROVED UNIVERSITY DEGREES! Economical home study for Bachelor's, Master's, Ph.D., **FULLY APPROVED** by the California Superintendent of Public Instruction. Prestigious faculty counsels for independent study and life experience credits (5000 enrolled students, 400 faculty). **FREE INFORMATION**—Richard Crews, M.D. (Harvard), President, Columbia Pacific University, Department 2E81, 1415 Third Street, San Rafael, CA 94901. Toll free: (800) 227-0119; California: (800) 552-5522; or (415) 459-1650.

SCHOOLS

HIGH SCHOOL AT HOME, NO CLASSES. LOW MONTHLY PAYMENTS. INFORMATION FREE. EST. 1897. CALL 1-800-228-5600 OR WRITE AMERICAN SCHOOL, DEPT. #345, 850 E. 58TH ST., CHICAGO, IL 60637.

EMPLOYMENT INFORMATION

ALASKA employment, land programs, business opportunities. Settler Newsletter \$10, Box 34118, Juneau, AK 99803.

HELP WANTED

OVERSEAS. To \$1000 Daily! **FREE** list. **ZINCPO**, Box 585, Dearborn, MI 48120

GUARANTEED Work! Honest/Legitimate! Assemble products at home. 800-226-3601 x7030.

LAW ENFORCEMENT JOBS. \$17,542-\$86,682/yr. Police, Sheriff, State Patrol, Correctional Officers. Call (1) 805-962-8000 Ext. K-20024

ASSEMBLE PRODUCTS At Home! Workers Needed Now! Many Positions. Call For Details. (415) 206-7744, Ext. 105.

\$329.82 Weekly Assembling Our Products At Home. 1-800-333-3294 ... 415-432-2514 (Message).

OVERSEAS ... \$30,000 - \$75,000+. Free Report! Employment, Box 5730-AM, Lighthouse Point, FL 33074.

EASY Work! Excellent Pay! Assemble Products At Home. Toll Free 1-800-467-5566 Ext. 5038

AUSTRALIA WANTS YOU! Big Pay! Transportation! New Employment Handbook — \$3.00. International, Box 5730-AM, Pompano Beach, FL 33074.

GOOD PAY! Make simple products at home! **SASE**: Creations, Box 563-PM, Newport, OR 97365

POSTAL JOBS to \$60,896: Plus Vacation, Retirement, with proven system. Free details - Happiness, Box 527, Belleville, Kansas 66935

FOR INVENTORS

PATENT IT ECONOMICALLY! Free details. Licensed since 1958. Raner Associates, 2008 Fondulac, Richmond, VA 23229.

WORK DIRECTLY WITH REGISTERED PATENT ATTORNEY AND ENGINEER

WITH thirty-one years combined engineering and patent experience, U.S. and international patent applications, **PATENT** and **DEVELOP** your idea with the experience of an expert. Call or write for free **CONFIDENTIAL DISCLOSURE, RECORD OF INVENTION** and **148 PAGE BROCHURE**. Introduction to Industry, Marketing Plans, Overseas Production, Prototypes and Research Readily Available. Also specializing in Copyrights and Trademarks—**LESS THAN ONE HOUR FLIGHT TIME TO U.S. PATENT OFFICE—TOLL FREE FROM U.S. AND CANADA 800-367-7748** or write: **MICHAEL I. KROLL** Registered Patent Attorney, U.S. Patent registration #26,755; 171 Stillwell Lane, Syosset, New York 11791. Outside USA (516) - 367-7777 - FAX: (516) - 692-2787.

PATENT AND DEVELOP Your Invention. Registered Patent Agent and Licensed Professional Engineer. Send for **FREE PATENT INFORMATION** Every Inventor Should Have. Richard L. Miller, 12 Parkside Drive, Suite-M, Dix Hills, NY 11748-4879. (516) 499-4343.

INVENTORS! Can you patent and profit from your idea? Call **AMERICAN INVENTORS CORP.** for free information. Serving inventors since 1975. 1-800-338-5656.

(Continued on next page)

FOR INVENTORS

(Continued from preceding page)

BE A SUCCESS! NEW BOOK helps inventors register patents, trademarks, trade secrets, copyrights, more. 1-800-837-1037.

INVENTIONS, ideas, new products. We submit to industry. Call 1-800-288-IDEA.

ACCUSEARCH Specializes in Thorough, Prompt, Inexpensive Patent Searches. 1-800-999-5498.

FREE protection forms and information kit. Affiliated Inventors Foundation. 1-800-525-5885.

REGISTERED PATENT ATTORNEY. D.A. Kettlestrings. Free Information. 1-800-748-6216

IDEAS To Manufacturers - \$60.00. Get Started - \$29.00. Balance Later. Danco, 5050 Klondike Road, Lithonia, Georgia 30038

INVENTORS! Your first step is important. For **FREE** advice call **ADVANCED PATENT SERVICES**, Washington DC 800-458-0352.

ALL New Ideas/Products Free patenting, development and licensing package. call Davison & Associates 1-800-677-6382.

LEARN how to offer your invention for sale or license. Free booklet outlines procedures, royalty rates, requirements. Kessler Sales Corporation, C-5-FI, Fremont, Ohio 43420.

CONCEPT TO REALITY . . . Let our Professional team engineer your invention for producibility, develop a marketing analysis, and pursue a patent. Call or write for free information. Diversified Products, 301 N. Main, Suite 304, Pueblo, CO 81003. 1-800-782-0771.

PATENT SEARCHES. **FREE** Details, PatentFinders, Suite 185-B, 3220 N Street, N.W., Washington, D.C. 20007.

TALK IS CHEAP. Have an idea? Don't know what to do? Before you spend thousands, spend a few minutes with IvenTel. We can help. 1-900-226-8368. \$1.95 per minute. Not a recording.

NEED HELP Figuring the Cost of your Advertisement?? Call us at 212-649-3167 or send us a FAX (212-586-5562) and we'll FAX Back with a Price Quote.

INVENTIONS WANTED

INVENTORS - Eureka Solutions pays to showcase patented inventions! Patentable ideas considered also. Free information 1-800-869-3255.

INVENTORS: Call TICI for free information/Inventors Newsletter. 1-800-468-7200 24 hours/day - USA/Canada

INVENTORS! Call IMPAC for free information kit. USA/Canada: 1-800-225-5800 (24 Hours!).

INVENTIONS DEVELOPED & MARKETED. Licensed Professional Patent Development Engineer, U.S. Patent Office Former Examiner, Manufacturers Representative, Suite 3815 PM, Woolworth Bldg., New York, NY 10279.

INVENTORS: Free information on offering your invention for sale. Kessler Sales Corporation, C-5-IW, Fremont, Ohio 43420.

REAL ESTATE & FARMS

WHY RETIRE TO FLORIDA? Over half of North Carolina retirees came from Florida - learn why! North Carolina golf & lake homesites from only \$10,900. Free literature. 1-800-768-7358.

REAL ESTATE FOR SALE . . . Hunting & fishing retreats, lake & river camps, all types of wilderness properties . . . Call or write for our **NEW FREE CATALOG** showcasing thousands of real estate values nationwide! **UNITED NATIONAL REAL ESTATE**, 4700-PM Bellevue, Kansas City, MO 64112. Ph: Toll Free: 1-800-999-1020.

CALIFORNIA. Lots. Acreage. \$50.00 Down. \$50.00 Monthly. Box 35291, Los Angeles, 90035

GOVERNMENT HOMES from \$1 (U repair). Delinquent tax property. Repossessions. Your area (1) 805-962-8000 Ext. GH-20024 for current repo list.

NORTHERN IDAHO. 5-10-20 ACRES. Beautiful Northwest forest and lake country. Hunting, Fishing, Recreation, Retirement. **FREE** brochure. **NATIONAL ASSOCIATED PROPERTIES**, 1111-ME Sherman, Coeur d'Alene, Idaho 83814. (208) 664-8161.

GOVERNMENT LANDS

HOMESTEADING government land: how, where, and "secrets" you must know first. 80 pages. \$16 plus \$2 shipping. R&D Associates, Suite 520A, 219 First Avenue North, Seattle, WA 98109.

GOVERNMENT LAND OPEN TO CLAIM, 20 to 40 acre locations available for \$20 government fee in Alaska, Arizona, Arkansas, California, Colorado, Florida, Idaho, Louisiana, Mississippi, Montana, Nevada, New Mexico, Oregon, Utah, Wyoming. For complete instructions, maps, filing forms and telephone helpline send \$20; or for more information send \$3. Public Lands Title, P.O. B. 2945-X, Port Angeles, WA 98362

BUY IT WHOLESALE

ROLEX PRESIDENT/SUBMARINER Exact Replicas. Quality Watches. Wholesale Prices. Brochure. 1-800-553-4334.

BELTS, Buckles, Hat Tacs, Jewelry. More. Complete line fast sellers. Big Profits. Complete dealer set up. Color catalog \$1.00. Anchor, Box 3958-PMR, North Providence, RI 02911

EARN MONEY selling Gold and costume jewelry, rings, watches-Buy Direct. 130% Below Retail. Catalog \$1.00. Anka-PM, 40 Freeway Drive, Cranston, RI 02920

CLOSEOUT Jewelry & Craft Supplies. (Catalog 50c). Roussels, 107-1631 Dow, Arlington, MA 02174-7199

VACUUM CLEANERS "Discount Prices" New Rainbow \$699.95, Kirby, Filter Queen, Tri-Star, Panasonic, Royal, Oreck. Details: ABC Vacuum Warehouse, 6720 Burnet-PM, Austin, TX 78757. (512) 459-7643.

BUCKLES, Belts. Giant line. Fast sellers. Fantastic Profits. Huge Color Catalog \$1.00. Buckles, 4320 Anthony Ct., Suite 12, Rocklin, CA 95677.

WHOLESALE Vertical Blinds and Vinyl Mini-Blinds. For complete price list, send \$1.00 to: Wholesale Blinds, 307 #G4 N. Euclid Way, Anaheim, CA 92801 or call Curt (800) 654-9151.

COMPRESSORS - factory direct, U.S. made 1/4-3/4 H.P., electric/gas, new/repared. **SPRAY EQUIPT., GUNS, TANKS**. Catalog, price, def. Compressors. Box 613, Lake Forest, ILL 60045. \$6.35

ADVERTISING AGENCIES, ADV. SER. MAILING LISTS

ACTIVE NEW OPPORTUNIST NAMES! GUARANTEED! FAST DELIVERY! MIXED STATES! 200/\$12; 500/\$18; 1000/\$28. **DEALER'S CO-OP, BOX 526-PM, GRIFFITH, IN 46319. 1-(800)-992-9405.**

FREE SAMPLE! OPPORTUNITY SEEKER/MLM NAMES. VENTURE-LP, BOX 336, RIVIERA, AZ 86442 CALL 1 (800) 628-7060 VISA/MC

RUBBER STAMPS

MAKE Rubber Stamps. Highly Profitable. Free details. Stamper, POB 22809 (GX), Tampa, FL 33622

PRINTING PRESSES, RUBBER STAMP OUTFITS

BARCO Type Founders: Type and Rubber Stamps catalogue. Mail \$2.00 refundable on first order. P.O. Box 1011, Bensenville, 60106

TYPE for printing and stamps. Catalog \$2.00 deductible. Quaker City Type, R.D. 3, Box 134, Honeybrook, PA 19344

RUBBER Stamp Makers. Letterpress Printers Supply Catalog. \$2.00 Deductible. Acme/Star, 1720 N. Marshfield, Chicago 60622

CLOCKS, WATCHES, OLD GOLD, JEWELRY

HIGHEST CASH for Gold, Jewelry, Gold Teeth, Rings, Diamonds, Watches, Silver, Platinum. Mail Articles Today. Free gift with information. Chicago Gold & Precious Metals, 10 South Wabash, Dept. 558, Chicago, 60603.

BUYING Gold, silver, forklift contacts, silver solder, gold and silver coins. G.F. R.G.P., gold plated electronic scrap and eyeglass frames. R.L. Refiners, 652 Myrtle St., Elizabeth, N.J. 07202. 908-353-5049.

TAKE NO CHANCES. Deal with oldest, most reliable firm in old gold business. Established in 1934. We buy Gold, Silver, Platinum, Diamonds, Highest Cash. Free Information: Rose Industries, 29-A East Madison, Chicago 60602

TREASURE FINDERS

ATLANTIS finally located near Canada. Gold needs salvaging. Details US\$30. Alexander Strang Fraser, Box 991-K, Nelson, BC, Canada V1L 6A5

MANUAL ROCK CRUSHER and pulverizer you can build for \$60. Complete instructions and illustrations. \$15.00 **DEVINING ROD** How to make and operate this amazing locating tool. Complete instructions and illustrations. \$15.00 to: **R.G. TECH PUBLICATIONS**, Box 8245, La Crescenta, CA 91224-0245

PROFITABLE OCCUPATIONS

FREE information Starter & Alternator Rebuilding. Box 422, Seymour, TN 37865

FREE Brochures. Repair Air Conditioning, Refrigeration, Gas Heating, full instructions. Doolco, Inc., 11252 Goodnight, Dallas, TX 75229. 1-800-886-COLD.

PLASTERCRAFT . . . Profitable Home Business 3000 Molds Available. Details. Lynette, 6251C Mentpark, Mentor, Ohio 44060.

SALESMEN-DIST.

MAKE EXTRA MONEY DURING YOUR SPARE TIME! Earn weekly commissions showing our exciting line of Calendars, Pens and other popular Advertising Gifts. Prompt, personal service from AAA-1 firm. Our 82nd year. No experience necessary. No investment or Collections. Set your own hours. Full Time Potential! Write to: Richard Lowe, **NEWTON MANUFACTURING COMPANY**, Dept. MA24244, Newton, Iowa 50208. 515-792-4338.

BUSINESS OPPORTUNITIES

IMPORT - Export opportunity, profitable world-wide, mail order business from home, without capital. We ship plan for no risk examination. Experience unnecessary. Free Report. Mellinger, Dept. W2703, Woodland Hills, California 91367

\$225 DAILY "CHROME PLATING" Auto Parts, Motorcycles, inexpensive, easy, (Free) information: Chrome Plating, Box 2285, Waldorf, Maryland 20604

"JUNKED" Tires \$1.00 Pound? (Send Stamp). Le Valleys, B1191-E, Wildwood, FL 34785

LET The Government Finance your small business. Grants/loans to \$500,000. Free recorded message: 707-449-8600. (KZ3)

MAKE Rubber Stamps. Highly Profitable. Free details. Stamper, POB 22809 (GC), Tampa, FL 33622

BECOME A REAL ESTATE APPRAISER. Home Study. Earn Professional Designation. Free Literature. 800-362-7070 Dept. RA127.

14,947 HONG KONG-TAIWAN Products Cheap. Small lots. Some samples free. Harbor, Box 1719PM1, Yuba City, CA 95992

MAKE YOUR DREAM COME TRUE, EARN \$75,000 YEARLY REPAIRING LARGE CRACKS IN WINDSHIELDS AND PLATE GLASS, NOT REPLACING THEM. CALL TOLL FREE 1-800-826-8523 (US/CANADA) OR WRITE: THE GLASS MECHANIX INC., 10170 NW 47TH ST., SUNRISE, FL 33351

EARN \$500 WEEKLY mailing letters. Free Details. Omega, Box 4309-A, West Covina, CA 91791.

MAKE MONEY IN YOUR OWN MAIL ORDER BUSINESS. Step by step program to achieve financial freedom. Send \$5.00. Brien and Assoc., Dept. PM-100, 16 Sherman Ave., Dobbs Ferry, NY 10522

MAKE \$15,000 MONTHLY! Easy. No investment. McDowell, Box 5529-A, Diamond Bar, CA 91765.

PROFITABLE Gold Foil Printer. Personalize business cards, pencils, matches. Free details. Gold, POB 24986 (GC), Tampa, FL 33623

HYDRAULIC JACK REPAIR MANUAL, CATALOG \$10.00. HYDRAULIC PARTS SUPPLY, BOX 4157, BROWNSVILLE, TEXAS 78520-4157

RECYCLE METALS. NO, NOT BEER CANS! Easy \$458 weekly! Free information. Recycler, Box 1214, Franklin, TN 37065-1214

PIANO Tuning quickly learned with home study courses. Diploma granted. American Tuning School, 17050 Teller Drive, Morgan Hill, Calif. 95037.

\$392.00 From Square Foot Plywood. (Huge Demand) Revealing Proof \$1.00 (Refundable). Woodwin, Bridgewater, Mass. 02324-2299

LEARN Sewing Machine Repairing. Men, Women. Lucrative Profits. Gresslin Correspondence School, Box 5104, Spencer, Iowa 51301.

(Continued on next page)

BUSINESS OPPORTUNITIES

(Continued from preceding page)

VENDING MACHINES. No selling. Routes earn amazing profits. "Big Catalogue FREE." Parkway Corporation, 1930 PMB Greenspring Drive, Timonium, Maryland 21063

EARN hundreds in finder's fees processing tax refunds. Local or national. \$15.95. Louis King, 803A W. Washington Blvd., Ft. Wayne, IN 46802-3356

NEW! GROW EXPENSIVE PLANTS. SELL FOR 2,000% PROFIT. Free information. Growbiz, Box 306-M1, Seminary, MS 39479

TAKE PICTURES for profit. Camera Ventures, Box 771, Lamar, CO 81052

MAILORDER Books. 1,000% Profit. Selectco, Box 1140, Clearwater, FL 34617

\$500.00 FROM ONE SACK CEMENT! FREE Picture Proof. BRINCO, Box 1092-M, Hesperia, CA 92345

BIG PROFITS! REPAIRING WINDSHIELDS and plate glass. \$70,000 yearly. Call 1-800-441-4527 for FREE details. Glass Technology, Inc., Dept. 12P, 434 Turner Dr., Durango, CO 81301

\$40,000 ON 1/2 ACRE! New Hydroponics - inexpensive, pleasant, practical! Free information. Robin's, Box 1214, Franklin, TN 37065-1214

\$1,000 WEEKLY AIR TOOL REPAIRING. Instructions, Parts and Tools Wholesale. Free Details. Box 534, Wichita Falls, TX 76307

VINYL'S where the money is! Professionally repair, recolor furniture. Quick, easy. Two \$20 jobs a day earns you \$1,000 a month. Homes, cars, offices, restaurants. Start earning in a few days. Details free. VIP, 2007 Montrose, Chicago 60618.

START A Million Dollar mail order business. We drop-ship 2955 best selling products. Lowest below wholesale prices. Immediate delivery. Spectacular home business opportunity. Free Book. SMC, 9401 De Soto Avenue, Dept. 20-37, Chatsworth, CA 91311-4991.

AUTO BATTERY RECONDITIONING! (EASY!). EARN HUNDREDS WEEKLY!! TRADE "SECRETS" REVEALED! (FREE) INFORMATION! BATTERY OUTLET, BOX 3300PM, HICKORY, N.C. 28603-3300.

\$1,000'S POSSIBLE, FREE. Stamped envelope: Progress, Box 93248, Los Angeles, CA 90093.

HOME Assembly Work Available! Guaranteed Easy Money! Free Details! Homeworker, Box 520, Danville, NH 03819.

ASSEMBLE PRODUCTS AT HOME. Many opportunities paying High Weekly Profits presently available without investment. Write: Businesses-B, Box 9008, Baldwin, New York 11510-9008

FORMICA: Repair Burned and Damaged Countertops WITHOUT REPLACEMENT! Quick, easy to \$600/day. Change Countertop Colors WITHOUT REMODELING! Details FREE! 206/256-9742. Write today to: Renew-All, Box 9900PC, Vancouver, WA 98668.

15,000 PRODUCTS Asian Factories. Lowest Prices. Deal Direct. Free Report. JHC, Dept. PM192, 8211 Mail Route, Sinking Spring, PA 19608.

RECORD VIDEOTAPES ... At Home. \$5,000 Monthly Possible. No Pornography. Free Details. Write: CMS Video Company, Dept. 17, 210 Lorna Square - #163, Birmingham, AL 35216.

\$10,000.00 MONTHLY TAKING PHOTOS at home! Photopro, 1811 Crenshaw #235M, Torrance, CA 90501. Recorded info: (213) 549-0997.

BIG MONEY REPAIRING AUTO WINDSHIELDS. Supplies and Information. Grubbs Glass Patch, P.O. Box 243, Monticello, AR 71655. 1-800-243-2213

ASSEMBLE PRODUCTS At Home! Workers Needed Now! Many Positions, Call For Details. (415) 206-7744, Ext. 101.

MAIL POSTCARDS, RECEIVE MLM COMMISSION CHECKS. Send \$1.00 for plan. Pearl Duddles, 1134 Miramonte, Mountain View, CA 94040.

BUY REAL ESTATE WITH LITTLE or NO CASH. Investments, Box 1092, Hesperia, CA 92345.

MAILORDER OPPORTUNITY: Start profitable home business without experience or capital. Information free. Mail Order Associates, Dept. 411, Montvale, NJ 07645

SILKSCREEN T-SHIRTS. Instructional video. Free details. Curmet Philmore, 4017 McDermed, Houston, TX 77025

\$4,000 WEEKLY helping United States government. No experience. DETAILS 1-813-852-8930

BUY Wholesale, Automotive, Industrial Supplies, Parts, low prices, high profits. No Experience necessary. Details Free: 139-07 Franklin Ave., Flushing, NY 11355

\$500.00 HOURLY Taking Photographs For Me! No experience needed. Free Report call recorded message: (303) 674-8155.

MAKE HOMEMADE BOOKLETS. I've earned \$187,000 with mine. Free information. Falcon, P.O. Box 5320, Sevierville, TN 37864

CAN YOU MIX CEMENT! This Business Is For You. Make And Install Pavingblocks For Big Profit. Details. Beck Engineering, P.O. Box 1304, Melville, NY 11747.

EARN \$8000 MONTHLY STAYING HOME! Free Details: Direct, Dept. PM192, Box 330370, Kahului, HI 96732-0370

BUMPERSTICKER Printer. Cheap, simple, portable. Free details. Bumper, POB 22791 (GC), Tampa, FL 33622

IDEAL WOODWORKING BUSINESS. Unusual Money Maker! Send Stamp. Pine Shop, 897-3 Mammoth, Manchester, NJ 03104.

GET RICH IN CONSTRUCTION. "SECRETS I USED TO EARN OVER \$1,000,000" For Beginner or Pro. One idea can earn you thousands. \$7.95 + \$2.00 Handling. CenturyPM, Box 2501, Darien, IL 60559

YOUR OWN BUSINESS - NO RISK Start profitable scholarship matching business from home without experience or capital. Free information. 1-800-365-8700 Ext. 926

\$5000 MONTHLY POSSIBLE! Details, Stamp. Charles, Box 823, Jonesville, VA 24263-0823

"MONEY Brokerage" Lucrative! (Free Booklet). Sources, PM-1, Box 291332, Davie, FL 33329

NEW! 2000% PROFITS - in Moldmaking/Casting. Free information: Castcrafter, Box 18586(M1), Memphis, TN 38186-0586

MILLIONS Being Made Contracting. NO Experience Necessary. Men or Women. Young or Old. For More Information, Write: Here's How Inc., P.O. Box 425, Aurora, OR 97002

HOW TO MAKE \$50,000 IN 90 DAYS AT HOME. Easy step-by-step business plan. send \$2.00 LSASE. A.P. Enterprises, 25440 Ciocndela, Carmel, CA 93923

SECRETS REVEALED Gigantic profits. Proven mailorder program. Free details. Field Enterprises, 498 16th St. NW, Largo, FL 34640

FREE LIST—"legitimate" companies offering home-employment. (Many choices!) Write: Joblist - PM192, Alexandria Bay, New York 13607-0250

GET Paid For Distributing Flyers On Parked Cars at Movies And Concerts. Contact Axion, Box 8015-A, Ann Arbor, MI 48107. 313-761-4842.

MAKE GREAT MONEY FIXING CARS. \$200/day business on shoestring budget. Secrets, how-to manual \$19.95. RSJ Industry, P.O. Box 271445, Escondido, CA 92030.

\$2000 monthly. No investment. Free information. Livingwell, Box 80334, Phoenix, Arizona, 85060

EARN \$1000 WEEKLY with your own low investment business! I've done it, so can you! FREE DETAILS! SASE. RAW Publishing Co., 3814 Cottle, Sanger, CA 93657.

\$1804 MONTHLY Buy/sell used cars (spare-time) FREE Details. Autonet, 507 Oak Drive, Friendswood, TX 77546

\$500. DAY IN YOUR MAILBOX. Send \$2.00 + SASE to: Knight Press, Box 90, Ft. Thomas, Kentucky 41075

ALUMINUM SCRAP—"Recycle Yourself"—SELL FOR \$25.00 POUND! FREE Information: Americrap - PM192, Alexandria Bay, New York 13607-0127

START Your Own Profitable Business At Home Easily With Little Or No Money. Supplement Your Income. Anyone Can Do It. Free Details. Evans O'Keefe Publishing, 280 P.A.S. #22A-PM, NYC 10010

\$300-\$600 Daily - Refinishing Bathtubs/Sinks/Tile. New Space Age Diamondglaze® Process. Tub King, 1153 N. Dearborn, Suite 425, Chicago, IL 60610. (312) 792-7071.

LEARN Ring Sizing/Repair. Gold Testing to buy & sell profitably. Gold Plating & More! Home Study Video. \$69.95 Conder Jeweler's Institute. (800) 654-6552

GET RICH! Secret law smashes debts—brings Cash, Credit!! FREE report!! Wealthkit/B, Box 32398, PBG, FL 33420

#1 MONEY MAKER Spare Time! No selling! No inventory! Publicly documented seven week \$19,919 income! Free audio cassette and Report reveal everything. Real Money, 111-PM West Topa Topa, Ojai, CA 93023

\$100,000 + (Homebased) Possible! No Selling/No Gimmicks. Free (40Page) Guide 1-800-343-3155.

\$300.00 PER DAY for MAILING LETTERS! Details FREE! Money-makers/B, Box 32368, Palm Beach Gardens, FL 33420

\$400.00 DAILY from your telephone answering machine! Never talk to anyone! CommTech-B, Box 32398, Palm Beach Gardens, FL 33420

MAILORDER Opportunity! Beginners Welcome! Details - \$1! FP5, BX1116F, Toronto, Canada, M4Y 2L5.

\$200 - \$500 weekly—AT HOME! No gimmicks—Details FREE! Homewokers-B, Box 32397, PBG, FL 33420

"HOW TO MAKE MONEY" Books in all categories. Catalog \$2.00. Planobarn, P.O. Box 1234-PM, Watermill, NY 11976

MONEYMAKING OPPORTUNITIES

BUMPERSTICKER Printer. Cheap, simple, portable. Free details. Bumper, POB 22791 (DD), Tampa, FL 33622

EARN \$500 WEEKLY mailing letters. Free Details. Omega, Box 4309-AM, West Covina, CA 91791.

MAKING EXTRA MONEY MADE EASY. FREE Subscription to Opportunity Magazine offers hundreds of proven ways. Write: Opportunity, Dept. S85, 73 Spring, New York, NY 10012.

HIGH Profits With Custom T-Shirts And Caps. Transfer machines, supplies. Press, POB 22809 (GG), Tampa, FL 33623

MAKE money watching T.V. exciting new method. Free Details. Trading, P.O. Box 1729, Pacifica, CA 94044

FREE DEMO VIDEO shows amazing new, easy-to-use system for engraving/carving any custom design on wood, glass, metal, ceramics, stone, porcelain, bone and most other surfaces. Call Paragrave Corporation toll-free at (800) 624-7415 or (801) 225-8300.

IT WORKS. Professional Knife Sharpening. Easy Step-By-Step Instructions and More on Video Cassette. Low Start-Up Cost and Overhead. Send \$49.95 + \$4.50 S&H To: Len Eisenzimmer, P.O. Box 30225, Portland, OR 97230-0225. Not Available In Oregon.

MAKE Extra Money in The Safety Of Your Home; No Experience Needed. Learn How To Write Short Paragraphs For Profit. Booklet Tells How, Where To Sell. Order Now, \$3.00. Adam Smith, 319 N. Brownell, PM 1, La Porte, TX 77571

TELEMARKETING AT HOME means MONEY! Successful New Method. Two Minute Recording. (716) 425-8857.

1750 Money-making Opportunities Investigated - 3% excellent! Redwood Institute: 415-855-8162 (recording).

"HOW TO HAVE IT MADE IN 90 DAYS." No strings attached. FREE book details. Dr. Huddleston, Box 31719, Aurora, CO 80041

RECYCLE OLD GOLD/SILVER. (\$65,000 yearly!). Instructions free. Goldsmiths, 723-P Disston, Philadelphia, 19111-4322.

TOP PAY! 150 Firms Need Homewokers Immediately. Directory \$1 #10SASE: Chiko, 81 Morton Dr., Dept. C, Kanata, Ontario, Canada K2L 1W9

MAKE Money With Your Camera. \$5.00 LSASE. Infoco, P.O. Box 1251, Hightstown, NJ 08520

\$200 - \$500 WEEKLY assembly-clerical. HOMEWORK, 1517DA Wilmot, Tucson, AZ 85712

EASY Business. Earn \$1,000's Weekly. Free details. Write or send stamped addressed envelope: Toddco, 4219 W. Olive Avenue, Burbank, CA 91505

MAILORDER OPPORTUNITIES

MILLIONAIRE Mailorder Expert Reveals Money-making Secrets. Free, exciting hour cassette: Mel Powers, No. Hollywood, California 91609

DOGS-PETS

OBEDIENCE TRAINING FOR DOGS MANUAL! Send \$24.95 to: Quaker Ridge Industries, 537 North State Rd., Briarcliff Manor, NY 10510

BEEKEEPING EQUIPMENT

BEEKEEPING EQUIPMENT Free Catalog. Bee Farm, Route 1 Dept. 77, Moravian Falls, NC 28654

BALDING

GROW Hair 4 months. New Discovery! Box 1213-C, Makati 1299, Philippines.

BALDING? Find Out What You CAN DO! 1-800-220-1293 24 Hours.

LOSING HAIR? Send \$1.00 SASE for information. Roimar International, 14314 SW Allen #415, Beaverton, OR 97005

YOUTH, attractiveness, patented process \$2.00. Wilton, Box 148164, Chicago, IL 60614-8164

HAIRPIECES FOR MEN

HAIRPIECES Save \$ Write Perry King, 2730 Octavia St., San Francisco, CA 94123

OF INTEREST TO ALL

ABSOLUTELY AMAZING! Make Ball Point Pen marks "Vanish" from clothes (#127-M201); Increase Auto Engine Life! (#241-M201); Valuable tips for Frequent Travelers (#319-M201). \$3.99 each item. Send name, address, item number; Summerton Press, 3983 So. McCarran Blvd., Suite 448, Reno, NV 89502-7510.

FREE PRIVACY CATALOG. Cash income opportunities. Hiding assets. Secret loans. New identity. Eden, Box 8410-PC, Fountain Valley, CA 92728.

POUR Sulfuric Acid on your skin without harm! Keep odors off skin and eliminate diaper rash too! Amazing new skin product works! Guaranteed! Send SASE + \$1.00 to: Willems, 11675 Valewood Drive, Victorville, CA 92392

"PET CROWS" The lost folk art of how to tame crows. Guaranteed \$9.95. Box 157, Quaker City, OH 43773

FREE grants for college. SASE. Weatherford, 4 Ridgemont, Jackson, TN 38305.

NEW YOU IN '92 Money, Confidence, Popularity, Respect. "Tap The Power Beneath The Surface." Newly Published. Amazing results. Guaranteed. Mail \$5.00. Excursion, 630 N. Tustin Ave., Suite 1504A, Orange, CA 92667

SWEEPSTAKES! Newsletters reveal winning secrets, plus hundreds of sweepstakes to enter and win! List \$5.00. Dana Sprague, 811 Justin Place, Anaheim, CA 92801

NEED HELP Figuring the Cost of your Advertisement?? Call us at 212-649-3167 or send us a FAX (212-586-5562) and we'll FAX Back with a Price Quote.

GOVERNMENT SURPLUS

DRUG RAID SEIZURES: Buy Dirt Cheap! Cars, houses, boats, computers; Seizures, Box 4309-A, West Covina, CA 91791.

GOVERNMENT AUCTIONS DIRECTORY, ANY STATE. \$5.00 to: Joe Wisike & Associates, Box 24106, Apple Valley, MN 55124

GOVERNMENT Give Aways, bargains galore, cars, homes, furniture, computers, boats. Auctions, 260 East 58 Street, Brooklyn, New York 11203.

JEEPS, Trucks from \$52.50. Low as 2¢ on dollar. Buy in your area. Directory \$3.00. Guaranteed. Surplus, Box 1409-PM, Holland, MI 49422.

HOW to Buy government surplus. Complete Information \$5.00. Carl Manion, 1 Ferris Court, Plattsburgh, NY 12901-9413

LOANS BY MAIL

BORROW \$500-\$40,000! "Overnight" on Signature. Keep indefinitely! Action, Box 5499-A, Diamond Bar, CA 91765.

MONEY Problems? Free Book describes Loans, Cash, Government Grants, other benefits, available to individuals. Write: Associates-AX, Box 9008, Baldwin, New York 11510-9008

BORROW \$100 - \$100,000! Fast! Confidential! Glendale, Box 260279, Plano, TX 75026 - 1-800-444-6599

IMMEDIATE CASH LOANS! Borrow \$1,000. - \$75,000. Regardless of credit or income - No Collateral required! **SAME DAY PROCESSING.** Call Toll-Free: 1-(800)-452-9869.

NEED-A-Loan \$500-\$100,000,00 Bad Credit No Problem 1-800-441-3012

FEDERAL LOANS for small businesses now available. (800)777-6342 for free details.

NEED MONEY? Borrow \$500 to Millions Quickly. Business-Personal. Everyone Welcome. To Qualify Request Free Application. Write: JDP, Box 430, Botkins, OH 45306. Call (419) 999-1338.

BORROW BY MAIL. Get \$500-\$75,000 Quickly. Nearly Everyone Qualifies! Send for Free Application. MJP Industry, Box 531, Bronx, NY 10461-0531

LOANS BY MAIL. Free Application! Quetzal Co., Box 537, Walla Walla, WA 99362

BORROW \$300-\$100,000 By Mail! Free Details! Write: TRK, Box 1058, Clearwater, FL 34617

FREE MONEY! \$300,000,000 Giveaway. Never repay. "Everyone Eligible." **NEW** Booklet \$1.00 (Refundable). International, Box 62372A, Virginia Beach, VA 23462.

CASH HOTLINE LOANS Up To Your Yearly Income. Fast Approval With Proof Of Employment 312-565-0919.

BORROW \$500-\$40,000! "On Signature!" 97% Eligible! Free Application: National, Box 7627, Long Beach, CA 90807

REMAILING SERVICE

RECEIVING Forwarding Worldwide. KAP Remails, 3030 Johnson Ave., New York, New York 10463

FREE! REMAILERS LIST. AGENTS NEEDED. PS, Box 29656, San Antonio, TX 78229

CONFIDENTIAL Mail Receiving, Forwarding Worldwide. MailPost, 2421-M Pratt, Chicago, Illinois 60645. (312) 764-0100.

WANTED MISCELLANEOUS

BUYING Tungsten Carbide, Moly, Tantalum, Gold, Silver, Platinum 1-800-321-6914.

FINANCIAL

GET FREE CASH! Private grants. Foundation giveaways. Loans. Millions available. Sources. Box 5529-A, Diamond Bar, CA 91765.

DEBTS? BILLS PILING UP? Bad credit is no problem! We'll help! Licensed/Bonded. Applications accepted \$500-\$50,000. Not a loan company. TCAC, Dept. PM, P.O. Box 26397, Birmingham, Alabama 35226 or call 1-800-869-0607.

COMPUTER-Erase bad credit free instantly, legally. Free details: Gold(PM), 13950 Ventura, Sherman Oaks, CA 91423

UNSECURED Personal Loans to \$50,000/Business Loans To \$700,000,000.00. (301) 369-8278.

HEARING AIDS

HUGE SAVINGS Eliminate Dealer Markups. Free Trial. Batteries Wholesale. Terms Arranged. Call Toll Free 1-800-323-1212. Or Write: Lloyds-PMC, Rockford, IL 61110

FREE HEARING AID CATALOG- Save 1/2 by mail! Write: "MoneySavers", 36658PM-1 Apache Plume Dr., Palmdale, CA 93550

FREE Hearing Aid Catalog. All Models. Huge savings! No salesman will call. Rhodes, Dept 31A, Brookport, IL 62910. 1-800-468-3100.

TOBACCO

CIGARS, Tobacco, Pipes, Chew. Free Catalog. Erie Tobacco Co., 1828 Euclid, Cleveland, Ohio 44115

SCIENCE & CHEMISTRY

"EXPERIMENTER" LABORATORY CHEMICALS GLASSWARE, Catalogue \$2.00. Established 1953. HAGENOW LABORATORIES, 1302 Washington, MANITOWOC, WISCONSIN 54220

FORMULAS, PLANS, ETC.

209 PROFITABLE Formulas! (Free List). Research PM-1, Box 291332, Davie, FL 33329

TRAVEL AND RESORTS

TRAVEL SMART Save 50%. Sanders, 109 East Pioneer, Sandy, Utah 84070

50% DISCOUNT! NATIONWIDE TRAVEL! Information: Fleet(N), 321 Juniper Court, Lawrenceville, Georgia 30245

SPECIAL SERVICES

INFORMATION. On anything. Ferguson Research Specialists, 60-15 Woodside, Woodside, New York 11377.

NEVER forget again! Find out how \$3.00. Forget Me Not, Box 291, Willow Springs, IL 60480

HERBS

HERBS - Yohimbine Pau d'Acro Others Catalog \$1.00 (Refundable). "One stop center." Jude Herbs, Box 563 PM, Huntington Station, NY 11746

HEALTH, VITAMINS

PSORIASIS Sufferers Discouraged? Write for Free important information that is helping thousands. Pixacol, P.O. Box 11687-PM, Carrollton, TX 75011

PFLAUMISTRY-RELIEVES TENSION: instructions and simulator send \$9.50 to: Dr. Pflaum, 2266 N. Prospect #200, Milwaukee, WI 53202-6306. Satisfaction Guaranteed or Money Refunded.

HYDROPONICS

INDOOR GROWING. Money maker! Greater yield than outdoors. Minimal maintenance! \$1 gets catalog and \$5 Coupon. Higher Yield, 29211-P N.E. Wylie Rd., Camas, WA 98607.

GREENHOUSES

GREENHOUSES - Redwood/Fiberglass Kits. Hobby/Commercial sizes. Free brochure. Gothic Arch Greenhouses, Box 1564-PM, Mobile, AL 36633. (800) 628-4974

RECIPES, COOKING, ETC.

GINGERSNAP Pot Roast \$2.00. A. Connolly, P.O. Box 69, Holbrook, New York 11741

SECRET West Texas Chili. \$3.00 SASE. P.O. Box 3764, Midland, TX 79702.

JOAN'S Cherry Cheesecake Delicious Recipe. Send \$2.00 SASE. RDB, Box 9402, St. John's NFLD, Canada A1A 3W6

AMAZING New Recipe. Tropical Fruit Pizza. Incredible Dessert For Any Occasion. Send \$3.00, SASE to: L&D, P.O. Box 557, Midvale, Ohio 44653.

ABSOLUTELY FANTASTIC CHERRY CREAM CHEESE PIE and more SASE \$3.00. ADJ, P.O. Box 2534, Rock Hill, SC 29732

CHESAPEAKE BAY CRAB DELICACIES. 10 Recipes \$4.00. Morris, Box 28385, Baltimore, MD 21234

BEST FRIED RICE RECIPES, \$4.00. SASE. B. Yap, 1412 Whitney Ave., H3, Hamden, CT 06517

HOT New Cocktail Recipes. \$3.00 SASE. Creative Ideas, P.O. Box 1251, Hightstown, NJ 08520

HOLIDAY GRILL RECIPES Five great recipes save time, add class to holiday gatherings \$3.00 plus \$1.00 S/H. Batteridge Communications, Box 231, Downingtown, PA 19335

OUR NEXT AVAILABLE ISSUE:
MARCH 1992
ORDERS MUST BE RECEIVED BY
JANUARY 6TH
ON SALE DATE: FEBRUARY 11TH

WINEMAKING, BEERMaking, ETC.

FREE! LARGE INFORMATIVE CATALOG. Cottage Brewing, Box 1227-R1, Daytona Beach, Florida 32115.

BEER, WINE make your own. Free catalog, quality supplies, excellent fast service. Beer & Wine Hobby, 180 New Boston Street, Woburn, Mass. 01801. 1-800-523-5423

WINEMAKERS - BEERMakers: FREE ILLUSTRATED CATALOG OF SUPPLIES, SEMPLEX, BOX 11476R, MINNEAPOLIS, MINNESOTA 55411

FREE CATALOG! GREAT PRICES! FAST SERVICE! SEBASTIAN BREWERS SUPPLY, 7710 91 AVE., VERO BEACH, FL 32967. 1-407-589-6563.

WINEMAKERS - BEERMakers - Free Illustrated Catalog - Fast Service - Large Selection - Visa/Mastercard - (816) 254-0242 - Kraus, Box 7850-L, Independence, Missouri 64054.

FREE, Homebrewer's catalog. Brewery, 1300 Quincey, Minneapolis, MN 55413. 800-234-0685.

FREE BEERMaking BOOK-Catalog. Finest Equipment, Ingredients. Fast Service! 1-800-852-9545. SPI, Box 784-P, Chapel Hill, NC 27514

HAND CRAFTED BEERS BY YOU FOR YOU. Brew Ha Ha, 217-J1 High Street, Pottstown, PA 19464. 800-243-2620 Anytime.

BURGLAR ALARMS & HOME PROTECTION

LOW COST Home Security Systems under \$100.00. Series 1000, 3 Amp model, or Series 2000, HD 5 amp model. Details send \$1.00 (refundable) + SASE: HDSS, P.O. Box 902182PM, Palmdale, CA 93590

COMING NEXT MONTH



Olympics Tech

Our special preview report takes you inside the games—inside the Sports Science Division of the U.S. Olympic Committee, where innovative technology is developed to help our athletes win; inside our ski team as they compete for the gold; and inside the CBS broadcast truck as they use the latest electronics to bring you the best view yet of this international sports spectacle.

Cadillac Versus The World

Cadillac's new-breed Seville STS goes head-to-head with its performance luxo-sedan peers, including Lexus LS 400, Infiniti Q45, Lincoln Continental and BMW 525i.

Our 90th Birthday!

Join us as POPULAR MECHANICS celebrates its 90th anniversary with a nostalgic time tour back to 1902, and forward to the future.

Boating '92

Our special section on the '92 powerboats and engines highlights all the innovative design and engineering features.

Working With Veneers

Here's how to give your woodworking projects the look of expensive wood at a fraction of the price by using veneers. We'll show you everything you need to know about veneers and how to apply them.

POPULAR MECHANICS (ISSN 0002-4556) is published monthly by The Hearst Corporation, 224 West 57th Street, New York, NY 10019, U.S.A. Subscription prices: United States and possessions, \$15.94 for one year; \$29.94 for two years. Canada and all other countries, add \$16.00 for each year. Second-class postage paid at New York, NY, and additional mailing offices. Authorized second-class mailing-in-Canada privileges by Canada Post, Windsor, Ont. (Reg. #9083) CANADA GST NBR. R106218291 Send returns to Canadian Direct Mailing Sys. Ltd., 180 Mercer St., Windsor, Ontario N9A 7C2. Registered as second-class matter at the Post Office at Mexico D.F., Mexico, June 20, 1960, © 1992 by The Hearst Corporation. All rights reserved. Printed in U.S.A. POSTMASTER: Send address changes to Popular Mechanics, P.O. Box 7170, Red Oak, IA 51591.

PICKUP

TO MAKE OUR TRUCKS GO FASTER, WE TOOK SOMETHING OFF.

\$850 off, to be specific. It's called our Extra Value Package. And when you load it on to one of our new and rugged 1992 Toyota Xtracab Deluxe Trucks, you'll quickly be able to tell the difference between a truck that merely drives down a highway and one that takes it over.

Imagine. With cloth seats, carpeting, chrome bumpers, power steering, tinted glass, sports stripe, a split bench seat, rear jump seats, a sliding rear window and, for your listening pleasure, an electronically tuned stereo, it's no wonder these trucks are movin'!

All this joined by solid 2.4 liter fuel-injected muscle under the hood, and you're bound to discover a whole new level on the confidence meter.

All of which goes to demonstrate that Toyota's 4x2 Xtracab Deluxe with the Extra Value Package isn't just a serious deal. But an extra serious truck as well. Call 1-800-GO-TOYOTA if you'd like a truck brochure or the location of your nearest dealer.

Save up to
\$850*

"I love what you do for me."

 **TOYOTA**



*Savings based on manufacturer's suggested retail price of individual options; actual dealer price of option package and customer savings may vary. Get More From Life... Buckle Up!
© 1991 Toyota Motor Sales, U.S.A., Inc.

THE WRAP FRESH FROM THE START




Winston Cup
Series

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

16 mg. "tar", 1.1 mg. nicotine av. per cigarette by FTC method.