

FEBRUARY 1993 \$1.95

Popular Mechanics

HOME IMPROVEMENT
Do-It-Yourself Electrical
Maintenance

BUILD 'EM, FLY 'EM!

SKY SCOOTERS

Now
Everyone
Can Afford
Their Own
Personal
Helicopter

**NEW
SUPER PRO
CAMCORDERS**
Latest Features
Make Great
Videos A Snap

MILLION-MILE REPORT
**OLDSMOBILE
EIGHTY EIGHT
ROYALE**
Why It May Be
One Of The
Best Cars GM
Ever Built

SPECIAL SECTION

BOATING '93

Year Of The Muscle Motor
Plus Surprising New Boats
And Great Gear



"One Of The Ten Best."

-Car and Driver



Intrepid ES

"Best Of What's New-
Car Of The Year."

-Popular Science

"A Best Buy."

-Motor Trend

Buckle up for safety.

We knew going in that the new Intrepid ES would be different. That it wouldn't look or act like the others in its class. And sure enough, the press has singled it out...for its dramatic cab-forward design. For the way it handles the road. For its exceptional room and comfort. And for thoughtful touches like its available integrated child seat, and standard airbags for driver and front passenger.



Intrepid has been called everything from innovative to revolutionary. And now that we've seen what's possible in a four-door sedan, we can't see building one any other way.

- *Standard driver & front passenger airbags*
- *Available anti-lock brakes & traction control*
- *Available integrated child seat*
- *Standard rear seat heat & air ducts*
- *Available automatic temperature control system*
- *Standard four-wheel independent suspension*
- *Available 5.5 liter, 214 horsepower, 24-valve overhead cam V-6*
- *Choice of warranties: 7/70 powertrain or 5/56 bumper-to-bumper. See these limited warranties & restrictions at dealer. Excludes normal maintenance, adjustments & wear items.*
- *For still more information, call 1-800-4-A-DODGE.*

Select Features

"Automobile Of The Year."
-Automobile Magazine



INTREPID  **THE NEW DODGE**

A DIVISION OF THE CHRYSLER CORPORATION

DODGE INTREPID
IS SO RADICALLY
DIFFERENT,
THE PRESS HAS
STARTED CALLING
IT NAMES.



Popular[®] Mechanics

FEBRUARY 1993
VOLUME 170
NO. 2



73 SPECIAL SECTION



38



47

AUTOMOBILES

38 Long-Term Test Cars

Toyota Corolla LE, Cadillac Eldorado Touring Coupe, Jeep Grand Cherokee Laredo and GMC Suburban SLE join our fleet.

51 Owners Report: Olds Eighty Eight Royale

Quality instills fierce loyalty in buyers.

85 Car Care

- **Car Clinic:** Car Care Q&A
- **Maintenance Basics:** Changing a flat tire
- **Saturday Mechanic:** Curing engine run-on
- **How It Works:** Air-conditioning system
- **New Products:** Improve your car

96 New Cars

Lexus GS 300, Olds Aurora, Mitsubishi Galant, Volvo 850 GLT and the Camaro pace car.

104 Detroit Spy Report

Another look at Ford's all-new '94 Mustang, '95 Lincoln Continental, and more.

BOATING

73 SPECIAL SECTION: Boating '93

- **New Boats**
More fun and more affordable than ever
- **New Motors**
The year of electronic fuel injection
- **New Gear**
The best and the most for your money

PM's 90th ANNIVERSARY

44 Possible Dreams

Through technology, what was old is new again.

HOME IMPROVEMENT

55 Home And Shop Journal

- **Home Maintenance:** Electrical systems
- **Comparison Test:** Power planes
- **New Tools:** Workshop partners

71 Appliance Clinic

Answers to fix-it questions.

72 Homeowners Clinic

Home maintenance Q&A.

SCIENCE/TECHNOLOGY

15 Tech Update

- City-size air purifiers
- Zero-emissions electric police cars, and more

29 Tire Technology

Supercomputers are designing our tires of the future.

32 COVER STORY: Quick-Build Kit Copters

For the price of a new car, you can build your own helicopter.

42 Bike For The Olympics

A forkless, monocoque-framed bicycle pushes radical design to the limit.

106 Science

Superpressure balloons may replace expensive satellites.

ELECTRONICS

47 Super Camcorders

The newest moviemakers let you shoot sharper, easier and faster.

100 Electronics

New tools lighten your workload.

DEPARTMENTS

2 Editor's Notes 12 Time Machine
7 Letters 122 Coming Next Month



EDITOR'S NOTES

● It's been the dream of many for years. We even predicted it in our February 1951 cover story. A helicopter in every garage. Think of it. You come out in the morning, push your lightweight rotorcraft out of the garage, start it up and away you go. Not being confined to a defined roadway, you're free to take the most direct route to work, which cuts your commuting time in half. At work, you land on the helipad in the lot, push your sky scooter into a parking space and you're ready to start the day. Well, it's still not a reality—not yet. But guys like Dennis Fetters of Revolution Helicopter Co. in Liberty, Missouri, are pushing the envelope to the point where it's real close. Check out the wild machines in our cover story this month, beginning on page 32, then make some room in the garage for your own personal helicopter. . . . They're round, they're black and they let your car roll down the road. What more do you need to know about tires? You would think nothing. So why are a battery of tire engineers in Akron, Ohio, sitting in front of computers right now as you read this, studying present tires and designing new ones? Because in the field of tire technology, better is always just around the corner. For instance, how about a tire that won't get you stranded in the boondocks even if you get a flat? Or one that will give you the same amount of traction on snow as it does on dry pavement? These developments and more are either here now or on the verge of being here, and you can read all about it in "Black Art," starting on page 29. . . . Okay, you can



Dennis Fetters shows off his Revolution Mini 500, one of the first of the new breed of sky scooters that could make the "helicopter in every garage" dream a reality.

start sending the hate mail and subscription cancellations. It's the February issue, and here's our annual Boating Guide, beginning on page 73. And, yes, there they are again. Photos and more photos of the new boats. And what's on the boats in those photos? Horrors! Disgusting! Men and women in, gosh, bathing suits! Would you believe it? Those libidinous PM editors have done it again! 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

Boating/Outdoors

Editor Joe Skorupa
Contributing Editor John Woodridge

Automotive

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

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 Deborah Frank
Art Editor John Bostonian Jr.
Production Editor Robin LaSalle
Art Assistant Nancy Coggins
Asst. Production Editor Kim Cheney

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 Juan Harris, Customer Service Department, Popular Mechanics, P.O. Box 7170, Red Oak, IA 51591 or call toll-free 1-800-353-4948. Please enclose your mailing label when writing to us or renewing your subscription • 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.

Use this address for subscription orders & inquiries. POPULAR MECHANICS, P.O. Box 7170, Red Oak, IA 51591.

MAILING LISTS: From time to time we make our subscriber list available to companies who sell goods and services by mail that we believe would interest our readers. If you would rather not receive such mailings, please send your current mailing label or exact copy to: POPULAR MECHANICS, Mail Preference Service, P.O. Box 7024, Red Oak, IA 51591-0024.

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.

20% Off!

...when you buy two or more Escort detectors.*

For the first time ever, our entire line of radar and laser detectors is available in a "mix or match" sale for savings of nearly \$80. If you've been waiting for the perfect moment to buy a radar or laser detector, this is it. Just take a look at the potential savings when you buy two. All detectors are backed with a 30-day money back guarantee and one-year limited warranty.



Total Radar and Laser Protection

Combine Passport 3200 WideBand with Passport 1000 Laser for complete radar and laser coverage and take nearly \$60 off the regular price.

Was: ~~\$298~~ Now: **\$238.40**

You save: **\$59.60**



Complete Radar Protection...For Each Car

Have two cars? Buy the most advanced radar detector available today for each and you'll save almost \$80 on this package.

Was: ~~\$398~~ Now: **\$318.40**

You save: **\$79.60**



Two-Band Radar And Laser Protection

Ka isn't used in your area? Then why buy a wide-band detector? Combine two-band Passport 2200 with a Passport 1000 Laser and save nearly \$40.

Was: ~~\$198~~ Now: **\$158.40**

You save: **\$39.60**



A "Free" Detector

Buy both Passport 3200 WideBand and Passport 2000 and you'll save \$49 — the cost of Passport 2000! Keep Passport 3200 for yourself and give Passport 2000 to a friend as a gift.

Was: ~~\$248~~ Now: **\$198.40**

You save: **\$49.60**

ESCORT
The Innovative Edge.™

Call toll-free 24 hours,
7 days a week:

1-800-433-3487

Shipping & handling extra. OH res. add 6% tax.

ESCORT

▶ Department 506823
5200 Fields-Ertel Road
Cincinnati, Ohio 45249

© 1993 GM

*The 20% discount applies only to new purchases of two detectors on the same order. Return of either detector will result in the loss of the 20% discount. Offer ends March 31, 1993.

Материал подготовлен редакцией журнала

Don't lose another hair without getting the medical facts.

Take 3 minutes right now to learn about your best chance to regrow hair

You've probably been losing your hair for a few years. So why not spend a few minutes learning how ROGAINE® Topical Solution (minoxidil 2%) could help you regrow hair. Some of it may get a little technical, but we think it's well worth reading. After all, ROGAINE is the only product ever proven to regrow hair.

How hair grows

Hair grows from follicles, which are constantly going through cycles. There's a growth phase, which lasts for 2 to 6 years. Then follicles begin a 2 to 6 month resting and shedding phase before a new cycle begins.

Under normal circumstances everyone loses between 40 and 100 hairs every day when those follicles are in the resting and shedding phase. But male pattern

baldness (androgenetic alopecia), the most common form of hair loss for men, is different. This form of hair loss causes a steady shrinking, or miniaturization, of follicles. Miniaturization of a follicle results in shortening a hair's growth phase. Over time, hair grows less and less, and rests longer. Eventually, there is no growth at all. The net result is an increasing number of short, thin hairs that are barely visible above the scalp surface.

How Rogaine regrows hair

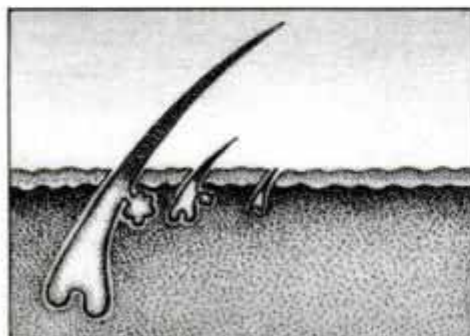
ROGAINE works in part by partially enlarging miniaturized follicles and reversing the miniaturization process. This prolongs the growth phase, allowing the hair to become longer and thicker. And with more hairs growing at the

same time, you may see improved scalp coverage.

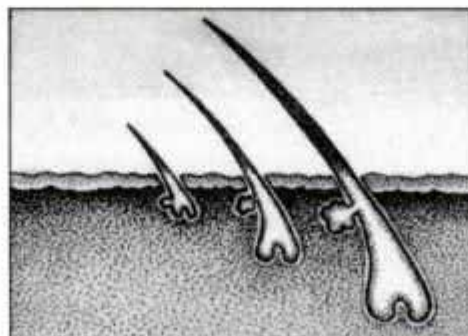
No one can accurately predict how well ROGAINE will work for you. However, hair-growth research suggests that patients having a large number of active follicles producing hairs at least $\frac{3}{8}$ of an inch or longer seem to have a better response to therapy with ROGAINE.

Clinical results with Rogaine

Clinical tests were conducted over 12 months by dermatologists at medical centers across the country. At the end of 4 months, 26% of patients using ROGAINE reported moderate to dense hair regrowth, compared with 11% of those using a placebo (a similar solution without minoxidil — the active ingredient in ROGAINE). After 1 year, virtually half (48%) of the men who continued in the study using ROGAINE rated their hair regrowth as moderate to dense. An additional 36% had minimal regrowth, and the rest (16%) had no regrowth. Side effects were minimal: 7% of users of ROGAINE developed itching of the scalp. ROGAINE should only be applied to a normal healthy scalp. Do not apply to a sunburned or irritated scalp.



Hair loss: miniaturization of the hair follicle



Hair growth: reversal of miniaturization

ROGAINE is a treatment, not a cure. So further progress is possible only by using it continuously to oppose miniaturization. Some anecdotal reports indicate that if you stop using ROGAINE, you will probably shed the newly regrown hair within a few months.

Make a 4 to 6 month commitment to see results

Now that you know how hair grows and how ROGAINE works, it's important that you understand why it takes time to see results. Although ROGAINE may prolong the growth phase, the follicles will continue to cycle. So several cycles may be necessary before you can see a difference in scalp coverage.

While some people see results faster than others, studies show that *at least 4 months of twice-daily treatment* are usually necessary before there is evidence of regrowth. ROGAINE is easy to use — just apply it as part of your daily routine.

Trends in the data suggest that those patients who are older, who have been balding for a longer period of time, or who have a larger area of baldness, may do less well.



Upjohn

DERMATOLOGY DIVISION

© 1993 The Upjohn Company
USJ8295.00
January 1993

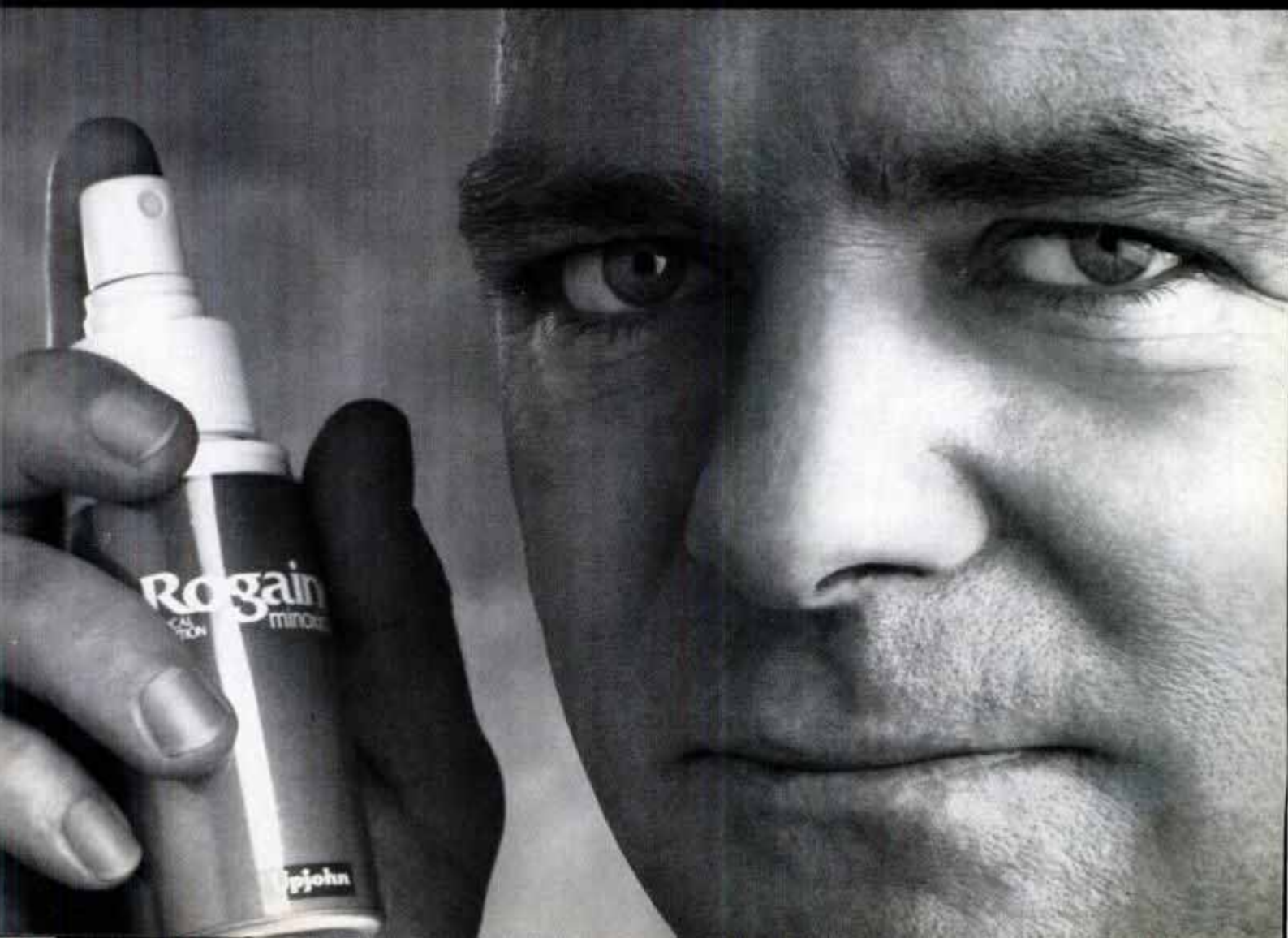
Now that you know what Rogaine can do, you know what to do

Because individual results can vary widely, it's important that you discuss your hair loss with your doctor to understand what you can realistically expect with ROGAINE therapy. Only a doctor can prescribe ROGAINE.

So see a *dermatologist or another doctor experienced in treating hair loss* today. Why just accept what nature has handed you when you can fight back?

For more information, a list of doctors in your area who can help you, and a certificate worth \$10 as an incentive to visit your doctor, call this toll-free number now: 1 800-765-3053.

Fight back with Rogaine.



Rogaine
TOPICAL SOLUTION
minoxidil 2%

The only product ever proven to regrow hair.

What is ROGAINE?

ROGAINE Topical Solution is a prescription medicine for use on the scalp that is used to treat a type of hair loss in men and women known as androgenetic alopecia: hair loss of the scalp vertex (top or crown of the head) in men and diffuse hair loss or thinning of the front and top of the scalp in women.

ROGAINE is a topical form of minoxidil, for use on the scalp. Minoxidil in tablet form has been used since 1980 to lower blood pressure in patients with severe high blood pressure. People who use ROGAINE Topical Solution absorb very small amounts of minoxidil, much smaller amounts than people taking minoxidil tablets for high blood pressure. Therefore, the chance that a person using ROGAINE at the recommended dose would have the same effects as those who take minoxidil tablets is remote. In fact, none of these effects have been causally linked to ROGAINE in clinical studies.

How effective is ROGAINE?

In men: Clinical studies with ROGAINE of over 2,300 men with male pattern baldness involving the top (vertex) of the head were conducted by physicians in 27 US medical centers. Based on physician evaluations of regrowth at the end of 12 months, 39% of the patients using ROGAINE had moderate to dense hair regrowth and 37% had minimal hair regrowth; 11% were rated as having no hair regrowth.

In women: Clinical studies with ROGAINE were conducted by physicians in 11 US medical centers involving 256 women with hair loss. Based on physician evaluations of regrowth after 32 weeks (8 months), 63% of the women using ROGAINE were rated as having regrowth that was moderate (13%) or minimal (50%) compared with 39% of those using placebo (6% moderate and 33% minimal). No regrowth was reported for 37% of the group using ROGAINE and 61% of the group using placebo.

How soon can I expect results from using ROGAINE?

Studies show that the response time to ROGAINE may differ greatly from one person to another. Some people using ROGAINE may see results faster than others; others may respond with a slower rate of hair regrowth. You should not expect visible regrowth in less than 4 months.

If I respond to ROGAINE, what will the hair look like?

If you begin with very little hair and respond to treatment, your first hair regrowth may be soft, downy, colorless hair that is hard to see. After continued treatment, the new hair should become the same color and thickness as the other hair on your scalp. If you start with a lot of hair and respond to treatment, the new hair may be the same color and thickness as the rest of your hair.

How long do I need to use ROGAINE?

ROGAINE is a hair-loss treatment, not a cure. If you have new hair growth, you will need to continue using ROGAINE to keep or increase hair regrowth. If you do not begin to show new hair growth with ROGAINE after a reasonable period of time (at least 4 months), your doctor may advise you to discontinue using ROGAINE.

What happens if I stop using ROGAINE? Will I keep the new hair?

Probably not. People have reported that new hair growth was shed after they stopped using ROGAINE.

How much ROGAINE should I use?

You should apply a 1-mL dose of ROGAINE twice a day to your clean dry scalp, once in the morning and once at night before bedtime. Each bottle should last about 26 to 30 days. The applicators in each package of ROGAINE are designed to help you apply the right amount of ROGAINE with each application. Wash your hands after use if your fingers are used to apply ROGAINE. ROGAINE must remain on the scalp for at least 4 hours to ensure penetration into the scalp. Do not wash your hair for at least 4 hours after applying it. If you wash your hair before applying ROGAINE, be sure your scalp and hair are dry when you apply it. Please refer to the Instructions for Use in the package.

What if I miss a dose or forget to use ROGAINE?

Do not try to make up for missed applications of ROGAINE. You should restart your twice-daily doses and return to your usual schedule.

Can I use ROGAINE more than twice a day? Will it work faster?

No. Studies by The Upjohn Company were carefully conducted to find out how much ROGAINE gives the best results. Using ROGAINE more often than twice a day or using more than 1 mL for each dose does not speed up the process of hair regrowth and may increase the incidence of side effects.

What are the most common side effects reported in clinical studies with ROGAINE?

Itching and other skin irritations of the treated scalp area were the most common side effects directly linked to ROGAINE in clinical studies. About 7 of every 100 people who used ROGAINE (7%) had these complaints.

Other side effects, including light-headedness, dizziness, and headaches, were reported both by people using ROGAINE and by those using the placebo solution with no minoxidil. You should ask your doctor to discuss side effects of ROGAINE with you.

People who are extra sensitive or allergic to minoxidil, propylene glycol, or ethanol should not use ROGAINE.

ROGAINE Topical Solution contains alcohol, which could cause burning or irritation of the eyes or sensitive skin areas. If ROGAINE accidentally gets into these areas, rinse the area with large amounts of cool tap water. Contact your doctor if the irritation does not go away. If the spray applicator is used, avoid inhaling the spray.

What are some of the side effects people have reported?

ROGAINE was used by 3,857 patients (347 females) in placebo-controlled clinical trials. Except for dermatologic events (involving the skin), no individual reaction or reactions grouped by body systems appeared to be more common in the minoxidil-treated patients than in placebo-treated patients.

Dermatologic: irritant or allergic contact dermatitis—7.36%; **Respiratory:** bronchitis, upper respiratory infection, sinusitis—7.16%; **Gastrointestinal:** diarrhea, nausea, vomiting—4.33%; **Neurologic:** headache, dizziness, faintness, light-headedness—3.42%; **Musculoskeletal:** fractures, back pain, tendonitis—2.59%; **Cardiovascular:** edema, chest pain, blood pressure increases/decreases, palpitations, pulse rate increases/decreases—1.53%; **Allergic:** nonspecific allergic reactions, hives, allergic rhinitis, facial swelling, and sensitivity—1.27%; **Metabolic-Nutritional:** edema, weight gain—1.24%; **Special Senses:** conjunctivitis, ear infections, vertigo—1.17%; **Genital Tract:** prostatitis, epididymitis, vaginitis, vulvitis, vaginal discharge/itching—0.91%; **Urinary Tract:** urinary tract infections, renal calculi, urethritis—0.93%; **Endocrine:** 0.47%; **Psychiatric:** anxiety, depression, fatigue—0.36%; **Hematologic:** lymphadenopathy, thrombocytopenia—0.31%.

ROGAINE use has been monitored for up to 5 years, and there has been no change in incidence or severity of reported adverse reactions. Additional adverse events have been reported since marketing ROGAINE and include eczema; hypertrichosis (excessive hair growth); local erythema (redness); pruritus (itching); dry skin/scalp flaking; sexual dysfunction; visual disturbances, including decreased visual acuity (clarity); increase in hair loss; and alopecia (hair loss).

What are the possible side effects that could affect the heart and circulation when using ROGAINE?

Serious side effects have not been linked to ROGAINE in clinical studies. However, it is possible that they could occur if more than the recommended dose of ROGAINE was applied, because the active ingredient in ROGAINE is the same as that in minoxidil tablets. These effects appear to be dose related; that is, more effects are seen with higher doses.

Because very small amounts of minoxidil reach the blood when the recommended dose of ROGAINE is applied to the scalp, you should know about certain effects that may occur when the tablet form of minoxidil is used to treat high blood pressure. Minoxidil tablets lower blood pressure by relaxing the arteries, an effect called vasodilation. Vasodilation leads to fluid retention and faster heart rate. The following effects have occurred in some patients taking minoxidil tablets for high blood pressure:

Increased heart rate: some patients have reported that their resting heart rate increased by more than 20 beats per minute.

Salt and water retention: weight gain of more than 5 pounds in a short period of time or swelling of the face, hands, ankles, or stomach area.

Problems breathing: especially when lying down; a result of a buildup of body fluids or fluid around the heart.

Worsening or new attack of angina pectoris: brief, sudden chest pain.

When you apply ROGAINE to normal skin, very little minoxidil is absorbed. You probably will not have the possible effects caused by minoxidil tablets when you use ROGAINE. If, however, you experience any of the possible side effects listed above, stop using ROGAINE and consult your doctor. Any such effects would be most likely if ROGAINE was used on damaged or inflamed skin or in greater than recommended amounts.

In animal studies, minoxidil, in much larger amounts than would be absorbed from topical use (on skin) in people, has caused important heart-structure damage. This kind of damage has not been seen in humans given minoxidil tablets for high blood pressure at effective doses.

What factors may increase the risk of serious side effects with ROGAINE?

People with a known or suspected heart condition or a tendency for heart failure would be at particular risk if increased heart rate or fluid retention were to occur. People with these kinds of heart problems should discuss the possible risks of treatment with their doctor if they choose to use ROGAINE.

ROGAINE should be used only on the balding scalp. Using ROGAINE on other parts of the body may increase minoxidil absorption, which may increase the chances of having side effects. You should not use ROGAINE if your scalp is irritated or sunburned, and you should not use it if you are using other skin treatments on your scalp.

Can people with high blood pressure use ROGAINE?

Most people with high blood pressure, including those taking high blood pressure medicine, can use ROGAINE but should be monitored closely by their doctor. Patients taking a blood pressure medicine called guanethidine should not use ROGAINE.

Should any precautions be followed?

People who use ROGAINE should see their doctor 1 month after starting ROGAINE and at least every 6 months thereafter. Stop using ROGAINE if any of the following occur: salt and water retention, problems breathing, faster heart rate, or chest pains.

Do not use ROGAINE if you are using other drugs applied to the scalp such as corticosteroids, retinoids, petrolatum, or agents that might increase absorption through the skin. ROGAINE is for use on the scalp only. Each 1 mL of solution contains 20 mg minoxidil, and accidental ingestion could cause unwanted effects.

Are there special precautions for women?

Pregnant women and nursing mothers should not use ROGAINE. Also, its effects on women during labor and delivery are not known. Efficacy in postmenopausal women has not been studied. Studies show the use of ROGAINE will not affect menstrual cycle length, amount of flow, or duration of the menstrual period. Discontinue using ROGAINE and consult your doctor as soon as possible if your menstrual period does not occur at the expected time.

Can ROGAINE be used by children?

No, the safety and effectiveness of ROGAINE has not been tested in people under age 18.

Caution: Federal law prohibits dispensing without a prescription. You must see a doctor to receive a prescription.

Upjohn

DERMATOLOGY
DIVISION

© 1992 The Upjohn Company
Kalamazoo, MI 49001, USA
CB-2-S

LETTERS

Tin Cans



What a magazine! What a terrific article on the newest "can" in the U.S. Navy—the USS *Arleigh Burke*. Hats off to Abe Dane for an excellent article. His humor and wit are greatly appreciated.

DAVID R. SENOGLES
NEW BRIGHTON, MN

Made In The U.S.A.

The "Where They're Made" charts in your Detroit and import car buyers guides were very interesting and enlightening. I was pleased to learn that there are several "import" cars manufactured in the United States and surprised at how many "domestic" cars are manufactured overseas. How about a followup article on where they're designed? I think it's terrific that many import cars are built in the U.S., but I would also like to know where the bulk of the design and manufacture of major components takes place. ERIC A. PAULDING
ROCHESTER, NY

Test Cars

When you tested the Olds Eighty Eight Royale and only got 18.2 mpg, were

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

you towing a boat and trailer with two flat tires? We rented an Eighty Eight Royale for a weeklong vacation and got 27-plus mpg on the first leg of the trip. Admittedly, this was highway driving. But we clocked an incredible 29.7 mpg on the second leg while driving between 65 and 75 mph with five passengers, lots of luggage and the a/c running. We loved the car.

PAUL ZURKUHLEN
LOUISVILLE, KY

Does anyone on your staff smoke? Apparently not, or they would have been quite perturbed that they would have had to stop every hour or so to empty the ashtray in the Pontiac Bonneville SSEi. I agree with you that the car is incredibly comfortable. It should be for \$30,000. But look at the ashtray. It's wedged in behind the floor shifter, and it's about the size of those pencils you get when you go miniature golfing. Do they design these cars around nonsmokers? What does Pontiac want me to do? It seems I have three choices: 1. When the ashtray is full, start tossing butts out the window and pollute the environment, 2. Go to Kmart



Reader Don Thompson built this keepsake for his friend Nickolus.

and buy one of those ashtrays with the beanbag on the bottom, or 3. Quit smoking, but I can't see that happening in the near future. If I do buy a Bonneville, I guess I'll have to stop at Kmart on the way home. Won't that look nice on the dash?

DANIEL GREGORY
SUTERSVILLE, PA

Red Oak Racer

Your red oak wagon project in the August '91 issue inspired me. I convinced my friends who wanted to buy a standard Radio Flyer for their son to allow me to build an all-wood keepsake. The body and siderails are red oak and black walnut. The undercarriage is ash. I used a solid-brass handle, tongue brackets and screws with extra bracing on the undercarriage to ensure survivability. Hub caps were added to cut wind resistance and hide sharp cotterpin ends. All joints are butts, attached with glue and screws. All corners are radiused with $\frac{1}{4}$ - and $\frac{1}{2}$ -in. router bits for a smooth appearance. It's taller and heavier at 19 in. wide \times 36 in. long than the one in your article. For the finish, I sprayed on Liquid Gold. All

in all, the project was great fun. I will be making more of these for friends and family—and each one will be unique.

DON E. THOMPSON
LONG BEACH, CA

Scientific America

Your answer to Edward Binder (Letters, page 14, Nov. '92) shows a propensity for political correctness, exactly the point Mr. Binder made. In Magellan's time you would have been known as a flatlander. The popular science of that time held that the world was flat. Our society believes in flying saucers and the Loch Ness monster, though no one has proved they exist. What happened to the predictions that the oil fires in Kuwait would devastate the atmosphere and subject the world to a so-called nuclear winter. Bear in mind that hype is just that and not fact. STAN CORBIN
WESTMINSTER, CA

Last year's political campaigns gave evidence that public (popular) opinion is formed by the media. You say that anything that "our society already acts as if it is fact" is good enough for you. That is, you (the media) can create hypotheses and, if society accepts them as fact, you are justified in reprinting them as proven facts. Have I been guilty of tortured reasoning? No more than you.

WARREN I. MITCHELL
KENT, WA

If science is governed by what is popular, then we can dispense with most of the research and let the public decide what is true and not true. Your re-

(Please turn to page 11)






“The
salesman
starts talking
resale value. I said,
‘Buddy, I’m gonna
drive this truck
into the ground.’”

Buying a pickup is less a decision you make than a turning point you choose. It becomes hard to imagine getting along without your truck – and harder still, parting with it. Resale value? You don't even think about resale value.

But the 90 years of accumulated strengths that make a GMC Sierra your fast friend – the strength, the power, the comfort and reliability year after year – are the same strengths that, for eight years running, have made Sierra more valuable at resale than any other truck in its class*. If you choose to part with your Sierra someday, you'll find others willing to put as high a premium on it as you do.

Call 1-800-GMC-TRUCK (1-800-462-8782) for a Sierra catalog. From the company that understands that resale isn't as much about cash as it is about value.

GMC, GMC Truck and Sierra are registered trademarks of General Motors Corp. © 1992 GM Corp. All Rights Reserved. Buckle up, America!   

*Based on combined average of MSRP of 3-, 4- and 5-year-old comparably equipped vehicles as compared to auction prices reported in 1985-92 January issues of *National Automotive Research Black Book*.



THE STRENGTH OF EXPERIENCE

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

9 mg. "tar", 0.7 mg. nicotine av. per cigarette by FTC method.

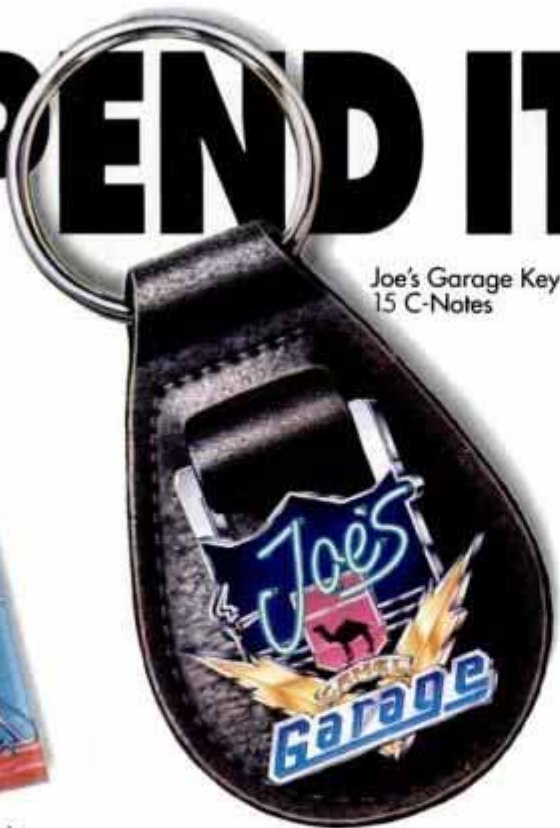
GET IT.



On Packs of Filtered Camels

© 1993 J. HEARST MAGAZINES COMPANY

SPEND IT.



Joe's Garage Key Chain - 15 C-Notes



Joe Flip-Top Lighter - 15 C-Notes

In The Camel Cash Catalog

© 1993 J. HEARST MAGAZINES COMPANY

Popular Mechanics

Publisher Robert B. Dillingham

Business Manager Agnes P. Maillaro

ADVERTISING

**Director John A. Pagliaro
New York**

224 West 57 St., New York, NY 10019

Roger W. Borsett

(212) 649-3140

Michael T. Campbell

(212) 649-3142

Robert G. Mattone

(212) 649-3141

Thomas D. Schreckinger

(212) 649-3143

Chicago

1 South Wacker Dr., Chicago, IL 60606

(312) 984-5190

Manager Richard T. Weithas

Rocco A. Smeriglio, Jr.

Detroit

Hearst Magazines Sales, Inc.

2301 West Big Beaver Rd., Troy, MI 48084

(313) 649-2981

Manager D. Craig Rebold

Laurence E. Lantzy

Los Angeles

3000 Ocean Park Blvd., Suite 2008,

Santa Monica, CA 90405

(310) 450-8881

Manager Jim D. Smith

Atlanta

Collinson and Company, Inc.

4315 Cowan Rd., Tucker, GA 30084

(404) 939-8391

Manager Newton B. Collinson, III

Jonathan M. Kiger

Dallas

Ingersoll, Redding, Kellner & Zeko

16990 Dallas Pkwy., Suite 220, Dallas, TX 75248

(214) 380-0416

Manager Daniel F. Kellner

Dean Zeko

Mail Order

Manager Barbara Jones

(212) 649-3136

Classified

Manager Dorothy Nolan

(212) 649-3167

MARKETING

Director William E. Congdon

(212) 649-3088

PROMOTION

Manager Erin M. Overend

(212) 649-3085

PRODUCTION

Manager Carole L. Hartman

Adv. Prod. Mgr. Patricia A. Woods

(212) 649-3164

Published by The Hearst Corporation

FRANK A. BENNACK, JR.

President & Chief Executive Officer

RANDOLPH A. HEARST

Chairman

GILBERT C. MAURER

Executive Vice President & Chief Operating Officer

Hearst Magazines Division

D. CLAEYS BAHRENBURG

President

K. ROBERT BRINK

MARK F. MILLER

Executive Vice Presidents

DANIEL E. ZUCCHI

Senior Vice President

ROBERT B. DILLINGHAM

Vice President for Popular Mechanics

RICHARD E. DEEMS

Publishing Consultant

POPULAR MECHANICS is published monthly by the Hearst Corporation, 930 Eighth Avenue, New York, NY 10019, U.S.A. Frank A. Bennack Jr., President; Randolph A. Hearst, Chairman; Gilbert C. Maurer, Executive Vice President; Victor F. Ganz, Vice President and Secretary; Edwin A. Lewis, Vice President and Treasurer; Hearst Magazines Division: D. Claeys Bahrenburg, President; K. Robert Brink, Executive Vice President; Mark F. Miller, Executive Vice President; Daniel E. Zucchi, Senior Vice President; George J. Green, Executive Vice President; Raymond J. Petersen, Executive Vice President; John A. Roban, Jr., Vice President & Resident Controller; Robert B. Dillingham, Vice President for Popular Mechanics.

LETTERS (Continued from page 7)

sponse was disappointing because of the high regard I had for your magazine. Are you using the "squeaky wheel" concept? C.A. PECORARO SHERIDAN, TX

It seems to me that you would rather go along with the silly people who believe anything the liberal press tells them and hope that someday you can be proven right. Attitudes don't make things right. GALE O. SHREFFLER ALLISON PARK, PA

I too have looked to "popular" science for what science is promoting, but always with consideration for truth. Our scientists have been carried away by someone's theory about CFCs and the so-called ozone hole. HAROLD SOUCY, P.E. CONROE, TX

The reason our society already acts as if the depletion of the ozone layer is fact is because the media keep telling us it's true. Just as people believe the Mitsubishi Eclipse is better than the Plymouth Laser, and Japanese cars are better than U.S. cars. KENNETH ARROWSMITH SULLIVAN, MO

Your readers will respect you more if you don't patronize them. JOHN T. BARR EASLEY, SC

Your reply sounds fair and just until one considers that the "current prevailing attitude" is created by self-serving journalism. In your quest to sell magazines, you feed into the bad news because you aren't original and creative enough to capitalize on the good news anymore. E.E. ACKLIN DALLAS, TX

There is great debate in the scientific community among eminently qualified experts as to the problems and their solutions. Tremendous economic damage could be done for no reason other than it's politically correct. A responsible media should take care to present both sides of an issue without regard to what is popular. ROBERT DEE WALKER DALLAS, TX

Many of these topics have gained the status of public perception by the outspoken actions of a vocal minority rather than the true feelings of the silent majority of the general public. If you sincerely wish to present the world in the context of the current prevailing attitude of society, please take the time to actually determine what those attitudes are. I challenge

you to simply publish a series of articles on the many controversial topics of the day, representing both sides of the issues objectively, and polling your readers to see just what they really believe. CHRISTOPHER SAMUEL AUBURN, MI

Okay, challenge accepted. Send me a list of what you consider the controversial topics of the day, we'll present them in a series of articles, and we'll do a poll by fax machine and present the results. This is open to any reader who would like to participate. —Ed.

Wouldn't you like to try your response again? You've turned over your forum to unelected bureaucrats, sky-is-falling chicken littles, rumor mongers and various interests opposed to individual freedom and the economic strength of the U.S. Tell it like it is. *That's* popular. MARION MCGEE COLUMBIA, MO

Phoney environmentalism thrives on scientific and technical ignorance. People are easily frightened by alarms about mysterious matters. The former head of the Cleveland Clinic told me about a patient's family

being informed that their loved one is dying. "Does he have cancer?" one of them asked. "No," the doctor answered. "Thank God," someone exclaimed. I expect PM to continue its gains in quality. Don't lose track of the foundation of your enterprise. RALPH ROHWEDER MOUNT VERNON, VA

Adolph Hitler and his propaganda artist, Herr Goebbels, sold a pretty good load to the German people causing a "we are the master race and are unbeatable" attitude in their society, but it sure wasn't fact. ROBERT R. WEBSTER COLLIERVILLE, TN

Maybe you should change the name of your magazine to *Popular Myths*. LARRY G. ELLISON BOZEMAN, MT

When I first began reading PM, the "Popular" in the title meant that your editors took mechanical and scientific developments and put them in popular language so that the average, non-technically trained person could understand and appreciate the developments. Science would then become popular. EDWARD BINDER ATHOL, NY

GOT IT?

Need a catalog? We'll send one.



Offer restricted to smokers 21 years of age or older.

To get a **FREE** Catalog, fill in, sign and mail to: Camel Catalog, P.O. Box 5958, Norwood, MN 55583-5958

Name _____ Apt.# _____
 Address _____
 City _____ State _____ Zip _____
 What is your usual brand of cigarettes? _____ Sex: M F

What is your birthdate? (required) ____/____/____ Today's date? ____/____/____
(month) (day) (year) (month) (day) (year)

I certify that I am a smoker, that I am 21 years of age or older; and that I want to receive offers, premiums, coupons, or free cigarettes that may be sent to me in the mail. I understand that giving false information in order to accept these offers may constitute a violation of law.

Signature (required) _____
(first) (middle initial) (last)

677

Limit one catalog per order and a maximum of 5 catalogs (total) per address. Catalog and premium quantities are limited, so act quickly. Check catalog for expiration dates. No promise of future catalogs beyond current catalog. Consumers must pay postage on mail-in offer request. No facsimiles or copies of order form accepted. Allow 10 weeks for shipment. Offer good only in U.S.A. Offer void where restricted or prohibited by law.

TIME MACHINE

90 YEARS AGO: FEBRUARY 1903

POPULAR MECHANICS

Building First Airship for St. Louis Aerial Races



The "Stanley" is shown alongside the other airships of the St. Louis Aerial Races.

POPULAR MECHANICS, FEBRUARY 1903, Vol. 1, No. 2, 25 CENTS

CONTENTS

Building First Airship for St. Louis Aerial Races

The "Stanley" is shown alongside the other airships of the St. Louis Aerial Races.

How to Stick with the Right Glue

Fresh Flock of Fold-Wing Planes

Zeppelin U.S.A.

Huge dirigibles had already darkened the skies of France and Germany. Now shipyard workers in San Francisco were building a 228-ft. airship called the *Stanley*. Sheathed in aluminum, it sported propellers at either end, plus two on top to permit touchdowns without venting hydrogen. The *Stanley* was destined for a cross-country airship race that organizers of the St. Louis World's Fair were trying to get off the ground—something the *Stanley* never did.



Blast From The Past

The sheer scale of turn-of-the-century blast furnaces spoke volumes about industry's zeal for steel. At one Colorado facility, each pair of

furnaces shared five blowing engines. These 500-ton brutes had cylinders big enough to walk through. The furnace line stretched for one-third of a mile.

60 YEARS AGO: FEBRUARY 1933



Nuts And Volts

The Ohio Brass Co. had a great collection of giant transformers, spark gaps, generators, oscillators and other electrical devices amassed in its quest for the perfect insulator. There, gleeful engineers terrified visitors by summoning high-frequency discharges, which shimmered around insulated lines and platforms. The copper spheres and strings of insulators charged the lab with a Frankenstein-meets-Buck Rogers air, which only added to the engineers' mystique.



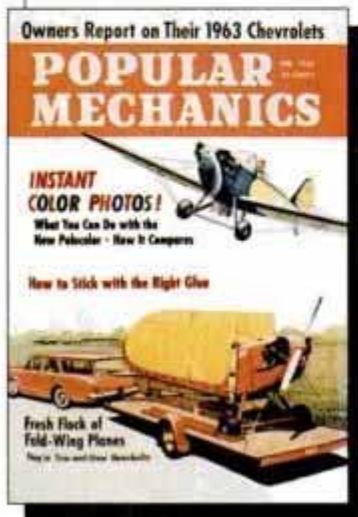
247 took off on its maiden flight, en route to rendering everything else obsolete. Still, the 18-passenger Curtis Condor was an impressive bird—2-stories tall, with a 91-ft. wingspan.

Bye-Bye, Biplane

Commercial aviation had soared in the past decade, but a revolution was waiting in the wings. As PM subscribers read about the Curtis Condor, Boeing's Model

A version with 12 sleeping berths would go into transcontinental service in 1934. But the Boeing 247 and the coming Douglas DC series quickly won over the airlines and doomed the Condor to extinction.

30 YEARS AGO: FEBRUARY 1963



Fold 'Em

Would home-built fold-wings put an airplane in every garage? That was the hope of the Experimental Aircraft Association, which sponsored a contest to encourage the do-it-yourselfer. The winning entries emphasized structural simplicity and ease of operation. With \$1000 to spare and a modest home shop, any amateur could replicate the aircraft. A Boeing engineer took first prize with *Fly Baby*, an open-cockpit single-seater built around an 85-hp Continental engine.



Surf And Turf

The Marines were always testing the mettle of new amphibious vehicles. The LVW (landing vehicle wheeled) conquered land and sea at a peppy 35 mph. With a plan-

ing hull and retractable wheels, it was designed as a high-speed cargo carrier. More radical was the Airoll, which lumbered through swamps and snow on balloon-tired tank treads. **PM**

PM HOTLINES

COMMUNICATE WITH US

We're trying our best to make it easier for you to communicate with us. Here are four ways you can do it.

LETTERS

Your written letters are always welcome. If we think your letter would be interesting to other readers, we might even print it in our Letters column (unless you request that it not be printed). Our editors are listed by department on the masthead printed in the front of the magazine next to Editor's Notes. Our address is 224 W. 57th Street, New York, NY 10019.

FAX MACHINE

You can fax written mail to us if you have access to a fax machine. Our fax number is (212) 586-5562, and is available 24 hours a day.

ELECTRONIC MAIL

You can call the PM computer any day between 6 pm and 8 am (only) Eastern time. The number is (212) 582-8369. Once you're on line, you can leave messages for specific editors, or direct inquiries and comments to a specific department. The department bulletin board also allows you to share your thoughts with other readers who call in.

New users get an identification number and password that allow you to access the system. Simply set your communications software to 8 bits, no parity and one stop bit (8-N-1), and set the baud at 300 or 1200. Please remember that we are not a professionally staffed, fully operational bulletin board. We're simply trying to make it easier for you to communicate with us. So please bear with us if it takes awhile to answer your message.

READER SERVICE BUREAU


Our Reader Service Bureau is operational five days a week during regular business hours. The phone number is (212) 649-3127. Please call our Reader Service Bureau, *not our editors*, for information on back issues, reprints of articles, subscription inquiries and so on. It will save us all time.

HOTLINE PHONE NUMBERS

Unfortunately, our Hotline Phone Service is temporarily discontinued.



Does Your Garage Door Opener Have A Weak Link?



There's a place for chains. And 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.™

GENIE



A Comfortable Home This Winter Starts With CertainTeed Insulation Today.

There are a lot of ways CertainTeed Fiber Glass Insulation can be a comfort to you. For starters, it can help keep your home warmer in winter and cooler in summer, while it helps save* on heating and cooling bills, too.

And CertainTeed insulation helps filter out noise as well. Insulate interior walls and ceilings around kitchens, bathrooms, bedrooms and in-home offices to help make every room more quiet.

Plus, by using the right amount of CertainTeed Fiber Glass Insulation when remodeling, you can add exciting design features to your home – like cathedral ceilings and larger picture windows – while retaining thermal efficiency.

For more information, see your local building materials retailer. Or call CertainTeed at 1-800-782-8777. It's a move you'll be very comfortable with.



CertainTeed 
Fiber Glass Insulation

*Savings vary. Find out why in the seller's fact sheet on R-values. Higher R-values mean greater insulating power.

Материал защищен авторским правом

TECH UPDATE

News Of Tomorrow's Technology Today



ILLUSTRATION BY JEFF MANGIAT

Convection Towers To Rinse Out Urban Smog

LOS ALAMOS, NM—People tend to picture chimneys as sources of soot, smoke and smells. But if one physicist has his way, a new breed of chimney could reverse that smokestack image by reversing air pollution.

Melvin Prueitt, of Los Alamos National Laboratories, believes that 500-ft. fabric-skinned towers could function as giant air purifiers. In Prueitt's scheme, water sprayers at each tower's top generate a fine mist that absorbs the pollution.

The air turns damp and cool and tumbles through the tower, creating a downdraft that draws more air into the top. At the tower's bottom, the air pressure turns wind

turbines to generate more electricity than the tower uses. The humid, clean air blows out radially, displacing the drier, dirty air upward.

Filter systems could cleanse the smog-laden water, and pumps could send it out to sea. Since the humidity level in the tower is 100%, sea water could be pumped in to clean the air without leaving salt deposits. That's good news for parched Los Angeles, which would need to muster a billion gallons of water a day to rinse out half its air.

Right now Prueitt's idea exists only in fluid-dynamics

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

studies and computer simulations, but he hopes to build a demonstration unit within five years.

Smog-plagued Los Angeles could benefit from 500-ft. convection towers that cleanse and humidify air.

Highlights This Month

- **Site Check**—Superdrill probes future atomic mortuary.
- **Kamikaze Probe**—Veteran spacecraft makes ultimate sacrifice for science.
- **One Tractor Mind**—Smart farm vehicles drive themselves.
- **Dish Watching**—Huge radio telescope gets facelift.
- **Head Lights**—Optical devices track brain oxygen during surgery.
- **Smokey And The Battery**—Peel-out power for electric police cars.



For a free product brochure call 1-800-962-2868.

*See your Chevrolet dealer for terms of this limited warranty. †J.D. Power and Associates® May 1992 Light Truck Initial Quality StudySM based on a total of 10,477 consumer responses indicating owner-reported problems during the first 90 days of ownership. **When properly equipped. Includes passengers, equipment and cargo. Excludes other GM products. ††Based on full-line truck company registration data 1982-1991. Excludes other GM products. Chevrolet and the Chevrolet Emblem are registered trademarks and Chevy is a trademark of the GM Corp. ©1992 GM Corp. All Rights Reserved. Buckle up, America!

Advertisement for Chevrolet 4x4 pickup truck. ©1992 GM Corp. Buckle up, America!

Long On Power.

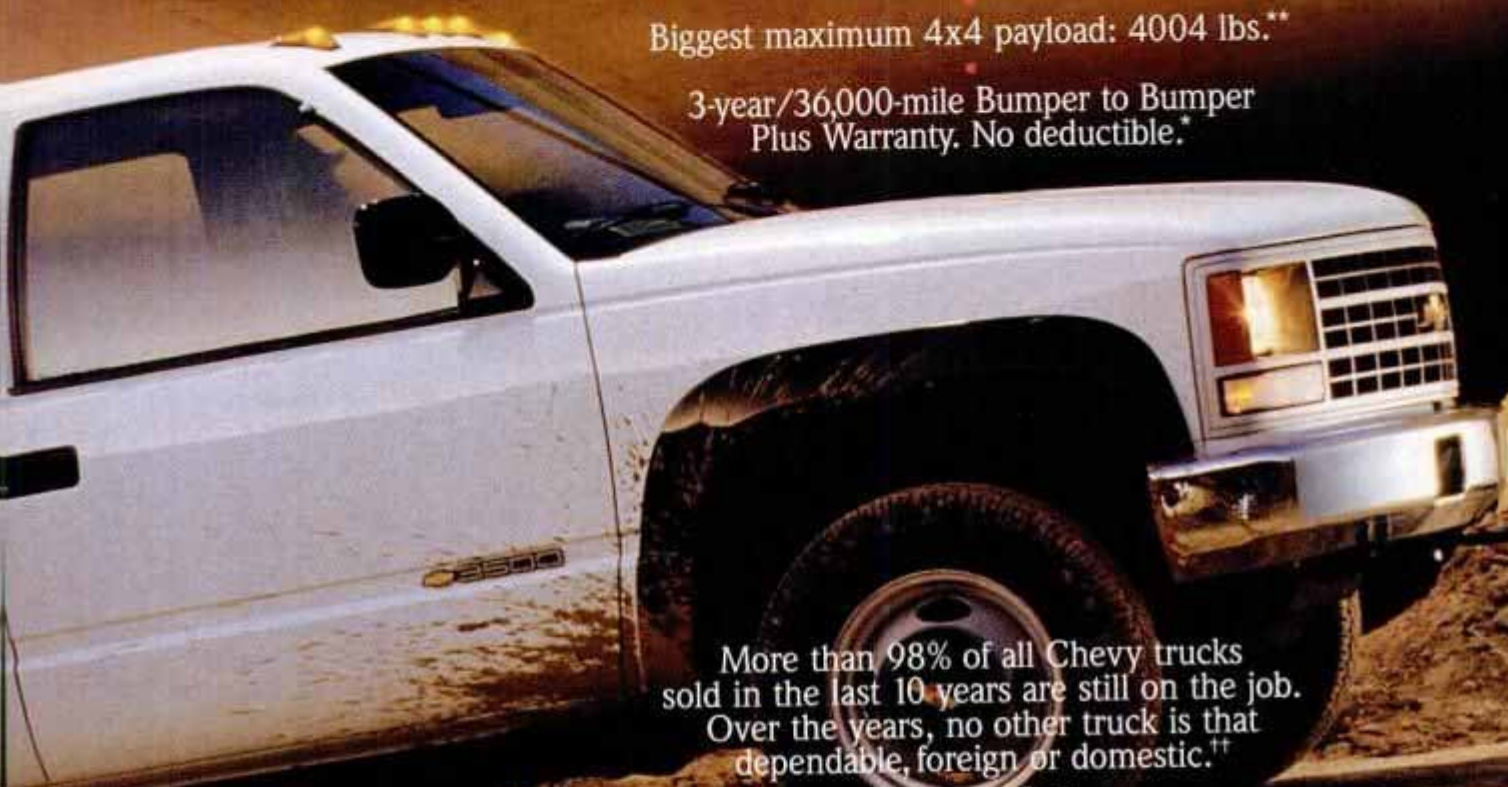
**Chevy 1-Ton Crew Cab.
Now With Available 6.5L
Turbo-Diesel Power.**

Most horsepower ever in a turbo-diesel pickup.
5-year/100,000-mile engine warranty.*

"Best full-size pickup in initial quality."
-J.D. Power and Associates.†

Biggest maximum 4x4 payload: 4004 lbs.**

3-year/36,000-mile Bumper to Bumper
Plus Warranty. No deductible.*



More than 98% of all Chevy trucks
sold in the last 10 years are still on the job.
Over the years, no other truck is that
dependable, foreign or domestic.††

Chevrolet.

**The Most Dependable,
Longest-Lasting Trucks.**

LIKE A ROCK

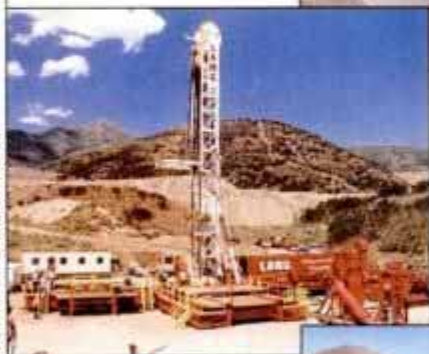


Atomic Gravedigger

LAS VEGAS, NV—A unique drill is exploring what may be the final resting place for America's high-level nuclear waste.



In LM-300 drilling rig, expanding compressed air cools drill bits and whisks cuttings to surface. Double-wall pipestring shields borehole from airflow.



The repository, to last 10,000 years, would lie 1000 ft. beneath Yucca Mountain, Nevada—if the Department of Energy can prove that water won't trickle in. The site's geology should address that issue, and that's where the LM-300 drill comes in.

Normally, drillers pump fluid down a borehole to cool the drill bit and flush rock cuttings to the surface. That won't work here, because liquid would taint the geological data.

Instead, compressors blow high-pressure air down between two concentric pipestrings. When it reaches the drill's reaming bit, the air expands and absorbs heat. A vacuum then draws the cool air—along with cuttings—back up through the inner pipe.

After reaming out a stretch of borehole, the drill takes geological samples with a coring bit that travels down ahead of the reaming bit.

Built by Lang Exploratory Drilling, the rig can suspend 150 tons of pipe and bit, and penetrate 3000 ft.



Burning For Venus

MOFFETT FIELD, CA—Built to last for eight months, the Pioneer Venus Orbiter surprised everyone by remaining operational for 14 years. But last fall, the probe performed its final mission: It hurled itself at hypersonic speed into the caustic Venusian atmosphere, going out in a blaze of glory.

NASA launched the 810-pound spacecraft, built by Hughes Aircraft, in 1978. Pioneer Venus carried an ultraviolet camera that snapped photos of the planet's clouds, and its radar drew up the first topographic maps of the surface.

NASA's Ames Research Center eked out propellant to the spacecraft's thrusters to hold it in orbit for as long as possible.

But 70 pounds of propellant only lasts so long. During its final plunge into



Atmospheric friction turns Pioneer Venus Orbiter into an extraterrestrial fireball.

Venus's atmosphere, the probe returned data that will help researchers determine whether lightning strikes on Venus and whether the planet ever had oceans.

Trackers lost touch with the spacecraft on October 8, when its transmitter presumably melted.

Tractor Pulls Itself



REGINA, SASKATCHEWAN—The Finnish company Kone Sampo is collaborating with Canadians on an autonomous-agriculture system built around two driverless tractors.

The vehicles, known as Module and Modulaire, are a tractor and a crawler, both of which run on hydrostatic drivetrains.

This spring, engineers will fit the machines with LORAN-like navigation appa-

Without drivers, lightweight Module and Modulaire don't compact the good earth.

ratus by Accutrak Inc. The system relies on radio beacons at a field's border. The vehicles triangulate to gauge their own positions and follow digital maps.

Without cabins, the vehicles weigh much less than comparable equipment and don't crush the life out of soil.

Kone Sampo says mass production will begin in 1994.

(More Tech Update on page 20)

Материал подготовлен авторским группой

Good news for people on Cardizem® (diltiazem HCl)

“Cardizem CD Should Save You Money”

If you are taking Cardizem (diltiazem HCl) tablets or Cardizem® SR (diltiazem HCl) capsules, ask your doctor about **Cardizem CD**

Cardizem CD should be more economical.

Only your doctor can change your prescription.

So ask your doctor if **Cardizem CD** is right for you.

For a FREE quarterly issue of *CardiSense*SM, a newsletter on healthy living, please call this toll-free number: 1-800-424-6911.



CARDIZEM CD

(diltiazem HCl)



MARION MERRELL DOW INC.
PRESCRIPTION PRODUCTS DIVISION
KANSAS CITY, MO 64114

CCDAH898/A6602

1027R2

©1992, Marion Merrell Dow Inc.

Материал, защищенный авторским правом



ILLUSTRATION BY ED VALIGURSKY

Spaceballs To Mimic Space Junk

HOUSTON, TX—While experts agree that orbiting junk threatens spacecraft, no one's sure just how messy space has become. A Shuttle experiment planned for this March will help officials get a handle on the problem.

The Orbital Debris Radar

Calibration System features three small metal spheres. A spring-loaded ejector will fire the balls into orbit from the Shuttle's payload bay. Ground-based sensors will attempt to track and characterize the objects as they fly around the globe.

Observers already know the spheres' physical characteristics like size, composition and reflectivity. So how the spheres show up on radar and telescope will help researchers refine models for characterizing unknown pieces of space junk.

Shuttle will eject ersatz space junk into orbit. Radars and telescopes will track spheres till they burn up in atmosphere.

NASA and Air Force planners ultimately want to be able to track space junk particles that are the size of a flea.

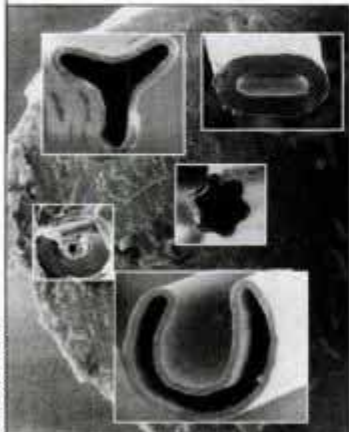


NASA PHOTO

Peewee Plumbing

EDWARDS AFB, CA—Air Force engineers at Phillips Laboratories have developed a process for making tubes as tiny as $\frac{1}{200}$ th the width of a human hair. The tubes start with a carbon fiber, which is coated with sapphire, metal, ceramic or other material. The fiber is melted away, leaving a tube of consistent cross section.

Experimenters are using the tubes as heat pipes to cool microchips, but they suggest many other applications.



Human hair dwarfs microtubes, fabricated in a variety of cross sections and materials.

AIR FORCE PHOTO

Calming Jittery Spacecraft



Air Force's ASTREX models behavior of a fast-moving space-based weapons platform.

PASADENA, CA—Earth-observing satellites, orbiting telescopes and space-based laser weapons all need large lightweight platforms that can aim their payloads with meticulous accuracy. Trouble is, such spacecraft are susceptible to jitters, which ruin instrument precision.

To cancel vibrations, designers are turning to adaptive structures, built around struts that stretch or shrink in

response to electrical or magnetic signals. Air Force and NASA now operate testbeds for the technology.

The Advanced Space Structures Technology Research Experiment (ASTREX) resides at Phillips Laboratories, Edwards Air Force Base. The 12½-ft.-wide structure simulates a space-based beam expander for a laser weapon, which would have to slew around rapidly while locked

onto a target. The active struts incorporate piezoelectric and magnetostrictive ceramics. Engineers are also testing high-temperature superconducting ceramics.

At NASA's Langley Research Center, engineers work with a flexible 52-ft. truss structure fitted with a

Langley testbed bounces laser between ends of 58-ft. platform to gauge vibration control.

laser, a mirror and an optical sensor. It allows researchers to try out motion-damping controls by bouncing the laser off the mirror and seeing how tight a spot it holds on the sensor.

Other adaptive-structure research is unfolding at Jet Propulsion Laboratory and Sandia National Labs.

The first space-based demonstration of the technology will come later this year, when the Navy launches a classified SDI experiment.



NASA PHOTO



**Chevrolet Motor Division presents
the definitive die-cast replica
of America's sports car.**



Shown approximately actual size of
7 1/2" (18.42 cm) in length. Scale: 1:24.



The hood opens to reveal the
powerful 350 cubic inch engine.



The dash is highly detailed and
shows full digital instrumentation.

Corvette. The name is synonymous with performance,
style and...well...sex appeal. It's the definitive American
sports car. The ultimate sweet dream machine.

And now, the legend's heading your way. In the form of
a superb 1:24 scale die-cast model of the 1986 Corvette.

Capturing the spirit and detail of the original, this
remarkable precision-engineered replica is loaded with an
array of operating features. Fully functional steering. Doors
that open and close. And the hood opens to reveal the fully
detailed tuned port injection V-8 engine.

From Franklin Mint Precision Models for just \$90.

RETURN ASSURANCE POLICY

If you wish to return any Franklin Mint Precision Models purchase,
you may do so within 30 days of your receipt of that purchase for
replacement, credit or refund.

ORDER FORM

Franklin Mint Precision Models
Franklin Center, PA 19091-0001

**Please mail by
February 28, 1993.**

Yes! Please send me the precision-engineered 1:24 scale die-cast re-creation
of the 1986 Corvette. My imported model will arrive ready to display and
with it informative reference material and a Certificate of Authenticity.

I need **SEND NO MONEY NOW**. I will be billed for a deposit of \$18.* and,
after shipment, for the balance in 4 equal monthly installments of \$18.*

*Plus my state sales tax and a one-time charge of \$3.
for shipping and handling.

SIGNATURE _____ ALL ORDERS ARE SUBJECT TO ACCEPTANCE.

MR/MRS/MISS _____ PLEASE PRINT CLEARLY

ADDRESS _____ APT. # _____

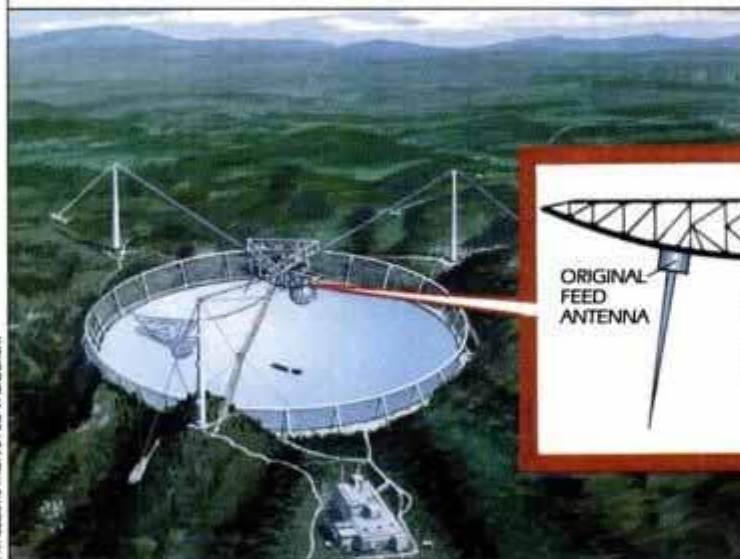
CITY/STATE _____ ZIP _____

TELEPHONE NO. (_____) _____

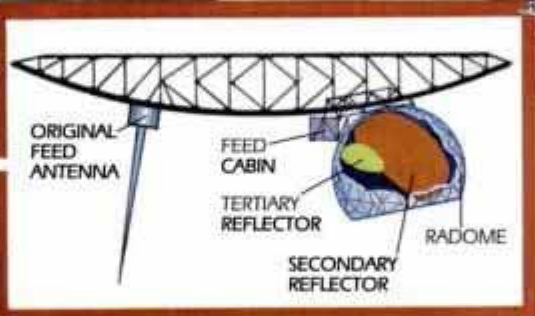
© 1993 FMPM 14282-6RFK-58
Official General Motors Licensed Product. CHEVROLET, the CHEVROLET Emblem, CORVETTE, VETTE and the
CORVETTE Emblem are registered trademarks of General Motors Corporation.

Franklin Mint Precision Models...Miles Ahead.

Radio Scope's New Set Of Ears



Dome (left), as big as a 5-story building, will replace existing antennas (right) on platform suspended over Arecibo's 1000-ft.-wide reflector dish.



ARECIBO, Puerto Rico—The 30-year-old Arecibo Observatory, still the world's largest radio telescope, is getting a major overhaul. NASA and the Na-

tional Science Foundation are financing the facelift.

First, to block out background noise, a 50-ft.-high steel-mesh shield will go up around the 20-acre dish.

A new transmitter will double the strength of signals sent out for radar studies of the solar system.

And a huge dome will replace a cluster of antennas that receive radio signals and radar returns. Inside, two subreflectors will focus signals onto a bank of feed-horns, for increased sensitivity at all radio wavelengths.

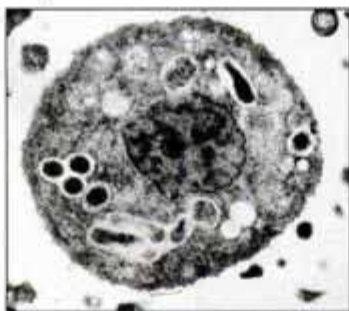
The improvements should be finished by 1994.

Germs Gobble Explosives

OAK RIDGE, TN—Researchers at Oak Ridge National Laboratories have run across a strain of bacteria that degrades TNT into harmless compounds.

The microbes aren't genetically engineered organisms, but occur naturally, residing inside larger microorganisms—amoebae.

The amoebae turned up in a toxic-waste site tainted with trichloroethylene. Mi-



crobiologists isolated the bacteria and cultured them with soil contaminated by



TNT. Within a few days, the germs had left the soil nontoxic.

The bacteria also secrete dispersants, which detach toxic compounds from soil and may help in cleaning up oil spills.

EODT Services has licensed the bacteria to clean up old munitions dumps.

Dark blotches in amoebae (far left) mark naturally occurring bacteria that clean TNT-tainted soil.

Blood Rotor Test Magic

SUNNYVALE, CA—Untrained personnel can carry out hours of laboratory blood tests in 10 minutes with a device known as a blood rotor.

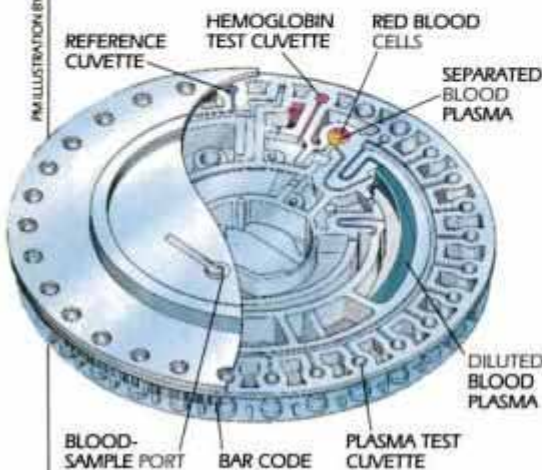
About the diameter of a

CD, the blood rotor accepts a few drops from a patient's finger. A miniature centrifuge then spins the device, forcing blood components into test cavities, called cuvettes, on the outer rim.

Each cuvette contains chemicals to run tests for sugar, cholesterol and other factors.

The blood rotor is manufactured and sold by Abaxis Corp.

Rotor separates and dilutes blood, channeling plasma and cells into cuvettes.



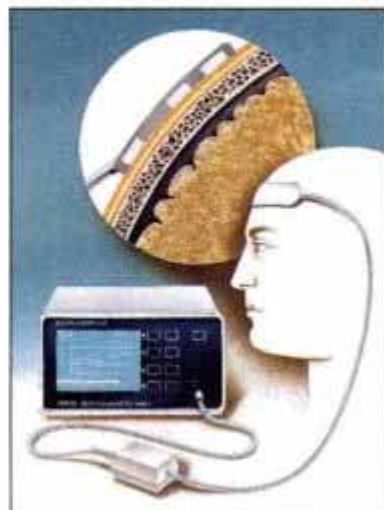
Brain Light Tracks Oxygen

TROY, MI—A new machine lets surgeons and anesthesiologists shed light on the brain to make sure a patient is getting enough oxygen.

Made by Somanetics Corp., the cerebral oximeter emits a near-infrared light beam to penetrate skin, muscle and skull. Interior tissues scatter the light, and two sensors on the device detect light that exits the head. A processor then measures the degree to which oxygen molecules have absorbed certain wavelengths.

Until now, hospital personnel have relied on clinical symptoms to detect changes in oxygen. The new device should help prevent

accidental brain damage during surgery.



Oximeter uses light beam to monitor supply of oxygen to brain during surgery.

New High-Tech Phonejak™ System Turns Any Electrical Wall Outlet Into a Phone Extension!

INSTANTLY USE UP TO TWENTY TELEPHONES AND TELEPHONE DEVICES STATIC-FREE THROUGHOUT YOUR HOME OR OFFICE – EVEN WHERE NO JACKS EXIST!

- EASY TO USE—NO INSTALLATION REQUIRED.
- USE ORDINARY ELECTRICAL WIRING AS TELEPHONE CIRCUIT.
- BETTER SOUND QUALITY THAN THE BEST CORDLESS PHONES.
- PAY NO FEES TO THE PHONE COMPANY. SAVE HUNDREDS OF DOLLARS A YEAR.



Enjoy up to twenty telephone extensions with clear clean sound.* Have telephones and telephone devices where you need them and when you want them. The Phonejak™ is easy to use and doesn't require expensive phone company hook-up charges and endless monthly fees.

Phonejak™ gives you the convenience of having a "phone in every room of your home or office"—without the cost. The advanced technology employed in Phonejak™ uses over 150 meticulously assembled, sophisticated electronic components, the same as the most expensive miniature computers.

State-of-the-Art Phonejak™ Telecommunications Transmission System, No. PX-101

The Static-Free Phonejak™ Telephone Extension System, designed like a miniature computer, comes complete with an advanced highly featured telecommunications transmitter and a receiver/extension device that may be moved from room to room. Supports up to 20 extension locations at one time.

Only **\$79** Per System
(\$6 S&H)

Additional Static-Free Receiver/Extension Device, No. PX-102

Use with the above Phonejak™ Transmission System to create up to 20 fixed extensions.

Only **\$49** Each
(\$2 S&H)

Satisfaction Guaranteed!

Phonejak™ is covered by a 1 year warranty for parts and labor. If you are not completely satisfied, for any reason, return Phonejak™ within 30 days for an immediate refund.

Call To Order Today!
1-800-222-1600

Or send check or money order to—

PHONE TECHNOLOGIES



615 Colonial Park Drive
Suite 102
Roswell, GA 30075



PHONEJAK™ WORKS WITH ANY PHONE DEVICE!

- CORDED PHONES
- CORDLESS PHONES
- SPEAKER PHONES
- ANSWERING MACHINES
- FAX MACHINES
- COMPUTER MODEMS
- PLUS ALL OTHER TELEPHONE DEVICES



* Some wiring systems may cause a variance in performance. Recommended for single phone lines.

Copyright ©1992 by Phone Technologies. Phonejak™ is protected by U.S. and International Patents.

THE HOTTEST THING TO HIT AMERICA SINCE



THE CHILI PEPPER.

It's beautiful. It's spicy. It's hot. It'll make you put on your shades and head for the nearest body of water.

It's the new 1993 Ford Ranger.

Ranger's sizzling new shape can be powered by an available 4.0 liter V-6. Combine that with push-button 4-wheel drive, a wider stance, improved steering and an interior full of

the best never rest™

refinements and you've got one hot truck.

Now no matter where you

THE NEW 1993 FORD RANGER.

go, no matter what the weather is, the new

Ford Ranger is the truck that's sure to make temperatures rise.



THE BEST-SELLING AMERICAN TRUCKS
ARE BUILT FORD TOUGH.

Buckle up—together we can save lives.

Материал защищен авторским правом



Electric Black-And-White

WILLITS, CA—Electric vehicles don't normally spark thoughts of high-speed car chases. But don't tell that to police officers in this northern California town.

They're testing a converted Ford EXP, electrified to get from 0 to 95 mph in a quarter-mile.

Key to the vehicle's performance is what inventor

Howard Letovsky calls "electric nitrous oxide." The device disengages the micro-controller that normally regulates power to the engine. Instantly the batteries' peak current becomes completely available. The driver kicks in this bypass mode simply by flooring the throttle pedal.

The car, known as Lectracop, has a minimum range of

25 miles, a typical day's work for a Willits police cruiser.

Lectracop runs so quietly that police can check a noise complaint without leaving the car. And it can approach a crime scene more stealthily

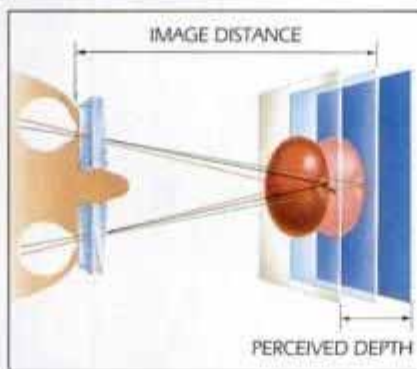
Ten deep-cycle batteries and bypass solenoids turn a 27-hp electric motor into a 160-hp rocket engine.

than a gas-engined car.

Letovsky is developing similar vehicles for at least one other California police department.

CITEC PHOTO; ILLUSTRATION BY DON MANNING

3D Vision For Laser Show



Chromostereoscopy creates 3D effect at New York's Hayden Planetarium.

ROSWELL, GA—A new 3D projection technique is debuting in planetarium laser shows.

Known as chromostereoscopy, the technique does not require double images.

Chromostereoscopy takes advantage of the brain's tendency to interpret blue objects (such as

sky) as more distant than red.

If light from an image passes through a double prism, the red wavelengths bend through a different angle than the blue. With double prisms over each eye, chromostereoscopic glasses cause the brain to separate depths of reds and blues.

A Georgia Tech researcher perfected this technique in the mid-'80s and later worked with MIT researchers to achieve the same refracting properties in inexpensive, thin plastic film.

In Search Of A Cleaner Vacuum

HOUSTON, TX—Later this year, Shuttle astronauts will turn loose a free-flying satellite built to produce the purest vacuum yet created.

Called the Wake Shield

Facility (WSF), the spacecraft resembles a 12-ft. Frisbee. As it moves at orbital velocity, its forward face will carve out a clear wake.

Experiments mounted on its aft face will run in $1/100,000,000$ th of the atmosphere they'd experience in the Shuttle's payload bay, which is often tainted with outgassings from the Shuttle itself. In an unusual deployment maneuver, the Shuttle will hold still as the WSF moves away, to keep the vicinity as clean as possible.

On its first mission the WSF will carry apparatus to Wake Shield Facility carves a swath of extra-high vacuum as it moves through space.



grow thin-film gallium-arsenide semiconductor material. After 40 hours, the Shuttle arm will retrieve the

facility and tuck it away in the payload bay.

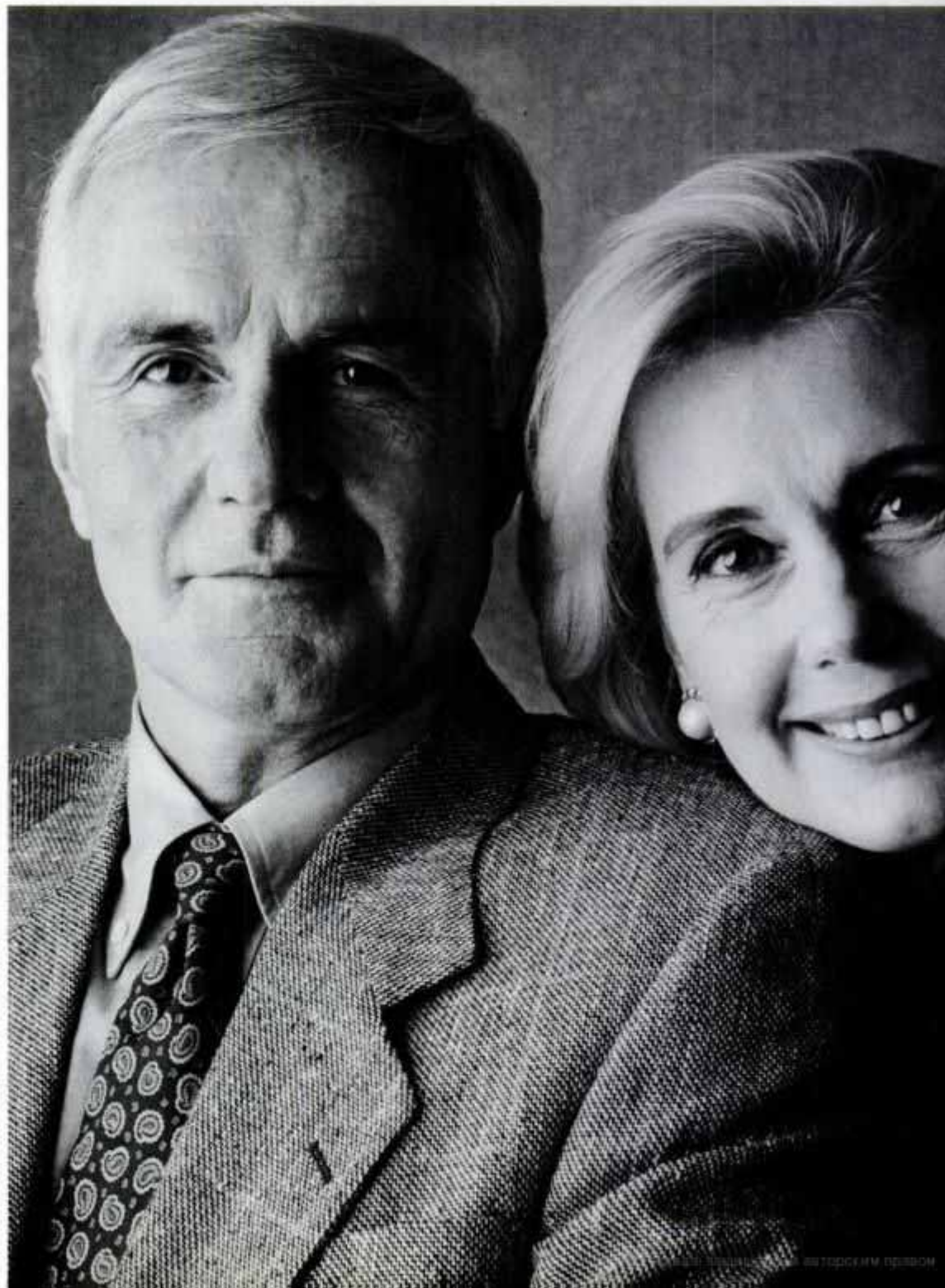
Three future WSF missions are in the planning.



AUDIO-VISUAL ENGINEERING PHOTO; ILLUSTRATION BY ADOLPHE BROTMAN

NASA PHOTO AND ILLUSTRATION

**What every man
should know
about his prostate.**



What and where the prostate is

Only men have a prostate. It's a walnut-sized gland located at the base of the bladder. It surrounds a part of the urethra, the tube that carries urine from the bladder through the penis.

The prostate supplies the milky fluid that helps transport sperm through the penis during ejaculation. The prostatic fluid also aids conception by providing support and nour-

ishment for the sperm and helping to make the vaginal canal less acidic.

What an enlarged prostate is

In most men, after age 45, the prostate starts to enlarge and may continue to enlarge for the rest of a man's life. This growth may be benign prostate enlargement, a non-cancerous condition. A major cause is the activity of a key hormone.

By itself, benign prostate enlargement isn't a problem. But as the prostate continues to grow, it can squeeze the urethra (like pinching a straw) and interfere with the normal flow of urine, causing uncomfortable and embarrassing symptoms.

Benign prostate enlargement is a common medical finding in older men. However, not every man develops the condition, and in those who do, it is not always progressive.

The urinary symptoms of an enlarged prostate

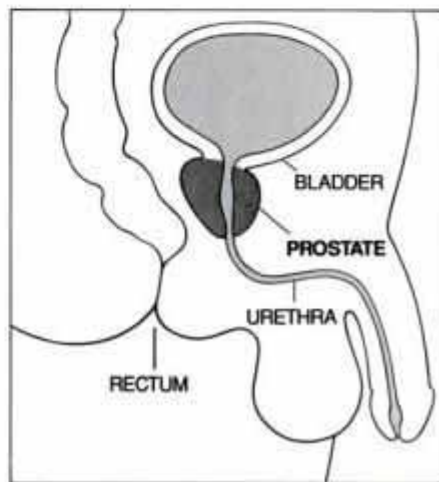
Among the symptoms commonly associated with an enlarged prostate are more frequent urination, especially during the night, or the sudden, almost uncontrollable urge to urinate. The added pressure on the urethra can also cause a weak, interrupted urine stream, a sense of the bladder not emptying completely, leakage, and difficulty in starting urination. It can even result in total blockage, a serious condition.

Why you should consult the doctor

Symptomatic benign prostate enlargement can be helped. Recent advances in treatment have been made, and today your doctor has several options. So now, more than ever, is an excellent time to consult your

doctor. You and your doctor should discuss which treatment option would be best for you.

If you experience any symptoms, see your doctor and speak frankly about the problem. A simple rectal examination enables the doctor to feel, with a gloved finger, the size and condition of the prostate. This exam, and other tests the doctor may recommend, will also help to rule out the possibility of prostate cancer. Benign prostate enlargement is not cancer and does not turn into cancer.



The prostate is located at the base of the bladder. It surrounds a part of the urethra, the tube that carries urine from the bladder through the penis. As the prostate enlarges, it can squeeze the urethra and cause urinary problems.

These days, prostate problems don't have to interfere with living your life to the fullest. That's what every man should know.

Talk to your doctor, soon. And, for a free booklet with more information, call 1-800-635-4452.



Things are tough all over.



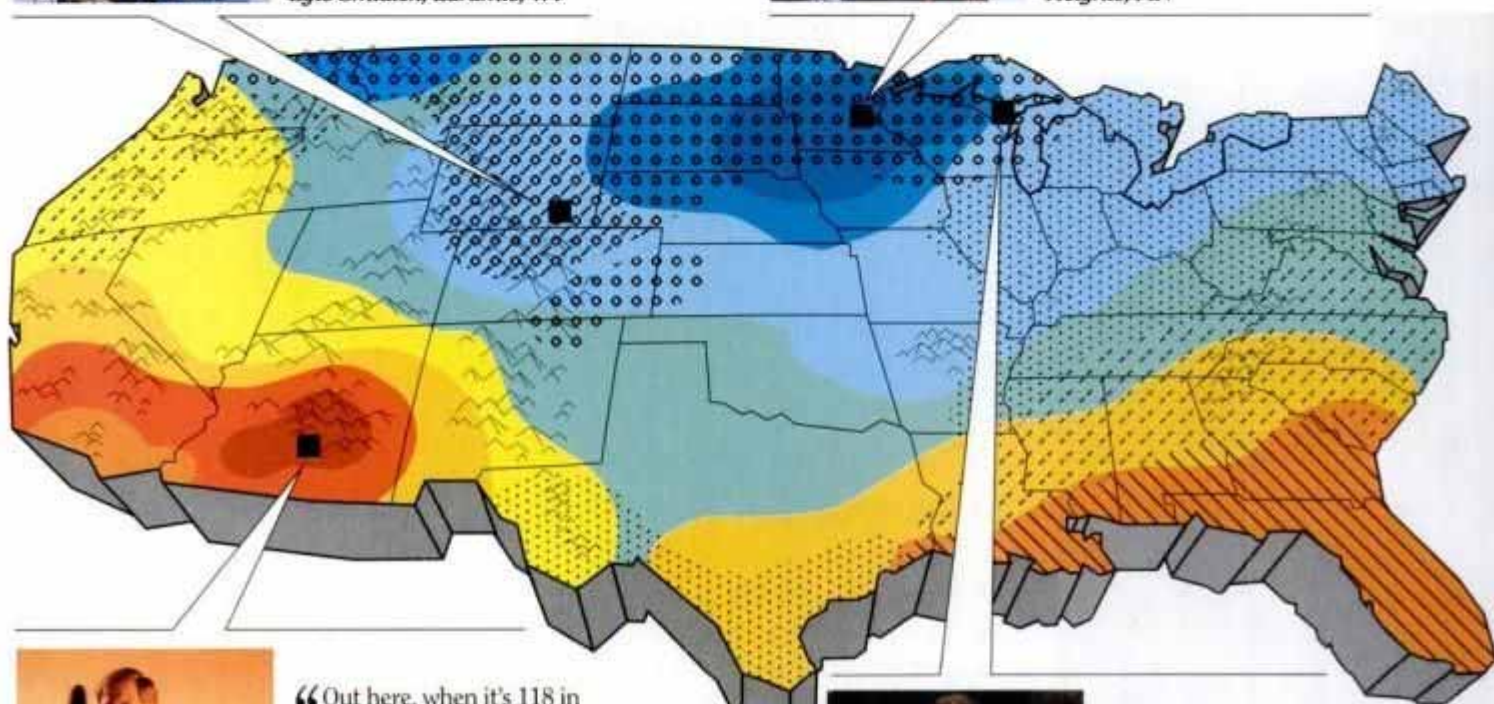
“My electrical system had a short that would drain an ordinary battery. But my Champion Switch gave me a backup start three times a day, three months running! Finally got the car fixed but I'll never switch my battery brand.”

Lyle Smialek, Laramie, WY



“My job puts me on 24-hour call. Even if it's 3:00am and 30 below, I gotta go. Champion's SubZero comes through where other batteries failed. Now, anytime my phone rings, you can count on me to come running.”

Gary Kaldun, Inver Grove Heights, MN



“Out here, when it's 118 in the shade, it might be 220 under the hood. I was burning up ordinary batteries in a year or less. Changing to Champion's Scorcher solved my problem. Who says you can't do anything about the weather?”

Bob Holt, Phoenix, AZ



“Way offroad, my Champion 700 broke loose all the way through the wheel well. Found it later that night, smashed up in a mudhole. Put it back in and started right up. Champion gets you out of the woods.”

Michael Thode, Escanaba, MI

All across America, people start with Champion® batteries.

Because we start with the idea that different conditions demand different solutions.

We make batteries to stand up to the cold, batteries that beat the heat and batteries that even

back you up with a reserve start at the flip of a switch. Pick a Champion, America's starting line-up. No matter where you live.

If you have a Champion performance story or need more information, call 1-800-289-4627.



America's Starting Line-Up™



GNB Incorporated
375 Northridge Road
Suite 300
Atlanta, GA 30350

A Pacific Dunlop Company

BLACK ART

Highest-tech is replacing cut-and-try as tire manufacturers race to improve the breed.

BY ED JACOBS

● Designing a tire used to be low-tech—as often as not, the tire company's art department would design a tread pattern and send it down to the engineering staff. How it worked on the road was less important than how it looked in the store. Even at best, designing a tire involved months of cut-and-try, building prototypes by hand and then mounting them onto some test mule for evaluation by skilled drivers—and then starting over with a different tire, influenced by the test results.

Times have changed. Tire companies now use the highest technology available to shorten the length of the development cycle and zero in on the desired characteristics. Finding out about that technology is difficult, though—the tire industry is nearly as secretive as the defense industry. Only employees are allowed into many of the design

facilities—and only if they need to be there.

In fact, many tire manufacturers don't even patent their best stuff, for fear of revealing how they've done it. They prefer to simply keep the information proprietary. So getting them to reveal their trade secrets to us has been an uphill battle. Here's some of the good stuff that they *are* willing to talk about.

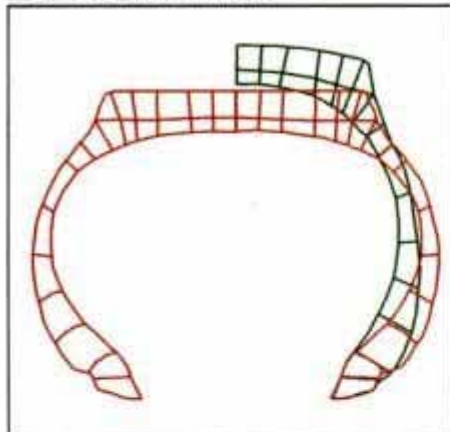
Supercomputers

Tires may look simple, but they're extremely complicated structures. Counting individual elements, there are thousands of pieces in each one—and nearly all of the pieces interact with one another somehow.

Modeling this nonlinear behavior was impossible in the traditional slide rule and drafting table days. Early computers improved on this, but giving desktop computers and workstations to individual



Thermographic false-color image of sidewall taken while tire is running on a dynamometer clearly shows manufacturer's logo.



engineers and scientists really got things started. With that came statistical design experiments, finite element analysis and computer-aided design (CAD), which allowed such things as computing the optimum tread pattern for a quieter ride.

Virtual Reality

Supercomputers are necessary for virtual reality, which is part of some of the most secret Department of Defense projects. It involves simulations so complex that they can create the look and feel of a particular environment . . . then put you in it. Tire companies are mum about the subject, but what virtual reality could do is mimic a car being driven through a test program on any course.

The simulation would create a custom environment including such things as ambient temperature, road temperature, weather conditions, road surface type, surface texture, bumps, potholes and tar strips. Then, changes in construction or compounding could be factored in to see how they would affect the performance of a new tire.

With feedback to the simulator, drivers could feel the differences the changes make while they are driving the course.

This volume of information is so immense that only a supercomputer can handle it. Currently, Toyo, Michelin and Bridgestone/Firestone are working on virtual reality—although, naturally, they don't discuss it.



Computer-generated images show (left to right) unmounted/inflated tire profile, pressure footprint across tread and false-color pressure footprint.

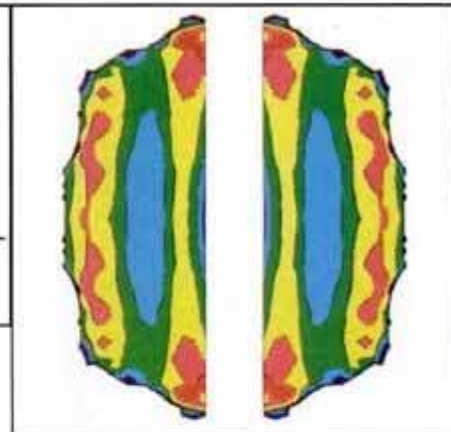
Stereo Lithography

Goodyear, Dunlop and Michelin use clever technology called stereo lithography to produce—in a few hours—plastic models of concepts that might otherwise take days or weeks.



High-tech extends to electron microscope testing of tire-manufacturing materials.

Once a design is developed on a CAD system, it is mathematically sliced into thin cross sections by special software. The data then guide a helium-cadmium laser, mounted above a vat of photo-sensitive poly-



mer. The laser's tiny, but intense, spot of ultraviolet light solidifies the polymer at the point of contact. By moving the laser over the vat to "paint in" the correct shape, a thin layer of solid polymer is formed conforming to the cross section.

Then an elevator device drops that layer a half-millimeter or so, polymer covers it and another cross section is formed on top of it. So it goes, until the whole component is formed, after which high-intensity ultraviolet light finalizes hardening.

Noise Simulation

Tire noise comes from the interaction of tread elements and grooves with the road surface. Until recently, eliminating it was literally cut-and-try. Sometimes many handcut tread designs were tested before the first mold could be ordered.

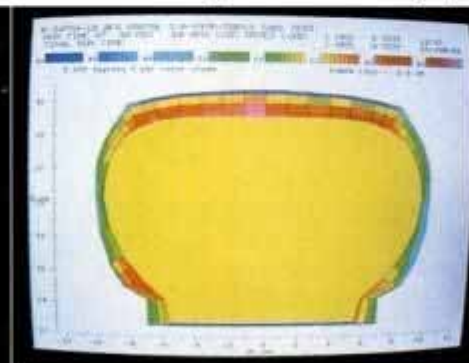
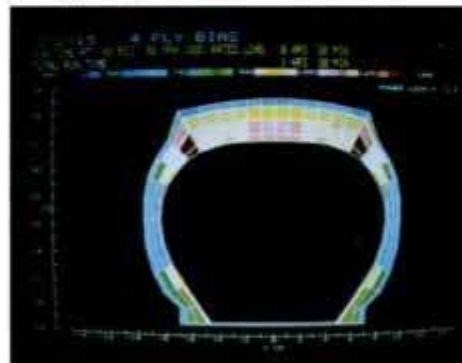
Now, computer simulators truncate months into hours by comparing computer-modeled designs to a large database. They predict how loud a design will be in specific frequency ranges, allowing designers to lower overall noise or shift some of it to less-objectionable ranges.

Most simulators generate only the noise you would hear from the side of the road, but Goodyear, noise-simulation pioneer BFGoodrich and its parent, Michelin, also predict noise transmitted into the vehicle.

Computer-Controlled Machining Equipment

Goodyear uses 5-axis milling equipment to produce models of experimental treads, as well as the models from which tire molds are made. It is driven by CATIA (Computer-Aided Three-dimensional Interactive Applications) software adapted from the aerospace industry and described as a generation and a half ahead of conventional CAD.

Dunlop uses 6-axis equipment to engrave lettering and styling elements on the sidewalls of molds, reducing production time from three days to 1½ hours.



Thermographic photography reveals false-color profiles of a bias-ply truck tire (left) and a high-performance passenger-car radial under load up to speed (right).

"Smart" Tires

Goodyear already has truck tires containing computer chips on the road. Bridgestone/Firestone and Continental are developing similar programs. So far, chips are used only for identification and tracking—important in tires that may change hands and be recapped several times in their 500,000-mile lifetime. Soon, though, the chips will record pressures, temperatures and operating conditions—information that easily could be fed back into the development programs.

Infrared Thermography

Since heat weakens materials, reduces durability and can lead to failures, companies pay very close attention to heat generation and buildup. Infrared thermography is the key.

In a typical system, an infrared scanner examines an inflated tire running under various speed, load, ambient-temperature and operating conditions. Then a graphics monitor or printer converts the data to a "false-color" picture of all (or part) of the surface of the tire.

Different colors represent specific temperatures and pinpoint trouble spots, just as they do on the weather



Concept-car prototype tire at right was taken from CAD/CAM tread pattern, shown above, to finished tire within a matter of a few weeks. Molds were cut by 5-axis CNC mill directly from computer database.



maps on CNN or the Weather Channel.

Using special software, Bridgestone/Firestone, Goodyear, Michelin and thermography pioneer BFGoodrich also determine temperatures within the tire. BFGoodrich can do it at up to 200 mph.

X-Ray Equipment

Just like doctors, tire engineers and scientists examine their "patients" with X-ray equipment. One method is exactly the same: X-rays passed through the tire expose film and produce a picture of the internal structure. Not only does this reveal internal flaws, it also shows how the tire was assembled and whether it met design specifications.

X-rays are used to check experimental and test tires, and for quality control. And the major players in racing—Goodyear, Michelin and BFGoodrich—also X-ray their racing tires.

CAT Scanners

X-rays are used in Computerized Axial Tomography, a sophisticated bit of medical technology brought to the tire industry by Dunlop.

A CAT scanner slices an object into a series of cross sections using X-rays emitted while it rotates around an object. The data recorded are processed by a computer and converted into cross sections displayed on a monitor or sent to a printer for study.

Using the scanner, it's possible to examine a mounted and inflated tire under load, to see how well the beads are seated in the rim or to check the loaded contours of the tire's internal components.

Holography

X-raying makes 2-dimensional images by passing energy through objects. Holography makes 3D images by bouncing light off of objects in a deliberate double exposure.

The first exposure is a straightforward
(Please turn to page 95)

Running On Empty



● One development attributable to all of this technology is the realization of something tire companies have wanted to make for generations—the first runflat tire systems actually effective enough to market.

It's a simple idea—build a tire that will run when it's completely deflated. The advantages are obvious: You simply can drive home and change your flat in the driveway the next morning, instead of late at night in a bad neighborhood or in the rain.

Goodyear will make its tire, the Eagle GS-C EMT (Extended Mobility Tire), sys-

tem available as an option on '94 Corvettes. One prerequisite: The Vette must be equipped with GM's low-air-pressure warning system, consisting of four radio transmitters, one inside each tire, and a warning receiver on the dash. Otherwise, a driver might be unaware that a tire was deflated.

Bridgestone also has announced a runflat tire, the Expedia S-01 Runflat A/M, which must be used with a special "wedge hump" wheel and a similar low-air-pressure warning system. The system will be used on new Callaway Corvettes.

ROTO SCO

The cost of vertical flight takes a nosedive with the entry of a new breed of quick-build kit copters.

BY MICHAEL PATRICK
PM Photos by Paul Bowen

● In recent years the attention of at-home aircraft builders has focused on machines that go faster, farther and higher. But during last summer's huge gathering of the aviation faithful at the Experimental Aircraft Association's convention in Oshkosh, Wisconsin, new aircraft boasting slower, shorter and lower performance figures turned lots of heads.

What made up for these shortcomings was the sheer freedom and flexibility of flying straight up—from a backyard or heliport—without the exorbitant costs that have been associated with helicopters right from the beginning.

Straight up with a twist

While home-built helicopters are nothing new (Rotorway has been making them for decades), the highly simplified design of these birds allows unheard-of buildability and economy.

The Mini 500, from Revolution Helicopter Corp., Liberty, Missouri, and the CH-7 Angel, from Elisport Helicopters, Turin, Italy, are single-seat machines. Both use the Rotax 582, a 67-hp water-cooled 2-stroke popular among fixed-wing kit-builders. The Mini 500 can be yours for about \$25,000, about what you'd pay for a well-equipped Dodge Intrepid. The Angel, the snazzy continental import, costs \$10,000 more.

Of the two, the Mini 500 has been faster out of the gate. Company president and chief designer Dennis Fetters reports that at year end orders exceeded 150 aircraft—even though full kit production wasn't set to begin until January, and the most recently ordered kit



REVOLUTION MINI 500

ROTOR



wouldn't ship until this summer.

"The phone's been ringing off the hook," he says, crediting the 500's appearance at Oshkosh for the robust business.

A quick examination of the 500's numbers explains the keen interest. With a gross weight of 820 pounds, the 500 can carry 400 pounds worth of pilot and gear and 15 gallons of gas. Maximum cruise is 95 mph. Due to its high-mounted rotor, the aircraft will hover in ground effect at 5500 ft. but at 7500 ft. out of ground effect. The 500 climbs at 1100 fpm and tops out at a 10,000-ft. service ceiling.

At 75% power, the Rotax engine burns a miserly 5 gallons of unleaded auto gas per hour. Fetters says that low burn, combined with low overhaul costs (\$300 to \$500) for the 500-hour TBO engine and similarly inexpensive overhaul on other parts, will keep operating costs down to \$10 per hour. This figure is so low it strains believability.

But there's more. A key element in Fetters' plan was to keep the kit as foolproof as possible. Thus the main and tail transmission and gearbox come assembled, instruments are ready to install and all parts are marked for drilling. The whole kit involves fewer than 1000 parts, including engine, rotorhead blades and tail rotor assembly. By comparison, the popular Air Command gyroplane, which Fetters also designed and sold in kit form, had a total of 1300 parts.

As a result, Fetters says a first-time builder should be able to put together a Mini 500 in 40 to 60 hours. Although some industry insiders express skepticism, Fetters is confident about the low build-time estimate, noting that assembly of his gyroplane

took about 40 hours.

And, despite the 500's quick assembly, Fetters says it will still meet FAA regulations requiring that a minimum of 51% of any kit's construction must be done by the buyer to qualify as a home-built aircraft.

Mini 500 builders can take pride in owning a solid piece of flying hardware, not some sort of toy. The cabin structure is a foam-fiberglass sandwich construction. The semi-rigid teetering blades are a composite of foam core and Kevlar with an aluminum spar and leading edge. Fetters says, the 9-ft., 6-in. blades should last the life of the aircraft, if properly maintained. Tail rotors are hollow aluminum and effective even when hovering in tailwinds of up to 20 mph.

Control rods on the 500 are housed within the aircraft's nickel-plated chromemoly steel driveshaft, and a special yoke control system eliminates the washplate common on many helicopters. Power is transmitted from the engine through two double-grooved, Kevlar-reinforced belts by an aluminum pulley that reduces output at a 2.433:1 ratio.

The aircraft comes with all engine instruments and is equipped for VFR flight. The center pedestal can easily accommodate additional equipment, including nav and comm radios. Switches and breakers are factory installed.

Overall design, as the aircraft's name suggests, was heavily influenced by the Hughes/McDonnell Douglas 500. "It looks like a Hughes 500," Fetters states unapologetically. "I wanted it to. Everyone loves the Hughes 500. I love the Hughes 500. I just couldn't afford one."

ROTO SCOOTER

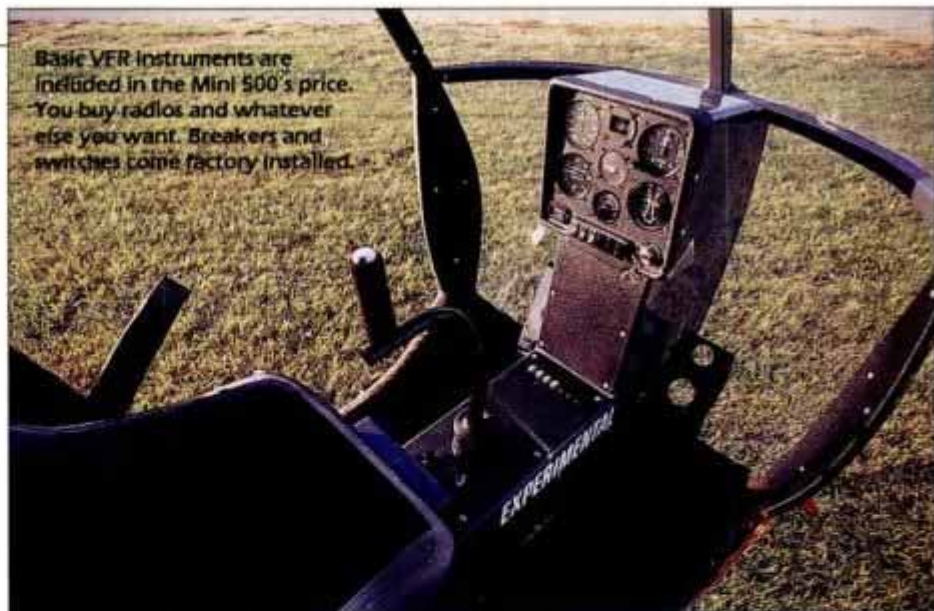
Little Angel

The Italian-made CH-7 Angel is much more radical in appearance, but it shares the quick-build, fun-flying attributes of the Mini 500. A flight-demo star at Oshkosh, the Angel is in fact the most recent in a long line of aircraft designed by Augusto Cicare, an Argentine of Italian origin.

At the time of its EAA appearance, the Angel was already in production. Max Khaled, a company spokesman, says more than a dozen Angels had been delivered by mid-November 1992, and the company, a newcomer to aviation, was turning out five to six full kits a month. That figure was to reach 20 or more a month in 1993.

By year end, all deliveries had gone to non-U.S. customers, since the FAA had yet to evaluate the kit and assembly procedures to ensure its compliance with the 51% rule. Once kits are shipped to the United States, Khaled said assembly should take approximately 40 hours.

At 28 ft. in length, 81 in. in height, its skids spread 62 in. and main rotor 19 ft. in diameter, the Angel closely matches the Mini 500's dimensions. It has a listed useful load of 308 pounds and 10-gallon fuel capacity. Max



speed is 86 mph, and it will climb at 1200 fpm.

Like the Mini 500, the Angel is fitted with composite, semi-rigid main rotors, metal tail rotors and a composite cabin fitted to a steel frame. Its control system eliminates the need of a swashplate. (Design rights to the main rotor control system are a matter of dispute between Elisport and Revolution, with the former claiming authorship and the latter citing its receipt of a U.S. patent for unique mechanical elements.)

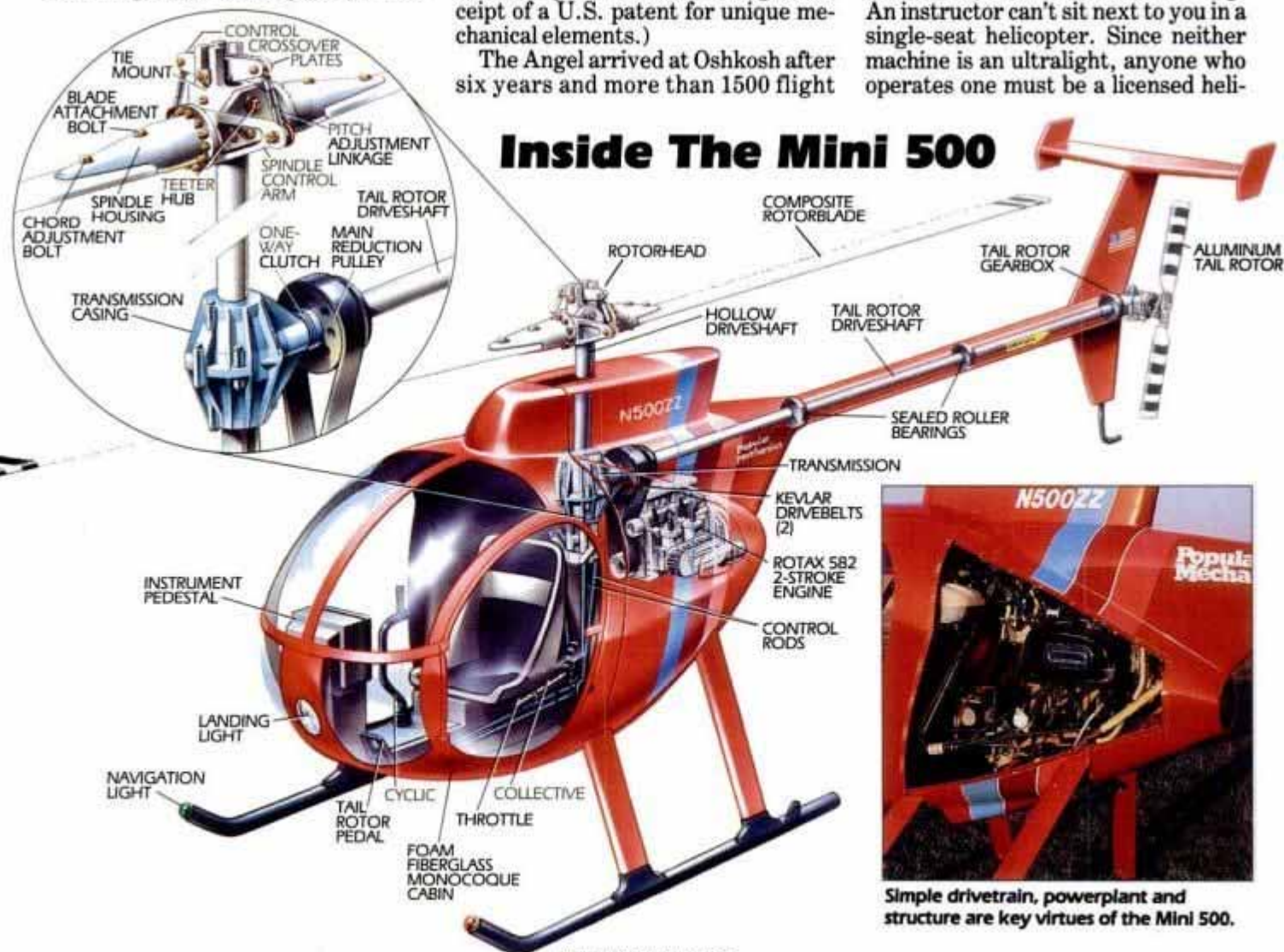
The Angel arrived at Oshkosh after six years and more than 1500 flight

hours of testing and refinement. The finishing touch was the design and fabrication of its cockpit—all the handiwork of Marcello Gandini, whose previous credits include the Lamborghini Countach and Diablo.

On your own

While a one-seat machine guarantees flight free of kibitzing passengers, its exclusivity does have certain drawbacks. First is the matter of training. An instructor can't sit next to you in a single-seat helicopter. Since neither machine is an ultralight, anyone who operates one must be a licensed heli-

Inside The Mini 500



Simple drivetrain, powerplant and structure are key virtues of the Mini 500.



ELISPORT ANGEL

copter pilot. And if you're not licensed, you'll have to get training in a different kind of aircraft first.

Theoretically, a student pilot could take dual instruction (20 hours minimum) in something like a Robinson R22 and then conduct his required solo flights (another 20 hours minimum) in his home-built single-seater. That would be legal, but many rotary veterans suggest that might not be the most prudent course to follow.

"A helicopter is inherently unstable," warns Steve Graves, an instructor with Farrington Aircraft, Paducah, Kentucky, who is licensed in gyroplanes, helicopters and airplanes. "I would recommend that a person get a license before they get into a single-place helicopter and fly solo."

Also urging caution is John Netherwodd, president of Rotorway International, which once manufactured a single-seat Scorpion. "Every helicop-

ter has different flight characteristics," he says, "and in single-place machines there's no one to train you." That's one reason Rotorway has quit the single-place market.

Nonetheless, the Mini 500 and CH-7 herald a new and unique kind of personal mobility. And, for many who have dreamt of flying alone where no one else can go, then settling softly onto whatever clear patch of ground presents itself, what once was fantasy may now be there for the taking. **PM**



The CH-7 Angel's sleek lines are the work of designer Marcello Gandini, whose previous work includes the Lamborghini Diablo and Countach.

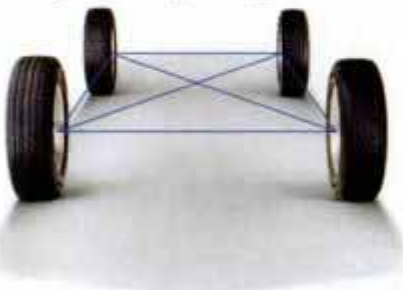
Beauty is only skin deep. Great engineering, however, goes all the way to the pavement.

CHEVROLET LUMINA EURO SEDAN

Admiring the Lumina's clean, angular shape doesn't make you a shallow person. But to discover its real beauty, we'd suggest a more thorough investigation.

Start at the bottom.

Developing the Lumina's 4-wheel independent suspension package was a

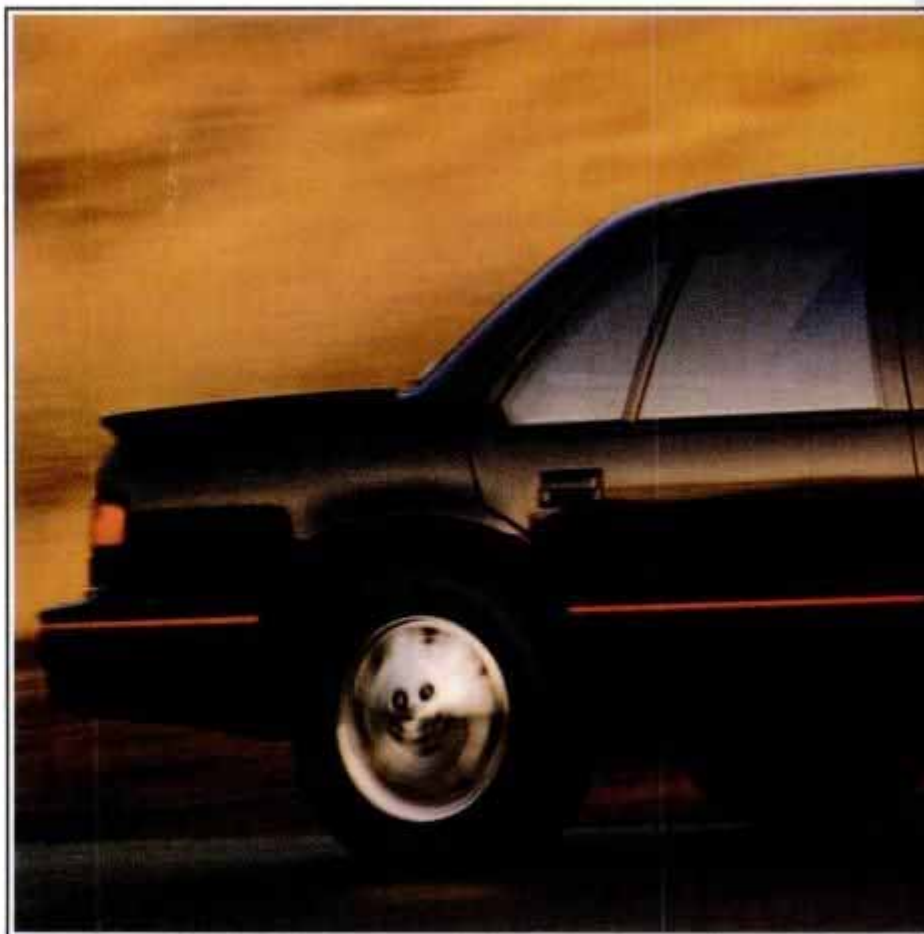


real trip: 100,000 miles' worth, to be exact. Along the way, more than 150 different suspension setups were evaluated.

It's no coincidence that the one we finally selected is the one that lets you make the most of Lumina Euro's smooth yet powerful 3.1 Liter V6 engine.

Rigid unibody construction means your senses will be stirred, not shaken.

The road of life is strewn with potholes. (Not to men-



tion bad patch jobs and crumbling asphalt.) Fortunately, the engineers who designed Lumina took this into account. Its stiff steel unibody works in tandem with the suspension to reduce body flex, for handling that's precise and predictable no matter how



inhospitable the pavement beneath you may turn.

All the conveniences of home. And nearly as much room.

A comfortable place to sit. Plush carpet underfoot. Good music on the stereo.



A place for your coffee mug.

And plenty of room to spread out. And why not invite a few close friends to join you?

After all, Lumina has more interior space than Accord,

Camry or even Taurus. So let the Lumina's good looks turn your head. However, be forewarned: this is one automobile that's engineered for a long lasting relationship. Then again, what else would you expect from the Heartbeat of America?



THE HEARTBEAT OF AMERICA™

Chevrolet, the Chevrolet Emblem and Lumina are registered trademarks of the GM Corp. ©1992 GM Corp. All Rights Reserved. Buckle up, America! 





TOYOTA COROLLA LE

LONG-TERM TEST CARS

Meet the new additions to our fleet.

● As always, a new year means massive turnover in the PM long-term test fleet. In this installment we welcome several newcomers—and say goodbye to a few veterans.

Toyota Corolla LE

If you checked our '93 Design & Engineering Awards, you already know that we think the new Toyota Corolla (and its sister car, the Geo Prizm) is something special. It's quiet, supple and much roomier than the previous Corolla (as you'd expect of a size increase that takes it out of the subcompact class and into the compact class).

In fact, the Corolla is very much like a slightly smaller Camry. There's not as much power, of course, but otherwise the experience is uncannily similar. Instrument panels and controls are virtually identical, exterior styling is strongly Camryesque and

the excellent quality of the overall fit and finish is solidly Toyota.

Our test car is an LE model, top of the Corolla line, with a 115-hp 1.8-liter dohc 16-valve 4-cylinder engine and 4-speed automatic transmission. It also has an antilock brake system, a

driver's airbag and 3-point active seatbelts for the front seats and both outboard rear seating positions.

Other goodies in our Corolla LE include a sunroof, an AM/FM/cassette stereo sound system, power mirrors, power windows and cruise control. It all adds up to a pretty luxurious compact, capable of long-haul comfort as well as

CADILLAC ELDORADO TOURING COUPE





JEEP GRAND CHEROKEE LAREDO

PHOTO BY CLIFF GROGAN

its more ordinary role as an urban commuter.

By the time you read this, we'll have a pretty solid idea of how well the Corolla performs in both roles.

—Tony Swan

Cadillac Eldorado Touring Coupe

In the past few years, Cadillac has re-established itself as a technology leader, a reputation it held from the 1930s to the '60s. Features like computer-controlled suspension, traction control and electronic transmission control have come first to American cars in Cadillacs.

Now for '93, Cadillac introduces the first mass-produced high-tech American V8 engine—the Northstar V8.

With 32 valves, twin overhead cams, aluminum cylinder heads, electronic fuel injection, computer ignition system and platinum-tipped spark plugs, the engine is capable of producing up to 295 horsepower. That rating places it clearly among the most powerful V8 engines available in this country.

We were so impressed when we first drove a Northstar-equipped car that we awarded the Northstar powertrain system (with the 4T-80E automatic transmission) one of our '93 Design & Engi-

neering Awards. Still, we wondered how such a complex engine/transmission system would hold up under the strain of hard daily use. So we recently put a Northstar V8 in our long-term test fleet. You can't long-term-test just an engine. So we asked Cadillac to wrap an Eldorado Touring Coupe around the Northstar.

In Eldos, the Northstar is available in two different versions. One is rated 270 hp at 5600 rpm. The other pumps 295 hp at 6000 rpm. Our test car has the more powerful 295-hp version and a 3.71 final drive.

We've just taken delivery of our Northstar Eldorado, so we'll keep you posted throughout the coming year.

—Joe Oldham

Jeep Grand Cherokee Laredo

When the Jeep Grand Cherokee was introduced last spring, we drove one and liked it. We were impressed with the ride and the overall quality of the vehicle, but frankly it didn't excite us.

When Chrysler recently announced the availability of the 5.2 Magnum V8 in the Grand Cherokee as an option,

then we got excited. So excited that we asked the Jeep/Eagle Division of Chrysler Corp. to provide us one for a long-term test.

Two-hundred-twenty horsepower in the brawny V8 means one thing in a sport/utility vehicle—towing capacity, up to 6500 pounds with the V8 and trailer-towing package. So the first thing we did was hitch up a trailer and tow it 700 miles, through the mountains of Pennsylvania, along the flatlands of Ohio and up into Detroit. Tow it did, in grand form and with decent gas mileage—almost 17 mpg.

Complementing the Magnum V8 in our test vehicle is a 4-speed automatic transmission, full-time 4-wheel drive and a 4-wheel antilock braking system. The Grand Cherokee also has a driver's-side airbag standard.

We have only two minor squawks so far. Wind noise above 80 mph is excessive and annoying—out of character with the Jeep's overall quietness and refined ride. Less of a problem, still an annoyance, is the keyless entry system. Unlike most, this system uses line-of-sight infrared light to operate, requiring you to carefully point



GMC SUBURBAN SLE

PHOTO BY G PHOTO

LONG-TERM TEST CARS



PM PHOTO BY GEORGE OLSON

the transmitter right at the receiver lens on the dome-light housing. It's going to be interesting to see if the darn thing works when there's snow covering the window or the receiver is shaded by the B-pillar. —Mike Allen

GMC Suburban SLE

Offered by both Chevrolet and GMC Truck, the Suburban underwent an extensive redesign for the 1992 model year—its first in 19 years—and we've been looking forward to putting one into service ever since.

Among other upgrades, our '93 Suburban has a new electronically controlled 4L-80E 4-speed automatic transmission, replacing the old hydraulically controlled unit. The net gain here is smoother shifting and improved efficiency.

Other specifics for our Suburban include GM's big workhorse 454-cu.-in. V8 engine (230 hp, 385 ft.-lb. of torque), 4-wheel drive and a payload of 2944 pounds. More important, in terms of how we intend to put this vehicle to work, is its tow rating: 10,000 pounds. The heavy-duty towing package also includes a bigger radiator, coolers for both engine and transmission oil and a 4.10:1 rear axle with locking differential.

Big is a word that applies to this whole rig, of course. Riding a 131.5-in. wheelbase, it's 219.5 in. long and weighs 5656 pounds. With all three rows of seats in place (our Suburban is configured for eight passengers), there's 49.5 cu. ft. of cargo space, more than the total volume of some compact sport/utilities. With the rear seat out and the center seats folded flat, maximum cargo space expands to 149.5 cu. ft., bigger than a lot of Manhattan living rooms.

We've got lots of hard work lined up for this big horse, so we'll have to see how our rig stands up to a steady diet of heavy hauling.

—Tony Swan



PM PHOTO BY RON HUSBY

Toyota Camry LE

The essence of a successful family sedan is smooth performance, plenty of space and bulletproof reliability. These have been the fundamentals for decades. And they're precisely what the Toyota Camry delivers.

Aside from the miles we've accumulated, our long-term Camry LE is going back to Toyota exactly as we received it. No squeaks, no rattles, no loose trim, no blemishes. No stumbles, no balks, no hints of temperament. No problems, in fact, of any kind. Requiring only routine maintenance, the Camry has delivered exactly the kind of service that puts sedans on the best-seller list—the kind of service that's so quietly efficient

and unobtrusive as to be subliminal.

ceptionally well-conceived sedan from a company famous for exceptional execution.

—Tony Swan

Nissan NX 2000

All PM long-term test cars get a thorough wringing-out, but none has ever undergone the kind of thrashing we've given this one. Our NX has been fed a not-for-sissies diet of Sports Car Club of America show-room stock racing, and we're pleased to report that this little pocket rocket thrives on abuse. After 10 races, including a trip to the SCCA Valvoline Runoffs at Road Atlanta last fall, it's ready for more.

Besides being the hottest thing in



PM PHOTO BY ROY ATAWAY

CADILLAC SEVILLE



the subcompact coupe group, the NX 2000 is also the hottest thing in its racing class (Showroom Stock B). There were 13 in the 32-car SSB field at Atlanta, and one of them—driven by Minnesotan Mark Youngquist—came home first.

With the season concluded, we can't find anything to dislike about this car. It's tops in its class for scoot, it's comfortable and roomy (for two) and it's tough. Despite all the racing bumps and thumps, there's still not a rattle or a squeak. —Tony Swan

Pontiac Bonneville SSEi

As this test car nears the end of its stint in our fleet and approaches the 20,000-mile mark, we have to weigh the good with the bad.

The good is the high performance of this roomy, good-looking 4-door sedan. This car can run with the best of the European and Japanese sport sedans. It's got the acceleration and handling to stay with anything in its size class. And the Bonneville costs thousands less than many imports of similar size and performance.

The bad is that our test car was plagued with annoying quality-control glitches that made our time with the car a bittersweet experience. In our last report, we mentioned the engine cam sensor that quit and the interior trim pieces that wouldn't stay put. You can add to that list a rear-view mirror that broke off in our hands one day, dash gauges that had a mind of their own and traction control and antilock brake systems that turned themselves off whenever we drove at very low speeds.

In fairness to Pontiac, their engineers have outlined to us a series of fixes for the '93 model year Bonneville that addresses most of these problems. And we recently rented three different Bonneville in three different cities that did not have these quality problems. —Joe Oldham

Cadillac Seville

When this car first entered our test fleet last year, we told you it would be the final test to determine if Cadillac had truly rendered a world-class sedan in the new Seville. We had already gone on record as loving the Seville's great combination of ride and handling. We liked its exterior design so much that we had given it one of our coveted Design & Engineering Awards. Now we were going to answer the final question: Could it stand up to a year at the hands of the POPULAR MECHANICS staff?

The answer is, yes.

Fact is, this has been one of the most boring long-term tests in history. Our test car has almost 20,000 miles on the clock. It has pattered along in gridlocked New York City traffic. It has covered 500 miles in 6 hours. It has been loaded to the gills with people and baggage. It has sat idle for several weeks. Through it all, it has never missed a beat. There is simply nothing to report.

Cadillac, you've done yourself proud. —Joe Oldham

Ford Crown Victoria Touring Sedan

After 20,000 miles of hard driving, it's hard to tell this big Ford isn't brand new. The ride is just as quiet, the sohc 4.6-liter V8 engine just as strong and

the 4-speed automatic just as smooth as the day we took delivery.

The only major problem we've experienced had nothing to do with quality. It began with a call early one morning from the Grosse Pointe, Michigan, police who told me they'd found the car about three blocks from my house with the driver's window smashed in, the ignition ripped to pieces, the sound system ripped out and all the lug nuts removed. That's as far as the thieves got. Apparently someone interrupted the work. In less than a week, Arnold Lincoln-Mercury, in nearby Roseville, had our Crown Vic ready to roll.

Aside from that, we've only had to fix one thing. A sensor in the Crown Vic's load-leveling air-spring suspension system tended to leave the rear end about an inch lower than the front, and was replaced. The irritating dashboard squeak we reported about earlier cured itself, after defying all attempts at diagnosis. Considering the electronic sophistication of this car, we're very impressed with its reliability.

Average fuel economy was over 21 mpg, nudging up toward 24 mpg in highway travel—about twice what big Fords delivered at the peak of their popularity 15 years ago.

Ford has brought the full-size rear-drive sedan concept up to date and then some.

—Jim Dunne



SUPERBIKE!

So radical it was banned until Barcelona, the forkless, monocoque-framed Lotus Sport bicycle turns high-tech into Olympic Gold.

BY CHARLES PLUEDDEMAN



● The gleaming black Lotus screams off the high-banked turn and onto the backstretch, closing in fast on the tail of a celebrated German racer. The crowd roars as the determined English pilot pushes the radically designed carbon-fiber Lotus past his competitor and blows him away in a new record time.

No, this wasn't another Formula One triumph for legendary Team Lotus, but a gold-medal performance at the Barcelona Olympics for the Lotus Sport, an exotic new monocoque bicycle developed by Lotus Engineer-

ing and ridden by English cyclist Chris Boardman. Equipped with a carbon-fiber body, cantilever monoblade suspension and titanium components, the Lotus Sport's design is so advanced it was banned from international competition until late last year.

In the bike's first major outing, at the Barcelona Olympics, Boardman and the Lotus Sport swept the field, twice breaking the world record in the 4000-meter individual pursuit event and ultimately defeating the reigning world champion. In the process, it changed cycling technology forever.

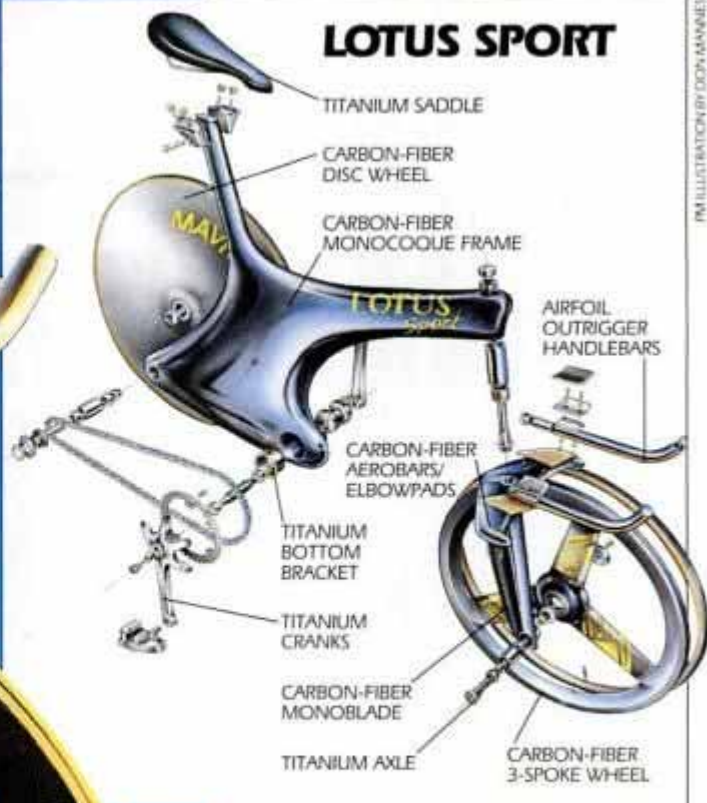
The Windcheetah

The Lotus Sport was conceived in 1982 by Mike Burrows, an English time-trial racer and designer of human-powered vehicles. The design, aptly named the "Windcheetah," had a monocoque frame with a high saddle and low handlebars, forcing the rider into a highly aerodynamic position. Instead of forks, the front wheel was secured by a single strut.

The bike's development was stymied because of rigid rules enforced by the Union Cycliste Internationale (UCI), the governing body for bike



LOTUS SPORT



TM ILLUSTRATION BY DON HANNES

But, according to Lotus aerodynamic engineer Richard Hill, the bike's weight is only critical in the early stages of a pursuit race.

Lotus used lessons learned from designing Formula One race cars to refine the airfoil shape of the Lotus Sport's monocoque—a 4.5-pound hollow structure that replaces the tube frame. The monocoque is a composite of unidirectional and stitched carbon fiber in an epoxy resin matrix, which is molded in two halves.

The rear wheel is supported by a cantilever arm that is part of the monocoque, while the titanium saddle is perched atop an airfoil-section seat post. A solid carbon monoblade carries the front wheel. Since the cantilevered monoblade is highly stressed in several directions, a special high-modulus carbon from Japan (an ex-

(Please turn to page 99)

racing. The UCI declared bikes like the Windcheetah ineligible for sanctioned events in the early 1980s.

The rules were liberalized in late 1991, and soon thereafter the bike's basic concept caught the eye of Lotus engineer Rudy Thomann, a bike-riding friend of Burrows. Thomann convinced Lotus Engineering that there was promise in the Windcheetah and the company purchased its rights just five months before the Olympics.

Bicycle designers have been using carbon-fiber tubing to build ultralight framesets for more than 10 years.



TM PHOTO BY CHRIS COLE

POSSIBLE DREAMS

Through changes in technology and marketing, what was old is new again.

BY MARY SEELHORST

● In preparation for Henry Ford Museum & Greenfield Village's "Possible Dreams" exhibit, I had the enviable task of reading through volume after volume of old POPULAR MECHANICS magazines. Not for fun, mind you. This was work.

I was looking for themes that we could use to organize the exhibit. Things that really revved the engines of PM's editors and readers over the past nine decades. I expected cars, trains and planes, buildings and bridges, tools and televisions, computers and rockets. But as I leafed through the 1920s issues of PM—in among the radios, powerplants and washing machines—I found . . . toothbrushes. But these were not ordinary toothbrushes. These were newfangled technologies, trailblazing the unexplored frontier of dental hygiene.

"Ultra-Sanitary Toothbrush Has Removable Bristles," "Toothbrush Head On Pivot Gives Better Cleaning," "Fountain Toothbrush Is Timesaver," and "Rubber Discs In Toothbrush Replace Bristles" were just a few of the titles from PM's pages.

Thus began one of the most popular features of the "Possible Dreams" exhibit. Throughout the exhibit we display examples of brand-new products—for instance, the latest model Interplak toothbrush, with its rotary bristles—and ask our visitors: "Think it's new?" Flip a panel and get ready to "Think again!" Dateline POPULAR MECHANICS, 1928: "Rotary Tooth-

Mary Seelhorst is curator of the "Possible Dreams" exhibit at Henry Ford Museum & Greenfield Village in Dearborn, Michigan.



brush Gives Aid To Dental Hygiene."

The rotary toothbrush was a spring-driven device with replaceable bristles, PM reported. The problem solved is the same in 1928 as in 1993. Only the technology—and no doubt the marketing—differ.

Everyone knows that the pump-up shoe is the latest fad in athletic footwear, right? But back in 1920, PM ran "Pneumatic Insole Makes Walking Easy," a captioned illustration of a shoe with a rubber bladder pumped up through a valve in the side of the shoe. So whatever happened to the pneumatic shoe of 1920? Simple—the NBA hadn't been invented yet.

One of the best-selling gadgets of recent years is the answering machine. The voice mailbox. Leave a message at the beep. Believe it or not, we found not one but two early devices for recording phone calls. So as not to spoil the effect if you plan to

come see the exhibit, I'll share with you the one we didn't use. A 1919 PM article described a system by which "one will not have to wonder, upon returning, whether the telephone has rung during his absence." A telegrapher at the switchboard would take the caller's message and tap it out in code. A device attached to the recipient's phone would print it out on paper tape. Only one problem—the recipient had to know Morse Code.

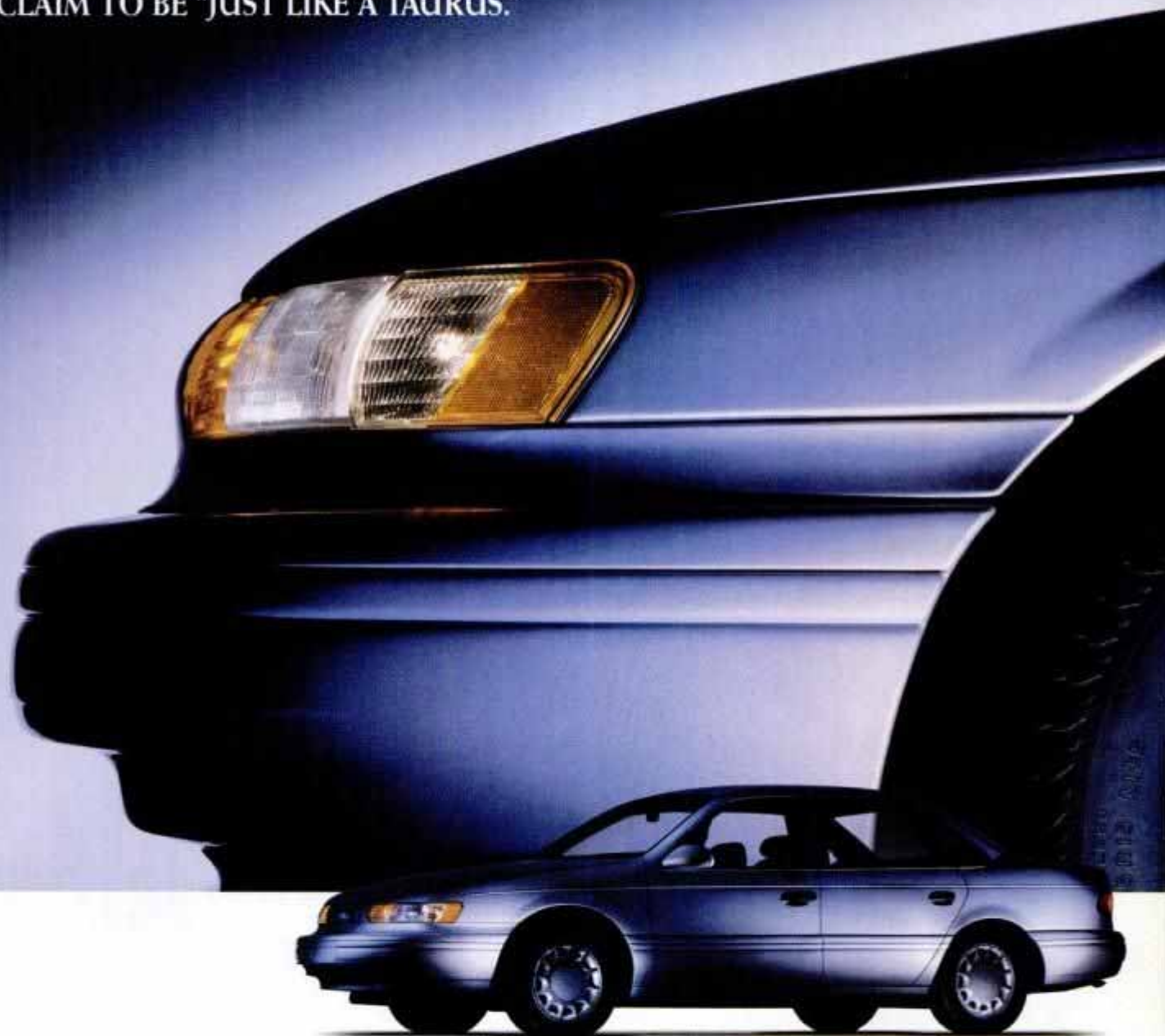
Some other "Think it's new? Think again!" comparisons that didn't make the final cut for the exhibit include a shower massage unit from 1921, inline skates from 1910 and facsimile machines beginning as early as 1905.

I was amazed to see a plug-in deodorizer for the kitchen in a 1930 issue. A 1902 article proposed a tunnel under the English Channel—and claimed that there had been 18 such proposals between 1800 and 1870.

We discovered picture-phones in 1934 and 1940, and even "TV Set Shows Two Pictures At Once" from 1954. It was done with mirrors.

So what does all this mean? Not much in the eternal scheme of things. Yet it is the backscratchers and the Rubick's Cubes of this world that make our short time here a bit more comfortable and a tad more fun. **PM**

THE ONLY CAR THAT CAN TRULY
CLAIM TO BE "JUST LIKE A TAURUS."



FORD TAURUS

There are imitators. And then there's the original. Ford Taurus. From the start, it's been a step ahead of its competition. And that's just where it's stayed, thanks to the more than 200 improvements we've made since it was

introduced. Like its sleeker design and smoother handling. And for safety's sake, we've given Taurus available anti-lock brakes. Plus the security of a standard driver and optional right-front passenger air bag supplemental restraint system. Air bags, in conjunction with properly worn safety belts, are one of the most effective restraint

systems available.

Ford Taurus. There simply is no substitute.

Buckle up — together we can save lives.

**HAVE YOU DRIVEN
A FORD LATELY?**



Starting your engine is a terrible thing to do.[®]

SLICK[®]
The Engine Wear
Protector. 50

ENGINE FORMULA

Protection at Start-up
for Automotive Engines



SLICK[®]
The Engine Wear
Protector. 50

ENGINE FORMULA

Protection at Start-up
for Automotive Engines

1 U.S. QUART (946 liter)

Because at start-up, virtually all your oil's in the pan, not in the engine. So when you turn the key, moving engine parts grind together. And in those first critical seconds, 70 to 80 percent of all engine wear occurs.

Slick 50 Engine Formula reduces engine wear. It treats the surfaces of moving engine parts with PTFE, the slipperiest solid substance known. Independent lab tests have shown that a single application of Slick 50 protects an engine at start-up and keeps on protecting oil change after oil change. In fact, test engines treated with Slick 50 showed 50 percent less wear than identical engines run with a premium carrier oil alone.

So to help your engine last longer, start driving with Slick 50 Engine Formula. Or start taking the bus.

SLICK[®]
The Engine Wear
Protector. 50

ELECTRONICS

SUPER CAMCORDERS

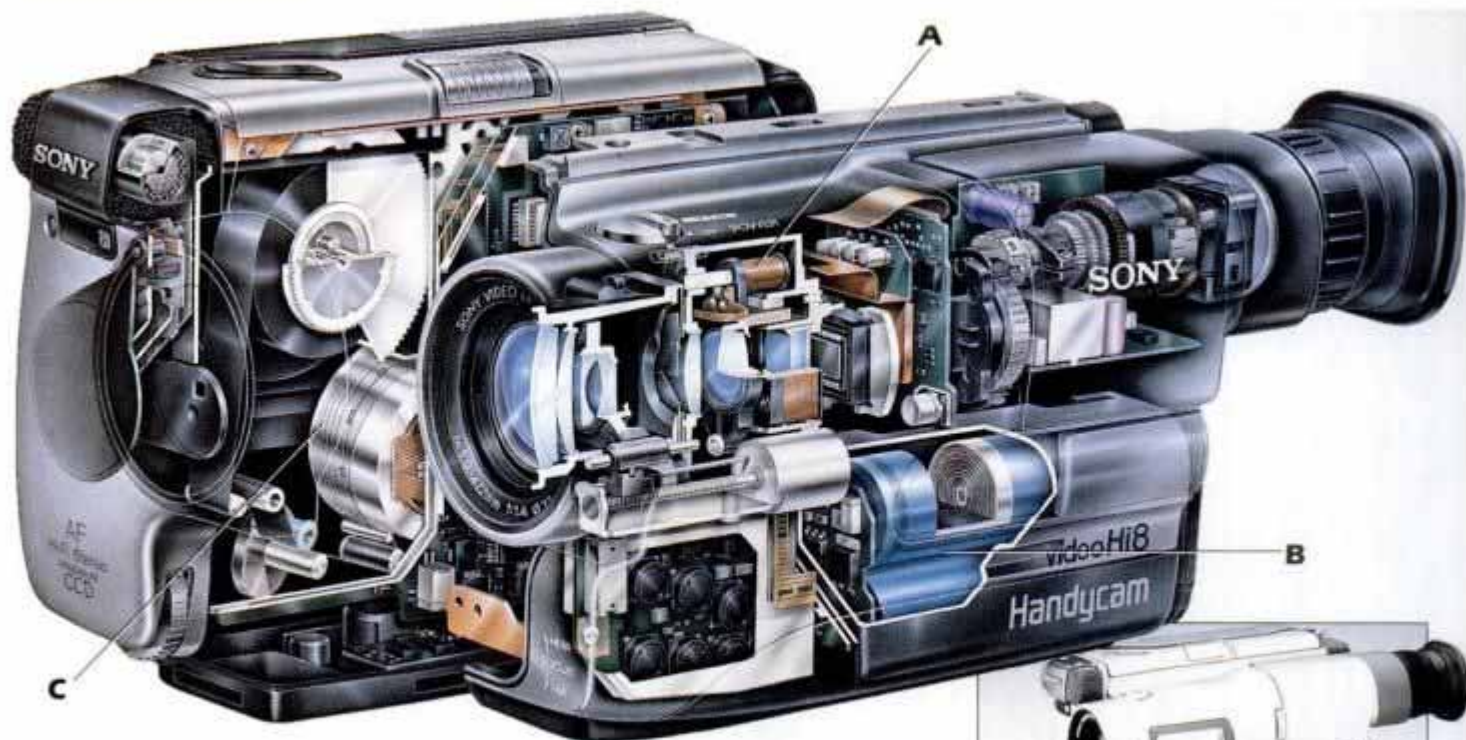
Shoot a sharper picture faster.

BY STEPHEN A. BOOTH, Contributing Editor

SHARP
VIEWCAM



● Super might be the most abused and overused word our language has to offer—and digital isn't far behind. But both terms truly apply to the new crop of camcorders just making its way into stores. Video manufacturers are taking the gloves off in an all-out battle of the brands. No more nice guys: Each contender is packing its best technology into new top-shelf moviemakers, hoping to grab a loyal following among folks who care about their home movies—and are willing to pay a bit more for performance. You'll find more than a bit of improvement and innovation in the latest Hi8 and Super VHS-C camcorders. One model from Sharp, for example, has a viewfinder the size



of a small TV. Others can make videos in a widescreen format. There are also new special effects so your production has a more polished look. All this is in addition to a better picture.

And thanks to digital signal processing (DSP), camcorders focus more quickly and accurately than before. They also maintain a stable image when your handling is shaky—even at extreme telephoto settings.

This image stabilization is important because digital circuitry also extends the reach of optical lenses, yielding zoom ratios as high as 64x. Meanwhile, on-board minicomputers will worry about exposure for you, so your sunsets and snowscapes are recorded as you remember them. And, because digital operation means fewer moving parts, battery life is extended.

You can take it for granted that the new camcorders haven't gotten bigger. Most of them still weigh in at around 2 pounds by the time you load the battery and tape. But handgrips and the placement of key controls are better than before, eliminating fumbling and preventing fatigue. Viewfinders rotate and have sportsfinder magnification, so you can compose from different angles comfortably and confidently—including waist-level. Moreover, many of the viewfinders are color, owing to the reduced price of color LCDs (liquid crystal displays).

What you'll see in the viewfinder has changed a bit, too. Several brands now incorporate an ultrawide-angle setting, equivalent to 28mm or 32mm on a film camera—and it's about time. Most people do most of their moviemaking indoors, where cramped

SONY CCD-TR200 HANDYCAM

The Sony TR200 Handycam's small size is due to (A) a new super-quiet gearless motor for the zoom lens, (B) a tiny longer-life lithium battery and (C) a more compact tape transport mechanism. The TR200 Handycam comes with a separate recharger/dock that stays wired to the television or videocassette recorder. Just snap in the camcorder for playback.



Shooting Wide

● The first TVs with theater-like, widescreen displays arrive this spring, and camcorders are ready to give your home movies the epic breadth these TVs inspire. Besides recording images in today's 4:3 TV rectangle, they'll shoot in Cinema and 16:9 Mode. Be careful: These terms are used interchangeably but can mean two different things.

One way of fitting a widescreen 16:9 image on a narrower 4:3 screen is to shrink it vertically. This is called Letterbox because it leaves blank bands above and below the image.

Those blank bands will still show up on a 16:9 TV, although the apparent image height will be greater. Usually, when a camcorder maker touts Cinema Mode, read Letterbox.

A better way to create 16:9 widescreen-ready images with a 4:3 recorder is to use anamorphic squeezing. Here, either lenses or digital electronics literally squeeze the image from the sides. Viewed in its shoehorned form it looks like hell—subjects are unnaturally elongated so that people become coneheads on a 4:3 screen. But everything looks normal when the image is decompressed—which occurs automatically when played back on 16:9 TVs. Usually, camcorders that use anamorphic squeezing state 16:9 Mode.

—S.A.B.

quarters necessitate a lot of annoying panning to get everyone and everything into the picture. And even outdoors, the wider angles of view permit pleasing panoramic compositions.

Along similarly wide lines, many of the new camcorders are ready for the forthcoming generation of widescreen TVs. These new sets make their debut this year with a 16:9 width-to-height ratio that is more theater-like than today's boxy 4:3 aspect ratio. Accordingly, to let you shoot for the future if you like, some camcorders have what's called either a Cinema Mode or a 16:9 Mode. These terms don't always mean the same thing (see "Shooting Wide").

There's no argument about some other special cinematographic features found in the latest moviemakers—features people have always wanted even if they didn't know how to ask for them.

As part of the digital autoexposure circuitry, the Twilight Mode (sometimes called Sunset) is way overdue. This feature permits natural-looking evening and night compositions, such as sunsets or fireworks.

Usually, a camcorder's automatic light balancing will try to compensate for dark scenes by boosting the gain.



JVC GR-SZ1



CANON UCS3

The result is grainy footage and muddied color, if any. Also, if things are too dark or the subject isn't a solid object—fireworks or clouds, for example—the autofocus lens goes berserk looking for a target. In Twilight/Sunset Mode, the automatic circuitry is put on hold and focus is set to infinity. What you see is what you get.

Among the other new creative features is Digital Still Mode, which basically captures snapshot-like freeze frames while you're shooting motion video, and uses them to punctuate the action. Typical usage: quick-snaps of little Johnnie, basketball in hand, at key points during a layup to the hoop.

All of the shooters discussed here are high-band models, called Hi8 in the 8mm tape format and Super VHS-C (for Compact) in the 1/2-in. system. High-band camcorders offer greater resolution than the conventional tape formats and even live telecasts.

Both conventional VHS and 8mm offer about 240 lines of horizontal resolution, and a live telecast in the U.S. maxes out at 330 lines. Hi8 and Super VHS deliver a theoretical 420 lines.

The argument for seeking high-band's level of resolution has to do with escalation: As TV displays become larger and more accurate, the limitations of the conventional videotape formats become visibly obvious. Additionally, many people today use multimedia computers to create presentations that incorporate still and

motion video. Because of all the electronic processing involved, it makes sense to start with the best images.

The big picture

Images on a grand scale are what you'll get with Sharp's new VL-HL1 Viewcam (about \$1700). It's the most revolutionary camcorder in this bunch, as the conventional eyecup-type viewfinder has been replaced with a 4-in. color LCD screen.

This novel and unique design encourages unprecedented freedom in moviemaking technique. Stuck behind a tall crowd at a parade? Just hold Viewcam above your head and shoot. The LCD rotates 180°, so you can angle it



HITACHI VMH39A

SUPER CAMCORDERS

to monitor what you're shooting, and it's large enough to view at arm's length or more.

In fact, by flipping the LCD to the same side as the lens, the operator can get into the movie and monitor the action on the LCD screen, running Viewcam by infrared remote control. The newly designed screen is also glare-resistant and bright enough to view in lighting that might otherwise wash out the picture, and it works well at extreme angles. Viewcam has another attribute: You can watch movies on the 4-in. screen when you're not making them. Try that with a peephole viewfinder.

Color LCD can be found in the eye-level viewfinders of new camcorders from Fujix, Hitachi, JVC and Minolta. The Hitachi VMH39A Zoomcam (\$1800) and Minolta 8-848 share the distinction of having a 64x digital zoom lens. This means DSP is used to enlarge, by 8x, a portion of the image captured by the optical 8x lens.

Because smaller and smaller areas of the image-pickup chip are magnified, containing fewer and fewer pixels (picture elements), you might expect coarser images as the telephoto ratio increases. Fortunately, these two use a 470,000-pixel pickup where others use a 410,000-element chip, and so they have resolution to spare. Also, the DSP keeps things pretty sharp and stable. JVC doesn't go this far with the digital zoom in its GR-SZ1 (\$2000)—only up to 22x, or double the 11x optical zoom. Still, that's the equivalent of 1025mm lens on a 35mm-film camera.

The multifunction lens on JVC's Super VHS-C camcorder is unique. Like the Fujix H128SW (\$2000), it starts out at an ultrawide-angle 4.5mm (about 32mm in film). Then JVC's lens ranges out to become what amounts to a microscope. Fitted with a lens extender, the GR-SZ1 delivers a 344x magnification when projected on a 35-in. TV.

Meanwhile, Canon is using DSP to enhance the picture quality of its two Hi8 models (UCS2, \$1700; UCS3, \$2800). In fact, the company says that digital processing enables the camcorders' 410,000-pixel pickup to deliver images as good as pro-type models that employ two or three pickup chips. DSP also handles programmed autoexposure in these Canon camcorders. Just dial in the preset programs for SPORTS, PORTRAIT, SNOW and SAND, for example, then the camcorders do the rest.



FUJIX H128SW

Docking camcorder

Sony once again is earning its reputation for innovation. The new CCD-TR200 Handycam (\$1600) is the first camcorder to use a lithium-ion battery. Moreover, it comes with a docking module that has all the inputs for connection to a TV. To play back your movies, just snap the camcorder into the docking module.

One advantage of a lithium-ion battery is obvious—size. It makes the TR200 some 30%

charge takes 90 minutes in the Ready-Charge slot of the Handycam Station docking module. Meanwhile, a second battery stowed in the camcorder charges in 5½ hours.

If the TR200 is small and light, it's also fast and silent. A new linear focus motor drives the lens without gears. Focusing and zooming are achieved by coils that float in a magnetic field.

The coils move in response to autofocus input from the image-pickup chip and fingertip pressure on the rocker-like zoom controls. No gears, no noise: It is eerily silent. This makes the 1.5-second wide-to-tele zooming seem all the faster.

The digital autofocus is virtually instantaneous.

All the TR200's attributes also can be found in Nikon's VN-720, Ricoh's R-87H and Yashica's KX-V1U.

Meanwhile, some technologies PM spied in Japan recently promise even better home videos. Sony and Panasonic are selling camcorders in Japan with three CCD image pickups, priced at \$2800 and \$2400. In these pro camcorders, a prism splits the lens into red, green and blue beams. Separate image pickups process each color. The visible result is richer color and sharper, more filmlike images, especially in shadow areas. Minolta already sells a 2-chip model, the Pro-8-918, for \$2800, in the U.S. One chip processes green, while the other processes red and blue.

Also, a color viewfinder sharper than any LCD we've seen is in the works at Mitsubishi. A prototype palm-size camcorder on display at a trade show marries a 1-in. black-and-white cathode ray tube to a modern-day color wheel. Nothing spins except your eyes—it's a filter that sends sequentially timed color filters over the CRT in response to digital signals from the image pickup. **PM**



MINOLTA 8-848

smaller than previous Handycams, with no less juice. This is an accomplishment as Sony's FL (Full Load) mechanism already has shrunk the tape transport to a volume just slightly larger than the 8mm cassette. The battery also is 35% lighter than NiCds of the same capacity. You'll learn the other advantage over NiCds when you recharge. The new powerplant can be recharged at any point, regardless of remaining capacity. A full



OLDSMOBILE EIGHTY EIGHT ROYALE

Few models command
this kind of ongoing loyalty.

BY MICHAEL LAMM, Contributing Editor
PM Photos by Roy Attaway

● Oldsmobile's recently renewed (for '92) Eighty Eight Royale has been a pleasant surprise for GM's rocket division. It still shares GM's H platform with the Pontiac Bonneville and Buick LeSabre. But the latest Eighty Eight looks totally Oldsmobile, thanks to a successful reshaping of all sheet-metal and a redesigned interior.

Besides its appealing exterior, what this means is real 5- to 6-passenger seating, an increase of 1.2 cu. ft. in the trunk and a glovebox that's twice the size of the old one.

The Olds Eighty Eight is no longer available as a coupe. It's offered only as a 4-door sedan in two series—Royale and Royale LS, with a special luxury trim package available to elevate

an LS into an LSS. (The LSS will be a separate model for '93.) Standard equipment includes a driver's airbag, which a number of owners in our survey mentioned as important to their purchase decision. Antilock brakes are standard on the LS and optional (\$450) on the base. Additional LS equipment includes: rear-seat outlets for heating and a/c, power door locks, cruise control, automatic radio anten-

na and cornering lamps.

Also standard in both series are: a 55/45 split front bench seat, kid-proof rear door locks, GM's Pass-Key antitheft system and the usual power goodies you'd expect on a car that stickers right at 20 grand. Traction control, available on the LS only, adds \$175.

You can also order a towing package (\$325) and the FE3 touring suspension (\$718) for either series. FE3 includes 16-in. alloy wheels, all-season tires, added cooling capacity, quicker steering, automatic load leveling and recalibrated struts.

The Eighty Eight offers only one powertrain—GM's port-injected 170-hp 3800 V6 with an electronically controlled 4-speed automatic.

OLDSMOBILE EIGHTY EIGHT ROYALE



When the first Olds Eighty Eight (it was the 88 back then) appeared in 1949, it was a hot number aimed at the young family man on his way up. In tabulating our survey, it quickly became apparent that the current Eighty Eight appeals to those same buyers—literally. A number of our respondents had owned a 1949 original, and prior Olds ownership ranked as the No. 1 reason for choosing a new Eighty Eight. Nearly 60% of our respondents had owned Oldsmobiles before, and many had owned several—15 wasn't uncommon, and some had owned as many as 30. The survey champ had owned 34.

Drivers in so mature an age group—all but a handful in our survey were over 50—definitely know what they want. And they tend to be fussy about details. Our survey didn't uncover



Eighty Eight's instrument panel layout and lighting drew complaints from owners.

any big problems, but nearly everyone had some sort of nitpick.

For example, while handling got top marks generally, a few drivers complained about torque steer, even under normal acceleration.

The Eighty Eight's front quarter windows also caused a few grumbles, partly because their framing interferes with the driver's view to the side

(including the driver's view of the outside mirrors), partly because some owners thought they contributed to wind noise. Rattles and road noise also annoyed 9.1% of our owners.

As mentioned, antilock brakes are part of the LS package, but an additional 27.3% of our respondents ordered ABS on their standard Eighty Eight Royale. ABS was roundly

SUMMARY OF OLDS EIGHTY EIGHT ROYALE OWNERS REPORTS*

Total miles driven:	1,451,034	Braking:		Seating comfort	14.9	Battery	10.3
Average miles driven:	5602	Excellent	68.3%	Instrument panel layout/lighting	10.6	Power windows	7.4
Purchase price:		Good	29.4	Trunk (shape, liftover height)	9.1	Speedometer	7.4
Average	\$20,775	Average	1.9	Side vision/quarter windows	9.1	Windshield wipers	7.4
Range	\$15,800-\$26,000	Poor	0.4	Noises and rattles	9.1	Did you repair it yourself?	
Why did you choose the Oldsmobile Eighty Eight Royale?		Overall performance:		Suggested changes:		No	100%
Owned Oldsmobiles before	58.5%	Excellent	66.9%	Improved side vision	18.0%	Dealer repairs satisfactory?	
Styling	33.3	Good	30.5	Redesigned instrument panel	14.1	Yes	81.2%
Price/value	9.7	Average	2.3	Improved seating comfort	13.5	No	18.7
Handling	7.8	Poor	0.4	Improved trunk access	9.4	Dealer service opinion:	
Size, roominess	7.4	Control layout:		No changes	8.8	Excellent	55.0%
Performance	6.6	Excellent	42.6%	Eliminate rattles, noises	5.9	Good	38.4
Model choice:		Good	45.3	Workmanship opinion:		Average	4.7
Eighty Eight Royale	58.0%	Average	8.2	Excellent	58.9%	Poor	1.9
Eighty Eight Royale LS	42.0	Poor	3.9	Good	37.3	Number of vehicles owned:	
Major options chosen:		Instrumentation:		Average	3.0	This vehicle only	41.3%
Antilock brakes	69.3%	Excellent	43.6%	Poor	0.8	Two vehicles	45.8
Digital instruments	40.8	Good	41.6	Comfort opinion, front seats:		Three vehicles	9.2
Traction control	27.4	Average	12.8	Excellent	56.3%	Four or more	3.7
Towing package	25.6	Poor	1.9	Good	34.0	Principal driver:	
FEB touring suspension	22.4	Driver sightlines:		Average	7.1	Male	59.8%
Bucket front seats	21.4	Excellent	42.4%	Poor	2.6	Female	32.4
Avg. mpg, city/hwy.:	20.2/27.2	Good	37.4	Average	15.2	Equal	7.8
Engine power:		Poor	5.1	Comfort opinion, rear seats:		Age distribution of owners:	
Excellent	61.6%	Specific likes:		Excellent	48.4%	Under 29	0.8%
Good	34.6	Handling	46.5%	Good	45.1	30-49 years	10.5
Average	3.4	Styling	38.3	Average	6.1	50-plus	88.6
Poor	0.4	Ride quality	33.0	Poor	0.4	Based on your experience, would you buy an Oldsmobile Eighty Eight Royale if you had it to do over again?	
Handling:		Comfort, roominess	30.9	Mechanical trouble?		Yes	66.9%
Excellent	70.2%	Economy of operation	23.0	No	74.8%	Maybe	32.4
Good	27.2	Engine power	22.2	Yes	25.2	No	8.9
Average	3.4	Specific dislikes:		What type of trouble?			
Poor	0.4	No complaints	15.9%	Air conditioner	13.2%		
				Heater fan	10.3		

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

praised, and several drivers told us how they had avoided or steered around potential accidents. However, a few also mentioned that the system's noise and pedal feel takes some getting used to.

Another area of nitpicking was the trunk. Though there's more capacity, the cargo floor is irregular, so grocery bags tend to fall over, and some owners complained that they couldn't fit their golfbags inside. The trunk also has a higher—by 2.8 in.—lifter sill than the previous Eighty Eight.

The big airbag container in the steering-wheel hub makes it hard for short drivers to see the ignition switch and control stalks, especially with the tilt column in the down position. And there were a few complaints about the front seat—some found it too low, some too firm, and taller drivers wanted more rearward travel.

If this sounds like a lengthy list of complaints, it's important to keep in mind that our survey group represented an unusually experienced body of owners.

Overall satisfaction

And the same owners who had specific nitpicks reported overall satisfaction with their Eighty Eights. "Best car I've ever owned," was a frequently repeated comment. A few had taken advantage of Oldsmobile's bring-back offer, explaining that they hadn't cared for some aspect of the '91 model Eighty Eight that they'd bought, so they'd traded it for the new car at full market value.

Fuel mileage in our survey came close to the EPA estimates of 18/28 mpg (city/highway). Our owners beat the city projection by 2.2 mpg.

Operation was mostly troublefree, with roughly 75% reporting no mechanical problems of any kind. Of the 25% who did have difficulties, 81.2% were satisfied with their first visit to the dealer service department. The most common problems had to do with the ventilation blower fan not working properly and batteries that wouldn't hold a charge.

Dealer report card

The Olds customers in our survey seem to get along very well with their dealers. Most of these relationships are longstanding, which probably has a lot to do with the exceptional level of satisfaction: Nearly 97% of our respondents rated their dealers' sales policies as good to excellent.

Whatever the business, there's no doubt that happy customers keep coming back. The Oldsmobile Eighty Eight Royale makes an excellent case in point.



Subdued but contemporary styling ranked second—behind handling—among best-liked features of Olds Eighty Eight owners. Styling also ranked second in Eighty Eight purchase motivations. Previous Oldsmobile ownership experience was tops in this category.

EDITORS REPORT

Evolution Of The Eighty Eight

● Like most of the people in our survey group, I have an Olds Rocket in my past—a '54 hardtop coupe. Unlike our owners, I didn't get mine new. It came along when I was still in my era of disposable cars—a series of near-junkers that went to the boneyard when I'd extracted their last gasps.

Although it didn't look too bad, my '54 was near the end. Standing on the throttle—something I did almost every chance I got—produced big blue clouds, and small puddles of fluids marked any place it sat for more than a half-hour or so. It finally sucked a valve during a full-throttle stoplight departure, substituting a dense white smokescreen for the customary blue cloud.

But I loved it anyway, partly for its looks, more for its muscle. In a time when manhood was measured out in long black streaks of burned rubber, that battle-weary Olds lowered my adolescent squeaks to a solid baritone.

Today's Eighty Eight won't peel rubber like those big-inch V8s of yesteryear—in fact, it won't peel rubber at all—but it's still an easy car to like a lot. This doesn't mean we've entirely lost our taste for wheelspin. It means that we think the new Eighty Eight is solidly in step with the times.

Besides our long-term association with the '92 LSS pictured here, we've had several other new Eighty Eights in our care during the past year or so, and all have registered the same box score: no runs, no squeaks, no rattles. We disagree with those owners who regis-

tered complaints about wind and road noise—the Eighty Eight is certainly contemporary in this respect—and we haven't had any complaints from staff members concerning torque steer or driver sightlines, either. In terms of operating efficiency, every new Eighty Eight we've encountered has been the same: seamless.

In fact, about the only owner complaint that we endorse concerns the Eighty Eight's instrumentation, which isn't as contemporary as the rest of the car. But we know that Oldsmobile is working on this.

The quality we like best about this car is its behavior on the road. While the 3800 V6 won't conjure up memories of the old Rocket Eights, it has enough low-end grunt to keep up in the cut-and-thrust of commuter traffic, and it's an effortless performer on the interstates. Handling, something that our owners endorsed, is an even stronger suit. With the FE3 suspension, the Eighty Eight is agile without being excessively stiff, yielding a ride-handling balance we wish we could see in more GM sedans.

Response to styling, of course, is always subjective. We see the Eighty Eight as conservatively contemporary, as well as good looking. And, like the Olds marketing people, that leaves us scratching our heads. Why doesn't this excellent car appeal to younger buyers? It's great to keep owners coming back decade after decade, but this is also a car for today.

—Tony Swan



***“I spend a lot of time
in a truck, so it has to be***

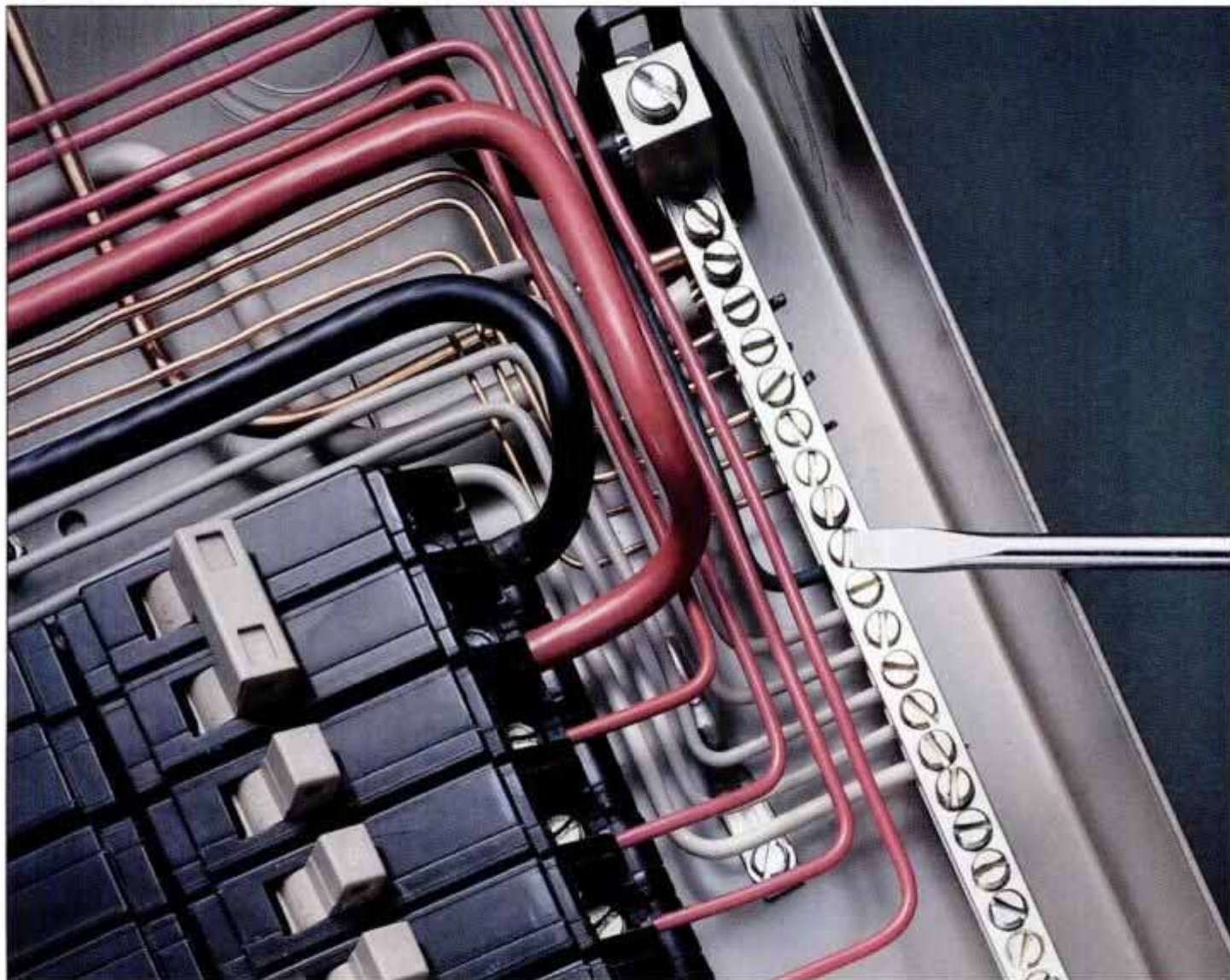
**Ford Trucks.
The Best Never Rest.™**

***comfortable. And
even though my
Ford pickup's
built to stand up
to almost anything, it's
a pleasure to be in. My wife likes the
seats and touches like the coffee cup holder.
She also likes the fact we can take the
kids along. Times have changed. And the
Ford full-size pickup's changed right
along with them.”***



THE BEST-SELLING AMERICAN TRUCKS
ARE BUILT FORD TOUGH.

PREFERRED CARE Ask your Ford dealer about the 1993 model F-Series Preferred Care Program.
“Best-selling” claim based on sales by Division. Buckle up—together we can save lives.



HOME IMPROVEMENT

ELECTRICAL SYSTEM MAINTENANCE

A checklist for peak performance from your home's power supply.

TEXT AND PHOTOS BY MERLE HENKENIUS

● A properly installed electrical system is remarkably durable, especially given the number of devices and connections in the average home. Still, some maintenance is often required.

Perhaps several receptacles will suddenly stop working, or a light switch will work erratically. Circuit breakers may begin to trip even though you're not using substantially more

power. You might also notice a momentary flickering of a ceiling light every time someone shuts a door. These are all simple electrical problems with easy solutions. All it will take is a couple of hours of troubleshooting to put your home's electrical system back in order.

While troublesome switches and receptacles simply need to be replaced, most other routine electrical problems can be attributed to loose wiring connections. Though the hundreds of wiring connections in a home are originally made securely, they almost always loosen over time. The source of the problem is a combination of vibration and heat.

What would cause a house to vibrate? Just about everything that moves—including nearby cars, trains, airplanes and even our own feet. Such relentless vibration eventually causes twist connectors and screw terminals to loosen their grip on the wires they hold in place.

Once a connection loosens—even slightly—resistance to current flow increases. And with resistance comes heat. Each time current passes through a loose connection, the wires and connector heat up, causing them to expand. When the current is stopped, they cool and contract. This

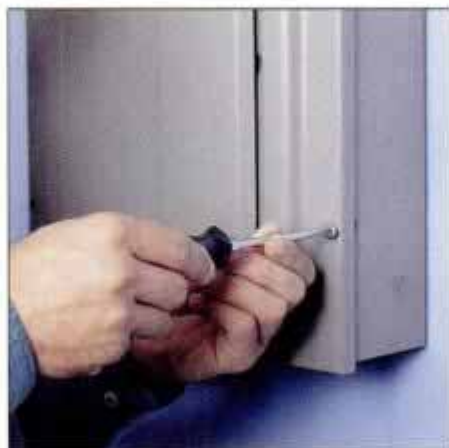
repeated expansion and contraction further loosens connections, causing more heat, which eventually trips circuit breakers or causes wires to back out of their connectors entirely. If not corrected, these loose connections may begin to spark, thereby creating a fire hazard.

Loose Service Panel Lugs

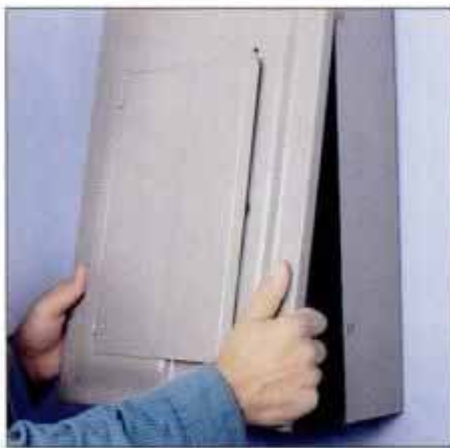
We all have a healthy respect for the power inside service panels, and rightly so. But with care, you can work within a panel safely. The task at hand is to tighten any loose screws that hold the circuit wires.

Start by shutting off all power to the circuit breakers and their circuits by switching off the main disconnect switch. Then, loosen the screws from the panel cover and pull off the cover (Photos 1 and 2). This will reveal all the wire terminals, both on the breakers and the neutral bus bar. (Some panels will have a separate grounding bus as well.) Even with the power off, you'll need to exercise some care, as the service conductors leading to the main disconnect and neutral bus will remain hot—make sure that your screwdriver touches only the screw to be tightened.

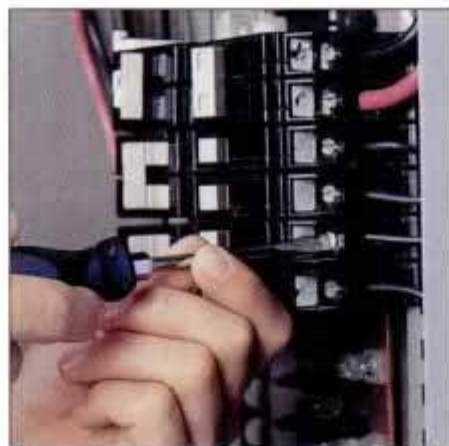
Tighten each terminal screw that binds a wire or set of wires within the panel (Photos 3 and 4). First do all the breaker terminals, then all the neutral bus terminals, then all grounding bus terminals if you have a dedicated grounding bus. As it's possible to overtighten these terminals, don't be tempted to torque the screwdriver with a wrench. Simply tighten each screw until it's snug, and leave it at that. With all lugs tightened, replace the panel cover and move on to the next trouble spot.



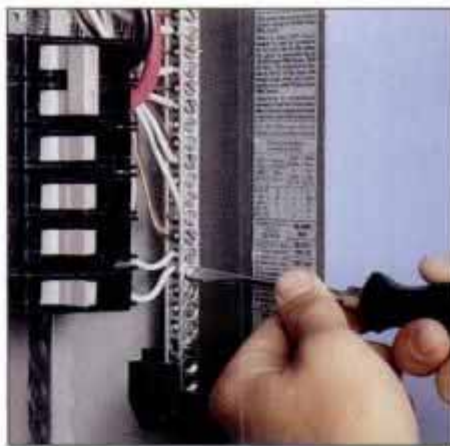
1 Begin by shutting off power at the service panel main switch. Then, remove the screws that secure the service panel cover.



2 With the screws removed, lift off the service panel cover to reveal the circuit breakers, bus bars and circuit wiring.



3 Tighten the hot lugs on each breaker with a sturdy screwdriver. Tighten the lugs until snug, but avoid excessive torque.



4 Follow by tightening each lug holding a wire on the neutral bus and the grounding bus, if the service panel has one.

Flickering Lights

When a ceiling light flickers with the slightest vibration, expect a loose wire connection to be the problem. The most likely spot to look is in the ceiling box. First, shut off the power to the circuit at the breaker, then simply undo the fixture globe or diffuser, drop the base down and pull the wires from the box (Photos 5 and 6).

A bad connection may be obvious, as when a wire falls out of its twist connector with the slightest disturbance. If this is the case, undo the twist connector, twist the wires back together and tighten the connector back over them (Photos 7 and 8). When joining a stranded fixture lead wire to a solid circuit wire, carefully wrap the



5 To service a flickering light fixture, start by removing the fixture's globe or diffuser. Then, carefully pull the fixture down from the ceiling.



6 Loosen the screws that secure the fixture base to the ceiling box. Then, carefully pull the fixture down from the ceiling.

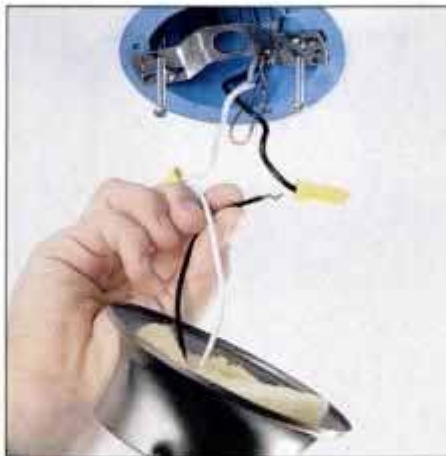
stranded wire around the end of the solid wire before twisting the connector over them.

If none of the wires are obviously loose, remove each connector, twist the wires together and replace the connector. If you find that the stranded wire in one or more connectors is frayed or scorched, cut off the affected section and strip about $\frac{3}{8}$ in. of insulation from the new end. Then, twist the wires together and install the connector.

If you don't solve the problem at the ceiling box, expect a loose connection in the switch box, usually on the neutral side of the circuit. If redoing the switch-box twist connectors doesn't help, it may be time for a new switch.

Replacing Defective Switches

Switches do wear out, often displaying a variety of symptoms. In some cases, the switch simply will remain either on or off, no matter which way you flip the toggle. A more likely scenario has the switch behaving errati-



7 Check each connection. If a wire is loose, the connection may separate completely when the wires are disturbed.



8 Twist stranded fixture wire around the solid circuit wire and thread the twist connector back over them.

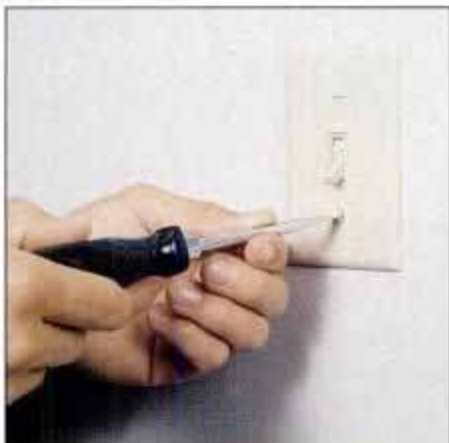
cally before it fails completely. It may work only when used slowly, or when pressure is applied at an angle, or with any number of other special touches. Regardless of how you get it to work, an inconsistent switch is on its last legs and needs to be replaced.

Replacing a switch is a simple oper-

ation, requiring little or no knowledge of electricity. With the circuit power off, remove the cover plate and yoke screws and pull the switch from its box (Photos 9 and 10). No matter what wiring configuration is in place, you'll find that only the hot wires will be switched. The white neutral wires will be joined with a twist connector and do not need to be disturbed.

Cut the wires near the switch and strip about $\frac{1}{2}$ in. of insulation from the ends of each (Photos 11 and 12). Then insert one wire in each round hole at the back of the switch (Photo 13). Finally, mount the switch in the box and replace the cover plate.

The only variance from this procedure will be if the defective switch happens to be a 3-way or 4-way switch that allows the light to be controlled from more than one location. In this case, three or four wires will need to be transferred to the appropriate terminals on the new switch. Be sure to transfer only one wire at a time to prevent mixing them up.



9 To replace a switch, begin by removing the switch's cover plate. This will reveal the yoke screws that hold it to the box.



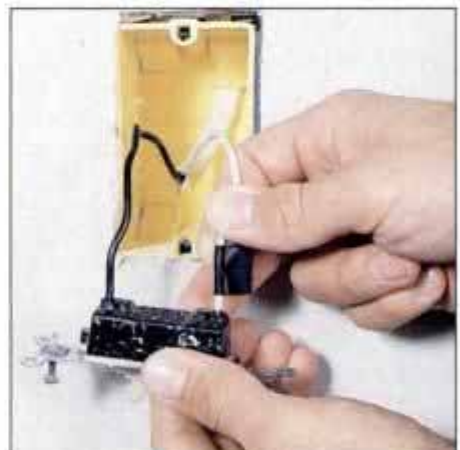
10 Remove the switch's yoke screws and pull the switch out from its box to gain access to the fixture wires.



11 Use a multitool or side cutters to cut the wires. To replace 3-way switches, transfer one wire at a time to the new switch.



12 Strip roughly $\frac{1}{2}$ in. of insulation from the ends of each switch loop wire. A wire-stripping tool best handles the job.



13 New switches often have push-in connectors as well as screw terminals. Simply push each wire into its respective hole.

Replacing A Defective Receptacle

When a receptacle fails, it may affect only that outlet, or it may discontinue power to the several outlets following it on that circuit. The difference is in how the receptacle is wired. In years past, it was common to fasten incoming and outgoing wires directly to the receptacle, thereby making the entire circuit dependent on each receptacle. If one receptacle failed, the circuit was broken.

Today, most codes require a continuous circuit, with pigtail connectors joining each individual receptacle to the circuit. In this way, the circuit will remain intact, even when one of the receptacles fails.

Replacing a receptacle is also a quick and easy task, but if several outlets are dead, you'll need to first determine which receptacle is the culprit. The simplest approach is to shut off the power to the circuit, remove the cover plates of the first and last boxes in the series of dead outlets and inspect the wiring. One box will contain incoming and outgoing wires (two whites, two blacks and two grounds), the other will have only incoming wires (a single black, white and ground). The problem will lie in the box having both incoming and outgoing wires.

With the problem outlet identified, pull it from the box and cut the incoming and outgoing black, white and bare ground wires from the defective receptacle (Photos 14 and 15). Then, strip $\frac{3}{8}$ in. of insulation from each wire and use a twist connector to join all like-colored wires with an insulat-

Restoring An Interrupted System Ground

Most electrical codes require a home's electrical system to be grounded through the copper or galvanized-iron water supply pipes that lead from the water main to your faucets. This is done by clamping the ground wire from the panel to a pipe. A problem can arise, however, when a homeowner unknowingly disrupts this continuous ground by splicing a length of plastic pipe into the water system.

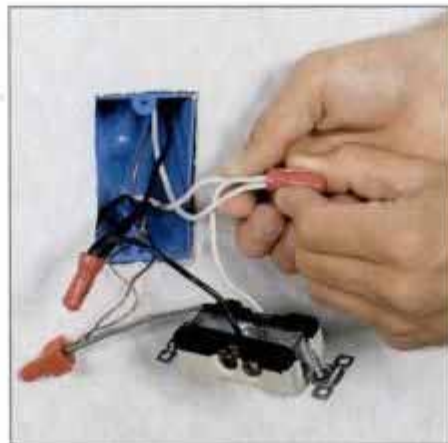
Though not allowed by code in many areas, plastic water piping has enormous appeal to those uncomfortable with traditional piping materials and methods. If a part of your home's water supply piping has been replaced with plastic, you can still have the protection provided by a proper and legal ground.



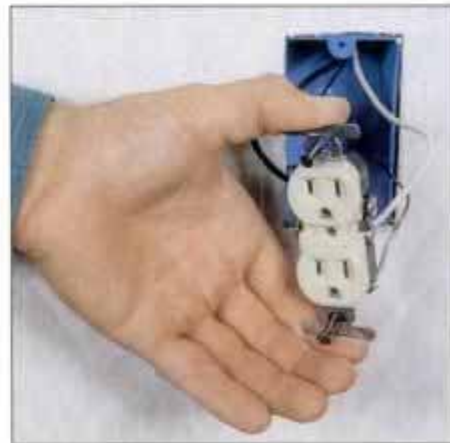
14 Remove a defective receptacle just as you would a switch. Take off the cover plate and remove the switch yoke screws.



15 Cut the incoming and outgoing black, white and bare ground wires from the defective receptacle.



16 Join like-colored wires to an insulated pigtail. Attach white pigtail to silver screw, black to brass, and ground to green screw.



17 End-of-the-run receptacles have two circuit wires attached (plus ground). Fasten wires directly, in old or new installations.

ed pigtail of the same color (Photo 16).

Next, fasten the white pigtail to the silver terminal on the receptacle, the black wire to the copper terminal, and

the ground wire to the green grounding screw (Photo 17). Mount the receptacle in the box and replace the cover plate.

To reestablish the ground, simply fasten approved grounding clamps to the metal piping on each side of the plastic splice (Photo 18). Then span

the gap with a short length of No. 4 solid ground wire. Bind the wire tightly in the clamps and the job is complete (Photo 19). **FM**



18 To reestablish an interrupted ground, secure an approved clamp to the metallic pipe on each side of the plastic pipe.



19 Connect the two grounding clamps with a length of No. 4 ground wire. Tighten the fastening screws securely.



COMPARISON TEST

POWER PLANES

For on-the-job surfacing, nothing's faster than a power plane.

BY THOMAS KLENCK, Associate Home Improvement Editor

● When you really think about it, just about every woodworking tool you'd want to own is one of three basic types: a cutting tool, a boring tool or a surfacing tool. And, if you think about it a little further, you'll see that, when it comes to portable power tools, the surfacing market is dominated by sanders and routers—well, almost. There's one tool designed solely to handle flat surfaces with the voracity of the toughest portable performers—the power plane.

As its name implies, the power plane is the motorized counterpart to an ordinary hand plane. In place of the hand plane's single blade, however, the power plane utilizes a spinning cutterhead. Most models feature a 2-blade cutterhead, and actually are more like small portable jointers than hand planes. Like a jointer, the depth

of cut is controlled by adjusting the height of the front shoe rather than the cutter depth. Blade height is set to the exact depth of a fixed rear shoe.

Except for the Porter-Cable Porta-Plane and Versa-Plane, which feature helical cutters (see "Power Planes With A Twist," page 63), all standard power planes come with flat carbide or high-speed steel (HSS) blades. Most HSS blades are similar to standard jointer blades and can be resharpened. The carbide versions are double-edged and reversible. When the blades get dull, you simply slide them out, turn them upside down and reinstall for a fresh edge. Reversible carbide blades also feature a self-setting groove that automatically positions them at the right height. Single-edged HSS blades must be reset whenever they're reinstalled.

All of the power planes that we tested—with the exception of the Sears unit—accept an adjustable fence for cutting rabbets, and, in most cases, this is standard equipment. Even the most powerful of these tools won't cut more than about 1/8 in. in one pass, so deeper rabbets are made by taking successive cuts. (To control the final depth of a rabbet, power planes have an adjustable depth stop.) The fence also serves to hold the tool square with the wood for edge planing, and some versions are adjustable for handling bevels at any angle. For simple 45° chamfers, all of the power planes in our test group have a V groove in the front shoe for guiding the tool along an edge corner.

The front shoe adjustment is handled by either a straight up-and-down action, activated by a simple screw, or



HITACHI F-30A

AEG EH 102



BOSCH 1593



RYOBI L-1323ALS



MAKITA 1100

by a diagonal motion (see drawing on page 61). While either system works, the screw-activated adjustments on the Makita, Hitachi and Ryobi models require several knob rotations to move the front shoe through its full range. This makes reading the depth scale confusing, because any particular knob position corresponds to two, or three, actual depth settings, depending on how many times the knob has been rotated. The diagonal mechanism, on the other hand, adjusts through the complete depth range with less than a complete rotation of the knob.

In theory, you might think that a power plane could be used to speed up every operation a hand plane might handle. However, this beast has its own peculiarities that both limit and expand its usefulness. Its cutting appetite makes it unsurpassed when a lot of stock must be removed. However, that same appetite makes this tool less than adequate for fine work and accurate trimming. If you want to chamfer your pressure-treated deck railing or trim a door that's 1/4 in. oversize, a power plane passes with straight As. Don't expect great re-

sults taking a 1 x 6 down to 1/2 in. thick or accurately jointing edges for gluing, though.

For our comparison test, we focused on entries with a maximum depth of cut of 1/8 in. and a cutter width of 4 in. or less. The only major manufacturer not represented is Freud. According to the company, it was out of stock at the time of our tests, as were the major mail-order suppliers we contacted.

AEG EH 102

This power plane has the second-highest amperage rating of our test group and a cutterhead speed just below the group average. We found it to be well balanced and easy to handle even though it's slightly bulkier than some of the others. The fence and depth stop both have easy-to-read scales in inches and millimeters.

One unique safety feature is the retractable blade guard. This is a curved plastic shield, which operates like the blade guard on a circular saw. It enables you to put the tool down before the cutterhead stops spinning, and can be retracted manually by a knob on the housing side. The carbide

blades are held in place by height-adjustable gibs.

In terms of shoe length, the AEG falls below average. This makes for a slightly uncertain feel in terms of stability when compared with longer-shoe tools. Also, this tool has a safety button that must be depressed to operate the trigger. The trigger can't be locked on.

In general, we found the AEG model to be very powerful and easy to handle. The depth-of-cut knob scale indicates the full depth range in less than one complete revolution, and is easy to read.

Bosch 1593

Our Bosch entry bears a few similarities to the AEG and a few important differences. Like the AEG, it has a diagonal-action front shoe adjustment—the entire depth range is controlled through a knob rotation of about 90°. The Bosch also has a safety button that frees the trigger, and the trigger can't be locked on.

The fence and depth stop designs are also similar to the AEG model. The Bosch uses larger, friendlier knobs, however, and, while its depth



PORTER-CABLE 9367



ELU 3375



SKIL 1575



SEARS 27706

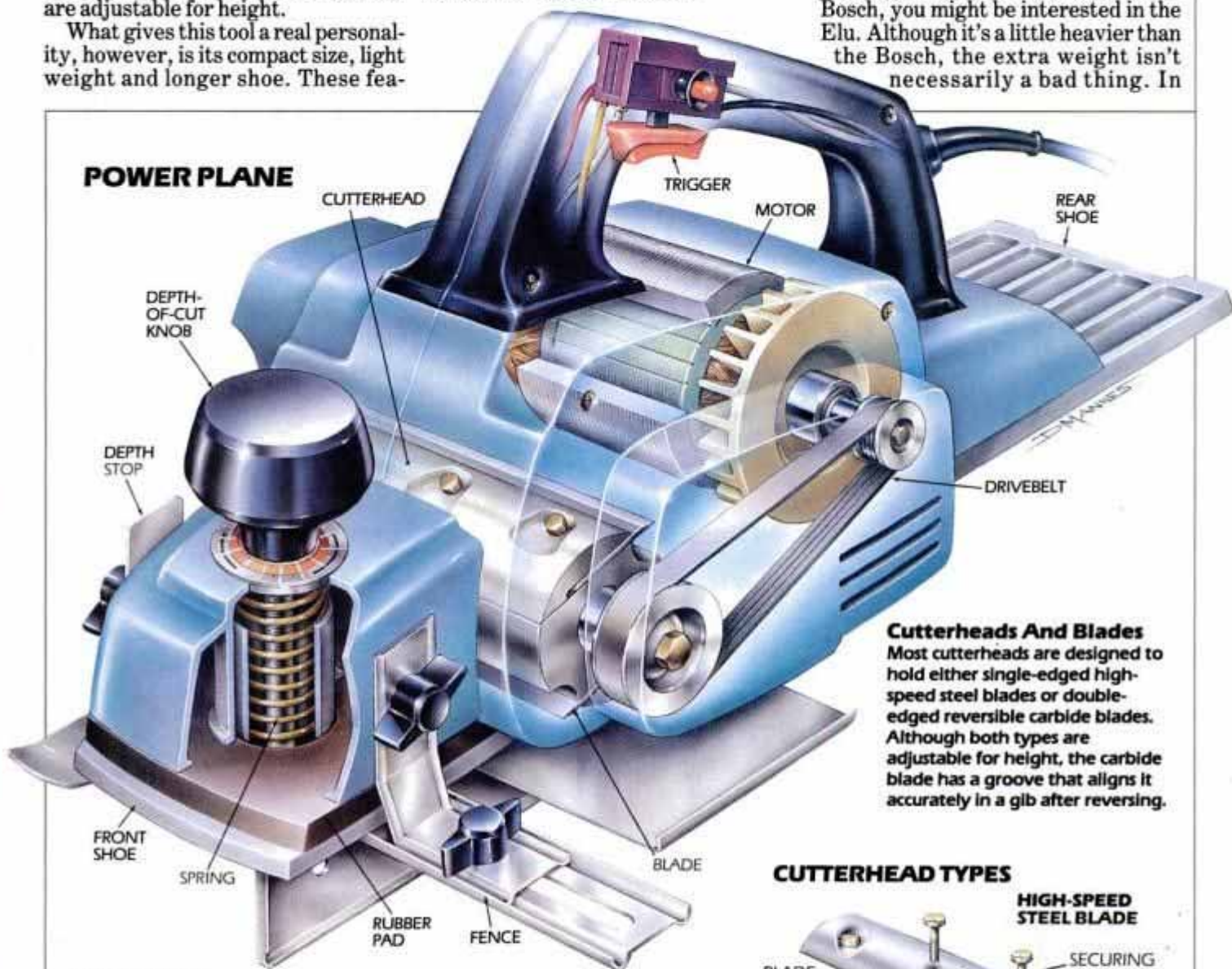
stop has a scale in inches and millimeters, the fence has no scale. The Bosch tool comes with reversible carbide blades, which are secured by gibs that are adjustable for height.

What gives this tool a real personality, however, is its compact size, light weight and longer shoe. These fea-

tures, along with the lowest noise level of the models tested, make it a power plane that's easy to handle, fairly stable and a pleasure to use.

Elu 3375

If you're looking for power more in line with the AEG, but in a compact package that is comparable to the Bosch, you might be interested in the Elu. Although it's a little heavier than the Bosch, the extra weight isn't necessarily a bad thing. In

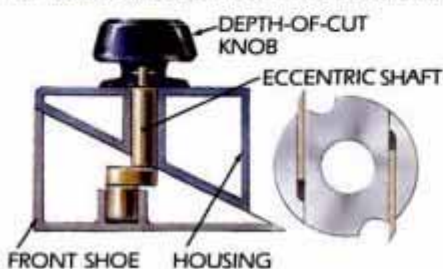


POWER PLANE

Cutterheads And Blades
Most cutterheads are designed to hold either single-edged high-speed steel blades or double-edged reversible carbide blades. Although both types are adjustable for height, the carbide blade has a groove that aligns it accurately in a gib after reversing.



VERTICAL-MOTION FRONT SHOE

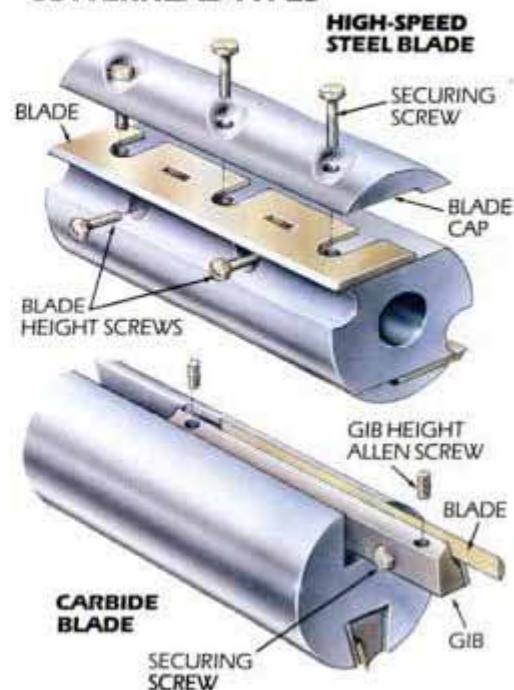


DIAGONAL-MOTION FRONT SHOE

Depth-Of-Cut Control

Power planes control cutting depth by adjusting the height of the front shoe. A screw-activated adjustment draws the shoe up as the knob is tightened. Several complete rotations may be required to move the shoe through the depth range. A diagonal-action shoe moves forward and backward as well as up and down. An eccentric shaft moves the shoe through the depth range in less than one rotation.

CUTTERHEAD TYPES



general, we found that the heavier tools were more stable.

The depth-of-cut adjustment on the Elu appears to be a screw-activated type, but accomplishes its full range of travel through one rotation of the knob. It's easy to operate, and the depth scale is easy to read.

The Elu fence is an aluminum die-cast unit, as opposed to the stamped-steel construction of all entries except the Makita. Unlike the AEG, Bosch and Porter-Cable fences, which attach to the tool body through an L bracket, the Elu fence features a square, horizontal rod that slides through a hole at the front of the housing. The economy here is that only one knob is necessary to adjust and remove the fence. Another plus is that this type of fence serves as a handle so you can apply side pressure to keep the fence against the wood. Neither the fence nor the depth stop have scales.

The standard blades are reversible carbide, held in place by adjustable gibbs. And, this tool has a lock-on button so you can let go of the trigger on long cuts. On the down side, we found that the front edge of the shoe should be rounded or beveled so it doesn't catch on and tear the grain.

In terms of performance, the Elu's 7.2 amps and 15,000-rpm no-load speed easily handle full-width cuts at maximum depth.

Hitachi F-30A

In terms of capacity, this power plane is comparable to all of our other test tools. However, everything else about this tool places it in a different class. First of all, the tool is long—almost 5½ in. longer than the AEG, its nearest competitor in terms of amperage. And, when it comes to leveling surfaces, there's no substitute for length.

The tool is also very heavy—a feature that helps keep the shoe firmly on the work. As compared with most of the other power planes, the handle on the Hitachi is more like a hand-plane handle—angled for pushing rather than bearing down. We found this angle to be more natural and comfortable. This tool has neither a safety button to prevent accidental starting nor a trigger lock button.

The fence is similar to those designed for the Makita and Skil tools. It has two rods that pass through holes in the housing and is locked in place by two small knobs. We found, though, that the knobs vibrate loose with the fence removed—a problem Elu thoughtfully addresses by installing a spring under its single knob. The Hitachi fence is the only one supplied that can be adjusted for beveling. Other makes offer angle-adjustable fences as optional accessories.

The cutterhead holds two high-speed steel blades. The side cutterhead guard, usually a spring-loaded flap that lifts up over the stock when rabbeting, is simple, but unusual. It rotates away from the cutterhead like a hinged flap and then falls back under gravity. It has a small magnet to hold it in place until the next cut.

The only real complaint we have is with the depth-adjustment mechanism. It requires several complete rotations of the knob to progress throughout the entire depth range. The scale on the knob is laid out on a spiral and is only comprehensible if you know how many turns you've made from either the maximum or minimum cut.

As a performer, the Hitachi F-30A is arguably the most impressive tool in our selection. If you can handle the weight and put up with the spiral depth scale, you probably won't be disappointed.

Makita 1100

As far as size goes, the Makita entry is on par with the Hitachi. It, too, has a very stable long shoe and, at more than 10 pounds, the weight to keep it on track. However, Makita has opted to moderate its motor size and go for speed. The cutterhead no-load speed is rated at 16,000 rpm—only Skil matches this figure.

We found this tool to be very powerful and smooth, and, like the Hitachi, its hand-plane-like handle angle contributes to a normal planing motion. The fence is a 2-rod design, but it is cast like Elu's version. And, Makita deserves a round of applause for its power cord—a full 17 ft. long.

Unfortunately, the Makita has the same screw-type depth-of-cut adjustment as the Hitachi, along with the same nearly indecipherable spiral depth scale. And, the side cutterhead guard is similar to the hinged flap of the Hitachi. However, Makita's version is simply a stiff flap that you manually open and close when cutting rabbets. We also found the space between the trigger and motor housing to be a little small for our fingers. The trigger can be locked on.

Porter-Cable 9367

P-C's 9367 is scaled closer to the Bosch unit and boasts some worthwhile features. All planers throw out a lot of shavings—especially if the depth of cut is substantial. And, there are situations when you may want to hook up to a shop vacuum. Porter-Cable's answer was to design a chip chute that directs the shavings either to the right or the left. This not only facilitates hooking up a vacuum (vac adapter supplied), but is handy without dust collection.

Another distinguishing feature of this tool is its almost-horizontal handle. It provides excellent balance and,

POWER PLANE SPECIFICATIONS

MANUFACTURER	MODEL	PRICE	AMPS	RPM	CUTTER WIDTH	MAX. DEPTH OF CUT	BLADE TYPE	FRONT SHOE LENGTH	TOTAL SHOE LENGTH	NOISE LEVEL (dba)	CORD LENGTH	WEIGHT (lbs.)	SUPPLIED ACCESSORIES*
AEG	EH 102	\$259	7.7	13,000	4"	1½"	Carbide	3¼"	10⅝"	95	14' 4"	8.25	F,D,C
Bosch	1593	\$279	6.9	13,000	3¼"	½"	Carbide	3⅞"	11½"	91	6' 6"	6.6	F,D
Elu	3375	\$200	7.2	15,000	3⅞"	¾"	Carbide	3⅞"	12"	95	9' 3"	7.2	F,D
Hitachi	F-30A	\$321	8.3	12,000	3⅞"	½"	HSS	4⅞"	16"	95	8' 4"	8.8	BF,D,C
Makita	1100	\$455	6.8	16,000	3¼"	½"	Carbide	4"	15¼"	93	17'	10.8	F,D,C
Porter-Cable	9367	\$250	6.5	12,000	3¼"	½"	Carbide	4½"	11½"	95	14' 3"	9	F,D,C,V
Ryobi	L-1323ALSK	\$246	6.2	14,000	3¼"	½"	HSS	3¾"	14½"	91	6' 3"	7	F,D,C,K
Sears	27706	\$125	4.5	15,000	3⅞"	⅛"	HSS	2¼"	9½"	100	8'	9	G,FB,D
Skil	1575	\$188	7	16,000	3¾"	⅛"	Carbide	3¾"	11¾"	95	8'	7	D

Shoe lengths, cord length and noise level as measured, other specifications as supplied. Prices are suggested retail, tools are frequently sold for less.

* F=90° fence, D=depth stop, C=case, BF=beveling fence, K=blade setting tool, G=fixed guide, FB=fixed beveling fence, V=vac adapter.



Cut depth is set with a knob that adjusts the height of the front shoe. Elu (shown) adjusts through its range in one rotation.

along with the unit's light weight, makes bringing the tool up to the work effortless. However, at normal bench height, we found the handle position a little awkward.

Overall shoe length is about average for this group. The front shoe, however, is well over one-third of the total length. While a power plane's overall length helps in straightening surfaces and edges, the front shoe's job is to start the cut properly—a job the P-C does with flying colors.

This tool's fence is mounted on an L bracket similar to Bosch and AEG, but there's no scale on either the fence or depth stop. The unit has a depth knob that operates through its full range with a 90° rotation of the knob. If anything, the knob is a little too easy to turn—we found that when using it as a front handle, the setting was occasionally changed.

Another unique feature is the spring-loaded tool stand at the rear of the 9367. In the down position, it allows you to rest the tool on a surface without endangering the surface or the cutterhead. When making a cut, the stand flips up as it passes over the wood. Like AEG's cutterhead guard, the stand prohibits starting a cut in the middle of a surface. You will have to flip up the stand manually to get the job done.

As far as performance goes, the 9367 handled just about anything we threw at it. It did, however, balk at diagonal surfacing at its maximum, 1/8 in., cutting depth—the chip chute tended to clog. The gibs that hold the carbide blades in place are secured by Allen screws, as opposed to the hex-head screws chosen by the other makers that use this arrangement. The tool has a trigger-lock button.

Ryobi L-1323ALSK

The L-1323ALSK is almost a downsized version of the Hitachi and Ma-



Hitachi, Makita and Ryobi depth knobs require several rotations for complete range. Spiral scale is difficult to read.

kita power planes. It features a relatively long overall shoe length and a proportionately short front shoe. This tool also has the same depth mechanism and difficult-to-read spiral scale. It departs from the larger-tool design with a more horizontal handle angle.

Ryobi uses a fence that's similar to Elu's single-rod version. However, this one is stamped steel. The depth



Fence on AEG, Bosch and P-C attaches to L bracket. Scale on AEG shows rabbet width in inches and millimeters.

stop is the most innovative of the group. It features a simple lever lock that makes it the easiest to operate. However, instead of the normal flat shoe that limits the cut by eventually reaching the surface of the work, Ryobi uses a small wheel. In principle, the idea is fine, except that the location of this particular wheel falls off the edge of 3/4-in.-thick stock, making

Power Planes With A Twist

● If you've used an ordinary hand plane much, you know that holding it at a slight angle can make the job go a little easier and produce a smoother surface. The idea is that the cutting edge moves through the wood obliquely, resulting in a smoother slicing action. When it comes to the rotary cutterhead on a power plane, a similar effect is achieved by using a helical cutting edge—an edge that actually spirals around the cutterhead body.

Porter-Cable's Porta-Plane (bottom right) and Versa-Plane (top right) both utilize this cutter design. The Porta-Plane (about \$335 with HSS cutter, \$370 with case and carbide cutter) has a 2 3/32-in.-wide x 3/32-in.-deep cutting capacity and a 7-amp motor. The 10-amp Versa-Plane (about \$460 with carbide cutter and case) has a 3 x 1/8-in. capacity. Both tools come with a fence that adjusts between -15° and 45° and replaceable stainless-steel shoes. In use, we found these tools powerful, smooth running and ideal for most edge-trimming applications. Their long lengths (16 in. for the Porta-Plane and 18 in. for the Versa-Plane) and wide, long fences provide excellent stability. About the only downside is that the cutters are expensive, ranging from about \$36 for the Porta-Plane's smaller HSS version to \$85 for the larger carbide that fits the Versa-Plane. And, you'll have to send them out to be resharpened.

Another Porter-Cable innovation is the model 320 Abrasive Plane (about \$200). While not a true power plane in that it doesn't use blades, this 7/4-in. tool is capable of trimming concrete and metal as well as wood. It uses aluminum-oxide or tungsten-carbide abrasive sleeves.



PORTER-CABLE
VERSA-PLANE



PORTER-CABLE
PORTA-PLANE



Helical power plane cutters create a smoother slicing action. Porter-Cable offers both carbide or high-speed steel.



The depth stop controls rabbeting depth. Stop on Bosch power plane has scale in inches and millimeters.



Hitachi fence is adjustable for planing bevels. Other tools have fixed 90° fences with optional beveling fences.



Skil and Sears tools have dedicated front handles. Depth knob on other models doubles as a front handle.



Retractable cutterhead guard on the AEG works like a circular-saw blade guard. Lever on the side retracts guard manually.

it ineffective for rabbeting narrow edges. In operation, this tool isn't quite as smooth as the others—perhaps because of its light weight.

Skil 1575

If your need for a power plane is occasional, or your budget is a little tight, the 1575 could very well be the answer. While it's not designed to go head to head with the professional tools, its performance is nothing to scoff at.

While its maximum cutting depth is half of most of the other entries, it has a long cutting width and its power draw is a healthy 7 amps. In terms of handling, the tool is relatively light in weight and is compact. In contrast to all the other tools, except the Sears, the Skil has a dedicated front handle. The depth-of-cut knob on the Skil is under the front handle and is easy to operate.

While the depth stop comes with the tool, the fence is only available as an optional accessory (No. 91516, about \$45). As both attachments are primarily used in concert when cutting rabbets, it's a little unclear why the stop comes with the tool and the fence doesn't. The plastic depth stop has a scale in millimeters and inches, and the fence is a dual-rod type that



Chip ejection on the Porter-Cable 9367 can be switched from one side to the other by pivoting the chip gate.

can be adjusted for beveling. Also available are a dustbag and case.

We found this tool to be reasonably effective, although when pushed to the limit, the chip chute tended to clog. Skil uses reversible carbide blades and doesn't offer a provision for height adjustment.

Sears 27706

This Sears power plane has a longer cutting width and a higher no-load rpm than the group averages. However, on every other count, this tool comes up a little short.

Its shoe length is minimal, and stability, especially at the start of a cut, doesn't come up to par with the others. The depth-of-cut knob doesn't have a scale, so there's no question of legibility—it's all guesswork. And, the 27706 isn't designed to accept an adjustable fence.

What it comes with instead is a short guide that you can attach to the side of the front shoe with a slot-head screw. The only purpose this serves is to keep the tool from falling off the work and, very marginally, to hold the tool square. A depth stop, also attached with a small screw, is provided. In addition to the guide and depth stop, Sears includes a fixed guide for putting a 5° bevel on door edges.



Extremes in handle angle are illustrated by Porter-Cable (top) and Sears. Hitachi and Makita handles are similar to Sears.

The blades on the Sears are reversible high-speed steel. They're smaller than the usual HSS blades and not meant to be resharpened. The cutterhead is designed so blade height doesn't need to be adjusted after reversing or installing new blades. If you're curious, you'll find that it's possible to fine-tune blade height, but the manual advises that you leave the factory setting alone.

Drawing Conclusions

Based on price range and included accessories, the Sears and Skil units qualify as consumer or occasional-use tools. And within this category, the Skil is clearly the better tool. In fact, the Skil holds up fairly well against the higher-priced competition.

The remaining tools all proved to be more capable and full featured. As far as power and stability go, the Hitachi followed by the Makita and Elu are our choices. The others all performed satisfactorily, and, in terms of features and design, are often superior to the Hitachi and Makita. The AEG and Porter-Cable both show good power, and the Bosch is the clear winner when it comes to compact design and easy handling. Ryobi's long shoe feels solid, but this tool gets a lower score on smooth performance. **PM**

NEW TOOLS

WORKSHOP PARTNERS

BY ROY BERENDSOHN, Assistant Home Improvement Editor

Corner Pocket

Porter-Cable's Pocket Cutter bores the holes and drives the screws for a pocket joint. You first bore the pocket, then bore the pilot holes and, finally, drive the screws to fasten the joint. Unlike other woodworking joints that use dowels or a mortise and tenon, no clamps are necessary to bring this joint together. P-C says that the screw is driven parallel to the joint's face. That way, there's little risk of the screw breaking through the surface or the parts being misaligned. The Pocket Cutter comes with its own square-drive bit for screwdriving. It accepts lumber $\frac{3}{8}$ in. to 1½ in. thick. It's powered by a 5-amp ball-bearing motor, and costs about \$330 at hardware stores and P-C distributors. Write Porter-Cable Corp., 4825 Hwy. 45 N., P.O. Box 2468, Jackson, TN 38302.



More Handy

Locking pliers are handy, but their reach is limited and they don't work very well on angled surfaces. This set of locking pliers addresses these shortcomings with extended jaws and swiveling clamp pads. The tool has a lever release mechanism that allows you to unlock it with one hand by flipping up the lever that protrudes slightly from the bottom handle. These locking pliers from Crescent cost about \$20 at hardware stores and home centers. For information, write Crescent Locking Pliers, P.O. Box 728, Apex, NC 27502.

The Cutting Edge

Made from extruded plastic, the Fine Line Cutting Guide helps you position wallpaper, flooring and carpet for easy cutting and an accurate fit at the corners. The guide shown measures 23 in. long, and a 6-in.-long mini cutting guide is also available. The tools couldn't be easier to use. They're shaped so you just lay the wallpaper or flooring material over them and slice along the edge with a knife. The radius of their curve positions the cut so when you lay the material down, it fits right to the corner. The model shown costs about \$13, and the 6-in.-long model, about \$9. Both are sold at hardware stores and home centers. Write Power Flo Products, 1661 94th Ln. N.E., Minneapolis, MN 55434.

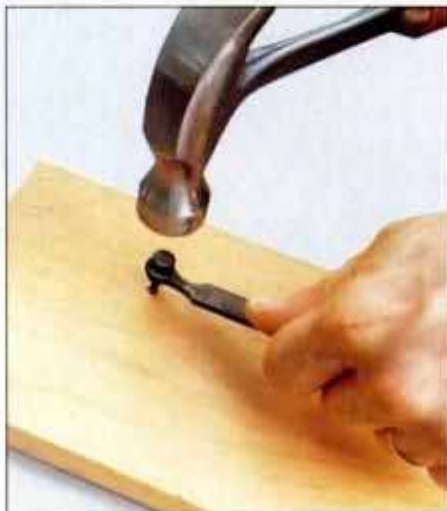
Just Like Dad's

When Sears asked its customers what they wanted in a 10-in. radial-arm saw, many responded that they wanted a saw like the one their father had. Sears says it obliged these customers by making its new 10-in. saw more like the ones it made decades ago. Sears says the new machine is easier to maintain because the saw track is easier to replace when it gets worn. The saw carriage rides on permanently lubricated ball bearings—another maintenance reducing feature. The company says the saw head is easier to align on the track than previous models, and the saw is generally easier to set up and use. Powered by a 2¼-hp motor that can run on 120 or 240 volts, the motor is protected with a thermal overload switch. The saw rips to 26 in. wide and, at 90°, can crosscut a 3-in.-thick × 15½-in.-wide board. The saw costs about \$600 at Sears stores. Write Sears Roebuck and Co., Dept. 903, B1-221B, Hoffman Estates, IL 60179.



Double Header

You would think there isn't much to improve on a nailset. Not so. Made from forged tool steel, this set has two angled heads ($\frac{1}{16}$ in. and $\frac{1}{32}$ in. dia.) for different size nails. According to the manufacturer, the heads are angled so the tool is easy to position, and this reduces the tendency of the set to move off the nailhead when hammered. This nailset from Gatco costs about \$10 at hardware stores and home centers. For more information, write Gatco, P.O. Box 600, Getzville, NY 14068.



problem with standard center-screw woodworking vises is that they often rack when you apply pressure between the vise and a bench dog. Now the pressure you apply to the workpiece via one vise handle is equally distributed, regardless of which handle you turn. The 12-in. vise includes enough chain for 16-in. spacing between the screws and costs about \$130. Write Veritas Tools, P.O. Box 1720, Ogdensburg, NY 13669.

Kicking Around

The Sidekick is a 42-pound machine that combines many of the characteristics of a radial-arm saw and a power miter saw (it does not, however, make rip cuts). It's powered by a 12-amp motor, and it's equipped with a 6½-in.-dia. blade. The saw cuts miters and compound miters and it can cross-cut stock up to 12 in. wide while cutting miters up to 9½ in. wide. The saw table is made from cast aluminum and the guide rails are stainless steel. Its aluminum fence has a sliding stop for repeat cuts. The Sidekick costs about \$500 at Delta machinery dealers. Write to Delta International Machinery Corp., 246 Alpha Dr., Pittsburgh, PA 15238.



The Pressure Is On

If you take your woodworking seriously, then you'll be interested in this chain-drive twin-screw vise. The



Pocket Guide

The pocket-size Smart Level is a 9-in.-long angle-reading electronic level. It measures any angle from 0° to 90°, and it also indicates shallow angles in terms of a rise-run ratio (1° slope per $\frac{3}{8}$ in. of horizontal length, for instance). The level has an automatic shutoff feature to prevent its 9-volt battery (not included) from being run down if the tool is left unattended. To recalibrate the tool, simply press its reset button. The Smart Level costs about \$45 at hardware stores and home centers. Write Wedge Innovations, 2040 Fortune Dr., Suite 102, San Jose, CA 95131.

Speed Control

This new 5-in. random-orbit sander has an automatic speed-control feature that prevents disc speed from increasing when the sander is removed from the surface. That way, the sander won't gouge the work surface when you place it back down and start sanding again. Its other nice features include hook-and-loop sanding discs, through-the-disc dust extraction and a removable dust skirt so you can sand flush to a vertical surface. Its side handle pivots, so you can adjust it to suit your grip. It costs about \$80 at hardware stores and home centers. Write Black & Decker U.S. Power Tools, Communications Dept., 10 N. Park Dr., P.O. Box 798, Hunt Valley, MD 21030.





High Tension

This hacksaw has the combined virtues of being well made and versatile. A product of the L.S. Starrett Co., the saw frame is made from cast aluminum with a thick steel tube. You can store extra blades in the tube, and the saw's mounting pins allow you to position the blade so you can cut straight or flush to a surface. Furthermore, the blade can be adjusted so it sticks out beyond the saw frame, for jab sawing in particularly tight spots. It costs about \$20 at industrial suppliers and hardware stores. For more information, write L.S. Starrett Co., Consumer Products Division, P.O. Box 10528, Charleston, SC 29411.

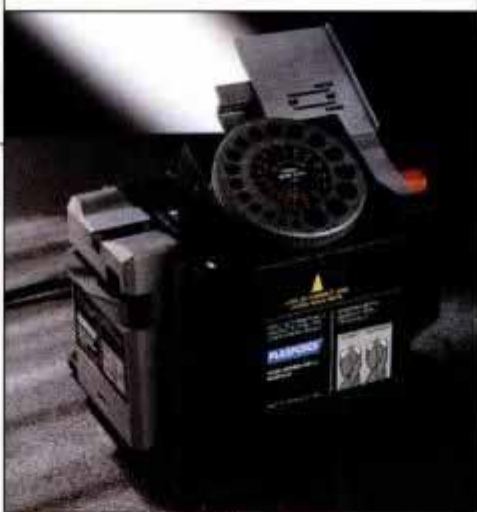
Straight And Narrow

Porta Rip is an aluminum base with an attached handle and slide bar that mounts to your circular saw and allows you to accurately rip strips from ¼ in. to 24 in. wide. The baseplate has a ruler with 1/16-in. increments, so there's no need to measure and mark or snap a chalkline before cutting. The slide bar can be removed from the base and functions as a guide for narrow ripping. The Porta Rip costs about \$50 through woodworking supply catalogs and home centers. Write Masterbuilt Mfg. Inc., 450 Brown Ave., Columbus, GA 31906.



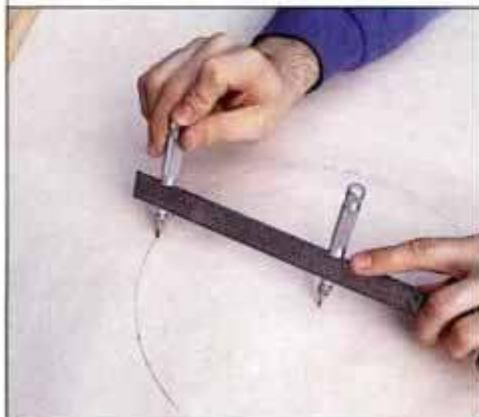
Running In Circles

Trammel points, like these, will allow you to make a circle as big as you want, providing you can find a straightedge long enough on which to attach them. This trammel set is nicely machined from aluminum. Each point is fastened to a hollow aluminum canister into which you can slip a pencil lead or a metal point. The canisters attach to straightedges from ½ in. to 1½ in. wide. They cost about \$12 at hardware stores and home centers. Write General Tools Mfg. Co. Inc., 80 White St., New York, NY 10013.



Nice And Sharp

Mount the appropriate attachment on the Ultra Sharp system, and you can regrind the edge on anything from a pair of scissors to a drill bit. The device is shown with the drill bit sharpening attachment. Another attachment is available for sharpening chisels and plane irons, and yet another regrinds masonry drill bits. Each attachment slides into place over the ¾-in.-wide aluminum-oxide grinding wheel. The device is powered by a fan-cooled motor protected by a thermal overload cutout. It costs about \$66 from Plasplugs Inc., 780 Vassar Ave., Lakewood, NJ 08701.



FREE!



16 PAGES OF WINDOW & PATIO DOOR ANSWERS.

Building? Remodeling? Replacing windows? The "Andersen" Window & Patio Door Factbook" will make you a smarter window shopper. You'll get 16 color pages with facts, photos, combination ideas, and more. Free. Just call us at 1-800-426-4261, use the coupon, or see your Andersen window dealer.

Come home to quality. Come home to Andersen®



I plan to build remodel replace.

Name _____

Address _____

City _____ State _____

Zip _____ Phone _____

Mail to Andersen Windows, Inc. 026-0293
P.O. Box 3900, Peoria, IL 61614.

1005 Copyright © Andersen Corporation 1991. All rights reserved.

- TRIPLE BRIGHT RUGGED CHROME HOUSING
- CONTOURED COMFORTABLE DESIGN
- POSITIVE EASY TO USE THUMB LOCK
- EASY TO READ DUAL MARKINGS FOR LOCATING STUDS
- PRO-TECH™ ANTI-CORROSION FINISHED BLADE

ARROW
presents...
THE BRUTE™

- TEMPERED STEEL BLADE REMAINS RIGID FOR APPROXIMATELY 7 FEET
- TRIPLE REINFORCED NON-SLIP END HOOK
- CALIBRATED FOR TRUE ZERO
- HEAT TREATED HIGH CARBON STEEL RETURN SPRING GIVES LONGER LIFE



RUGGED HEAVY DUTY PROFESSIONAL RULES!

AVAILABLE IN SIZES OF:

12' 16' 25' 30' 50' 100'

AND A MUST SEE 25' NEON GREEN

ARROW...AMERICAS BEST BUY FOR OUTSTANDING QUALITY AND VALUE. AT LEADING HARDWARE AND RETAIL STORES EVERYWHERE.



THE BRUTE™ STEEL RULE AVAILABLE IN: 50' AND 100' SIZES.



ONLY ARROW HAS THE EXCLUSIVE NON-SLIP END HOOK

ARROW FASTENER COMPANY, INC. 271 MAYHILL STREET, SADDLE BROOK, NEW JERSEY 07662
IN UNITED KINGDOM: ARROW FASTENER (U.K.) LTD., 14 BARCLAY ROAD, CROYDON CRO 1 JN UNITED KINGDOM
IN CANADA: JARDEL DISTRIBUTORS, INC., 6505 METROPOLITAN BLVD. EAST MONTREAL H1P 1X9 QUEBEC



Eurostyle

Channellock calls its new tongue-and-groove pliers European style because they have curved jaws for gripping a variety of fasteners, their jaw lugs are designed to prevent the jaws from slipping under load and their handles are prevented from closing completely, so you can't pinch your knuckles when the tool is being used. The pliers are drop-forged from high-carbon steel and have hardened teeth for maximum wear resistance. The 9½-in. size shown costs about \$8 at hardware stores. For more information, write Channellock Inc., 1306 S. Main St., Meadville, PA 16335.

Easy Going

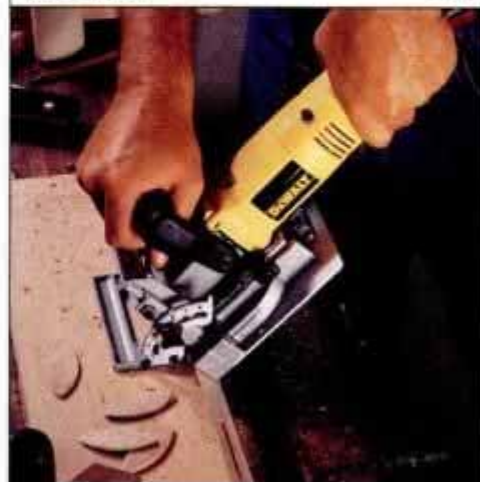
It's easy to set the depth on the DeWalt plate joiner because its fence rides on a rack-and-pinion mechanism. The fence also pivots from 0° to 90° and, when it's set at the latter angle, it doesn't have to be removed since it fits flush to the joiner's base. The tool's other nice features include a 6.5-amp ball-bearing motor, a vacuum-hose adapter and a metal carrying case. This plate joiner costs about \$300 at hardware stores and home centers. For more information, write DeWalt Industrial Tool Co., P.O. Box 158, 626 Ganover Pike, Hampstead, MD 21074.

PM

As Seen in

PM
Popular Mechanics

This product feature mark is available for advertiser use. Contact your PM sales representative for details.



APPLIANCE CLINIC

BY STEVE TOTH,
Contributing Editor

Dishwasher Flips Glasses

I have a Maytag dishwasher, model No. WU202, serial No. 312721RG, with a curious problem. When the machine was about 3 years old, the water pump failed and I replaced it with another Maytag pump purchased from our local Maytag dealer. The machine worked perfectly for six months. At this time, the force of the water began flipping over the drinking glasses on the bottom rack, breaking approximately 2-dozen glasses. Both the upper and lower spray arms are spinning freely and the water outlet holes are not clogged. Any clues?

R.P.H.
MERIDEN, CT

The problem may be with the lower wash arm, made of polypropylene plastic. When the wash arm has developed a crack or split, all the water under pressure that comes into the arm doesn't pass through the holes in the arm as it should. The water finds its way to the crack, enlarges it and squirts out in all directions.

This causes strange things to happen inside the dishwasher, including flipping glasses. I suggest you remove the lower wash arm and inspect it carefully. Look for a hairline crack, particularly along the top of the spray arm. A replacement wash arm is available from any Maytag parts distributor in your area. It is part No. 91697, and costs about \$20.

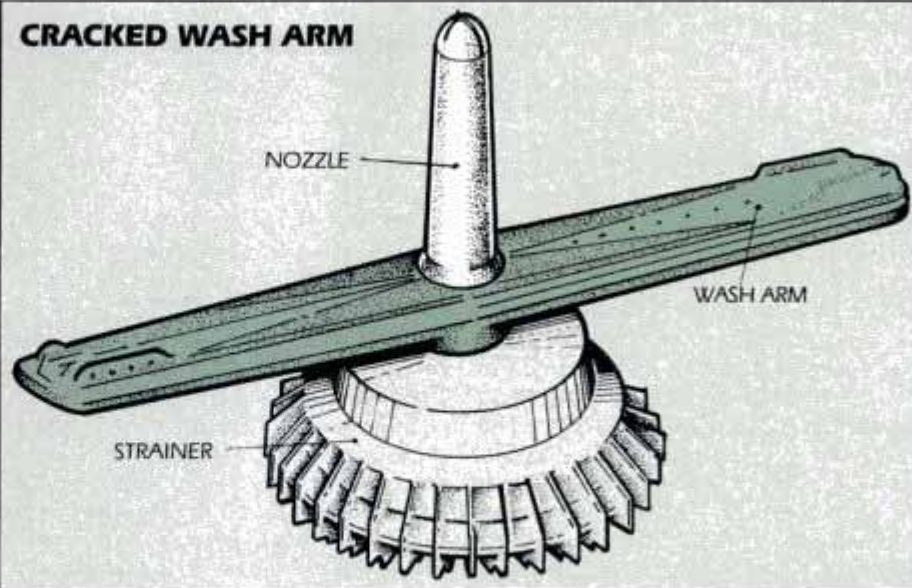
No Sealing Ring

I need help in finding the rubber sealing ring for the cover of my 4-quart Revere Ware pressure cooker. I am told that the company no longer makes pressure cookers. Thanks for any help.

DONALD F. MIER
WEST BRANCH, MI

Revere Ware discontinued making pressure cookers about the time microwave ovens were introduced. Parts, service, instruction and recipe books are not available either. However, Corning/Revere Co. makes an attractive offer to owners of Revere pressure cookers. If you send the company your old pressure cooker cover, they will send you a Corning/Revere

CRACKED WASH ARM



A crack in the wash arm of a dishwasher can cause water to spray out in such a way that it can flip over glasses. Inspect the wash arm carefully for hairline cracks.

replacement and accessory catalog. You may purchase one item from this catalog for 75% off the regular catalog price.

For more information, contact the Corning/Revere consumer information center, tollfree, at (800) 999-3436 between 8 am and midnight, Eastern time, seven days a week.

Needs Sears Manual

I recently purchased a new Sears automatic washer, model No. 110/82983120. After purchasing the washer, I went to the Sears service department to get a service manual and was told that the only manuals available are for belt-drive washers. I checked the manual and it has nothing on direct-drive models such as mine. Can you help me?

MARK A. STROHM
CLARK, NJ

Sears has a do-it-yourself repair manual for direct-drive Kenmore automatic washers. The manual is available from any Sears repair and parts center, Division 26, Source 110. It's part No. 1S, Lit. 4314044, and it costs about \$8.

Switches Are Failing

I own a Monarch electric kitchen range, model No. EA330WAG, serial No. ABE 1088. The control switches for the heating elements are starting to fail. The local repair people claim that Monarch no longer makes ranges and that replacement parts are not available. Specifically, the switch for the high-temperature, fast-heating top burner (left rear) and the switch

for the broiler element in the oven are faulty. Can you help?

BOYD SHANK
BROOKINGS, SD

The Monarch Range Co. went out of business in 1985. Hometown Glass & Improvement Inc. acquired a large supply of Monarch range parts and still has many of these parts in stock.

A left rear burner switch is still available under part No. 49023, and it costs about \$33, plus shipping. The rotary selector switch for the broiler element is no longer available. To keep your range in service, you can install a combination thermostat/selector switch. It is part No. 015011, and costs about \$90, plus shipping.

This control takes the place of both the selector switch and the thermostat, and it will not change the appearance of the range.

The wires on the old selector switch are removed and attached to the new control. The old nonfunctional selector switch is left in its place, and all oven operations are controlled by the new control.

The control is packaged with instructions and a lot of illustrations explaining exactly how to install it.

For more information about this control or for technical assistance, contact Hometown Glass & Improvement Inc., 1403 N. Spring St., Beaver Dam, WI 53916.

PM

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

HOMEOWNERS CLINIC

BY NORMAN BECKER, P.E., Contributing Editor

Blocked Vent Stack

Can you explain the workings and purpose of a vent pipe? Some months ago, during a heavy rain, water came pouring into a third-floor room. Our roofer came and said it was not a roof defect, but there might be a break or blockage inside the vent pipe. He filled a plastic beverage bottle with water and inserted it in the top of the vent. We have had no flooding since. However, at times I sense an unfamiliar odor throughout the house. Can you help with this problem?

NAME WITHHELD
 POTTSVILLE, PA

The odor that you smell is probably from sewer gas, which is the result of the vent stack being blocked. The vent pipe must never be obstructed. Its purpose is to vent sewer gas into the atmosphere and to maintain atmospheric pressure within the drainage system.

Each plumbing fixture in the house, such as a sink, has a bend known as a P-trap as part of its drainage piping. A little water is left in the trap every time water drains from the fixture. The trapped water forms a seal to block sewer gas

(which is normally present in the drain line) from entering the house.

When it rains, water enters the opening at the top of the vent stack. Normally this is not a problem. However, if the vent pipe is offset in the attic, and if this offset section is cracked or has a hole, water will drip onto the floor and wet the ceiling below.

If the vent stack is blocked, the sewer gas will rise to the point of the obstruction and then back out to a point where it can escape, such as a crack or hole. It can build up enough pressure to force its way past the water in the trap. In your case, the sewer gas is probably seeping out a crack in the vent stack, and from there the gas makes its way into the attic and seeps into the rest of the house.

I suggest that you look in the attic for the source of the leak. Don't forget to remove the plastic beverage bottle from the vent stack.

Oil Spot Sealer

This coming spring, or as soon as weather permits, I am going to put a blacktop sealer on my asphalt driveway. This will be the third sealer application on a 7-year-old driveway. Oil spots from automobile leaks always

show through after a sealer application. I have tried to raise the oil spots with solvents and soaps. I have tried to hide the spots by painting over them with flat black spray paint, all to no avail. Can you advise me of anything that would cover these oil spots? Thank you.

WILLIAM R. BRANDT
 WESTERVILLE, OH

If you continue to attempt to remove or seal the oil spots with gasoline or some other petroleum product, you may have to patch that area of the driveway sooner than you think. Those products will dissolve the asphalt binder.

Revere Products, in Solon, Ohio, has just the product you need to keep oil spots from showing through the driveway sealer. The product is called Oil Spot Primer, and Revere claims it will seal oil, grease, and chemical stains on asphalt. The company says that the primer can be used with all types of driveway sealers.

Apply the primer with a brush or roller. Prior to applying it, sweep off dirt and dust from the driveway. Also, scrape off built-up spots of oil, grease, dirt and chemical substances. Wash the driveway (Revere also sells a driveway cleaner).

A kit containing 1 gallon of sealer plus a quart of pavement cleaner costs about \$33, plus shipping. Other kit sizes are also available. For more information, write to Revere Products, 6680 Parkland Blvd., Solon, OH 44139, or call Revere at (800) 321-1976.

Bathtub Cleaner

Would you know of any chemicals that would clean a bathtub of a fine film of rust? Any information would be greatly appreciated. Many thanks.

HOMER H. BROWN
 SALISBURY, MD

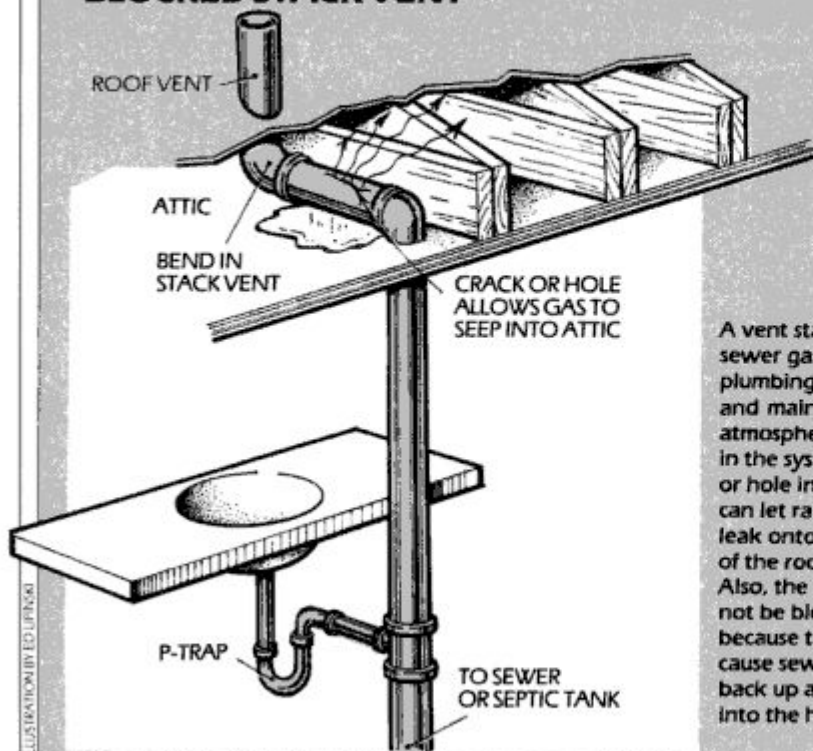
Try using ZUD. It's available at most supermarkets, and it is quite effective in removing rust and stains from bathtubs, sinks and other household items. It comes as a powder, and a 6-ounce container costs about \$1.30 at supermarkets.

RM

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.

BLOCKED STACK VENT



A vent stack lets sewer gas out of the plumbing system and maintains atmospheric pressure in the system. A crack or hole in the vent can let rainwater leak onto the ceiling of the room below. Also, the vent should not be blocked because this could cause sewer gas to back up and seep into the house.

SPECIAL SECTION

BOATING '93

•NEW BOATS!
Fun And Affordable
•NEW MOTORS!
EFI Is Everywhere
•NEW GEAR!
The Best You Can Buy

AGUA CALIENTE

The fun quotient is back in the hot '93 boats. And surprise—they're affordable, too.

BY JOHN WOOLDRIDGE, Contributing Editor

● It's early morning on Biscayne Bay, just south of Miami, Florida. As the sun clears the horizon and flashes away the mist, I idle the Baja Shooter out of the marina and nail the throttle. The wake boils as the big 7.4-liter Merc roars to life.



**BAYLINER
JAZZ**



BAJA SHOOTER

PM PHOTO BY SKIP GANDY

ASTRO 20 DCX



I'm instantly up on plane and making a laser-beam run down the Intracoastal Waterway. This is breakfast on the Baja, and it beats orange juice and cereal every time.

Without doubt, a part of me wants a boat as hot as Georgia as-

boater that other parts of me want a full-featured fishing machine, an affordable fun boat and a sporty day-cruiser for the whole family. Fortunately, there are new boats to satisfy my every need.

Instead, the Shooter features flowing, curvilinear lines that are more in tune with the '90s. This effort shows up in the custom engine vents, sweeping consoles and body-wrapping bolster seats. The base 60-mph Shooter (equipped with the Merc 7.4-liter engine) starts at about \$43,930.

In many ways, the Bayliner Jazz is on the opposite end of the spectrum from the Shooter, but that doesn't diminish its status as one of the year's hot numbers. The 12-ft. Jazz comes with eye-popping colors and graphics, and features Mercury's sizzling 90-hp Sport Jet engine.

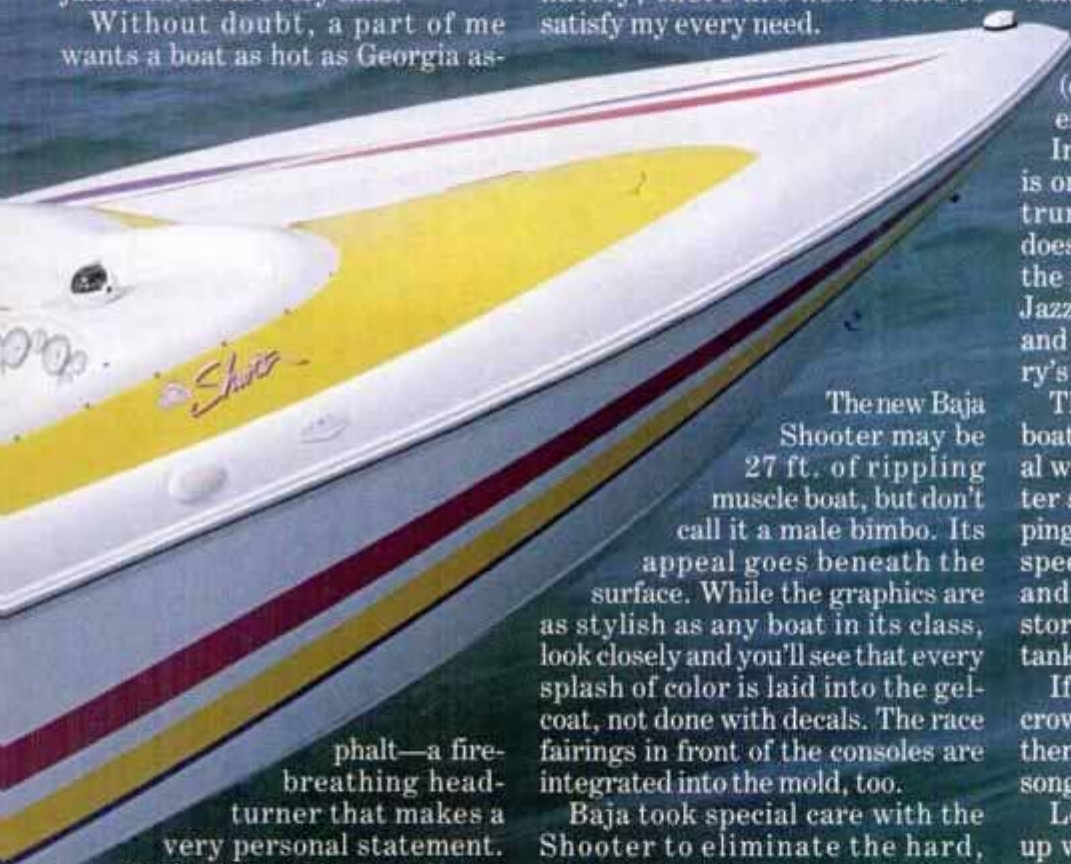
The Jazz is unique because it's a boat-lover's alternative to a personal watercraft. While it matches water scooters in terms of end-swapping fun, it can also hit 40 mph at top speed, carry multiple passengers and pull a waterskier. Generous storage space and a 17-gallon fuel tank set it apart, too.

If one-upping the water scooter crowd is your idea of affordable fun then the Jazz (\$7995) is playing your song.

Leave it to Chris-Craft to come up with a dramatically styled bow-rider to highlight OMC's innovative inboard-mounted outboard power system. This Chris-Craft 194 Quiet Rider has the look of a luxury stern-drive, but beneath the aft sunpad a compartment houses a 115-hp OMC Quiet Rider outboard.

Everything in the 194, from the layout of the cockpit to the custom steering wheel in the striking helm console seems to flow out of a graceful overall design concept. Package price is an affordable \$17,495.

Four Winns, of Cadillac, Michigan, continues to ride the wave it started with the introduction of the breakthrough Stable-V hull (see Design & Engineering Awards,



The new Baja Shooter may be 27 ft. of rippling muscle boat, but don't call it a male bimbo. Its appeal goes beneath the surface. While the graphics are as stylish as any boat in its class, look closely and you'll see that every splash of color is laid into the gel-coat, not done with decals. The race fairings in front of the consoles are integrated into the mold, too.

phalt—a fire-breathing head-turner that makes a very personal statement. Such a boat is the Baja Shooter. But I'm such a dyed-in-the-wool

Baja took special care with the Shooter to eliminate the hard, knife-like edges of the traditional high-performance deck and cockpit.



GRADY-WHITE ADVENTURE 20

BOATING '93

page 21, Jan. '93). It does so by adding the sweet-handling hull to its new 235 Sundowner cuddy-cabin cruiser. Because of the Stable-V, the Sundowner rides like no other boat its size. It has the lateral stability of a wider boat, the nose-flat takeoff of a longer boat and the smooth maneuverability of a sportier boat. Too good to be true? It sounds great, and it is.

The Sundowner is a substantial boat and it has many outstanding cruising features. Sterndrive power choices range from OMC Cobra's leading-edge 5.0-liter EFI (\$29,126) to King Cobra's 454 cid (\$32,411).



**FOUR WINNS
235 SUNDOWNER**



**BOSTON WHALER
OUTRAGE 21**

If your idea of a good time includes living large and entertaining in grand style, then Cobalt's new Condurre 272 is a boat you need to check out. Cobalt has emerged as the top luxury small-boat builder in the business and the Condurre 272 bowrider clearly adds to its prestige.

The stand-apart look on the 272 is accomplished by the use of architectural details that flow from form to function. On the reverse transom, an electronically controlled swim platform folds down at the touch of a switch. In the huge main cockpit, there's a cylindrical refreshment center. Inside the hinged passenger console, amazingly, there's a concealed head.

For those who want to put some zip in their sophisticated entertaining, the Cobalt Condurre 272's power options range from the Merc 7.4-liter (\$53,555) to the new Merc 502 Mag-

num EFI sterndrive (\$62,860).

Like all unsinkable Boston Whalers, the Outrage 21 is a fishing boat par excellence. Especially noteworthy is its wide center console, which not only gives ample protection for driver and passenger, but also features an oversized electronics box with a removable door, a covered chart slot to the right of the throttle and a convenient molded-in footrest.



**COBALT
CONDURRE 272**



**CHRIS-CRAFT 194
QUIET RIDER**

Twin pedestal seats and a cushioned 72-qt. ice-chest seat are standard. Base price on the Outrage 21 is \$19,995 without engines, which isn't a bad price for a legendary performer that carries a 10-year transferable warranty and some of the best quality hardware in the business.

The newest offshore boat equipped with Grady-White's proven SeaV2 hull is the Adventure 20 walkaround fisherman. The SeaV2, which was introduced on several models last year, offers excellent stability and tracking. Although it's relatively small for an offshore cuddy boat, it can handle up to 230 hp and has an 82-gallon fuel tank. Base price for the hull starts at \$18,200. Prerigged with a 150-horse Yamaha, it's \$29,755.

If bass fishing is your game, then Astro's new 20 DCX is the name. This top-of-the-line rig is for veteran anglers who realize that a true bass boat can have immense casting space *and*

the benefits of dual consoles. Experts say this is where the future of bass-boating is headed, so it's not surprising that Astro is already there.

Three Motorcraft batteries, a MotorGuide trolling motor and Humminbird fishfinding electronics are all standard. Anti-torque steering is standard, too. If you need to go 70 mph, then equip this baby with either the Merc 200 XRi or the Mariner 200 EFI. The package-boat sticker will be about \$22,500.

Now I dare you to say that's not the hottest lineup for fun in 1993. If you do, I'll be forced to do something drastic—expand my search. **PM**

NOW, get paid up to **\$600** while you learn to start your own highly profitable business!

Imagine...you can get in on one of today's most profitable businesses — locksmithing — and get paid while you learn how to do it! John Hopson of Dora, Alabama found out how easy it is...

"While taking the Locksmith Course, I earned about \$600, which more than paid for the course. I am now doing work that one year ago I thought was impossible..."

Foley-Belsaw — the world's most respected name in helping people launch profitable businesses —

Shortage of qualified people creates big opportunity.

This shortage of qualified people has created a big opportunity for anyone looking to launch a full or part-time money-making business. If you've got the right training and tools, people will seek you out and pay top dollar for your expert services. And now we'll give you the best training and tools...plus an amazingly easy way to get paid cash while you learn.



Start your business almost overnight — without risking a penny.

Office buildings, apartments, hotels, and homeowners all need locksmithing services. ONLY Foley-Belsaw's Locksmithing course makes it easy for you to both learn this fascinating craft — and then to get all the business you can handle. We give you everything you need to become a master locksmith who services locks and sophisticated security and fire alarm

systems. Plus you get a state-of-the-art Pro Key machine at no extra cost. You can start a booming business practically overnight. And because we back our course and materials with a 100% guarantee, you don't risk a penny to get going!



No experience necessary — make money after the first lesson.

Foley-Belsaw's unique hands-on training approach makes it easy to learn at home. No experience necessary. Plus, our shortcut coursework reduces the time it takes to master this craft. In fact, the first lesson shows how you can use the key machine to start earning big profits...spare cash that will buy you a new T.V....stereo system...or perhaps a dream vacation!

is offering you this unique course that puts cash in your pocket while you learn!

Never before have opportunities been as good for making big money in locksmithing. The crime rate is on the rise — and as a result, demand for locks and security systems has skyrocketed in every city and town in America. Unfortunately, there are not enough locksmiths to maintain all these new systems. In fact, right now there's only one locksmith for every 17,000 people.

Earn the Foley-Belsaw Diploma — respected worldwide.

Graduates of this course receive the handsome Foley-Belsaw Institute Diploma, a respected symbol of achievement. The Foley-Belsaw Institute is more than just a school. It is sponsored by the Foley-Belsaw Company — a major corporation with a 65 year, worldwide reputation for helping people establish themselves in profitable businesses.



Others have succeeded with our course —

"Before enrolling I checked other courses and also asked for advice from several locksmiths in my area. They all said yours was tops and has the most versatile key machine. I always wanted to be in business for myself, and now I am...thanks to Foley-Belsaw."

David Fairbrother
Milwaukee, Wisconsin

"Your interest in helping me to reach my objective was an important morale factor. I would like to tell you that around my area, your name is highly respected, and I urge anyone thinking of a profitable career to enroll with you."

Michael T. Matasic
Marina, CA

Send for Free Fact Kit Now and get 2 Bonuses.

Get all the facts about Locksmithing by sending for our Free Fact Kit. There is no obligation. And no salesman will ever call. Plus, if you reply now, we'll include in your kit these bonuses: a certificate good for Free Automotive Blank Keys (\$140 value) and a certificate good for Free Business Cards printed with your name.

Yes! Please rush me my Free Fact Kit, giving me full details about starting my own business in Locksmithing. I understand there is no obligation and no salesman will call.

Name _____

Address _____

City _____

State _____ Zip _____

Mail To: **Foley-Belsaw Institute**
6301 Equitable Rd, Dept. 12252
Kansas City, MO 64120

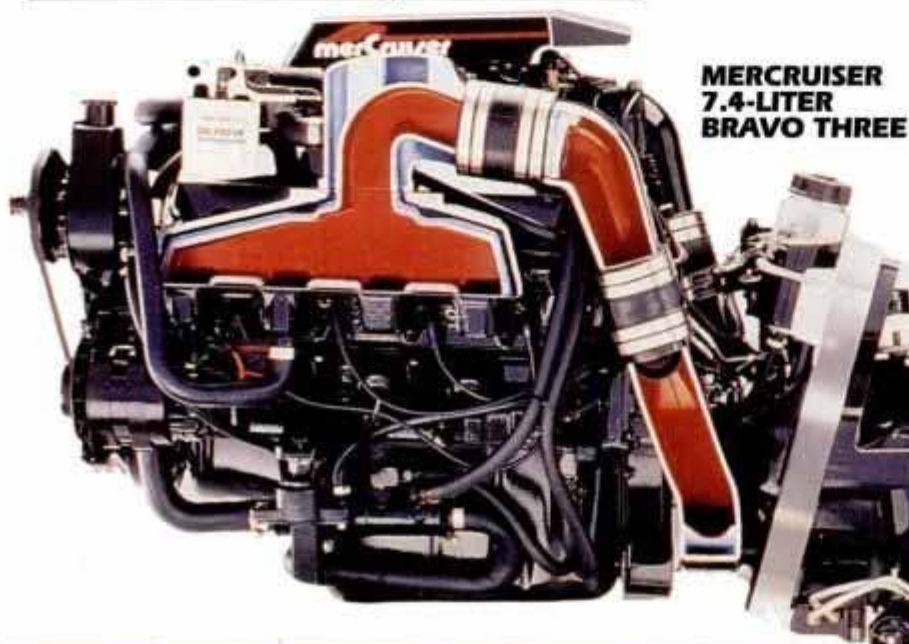
Since 1926



THE YEAR OF EFI

Engine builders shift into high gear with electronic fuel injection.

BY JOE SKORUPA, Boating/Outdoors Editor



MERCUISER
7.4-LITER
BRAVO THREE

● The E in EFI (electronic fuel injection) could stand for efficiency, because that's what it's been delivering in cars for the past 10 years. But to boaters, the E more appropriately stands for exasperation. The reason is that, until recently, marine engines were left out of the EFI loop. This was especially true in the stern-drive class, which should be the easiest engine to upgrade since it's based on familiar automotive technology.

But EFI exasperation is finally coming to an end. Both MerCruiser and OMC Cobra are introducing EFI stern-drives this year that have far-reaching consequences. OMC beat

Merc to the punch by a couple of months and scored a minor coup, but Merc's engineers were too busy working overtime to notice. Not only were



they developing boating's first non-automotive EFI system, but also another dramatic breakthrough—a drive unit with twin counterrotating props. Sound familiar?

Engineers on overtime

Why do marine engines need EFI and why did it take so long to develop? Well, first of all, the benefits of EFI are improved gas mileage, dependable chokefree starting and overall efficiency in all operating conditions. The reason it took so long, frankly, is that it was more complex and expen-



MERCUISER
502 MAGNUM
EFI



200 EVINRUDE OCEANPRO

sive than marine engine builders were comfortable dealing with—until now.

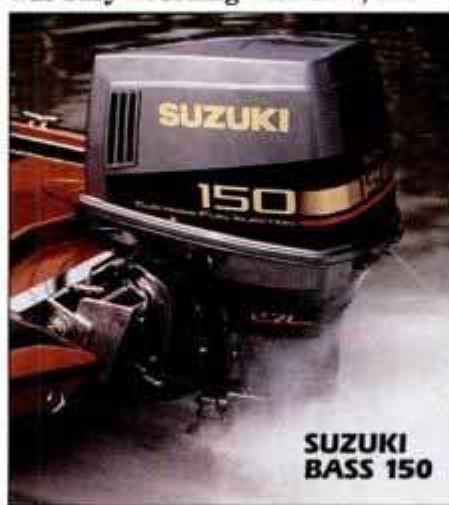
Market-leading MerCruiser was faced with a dilemma in the late 1980s: Should it take the easy way out and use available automotive EFI or build from scratch? It took a long time to decide, in part because General Motors was slow in providing technical support, but in the end Merc elected to do the right thing and build the system itself. The result is the new 502 Magnum EFI, a 415-horse 502-cid high-performance V8 that's one of the most impressive engineering achievements to hit boating in some time. The system features components either designed by Merc or by vendors to Merc specifications.

Chief among these is the Cross Ram Induction system developed by race-proven Lingenfelter Engineering. The low-profile, cast-aluminum intake manifold features 14-in. runners that help tune the engine to achieve peak power at 5000 rpm and boost torque throughout the powerband. The net result is that the 502 Magnum EFI pumps out 25 hp more than the carbureted 502 Magnum.

Other key components are a side-mounted throttle body (to keep the

profile low), fuel injectors with plastic-covered coils, a Delco Electronics ECM (electronic control module) and an engine-mounted high-pressure fuel pump with vapor separator.

While one group of Merc engineers was busy wrestling with EFI, another



SUZUKI BASS 150

group had its hands full with an equally formidable foe—twin counterrotating props. The result of the group's efforts is the revolutionary Bravo Three outdrive.

Like EFI, twin-prop technology has been on the market for at least a

decade, and it's been a proven winner in heavy midsize boats. The concept goes back to World War II torpedoes and, before that, to drawings dating back to 1837. But make no mistake, Merc's Bravo Three is aimed squarely at a specific target—the VolvoPenta DuoProp. Quite simply, Merc set out to build a better mousetrap.

The reason that twin counterrotating props work so efficiently is that two props in the water double the bite. The first prop sends high-speed water to the second prop, and the second prop accelerates it even more. At the same time, the process of counterrotation neutralizes power-robbing spin in the propwash. The net result is improved low-end torque, efficient overall power and handling, and resistance to blowout in all conditions.

The true beauty of the Bravo Three is that it's mated to familiar Merc componentry, and will have a major impact on the market. Despite a decade of lead time, the VolvoPenta DuoProp has exerted only minimal influence on the waterways. With the promise of Merc performance, parts, service and warranty, the Bravo Three will rapidly enter the mainstream. For these reasons and others, the Bravo Three was chosen as the winner of a PM Design & Engineering Award for 1993.

The Bravo Three comes coupled to a performance-tuned 7.4-liter V8, which delivers 300 propshaft hp. It's fitted with precision-forged gears, heavy-duty propshaft and bearings, stainless-steel props, a cone clutch, through-hub exhaust and a MerCathode electronic anticorrosion system.

Everyman's EFI

Despite Merc's admirable built-from-scratch philosophy, the truth is that the 502 Magnum EFI will probably only appeal to deep-pocket sport boaters. It's a pricey, high-performance unit that's aimed at a small part of the market. The new OMC Cobra EFI, on the other hand, is aimed squarely at the largest segment in boating—the bowrider/runabout crowd.

Admittedly, OMC's new V8 EFI sterndrives—5.0-liter and 5.8-liter OMC Cobra and 5.8-liter King Cobra—are based on available Ford technology, but the benefits outweigh the drawbacks. Ford has had the hot hand in Detroit recently, and, unlike struggling GM, it's a cooperative partner.

Ford helped OMC adapt its state-of-the-art multiport fuel-injection system to marine use quickly and affordably. Not only did OMC beat the competition to the EFI punch by several months, but it did so with engines

OMC COBRA 5.0-LITER EFI

Ford blocks and multiport EFI give bite to these Cobras.



OMC COBRA 5.8-LITER EFI

The 5.0-liter delivers 200 hp at the prop. The 5.8 delivers 235 hp.



that reach the heart of the market at a price that's the same as comparable OMC Cobra carbureted engines. For these reasons and others, the OMC Cobra line of EFI sterndrives also earned a PM Design & Engineering Award for 1993.

The brain behind OMC's EFI sterndrives is Cobra's familiar Spitfire electronic management unit, which works in conjunction with Ford's EEC-IV brain box. Other important components include an aluminum-forged intake manifold with tuned runners, a low-pressure pump that draws fuel from the fuel tank, a water-cooled vapor separator and a second high-pressure fuel pump that transfers fuel to the injectors. OMC predicts that 70% of its sterndrives will be equipped with EFI within the next couple of years.

In outboard EFI news, both Mercury and Suzuki crack the 150-horse barrier as the technology of the future spreads through boating.

With bigger fish to fry, Merc didn't make much of its new 150-horse EFI outboards, but the truth is that boaters have a lot to gain as EFI moves through the horsepower spectrum. At the heart of the new Mercury 150 XRi/Mariner 150 Magnum EFI twins is Merc's brawny 2.5-liter block,

which displaces 153 cu. in. Interestingly, not only does the new EFI set-up deliver improved throttle response, fuel economy and torque throughout the powerband, but it also gives the engine the ability to swing a larger prop for better low-end kick. Both the Mercury and Mariner EFI 150s are premium-priced outboards for serious fishermen and boaters.

What's interesting about the Suzuki Bass 150, aside from a name that limits its appeal, is the fact that it uses digital, as opposed to analog, EFI. The main difference between the two is the speed of response time.

Digital EFI, which appeared on Suzuki's 225-horse outboard a couple of years ago, provides virtually instantaneous monitoring and adjusting. Analog EFI, which is found in Merc outboards, for example, samples engine data at intervals and makes adjustments based on averages. Although it might be difficult for most boaters to notice the difference, Suzuki deserves credit for promoting a state-of-the-art system.

The competitively priced Bass 150 is based on Suzuki's familiar DT150 powerhead, which has a relatively heavy block and a huge 164.3 cu. in. of displacement. It also has a generous 2.08:1 gear ratio to improve low-end

torque and allow the use of power-producing high-pitch props.

In non-EFI news, a couple of OMC outboards are making impressive debuts. The midseason rollout of a new series of V6 outboards makes it clear just how important saltwater fishermen are to OMC. Everything about the 200-hp and 225-hp Evinrude OceanPro and Johnson OceanRunner outboards is designed specifically for offshore fishermen. This includes a snagfree cowling, electro-deposition paint on the drive-leg, an impressive 183 cu. in. of displacement and finger-supported cylinders that add torque throughout the powerband. With the introduction of the Ocean series of outboards, OMC makes a strong bid for leadership in the saltwater market, an area poised to enter a technological renaissance.

OMC also makes a dramatic intro on the lower end of the power spectrum with the debut of a 15.6-cu.-in.-displacement powerhead that's used on the new Evinrude/Johnson 9.9-hp and 15-hp outboards. These motors, which were redesigned from the ground up, set a new standard for 2-cylinder compacts by using machined cylinders with slotted transfer ports, half-dome hyper-eutectic alloy pistons, idle relief ports, an umbrella-valve fuel pump and many other components usually reserved for bigger outboards. Despite the improvements, these will be competitively priced motors.

Finally, a note about VolvoPenta and its suddenly hot twin-prop technology. Although it's taken the Swedish company a number of years to develop a full line of gas engines and drives, it appears that Duoprop's time has finally arrived. In response to the threat of Merc's new Bravo Three, VolvoPenta has formed a bold partnership with OMC to develop a full line of jointly built and marketed Duo-prop sterndrives for 1994.

Stay tuned. Things are about to get interesting.

PM



MERCURY 150 XRi

EFI moves into the 150-hp outboard class in Merc's new 150 XRi, based on the performance-proven 2.5-liter/153-cu.-in. block.



JOHNSON 15

The pace-setting 2-cylinder Johnson 15-horse engine and its smaller brother, the 9.9, uses components typically found in V6s.

GREAT GEAR

Get wet with the best toys of summer.

BY JIM YOUNGS

● Just when we think we've got our boats outfitted and geared up just the way we want, along comes exciting new equipment and toys to tempt us. This year's offerings are especially seductive, and we've chosen some of the most interesting and exciting to showcase. The frustration is in keeping up with the hot, new stuff. But isn't that part of the fun?

Speaking of fun, personal watercraft continue to be a hotbed of excitement, and we spotlight two new entries. On the convenience front, we profile a new prop toolkit and a portable gas station. Always on the lookout to improve performance, there's a variable-pitch prop and an automatic trim-tab control. What else? Lots. Temptation is the name of the game.

Auto-Shift Fishing

A fishing reel with an automatic transmission? Abu Garcia's new Gold Max Sprint baitcasting reel (\$90) has one, and it comes with dual gear ratios of 6.3:1 and 3.8:1. When a strike hits, the reel automatically downshifts for a low-gear retrieve. The shift point is adjustable. It's also possible to lock in the higher gear. Contact Abu Garcia, 21 Law Dr., Fairfield, NJ 07004; (201) 227-7666.



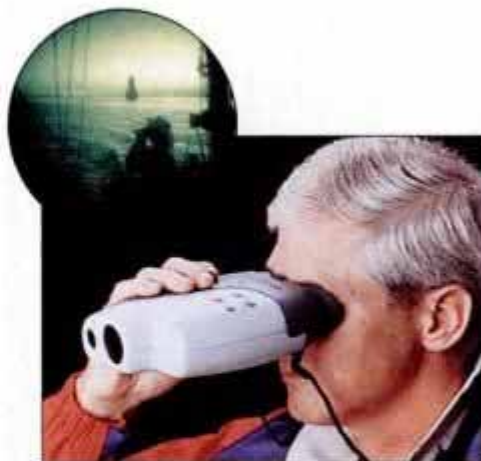
Radio Check, Over

Design goals for the new Navico Axis handheld VHF radio were rather lofty. All Navico wanted was a unit that offers one-hand operation, total waterproofing and protection against accidental dropping. Amazingly, the engineers pulled it off, although they didn't do it cheaply—the top-of-the-line unit in the new 300 Series costs about \$1000. Contact Navico, 7411 114th Ave. N., Suite 310, Largo, FL 34643; (813) 546-4300.



Shark Attack

When this shark bites, you'll scream for more. Made by the snowmobile folks at Artco, the Tigershark (\$5399) is a tandem personal watercraft powered by a 650-cc engine. Convenience features include nonskid deck pads, grab handles, an 11-gallon fuel tank and oil-injection. For more information, contact Artco, P.O. Box 810, 600 S. Brooks Ave., Thief River Falls, MN 56701; (218) 681-8558.



Night Eyes

Using proven military technology, ITT has developed night-vision binoculars for marine use. The Night Mariner (\$2400) amplifies available light up to 2000 times for optimum night vision. The binoculars are autofocus with a manual override and operate on rechargeable batteries. Weight is 1.5 pounds. For additional information, contact ITT Electro-Optical Products, 7635 Plantation Rd., Roanoke, VA 24019; (703) 563-0371.



Well Suited

Traditional marine survival suits are so massive and bulky that routine chores are virtually impossible when wearing them. Henri-Lloyd solves this problem with its new high-tech Sisstemair suit. The comfortable suit uses a CO₂ gas cartridge to provide both flotation and insulation on demand. It can also be inflated orally. For more information, contact Henri-Lloyd, Smithfold Ln., Worsley, Manchester, England M28 6AR.

Upshift/Downshift

How do you get both hole-shot power and top-end speed out of the same prop? Variable-pitch technology is the answer, and the Quicksilver Power2 (\$695) has it. This dual-pitch prop shifts automatically from low to high and fits Mercury, Mariner and MerCruiser power systems. For more information, contact Mercury, Mariner or MerCruiser dealers.



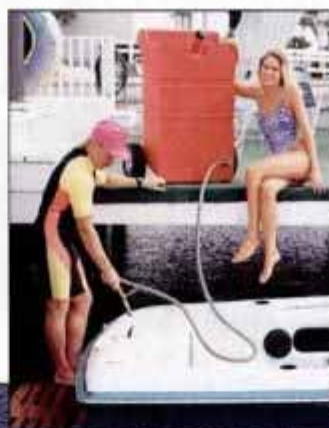
Crankcase Closed

No more bilge-oil mess or fumes in diesel engine compartments. That's the promise made by the Airsep oil/air separator, which separates blowby oil from fuel-rich gases. It then returns the oil to the crankcase and the combustible gases to the induction system. Contact Walker Engineering, 7405 Hayvenhurst Pl., Van Nuys, CA 91406; (818) 782-2154.



Pro-Puller

Removing stubborn props can be a frustrating exercise. Seeing a need, National Products has come out with a line of prop tools. The Pro-Pull kit (\$80) comes complete with a spare brass key, cotter pin, nylox nut, box wrench, puller and waterproof grease. It's backed by a lifetime warranty. Call (800) 497-7479.



Gas Station On Wheels

Lugging gas cans around is a chore many have done but few have relished. Gas Dock helps prevent some of the work by providing a 25-gallon fuel tank that rides on pneumatic tires. It's fitted with handles for lifting and has a long hose with a variable-flow nozzle. Price is \$230 from Gas Dock, 30617 U.S. 19N, Palm Harbor, FL 34684; (813) 789-9413.

Auto Trim Tabs

Bennett Marine's new Auto Tab Control system (\$399) makes trim-tab adjustment as easy as an idiot-proof camera. It electronically monitors your boat's attitude and automatically corrects for shifts in wind, sea or passenger load. It retrofits to existing units. Contact Bennett Marine, 550 N.W. 12th Ave., Deerfield Beach, FL 33442; (305) 427-1400.



Air Rider

In creating its unique new Explorer, Sea-Doo combined three proven marine components: 1. a rigid-bottom inflatable hull for stability, 2. a Rotax 580-cc Jetdrive for performance and 3. a personal watercraft-style control console for pizzazz. Its design characteristics and performance capabilities enable it to serve as a tender in the morning and a ski-craft in the afternoon. Cost is about \$8999. Contact your Sea-Doo dealer for more information. **PM**

CAR CARE

CAR CLINIC

BY MIKE ALLEN,
Associate Automotive Editor

The Noids Have It

I had a total fuel-injection failure on my Camaro last week—far from anywhere and, of course, late on a rainy night. I did manage to get the thing towed to a garage where the night help was, to be polite, not very knowledgeable. The mechanic didn't seem to be able to find the problem, claiming he needed an expensive tester that only the dealership has.

Turns out the problem was a loose wire that brought power to the fuel-injection computer. Isn't there a simple way to at least see if the injection is at fault rather than the ignition?

CHUCK DAVENPORT
JUPITER, FL

The days when you can safely yank one of the plug wires to look for a spark is gone. Lots of cars have electronic ignition boxes that don't take kindly to that. Some cars don't even have ignition wires—the coils are right on top of the plugs.

But checking the injection is easy. Go to your auto parts store and ask for a noid light (Yes, that's really what they call it. No, I don't know why.) to fit your injection harness—it should be about 15 bucks. This gadget is nothing more than a small LED cast into plastic with connectors to mate with your fuel injection.

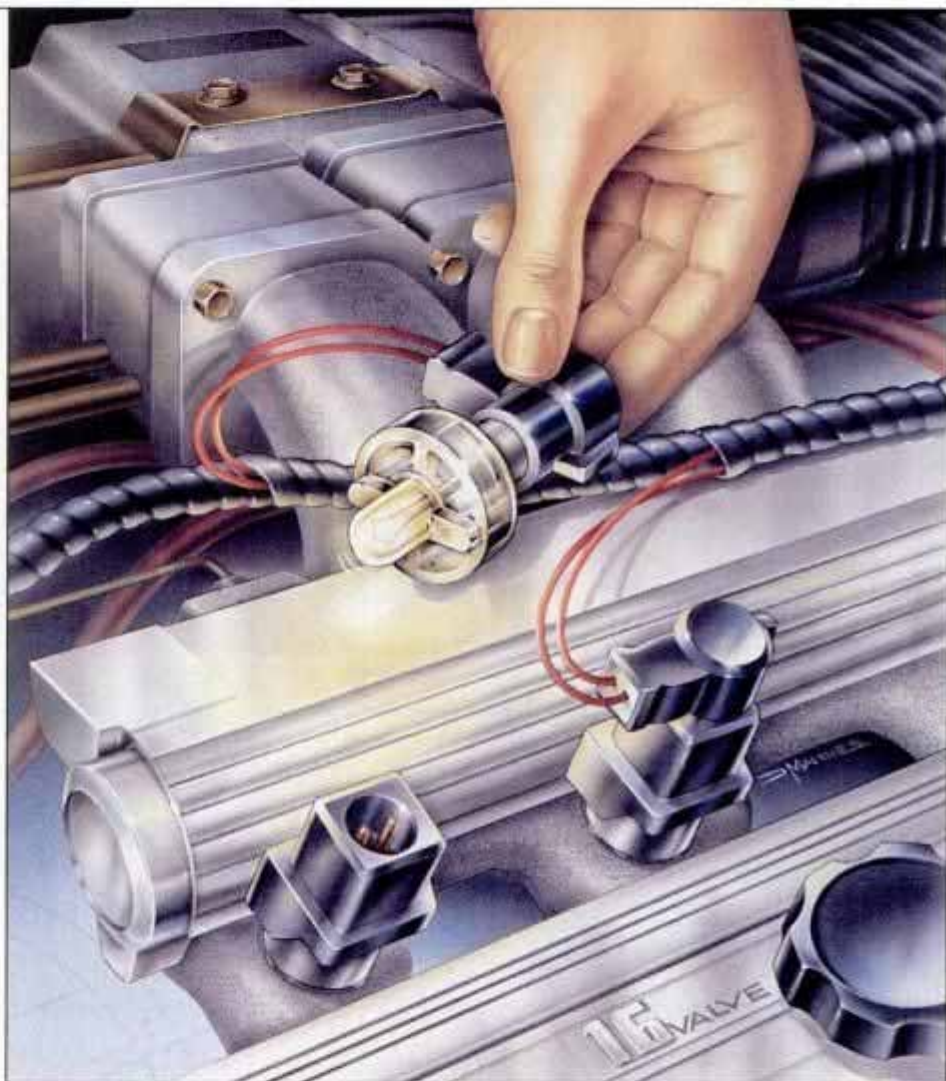
Pull the harness loose from an injector. Plug the noid light into the harness. Crank the engine. If the noid light flashes, the injection is working.

This test is by no means definitive, of course. But if you feel there is spark, and the fuel pump is running, this will tell you whether or not the fuel injection is at least trying to spray fuel.

Tagging Along

Please advise me as to the makes and models of small vehicles that can be towed by a 27-ft. Allegro motorhome, preferably economy trucks and sedans.

STAN KOZARSKI
BOSSIER CITY, LA



The problem is that any vehicle with an automatic transmission can only be towed for very short distances or at very low speeds. The tranny's internal pump, which provides lubrication and cooling, is driven from the input shaft.

My best suggestion is to purchase a towing dolly—one of those tiny 2-wheel trailers that lift two wheels of the towed car. This will get the drive wheels of whatever you're towing off the ground. In that case, almost any vehicle will do, regardless of the transmission.

If you insist on flat-towing, the best vehicle for the job would be a small 4x4 truck or sport/utility with manual locking hubs and a manual transfer case. Unlock the front hubs, and put the transfer case in NEUTRAL, as well as putting the trans-

mission in NEUTRAL.

Or for that matter, any small car with a manual transmission will be fine being flat-towed. The manual tranny doesn't depend on a pump for cooling, and will be okay for any distance or speed.

I don't recommend either of these two options, however. Think about the consequences if the vehicle is inadvertently left in gear when you tow it away. In the case of an automatic, the transmission fluid can boil. In the case of the manual left in, say, FIRST gear, the engine will blow from being over-revved.

Slush Never Sleeps

Around here they use a lot of salt on the roads, and when the spray hits the windshield, it reduces visibility considerably. The problem is that the

CAR CARE

windshield washer fluid I use is rated to -30°F , but it freezes in the nozzle before it gets to the windshield. This happens even if the temperature is only in the teens.

ROBERT BOCCIOLATT
WATERTOWN, NY

Usually the problem is the washer fluid freezing on the window, caused by rapid evaporation of the alcohol. The cure for that is to warm up the window with the defroster.

If the temperature is only in the teens, the washer fluid shouldn't freeze. Obviously the alcohol content of the fluid is not as high as it should be. Change brands.

Or try adding some 100% methyl or isopropyl alcohol to the fluid. It'll suppress the freezing point. One gadget I used back in Michigan spliced into the washer fluid line and the coolant line for the heater core. It pre-heated the washer fluid to close to 200°F , making quick work of melting snow.

For a cheap fix, try adding about 6 ft. of extra hose between the washer pump and the nozzles. Tape and in-

An Arresting Situation

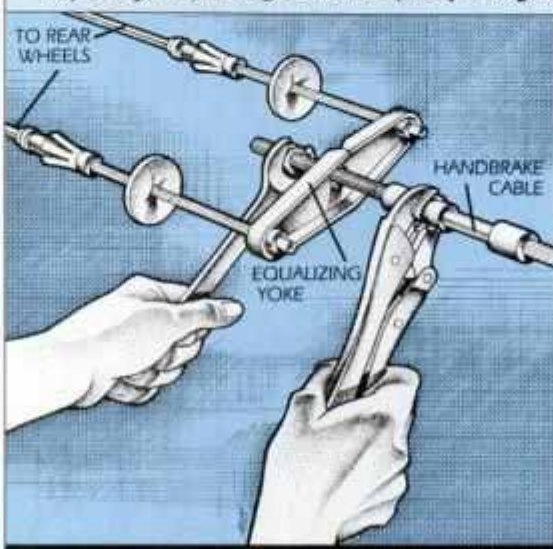
● Aunt Charlotte came to visit the old homestead last week. She parked her ancient Buick right at the top of the driveway, big as life. My driveway is slanted at a steep angle, so she set the parking brake—stepped down on the pedal with all the authority of her considerable bulk, too. But she forgot to put the car in PARK, and darned if the thing didn't roll straight back into a snowbank as she was walking up the stairs.

Adjusting the parking brake is a pretty straightforward deal. Start by being sure

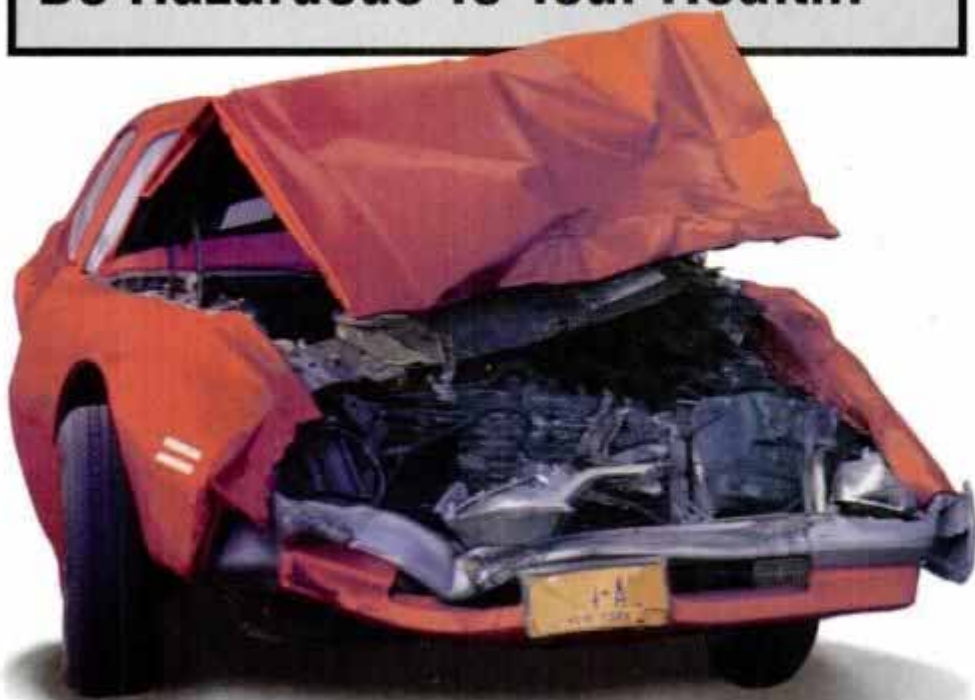


the rear drums are fully adjusted by tramping on the brakes a couple of times while backing up. Then locate the confluence of the three brake cables, either under the back seat or under the car. Start by evening up the two cables to the wheels so the equalizing bar is straight. Then tighten or loosen the main cable till it *almost* makes the brakes drag.

And try to get into the habit of using your parking brake regularly—the cables can seize up from corrosion if they don't get exercised regularly.



WARNING: Failure To Change Your Wiper Blades May Be Hazardous To Your Health.



An important factor contributing to your driving safety is often overlooked...even when you're looking right at it!

Worn out wiper blades streak and squeal across your windshield. It impairs your driving vision, and it could be the cause of an accident. TRICO recommends you replace your wipers every six months. That's because when it comes to safe driving, what you don't see, *can hurt you!*

Look to TRICO, the leading original equipment supplier of wiper blades for auto manufacturers worldwide.

Available wherever quality auto parts are sold.



TRICO

TRICO PRODUCTS CORP.
HIGH VISIBILITY

CAR CARE

sulate the extra hose along the length of the heater hoses. The washer fluid will pick up heat through the hose.

Time For A Change

I am about to change the fluid in my automatic transmission at about 50,000 miles. But even though the system holds 8 to 10 quarts of ATF, only about half of it will drain out of the pan—the rest remains inside the torque converter. I'd like to change all of the fluid, not just half. How?

THOMAS GRAY
CICERO, IL

Congratulations on your decision to change your tranny fluid—many manufacturers no longer recommend changing for the life of the vehicle. I recommend periodic changes.

I'd do a partial change every 25,000 miles, or every two years. Now that you've exceeded that, you have several options: One is to change the 4 to 5 quarts that drain normally, and not worry about it. Next is to drain what you can, add 5 quarts, run the engine for 10 minutes to flush the system and then drain it again—that'll get three-fourths of the fluid.

Some torque converters have a drain plug. Check your shop manual. If there is a drain plug, you can drain the converter, too.

I've also seen factory shop manuals

recommend drilling a hole in the converter, draining the ATF and then sealing the converter with a sheetmetal screw and copper crush seal. Not on my car—there's no way I'm going to get drill shavings inside there. Not to mention that the extra weight of the screw will cause an out-of-balance condition.

I'd do a partial change now, and while the pan was off, I'd add an after-market drain plug to facilitate

regular partial changes. Don't forget to recycle your used ATF, along with the used crankcase oil and differential lube.

*Differential lube? Yup, I'd change that, too, on the same schedule. **PM***

DO YOU HAVE A CAR PROBLEM?

Just ask Mike about it. Mail your question to Car Clinic, Popular Mechanics, 224 West 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.

TRANSMISSION PROTECTION.



Add one can every 25,000 miles, and your automatic transmission can be protected against 33 different causes of malfunctions. Guaranteed to seal leaks, smooth operation, and extend transmission life. In fact, works within 5 miles or your money back. Get Trans-X today. You could save a lot more than two dollars.

SERVICE TIPS

- 1993 Grand Cherokee security systems have been going off in the middle of the night. The cause is the hood contracting with the cold. The cure is a revised hood switch with a 0.20-in.-longer striker.
- Some 1987 and 1988 Mercedes-Benz cars may exhibit symptoms of stalling when coming to a stop and/or the cruise control disengaging intermittently. Wiggle the output pin on the Hall-effect speed sensor on the speedometer. If there's any movement, replace the sensor.
- If your '89 rear-drive Ford car or truck has a buzzing noise at idle or a grunting noise when the accelerator is depressed, Ford has traced it to pressure fluctuations in the automatic transmission. There's a kit to fix it.
- 1991 and '92 Chrysler vans (Caravan, Voyager and Town & Country) with erratic fuel pressure while driving may benefit from a new fuel pump module. Symptoms include fuel pump noise, erratic transmission shifting, engine power loss or engine die-out.

RECEIVE A \$2.00 CASH REFUND ON THE PURCHASE OF TRANS-X

Enclose original proof-of-purchase: Dated sales receipt with purchase price of Trans X circled. Mail proof **AND** this coupon to:
TRANS X REBATE, 239 West Grimes Lane, Bloomington, IN 47403

Name _____
Address _____

Not to be used in conjunction with any other Trans X offers. One redemption per household or organization. Official coupon required (reproduction void). Offer void where prohibited, taxed or restricted. Allow 4-6 weeks for mailing rebates. Offer valid only in the U.S.A.
K&W Products, Bloomington, IN 47403
Offer expires December 31, 1993

MAINTENANCE BASICS

CHANGING A FLAT TIRE

BY DON CHAIKIN,
Contributing Editor

● No matter how careful and conscientious you may be, sooner or later you are bound to face the inconvenience of a flat tire.

To help ensure that a flat tire is no more than an inconvenience, be prepared to deal with this eventuality. Each time you check your tires and their inflation—at least twice a month—check the spare. Mini-spares typically require about 60 psi. Use a tire-pressure gauge calibrated at least that high. Buy a good gauge and keep it in your glovebox.

Be sure that your car or truck is always equipped with a working, suitable jack, its handle or handles and a lug-nut wrench. Carrying a cross-type lug-nut wrench is a good idea, since the wrench's design offers secure and ample 2-handed leverage.

Equip your car or truck with either safety flares or a reflective-plastic warning triangle.

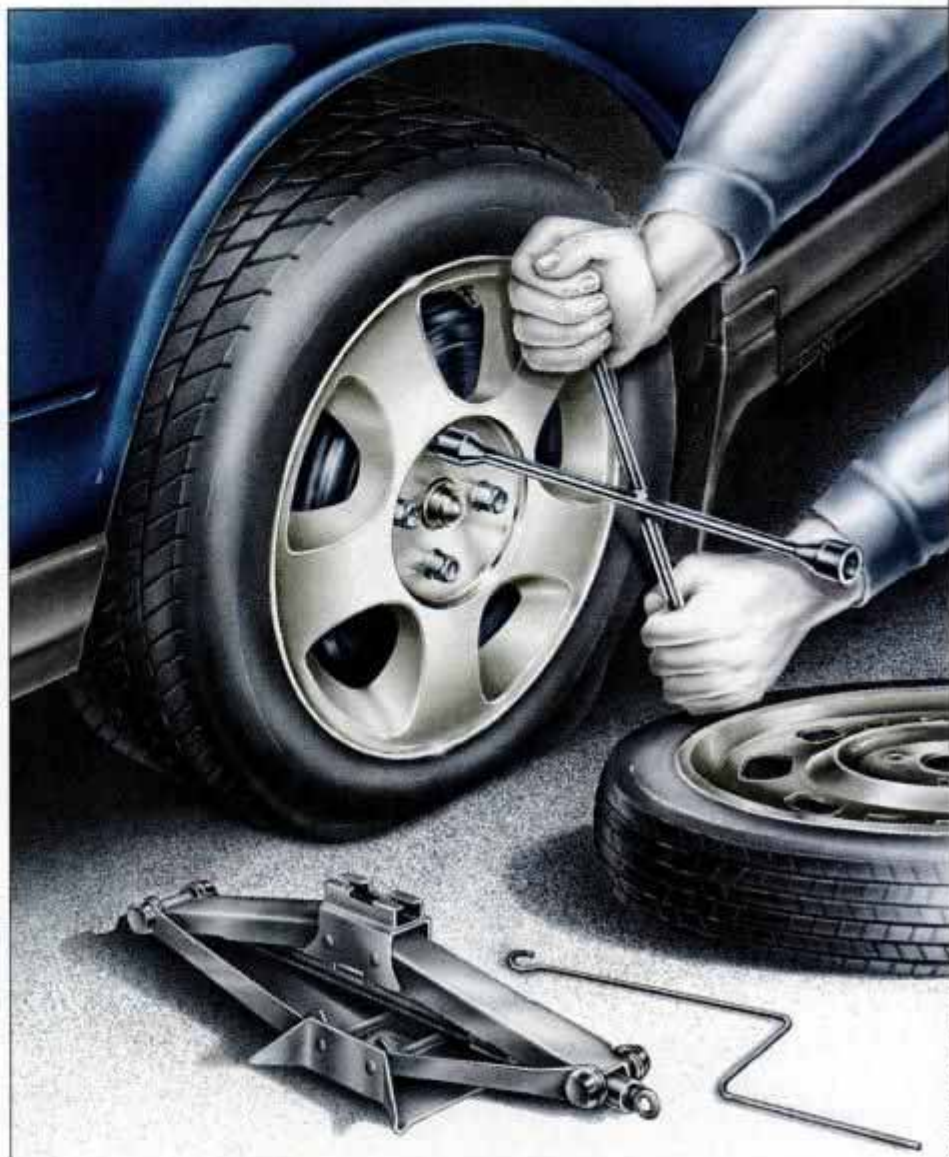
It's also a good idea to carry a small wheel chock—even a block of wood, 4 × 4 × 4 in. If you drive off-road or along roads without paved shoulders, carry a piece of ½-in. plywood, 2-ft. square, to place under the jack.

Other small items that can be handy when changing a flat are a brightly colored folding rain poncho, work-gloves, a flashlight and some waterless hand cleaner.

Besides having all the equipment necessary for changing a flat tire, be familiar with the procedure. Different vehicles need different types of jacks. Know how to use your car's jack and where it should be placed under the car—a reinforced section of underbody, suspension component or frame rail.

Should you get a flat tire, pull safely off the road and set the parking brake. Do not stop on a narrow shoulder, bridge or in a tunnel. If there is no safe place to stop, keep driving—slowly, in the right lane, 4-way flashers on—until you can pull off the road.

A car sitting on a jack is unstable at best. Do as much work as possible with the car sitting on the ground. When the car is being jacked up, it



should be empty—no passengers.

● Remove everything needed to change the tire. Set the flares or reflective triangle between you and oncoming traffic.

● Remove any wheel cover or hub cap to gain access to the lug nuts. Some wheel covers have locks or hard-to-spot pry slots. Check your owner's manual.

The jack handle or lug-nut wrench generally has a flat tip for removing the cover.

● Loosen all of the lug nuts. If you cannot loosen a tight nut, first be sure that you are turning it in the correct direction. Check your owner's manual to be certain that none of the lug nuts have lefthand threads.

Position the wrench on the nut so you can safely step on the wrench, using the weight of your body to help loosen the nut.

After all the nuts have been slightly loosened, position the wheel chock at the tire diagonally opposite the flat.

● Position the jack according to the carmaker's directions. Jack up the car so the flat tire clears the ground by 2 to 3 in.

● Remove the loosened lug nuts, saving the one that's farthest from the ground for last.

● Remove the flat tire and place it next to the car, then position the spare on the wheel studs.

● Put the lug nuts back on, the one farthest from the ground first. Anti-seize compound, or even oil on the threads and chamfer of the nut, will make removal easier next time.

Tighten the nuts just enough so the wheel is snug. Snug them in a criss-cross pattern.

● Lower the car back to the ground and remove the jack.

● Use the wrench to finish tightening the nuts, in a crisscross pattern.

● Remove the chock. Replace the cover, then stow the flat, the jack, its handle, the wrench, the wheel cover and the reflective triangle. **PM**

SATURDAY MECHANIC

CURING ENGINE RUN-ON

BY JIM PIECHOCKI AND MIKE ALLEN, Associate Automotive Editor

● You're about to treat your date to her fifth viewing of "Wayne's World," and so far your vintage ponycar's carbureted engine is on its best behavior. Everything changes as you pull into the drive-in and switch off your sled. Your motor emits an annoying *ka-thunk-kathunk* and continues to blow chunks for a full minute after you twist the key.

This phenomenon is often labeled dieseling because diesels run without the benefit of ignition spark—and so will a gasoline engine, sort of.

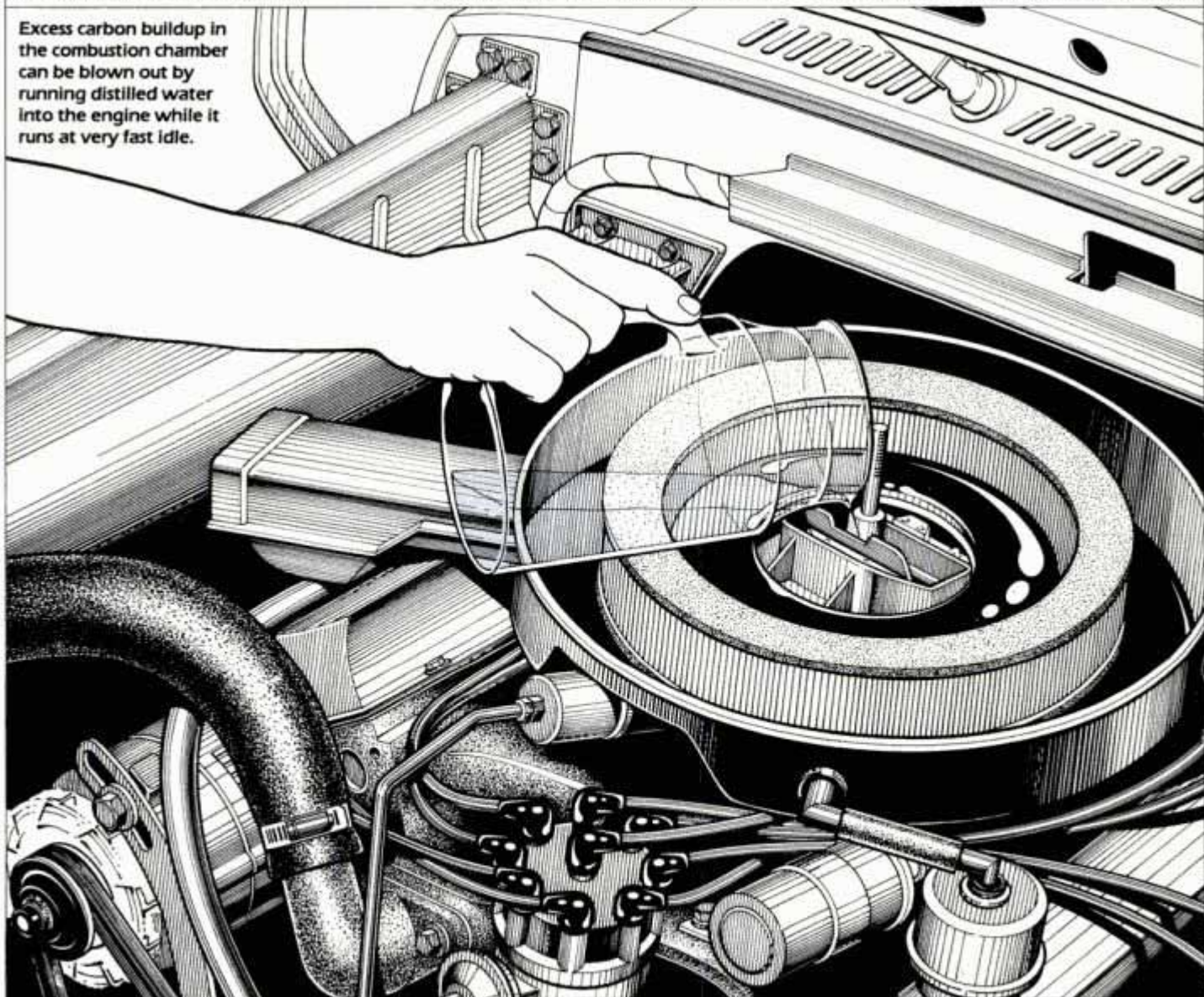
What's happening under the hood?

It takes two things to make an engine run: fuel and spark. With a carburetor and a mechanical fuel pump, fuel will continue to be pumped into the carb's float bowls, and then sucked into the engine as long as the engine continues to tick over—regardless of whether there's any spark to actually start the fire in the cylinders. We know of a fellow who forgot to take a car out of gear as he was towing it cross country. The tank was full when he left,

and very empty when he arrived.

Under the wrong circumstances, spark isn't necessary to ignite any gasoline pumped into the engine. The most common cause is a hot spot in one of the cylinders. The hot spot might be a sliver of head gasket poking out into the combustion chamber, an incandescent accretion of carbon or even an overheated portion of the cylinder head itself. As the fuel/air mixture is sucked into the cylinder, its temperature is below the point where the hot spot is hot enough

Excess carbon buildup in the combustion chamber can be blown out by running distilled water into the engine while it runs at very fast idle.



to ignite it. But as the piston rises and the mixture is compressed, the temperature of the mixture will rise and you've got combustion.

Mind you, the piston is probably still headed uphill when the bang happens, making for a very inefficient event, thermodynamically speaking. But it can be efficient enough to make even a V8 engine gain enough momentum to spin over with only one cylinder chugging along.

Dieseling won't melt your engine or crack your block—it really sounds worse than it is. One exception to this might be if your engine is prone to backfiring when it's dieseling. This is caused by unburned fuel pooling in the exhaust and igniting well downstream of the valves. A really good backfire can blow a hole in a marginal exhaust system.

Well, it's not that bad

If you have an occasional, minor problem with dieseling, try this: Just leave the car in DRIVE instead of putting it in PARK when you shut it off. The extra drag of the transmission will probably reduce dieseling to a few shakes. Another ploy is to fan the throttle a few times, drowning the engine in excess fuel. This can cause problems if you want to restart the engine in a few minutes, however. The extra fuel can wet the plugs.

Why does dieseling happen?

Dieseling can have several causes. Perhaps you are using cheap off-brand gasoline. Saving a few pennies per gallon can be a disaster in the long

run. Higher-octane gasoline is *harder* to ignite, which is a measure of its resistance to detonation in a running engine. Low-octane juice is therefore more likely to be ignited by a hot spot. Exacerbating this is the tendency for a detonating engine to run hotter.

Perhaps your mechanic increased your idle speed to help you squeak through your emissions test. Bad move. A higher-than-recommended idle speed may emit fewer hydrocarbons, but it may also make just enough power when your engine is dieseling to let the engine tick over to

Check fuel mixture and timing

One cause may be an overly rich fuel mixture. Check your mixture settings to see if this is the problem.

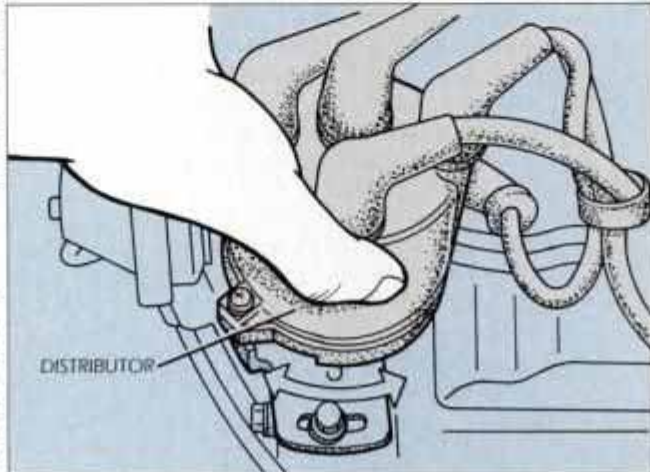
While you're at it, reset your engine timing. A poorly timed motor may misfire and deposit a film of carbon inside your cylinders. Also, an engine that's timed incorrectly will tend to run hotter.

Armed with a timing gun, attach the red lead to your battery's positive terminal, the black to the negative, and place your spark lead onto the lead to the No. 1 cylinder. Check the manual and see if any vacuum hoses should be disconnected, crimped shut or plugged. Also check for the correct idle speed setting. Start your engine and idle it long enough for it to warm up fully—it might be a good idea to start this project when the engine is already warm.

Now illuminate the timing mark with your timing light. If the timing is off, shut down the engine and loosen the clamp nut on the distributor hold-down. Then rotate the distributor to line up the timing marks. A tiny dab of white paint on the timing marks and indicator arrow will make them much easier to see. If the timing is off, you should check the ignition points and dwell angle before finalizing the timing, as resetting the dwell angle will also change the ignition timing.

Cool it down

A less-than-perfectly efficient cooling system can raise the temperature of the cylinder head and combustion

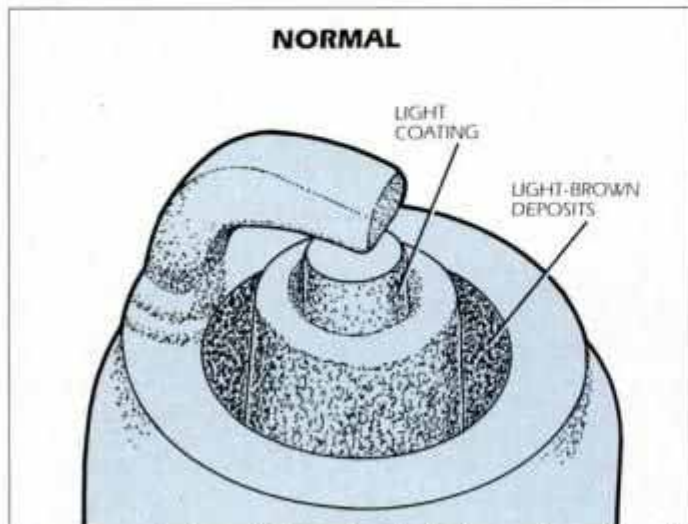


An engine with incorrect ignition timing will run hotter. Change the timing by slewing the distributor.

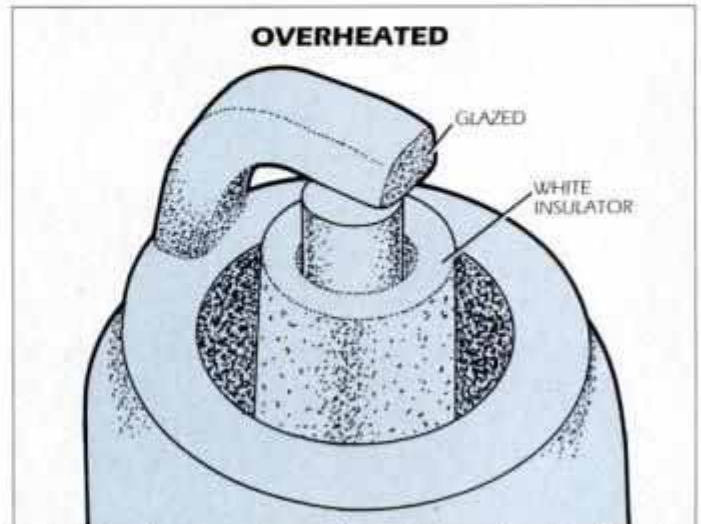
the next compression stroke—then the whole thing starts over.

The idle-speed sniffer test is a simple one. If your car can't pass it without bumping up the idle, then there's good reason to suspect other problems. Odds are that a proper tuneup will vastly improve the dieseling situation—as well as your gas mileage.

Sitting in your coughing car, the causes are less important than a cure.



A normal spark plug will show fine, light-brown deposits and a sharp, clean electrode gap.



A plug that's been running too hot will have glazed-looking electrodes and may have shiny spots on the insulator.

chamber enough to cause dieseling. If your car has no temperature gauge, but only an overheat warning light, you may not have any indication of overheating.

Start with the obvious. Look for leaves, bugs, birds or mud plugging the radiator fins. Be sure the fan shrouding, airdam or any internal baffling near the radiator is in place.

Check the level of coolant in the radiator—not the level in the overflow tank. When the radiator is cool to the touch, remove the pressure cap. If your system has an overflow tank, water should fill the radiator completely. If your vehicle has no tank, then the level should be within an inch or so of the top—if the radiator cap is in the middle of the top of the radiator. If the cap is on one side near the top, the coolant should be within about 2 in. of the fill neck. Top the system with a 50/50 coolant/water mix. If the level slowly sinks during the next week or so, start looking for leaks.

One overlooked spot for leaks is the hose between the radiator neck and the overflow tank. Check for cracks in the tank as well.

If your dieseling problem is bad when driving in the city, but okay on longer trips, you may have a fan-related problem. Air moving through the radiator may be adequate at freeway speeds, but insufficient to cool the engine in traffic. Check the viscous coupling if your vehicle uses one. Grab the fan blades (while the engine is shut off, obviously). There should be some resistance to motion, rather than the fan freewheeling. If the fan moves very easily, look for evidence of leaking silicone fluid around the fan hub.

If your vehicle uses an electric fan, be sure the fan is working and that the

thermostatic switch is turning the fan on and off at the correct temperature.

If all else fails, replace, or at least check, the thermostat. Don't try to make your engine run cooler by using a lower-temperature thermostat, though. Just replace it with a new one of the correct type and temperature rating.

Plugs

Spark plugs live in the heart of your engine, directly inside the combustion chamber. Consequently, the traces of combustion byproducts that gather can tell you many things about the efficiency of your engine. Too many cars, especially of older vintage like your dieseling carbureted classic, have severely neglected plugs. If your plugs haven't been changed for a couple of years or a lot of miles, you may not be able to glean much from reading them.

Here's how to do a proper spark plug change:

Start by using compressed air, high-pressure water or even a sharp stick and a can of carb cleaner to clean the area on the head that surrounds the plug socket. You don't want any dirt falling into the plug hole—it could cause problems if it made it into the cylinder—it might strip the threads if dirt catches on them and doesn't fall all the way in.

Get an old shoebox or a piece of cardboard, and punch holes in it to correspond with the plugs on your engine. Remove the plugs with a socket wrench, and insert them into the corresponding holes in the box, electrode-end up.

If you're in a dark, dingy garage, get a good light or move out into the sunshine. Using a magnifying glass,

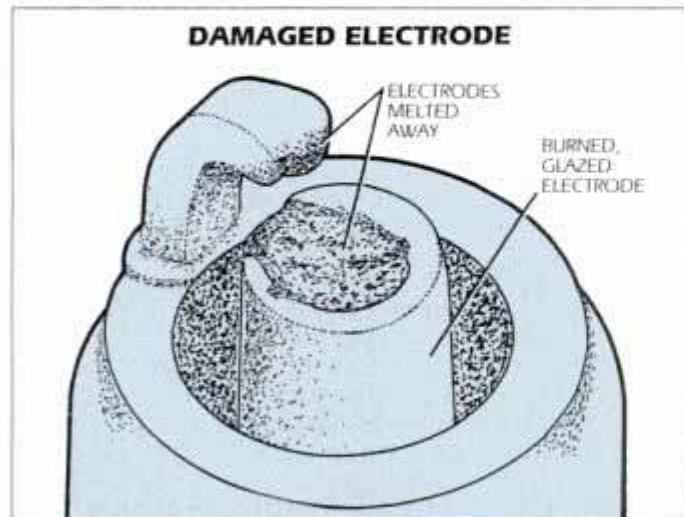
examine each plug carefully.

Start by comparing the plugs to each other. If all the plugs look pretty much the same, fine. If one or more plugs has a substantially different appearance, then there's some anomaly in your engine causing it. One plug that's oil-fouled would make you suspicious of the rings or valve guides in the corresponding cylinder. One cylinder that's obviously much hotter is probably running lean, most likely from a manifold vacuum leak near the runner for that cylinder. Check for obvious leaks like a deteriorated grommet on the PCV valve. Any leanness caused by a vacuum leak will make the engine run hotter, as well as the single cylinder closest to the leak.

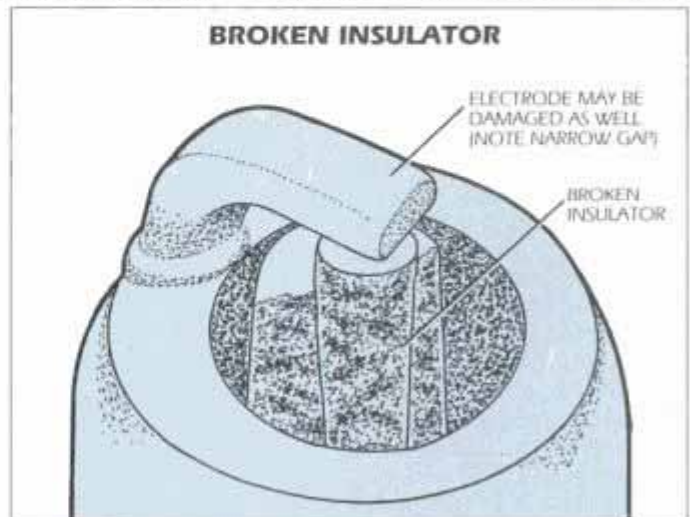
If all the plugs look about the same, check the gaps. They should be within specifications, and the electrode corners should be flat and square. Electrons are more likely to jump from a sharp corner than a round one, reducing the voltage necessary to initiate a spark. Look for evidence that the plug is firing electrically—a shiny, bare-metal appearance at the corners of the electrodes.

Any cylinder that's not firing at all will have a wet, gasoline smelling surface. Or perhaps it's oil-fouled—see if the gas evaporates from a warm plug within a few minutes. If you've wisely elected to change the plugs on a cool engine to save yourself from horribly burned fingers, try flicking your Bic lighter and evaporating the gas. Oil fouling will remain, gasoline fouling will dry up.

A dieseling engine might well show evidence of an overheated plug—one (or more) with white, glazed-looking deposits baked onto the surface of the insulator. Or you may find small me-



Severe overheating caused by detonation or poor ignition timing can actually melt and erode the metal electrodes.



Severe detonation can fracture the ceramic insulator, which in turn, can damage the electrode, closing the electrode gap.

tallic-looking spheres just barely large enough to see.

Reinstall or replace the plugs. Be sure the new plugs are the correct type and heat range. Put a small dab of antiseize compound on the threads, being careful to keep it away from the electrodes or insulator.

Anti-dieseling solenoid

Some older cars regulate engine run-on with an electrical anti-dieseling solenoid, located at the base of the carburetor. This shuts off the supply to the carb's idle circuits when the ignition is turned off.

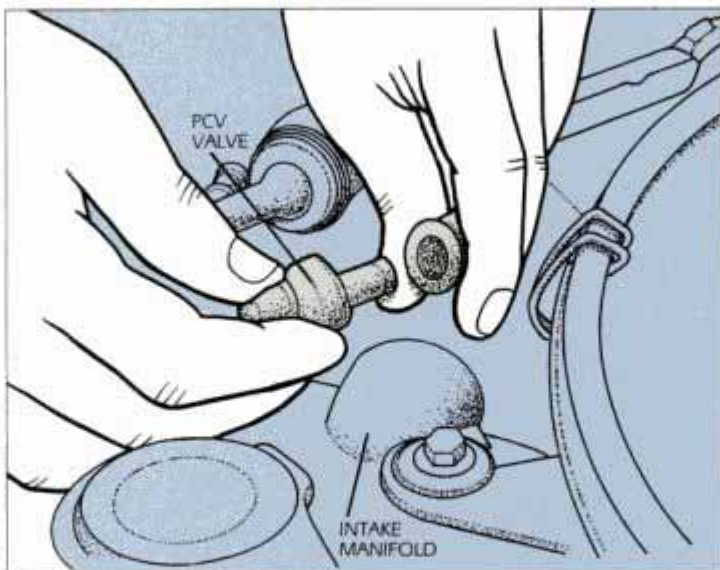
If the valve is corroded or fouled by debris, or the return spring is rusted through or worn out, the valve may stay open and permit the engine to diesel. Unscrew the valve and check the appearance and operation of the plunger, as well as the bore where it seats. If you replace the valve, be sure it's operating properly or the engine won't idle. A previous idling problem may have prompted someone to disable the solenoid as a quick-fix solution.

High-rev engine cleaning

If resetting your motor's fuel mixture and timing doesn't help, there are a few alternatives.

If you own a high-revving sports car with a manual transmission, you can literally blow out carbon deposits with a procedure called an "Italian tuneup." For many years there wasn't a maximum speed limit on the Autostradas or freeways in Italy. An owner of a high-performance car that used the cruder ignition systems of the day might have considerable difficulty with fouled plugs after a few days of low-speed driving in the city. A trip to a neighboring city on the Autostrada would raise the combustion chamber's temperatures high enough to literally burn away the carbon accumulation on the plugs and restore performance. The term has stuck around—although modern, fuel-injected cars with high-energy electronic ignition systems really don't need this kind of exercise.

Remember to obey your state highway traffic laws, but the essence is to warm up the car thoroughly, find a relatively traffic-free chunk of freeway and slow down to 30 mph or so be-



A deteriorated PCV valve grommet or hose can cause a vacuum leak, lean fuel mixture and subsequent overheating.

low the speed limit. Then downshift and bring the revs up to as fast as you dare. Repeat this a half-dozen times or so. This will not only clean off the plugs, but also will burn or loosen some of the thick, crunchy carbon accumulation on the head and piston crown.

Water-injection carbon removal

Face it, most of us don't drive sports cars. For lower-revving 6- or 8-cylinder engines, or if you live in an urban area where there's no appropriate place for a high-speed run, there is a variation that works just as well. You'll need a small-mouthed soft-drink bottle or some container that will allow you to dispense a thin stream of water, a couple of pints of distilled water and an assistant.

With the car thoroughly warmed up and idling, remove your air filter and expose the carburetor.

Let the engine warm up until the radiator water is around 200° F. Fill the bottle with lukewarm distilled water. Now have your assistant sit behind the wheel and idle it at about 2500 rpm above normal idle. If your car lacks a tachometer, do it by ear: That's about the speed your engine turns over at 70 mph.

Keeping your fingers and hair clear of the open carb throat and the whirling fan blades, carefully pour water into the open ports of the carburetor. With your free hand, signal your assistant to gun it. Every time he or she guns the engine, trickle about 3 tablespoonfuls of water into the carb.

Pour an even amount of water into each carburetor barrel. You must also

wear eye protection to prevent any stray water from being fanned back into your face.

You may be surprised by what flies out of the tailpipe. Greasy black smoke will signal that your engine is cleansing itself of its internal carbon.

Be *very* careful not to add too much water to the carburetor at once—it's a long shot, but enough water cascading into the cylinder all at once might take up the volume between the head and piston. While steam and combustion gases are compressible, water is not.

And if there's no room left when the piston hits Top Dead Center, the consequences include a broken piston, bent crankshaft or twisted rod.

The actual carbon removal is caused by the thermal shock of water exploding into steam inside the cylinder. This will literally pulverize much of the carbon, which then blows out of the exhaust.

Of course, do this outdoors. Curious onlookers should be shooed away from the tailpipe, lest they receive a face full of toxic goo. We also suggest that you avoid doing this near sensitive surfaces, like the laundry hanging on the line or a white-painted garage door.

Continue the technique of rev-pour-gun-goo until the black smoke stops. If the vehicle continues to emit smoke after several pints of water, check with your mechanic, who may tell you it's time to get out while you're still ahead.

What about fuel injection?

Fuel-injected engines generally don't run on after the key is turned off. Think about it—the electric fuel pump is not generating any fuel pressure, and the electrically activated fuel injectors aren't being triggered. But once in a great while it can happen—but only on an engine that's running so sick that the dieseling is one of the minor symptoms.

There's a certain amount of fuel under pressure in the fuel lines and fuel rail—enough to turn over the engine for a few seconds. And if one or more of the injectors—including the cold-start injector, if your vehicle uses one—is leaking, then it's possible that it will provide enough fuel to let the engine run on.

PM

HOW IT WORKS

AIR CONDITIONING

BY DON CHAIKIN, Contributing Editor

● In order to comprehend how air conditioning works you have to understand some basic laws of physics, specifically those concerning the concepts of hot and cold.

Very simply stated, everything in our world has heat. However, the amount of heat varies and those things with less heat are considered to be colder than those with more. In other words, air conditioning—or any form of refrigeration for that matter—does not make things cold, it simply

makes them less hot by removing some of the heat. The less heat an object has, the colder it is. The total absence of heat is called theoretical absolute zero or 0° Kelvin.

The other important fact that is critical to the workings of air conditioning is that heat always flows from an object with more heat to an object with less. Much the way water always flows downhill, heat transfers from the warmer to the cooler object.

Once you know the physics of heat

and heat transfer, understanding how your car's air-conditioning system cools the inside of your car is rather straightforward.

The air-conditioning system is a closed system with a chemical—the refrigerant—circulating through it. As this refrigerant circulates, its temperature goes up and down, and it changes from a vapor or gas to a liquid and back again in the process.

The refrigerant is forced through the system by a pump, called the compressor, which pressurizes, or compresses, the vaporized refrigerant.

Another law of physics that comes into play here is that when a gas is pressurized, its temperature increases. Take the same amount of heat, squeeze it into a smaller volume, and the temperature goes up—even though no heat has been added.

This compressed, heated refrigerant leaves the compressor and moves along to the condenser. The condenser looks and acts much like the engine-cooling radiator. As the heated refrigerant moves through the tubes of the condenser, it is cooled by the air flowing through it in the same manner that the engine coolant is cooled in the radiator.

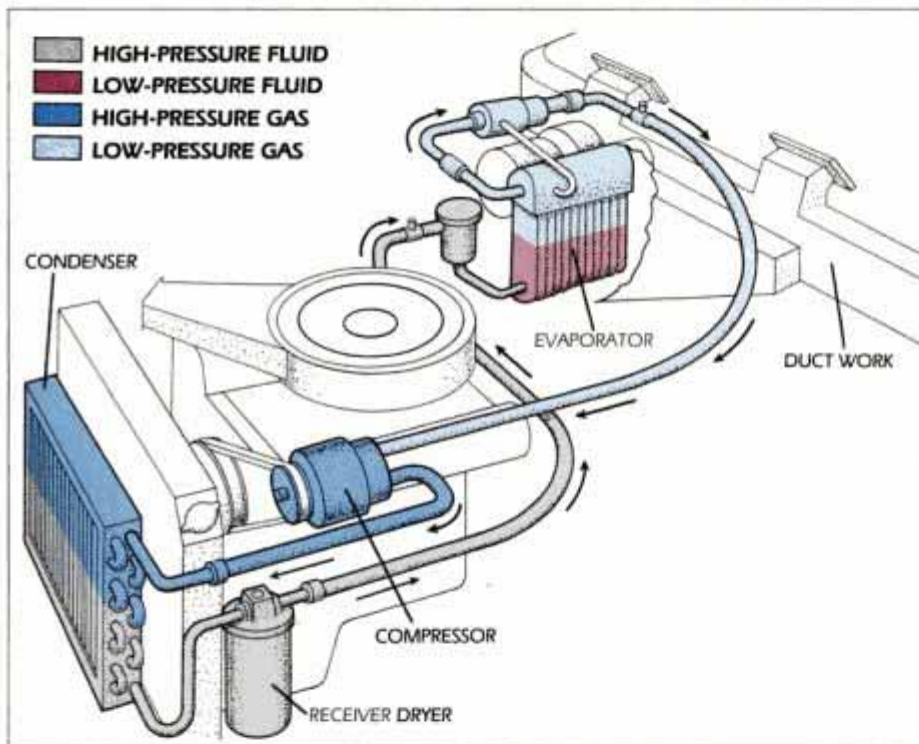
As the refrigerant cools, it condenses, or becomes liquid again. The liquid goes to a small tank, called the receiver dryer, where excess liquid refrigerant is stored and any water collected during the condensation process is removed.

Though the refrigerant has become a liquid and is cooler than when it left the compressor, it is still pressurized.

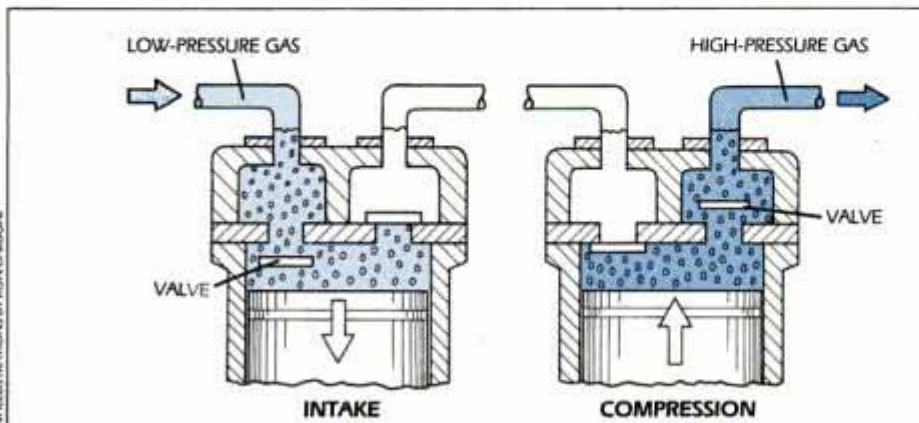
The pressurized liquid refrigerant flows to the evaporator where it becomes depressurized. As the refrigerant becomes depressurized, it expands, or evaporates, back into its vaporized or gaseous state.

And, as compressing the gas into a liquid raises its temperature along with its pressure, lowering that pressure lowers its temperature. The rapidly cooling, evaporating refrigerant draws the heat from the fins of the evaporator, which take the heat from the passenger compartment.

In addition to simply cooling the air, the air conditioner also lowers its humidity, since cool air can hold less moisture than an equal amount of warmer air. As the air cools on the evaporator fins, it leaves water droplets, which drain through a tube and outside of the car. This is why on particularly hot and humid days, you may find water puddles under your air-conditioned car.



The evaporator in your car's air conditioner takes the heat and passes it along to the circulating refrigerant, which is cooled by the condenser.



Besides moving the refrigerant through the system, the engine-driven compressor also raises the refrigerant's pressure and its temperature.

CAR CARE

NEW PRODUCTS

IMPROVE YOUR CAR

High-Performance Mud And Snow Tire

BFGoodrich has developed a new mud and snow tire so owners of high-performance cars need not keep them garaged all winter. The new Comp T/A HR M&S has an aggressive tread that offers 32% more snow traction and 20% more wet traction than the all-season Comp T/A HR4. The Comp T/A HR M&S is available in six sizes, from P185/60R14 to P215/60R16. Prices range from \$110 to \$145, depending on size. From BFGoodrich, 600 S. Main St., Akron, OH 44397, (800) 321-1800.



Road-Sensing Truck Shock

Some sports cars and luxury cars are equipped with computer-controlled shock absorbers which vary damping. This new "Road Sensing" shock absorber from Monroe Auto Equipment offers a similar result for light trucks, minivans and sport/utility vehicles. Tapered grooves on the inner wall of the pressure tube allow some hydraulic fluid to pass around the piston as it moves, providing a softer ride. The grooves taper and disappear toward both ends of the piston's travel, resulting in firm damping under extreme conditions. Price is about \$32 per shock. From Monroe Auto Equipment, International Dr., Monroe, MI 48161; (313) 243-8000.



New MIG Welders

Regardless of how much maintenance work you do on your car or truck, you may not need a welder often, but when you do, there is no alternative. Miller Electric has introduced four new Millermatic MIG welders, including the Millermatic 90 which operates on 115-volt household current. The Millermatic 90 runs several different size welding wires and supplies 90 amps at a 20% duty cycle. More

powerful is the Millermatic 120, which delivers 120 amps at a 30% duty cycle and can handle both gasless and solid wire in a variety of sizes. Also new are the industrial-strength Millermatic 250 and 250MP with 250 amps at 40% duty cycle or 200 amps at 60% duty cycle, respectively. Prices for the new welders range from \$600 to \$1935. From Miller Electric Mfg. Co., P.O. Box 1079, Appleton, WI 54912; (414) 735-4576.

Universal Trailer Hitch

Action Manufacturing has developed a family of multiuse hitches that make sense for anyone who has to tow different trailers. Called Roto-Eze, the hitches have 1 $\frac{1}{2}$ -in., 2-in. and 2 $\frac{5}{16}$ -in. chrome-plated balls on a single assembly which mounts to the hitch receiver. To change ball size, remove a locking pin, rotate it and then put it back in the bracket. The Roto-Eze hitch series is available in nine different versions, in Class III and Class IV varieties.



Prices range from \$189 to \$589. From Action Mfg. Inc., 1755 E. Bayshore Rd., Suite 17D, Redwood City, CA 94063; (415) 368-4390.

Wheel Bolt Circle Template

Finding custom wheels for your car or truck involves more than simply knowing the wheel diameter. If the wheel's bolt-circle pattern is incorrect, the wheel will not mount on the studs. To ensure that you have wheels with the correct bolt circle, use this Bolt Circle Template from Made For You Products. The lightweight, plastic template has drilled holes to cover the wheel stud pattern of every car and truck. Cost is \$5, plus shipping. From Made For You Products, P.O. Box 720700, Pinion Hills, CA 92372; (619) 868-6962.



PM

BLACK ART (Continued from page 31)

ward image of the inflated tire. The second is made after vacuum is applied to the pressure dome in which testing is being done. Because the tire is fairly rigid, little should change from one exposure to the next. However, even a tiny defect, such as a bit of air trapped between components, will cause distortion, which shows up as a distinct bull's-eye fringe pattern on the film.

Holography can be used to follow the spread of flaws during testing or in plants to spot-check for manufacturing flaws. BFGoodrich and Bridgestone/Firestone use it on all of their race tires.

Shearography

Shearography superimposes multiple images lit by a krypton-ion laser. A special lens "shears" each exposure into staggered images—like seeing something slightly cross-eyed—and two or more exposures are made with the tire in increasing vacuum. Placing the film in a special viewer reveals flaws as butterfly-shaped fringe patterns. Bridgestone, Pirelli, Goodyear and several others worldwide use this technology. NASA uses it on Space Shuttle tires.

Other Developments

- High-speed force-and-moment machines that measure interactions between tire and road at 100 mph.
- Image analyzers that measure footprint-pressure distribution by producing false-color images.
- Special pressure-sensitive papers that measure pressure distributions.
- General's system to predict treadwear in days instead of weeks.
- Ultrasonic systems for cutting rubber components at Bridgestone and BFGoodrich.

What has all of this technology meant? For the industry, it has meant reduced product-development cycles and quicker response to consumer and auto industry needs. It also has allowed companies to stay competitive, reduce costs and produce better products. The consumer has benefited from reduced heat buildup and rolling-resistance reductions of 15% to 20%, delivered in the form of longer tread life and better fuel economy. Computer advances have produced 80,000-mile all-season tires from Michelin and Bridgestone and Goodyear's unique Aquatread wet-weather tire. Perhaps the most telling indicator of industry progress, though, can be found on the performance side. Gains in recent years have been so huge that you now can buy street tires that outperform the best racing tires of a dozen years ago. **PM**



If you'd like to know more about how we charcoal-mellow Jack Daniel's here in Tennessee, drop us a line.

IT TAKES A SHARP SAW to make a smooth whiskey.

You see, unlike bourbons, Jack Daniel's Tennessee Whiskey goes through a step called charcoal mellowing. We seep our whiskey—drop by drop—through room-high mellowing vats of finely-tamped charcoal. To fill just one of these vats with charcoal, our sawyer will cut enough hard maple wood to stack 32 ricks, seven feet high. Then, he'll do it all over again. No doubt, charcoal mellowing is hard on our saw and our sawyer. But it sure makes things easy on our drinkers.

SMOOTH SIPPIN' TENNESSEE WHISKEY

Tennessee Whiskey • 40-43% alcohol by volume (80-86 proof) • Distilled and Bottled by Jack Daniel Distillery, Lem Motlow, Proprietor, Route 1, Lynchburg (Pop 361), Tennessee 37352
Placed in the National Register of Historic Places by the United States Government.



NEW CARS

**Lexus GS 300**

● While it was hard for most of us to perceive a gap between the ES 300 and LS 400 sedans, Toyota's Lexus product planners saw it all along. And here's the proof: the new GS 300, which fits neatly between the two in price, size and performance.

Although the new sedan has some basic commonalities with the sleek SC 300 coupe—front engine, rear drive, double wishbone suspension, 3.0-liter dohc 24-valve inline Six—it represents a fresh sheet of paper in virtually every other respect.

The origin of that sheet of paper can be traced to the ItalDesign studios of Giorgetto Giugiaro, in Turin, Italy. Toyota sanctioned a design competition—Giugiaro versus the home team—and the ItalDesign concept took first prize. After some refinements within Toyota, the Giugiaro design emerged more or less as you see it, sophisticated, original and, with a coefficient of drag of 0.31, slippery.

With a 100.4-in. wheelbase and overall length of 194.9 in., the GS 300 is only slightly smaller than the flagship LS 400 and almost identical in terms of interior volume. It gives away a half-inch of rear-seat legroom, but actually has more in the way of shoulder room.

It also matches the LS 400's phenomenally quiet operation, thanks in large measure to Toyota's trademark

isolation of suspension and power-train components from the passenger compartment. The GS 300's engine, differential, power steering unit and suspension pieces are bolted to front and rear subframes, which are separated from the main floor pan by liquid-filled bushings.

An inline 6-cylinder engine fits in nicely with a vehicle concept that puts a premium on smooth, quiet opera-



Lexus GS 300's clean, uncluttered instrument panel is reminiscent of LS 400.



220-hp 3.0-liter dohc 24-valve inline Six drives rear wheels via 4-speed automatic.

tion, of course. But this one also has the additional benefit of remarkable potency—220 hp and 210 ft.-lb. of torque. Although the only transmission available with the sedan is an electronically controlled 4-speed automatic (the SC 300 coupe offers a 5-speed manual, as well as the automatic), this is still sufficient to push the GS 300 from zero to 60 mph in about 8.5 seconds. It also gives the car a heady top-speed potential of 144 mph—pretty impressive numbers for a 3652-pound sedan.

The GS 300's braking credentials are just as impressive, with ventilated discs fore and aft—11.66-in. rotors front, 12.10-in. rear—and a 3-channel antilock system, all standard equipment. Other standard features are dual front airbags and automatic front seatbelt pretensioners. A traction control system is offered as an option.

Inside, the GS 300 reflects the same level of quality, comfort and detail that helped make the LS 400 an instant winner—walnut trim, automatic climate control, power everything and a 225-watt, 7-speaker AM/FM/cassette sound system. The short option list includes a couple of stereo upgrades, a power moonroof, a leather trim package and a voice-activated portable cellular telephone.

While the GS 300 isn't quite as hard-edged as the SC 300 coupe, it's certainly classifiable as agile. The

double wishbone suspension helps keep the 215/60VR16 tires firmly on the pavement in hard cornering, limiting the camber gain that goes with strut suspension systems. With its 53.6/46.4 front/rear weight distribution, it's well balanced, well mannered and satisfying.

In fact, in some ways it's a more satisfying car than its big brother. Though the LS 400 is clearly the flagship in terms of silky performance, the GS 300 isn't far behind. And its styling reflects an originality that the bigger car lacks.

Oldsmobile Aurora

General Motors will be putting some real rocketry back into its Rocket division when the Oldsmobile Aurora rolls out in mid-1994 as a 1995 model. Previewed at Detroit's North American International Auto Show in January, the Aurora brings V8 power back to the Olds lineup.

A sleek and sophisticated 4-door, the Aurora will be powered by a 4.0-liter dohc 32-valve aluminum V8 developed from Cadillac's outstanding 4.6-liter Northstar V8. The difference in displacement is attributable to slightly smaller cylinder bores for the 4.0-liter, which in turn dictated new cylinder heads.



Even with its smaller displacement, output will be impressive at 250 hp and 265 ft.-lb. of torque.

GM's new 4T-80E electronically controlled 4-speed automatic trans-axle will send power to the front wheels through equal-length halfshafts, a design that eliminates torque steer.

Besides its sleek new shape, '95 Olds Aurora will have a 250-hp dohc 32-valve 4.0-liter aluminum V8.



is aimed at the personal luxury market, à la Cadillac's Seville STS, and takes the place of the discontinued Toronado/Trofeo.

More important, the Aurora is designed to be the linchpin of the division's future in GM's overall marketing realignment.



New Camry-sized Mitsubishi Galant is due in dealer showrooms this June.

Mitsubishi Galant

Left behind in the recent round of mid-

size reshuffling that produced the new Toyota Camry, Nissan Altima and Mazda 626, Mitsubishi's Galant sedan series has undergone a complete redesign for mid-'93 introduction as a 1994 model.

Due in dealer showrooms this June, the new car was previewed at the recent Detroit show. Like its major Japanese competitors, the new Galant will be bigger than the car it replaces, riding a 103.8-in. wheelbase (versus 102.4) and measuring 187.0 in. overall (versus 183.9). The size increases will put the Galant into roughly the same size class as the highly successful Camry, yielding more interior volume and improved ride quality. Styling is smoother than the old Galant, with a coefficient of drag of 0.29.

Although Mitsubishi has several V6 engines available, initial Galant engine offerings will be limited to a pair of 2.4-liter Fours—an sohc version of about 140 hp and a dohc 16-valve edition capable of producing about 160 hp. Both are variations of existing blocks, topped with all-new cylinder heads. A 2.5-liter dohc 24-valve V6 is planned for later introduction, probably this fall.

Like the Altima and 626, the new Galant's platform is substantially stiffer than the old. This, plus Mitsubishi's sophisticated multilink independent suspension system, variable-

(Please turn to page 98)



Audi's New Smoothie

● Here's another shape of cars to come from Audi. This one belongs to the next-generation Audi V8 Quattro, snapped by our spies in Death Valley, California.

Consistent with current Audi design trends, the new sedan is smoother and rounder than the current V8 Quattro.

Reminiscent of Infiniti's Q45 sedan, the new Audi features a monochromatic look, with body-colored side moldings and bumpers. The quad-headlight styling treatment shown here is one of three

under consideration. The others feature more conventional flush lenses covering quartz-halogen lamps.

There's probably going to be more power to go with the new sheetmetal. The big sedan's dohc 32-valve V8 engine got a bump in displacement for '93, from 3.6 liters to 4.2, raising output to 276 hp and 295 ft.-lb. However, with 2 tons of all-wheel-drive luxury sedan to propel, Audi's powertrain engineers are busy looking for even more muscle.



Front-drive 850 GLT is designed to combat Volvo's stodgy image.

assist power steering and 4-wheel vented disc brakes promise to make it an entertaining car to drive.

The new Galant will be offered in four trim levels—S, ES, LS and GS. The first three will be powered by the sohc version of the 2.4, while the sportier GS gets the higher output twin-cam edition, along with higher spring rates, stiffer shock damping and a rear antiroll bar.

Mitsubishi will assemble the new Galant at its Diamond Star facility in Normal, Illinois. The company expects the new cars to have sufficient local content to qualify as domestic automobiles.

Volvo 850 GLT

Fun-to-drive has never been high on the list of reasons for buying Volvos. Pleasant to drive, yes. Safe to drive, always. Durable, well made, enduring—Volvo's list of virtues is long and enviable. But it's been rare for sport-sedan shoppers to have Volvos on their lists.

The 850 GLT is Volvo's response to this stodgy image problem. It's not exactly a BMW 535i, but it's got more sporting character than any large Volvo sedan in recent memory.

Considering the goal, it's interesting that Volvo chose to develop the 850 GLT with front-wheel drive. While there have been some small front-drive cars bearing Volvo badges in Europe, this is the first time front-drive has found its way into a bigger Volvo, and the first time a front-drive Volvo has found its way to the United States.

The rear suspension engineering—Volvo calls it the Delta Link system—that makes this system work is also interesting. Employing a beam axle and semi-trailing arms, the key to this setup is its directional bushings that create a mild rear-steer effect when the driver turns into a corner, reducing the inherent understeer that normally goes with front-wheel drive.

The result is a level of cornering capability that's just this side of aggressive, reminiscent of current Saabs. It

could be even more athletic with higher damping rates and harder suspension bushings, but Volvo didn't want to compromise the everyday comfort that's been one of its long suits.

Strong engine performance is another important element in the fun-to-drive equation, and the 850's new 2.4-liter dohc 20-valve aluminum inline Five does a good job. Although peak horsepower—168—is so-so versus some sport sedans in the \$25,000 bracket, the new Five has an exceptionally flat torque curve, which adds up to good acceleration. Mated to a 5-speed transaxle (a 4-speed automatic is also offered), there's enough low-



New Z28 will make Camaro's fourth Indy 500 pace car appearance in '93.

end grunt to get the 850 from zero to 60 mph in about 8.5 seconds.

For all its character distinctions, the 850 is very much a Volvo when it comes to safety features. Its excellent 4-wheel disc brake system includes an antilock feature as standard equipment, and there are dual airbags and 3-point seatbelts for all five seating positions. Volvo's ongoing work in crashworthiness—particularly in the area of side-impact protection—also shows to good advantage here: The 850 GLT already meets federal standards for 1997.

Although the 850 is 8 in. shorter than the 9-series Volvos it resembles, it's just as roomy and comfortable inside. Volvo's seats have long been among the best in the industry, and the 850's continue that tradition.

In fact, the 850 GLT embodies all of Volvo's excellent traditions—except for the B word. Bland doesn't apply to this one.

Camaro Pace Car

When you tune in for the 1993 running of the Indianapolis 500, you'll already know what the pace car looks like, because here it is. Chevrolet is celebrating the fourth generation of its famous ponycar by supplying this black-on-white Z28 coupe to pace this year's field.

Camaros have paced three previous Indy fields: 1967, '69 and '82.

As in years past, Chevrolet will offer replicas of its Indy pacer wearing identical graphics. Last time around, 6360 pace-car replicas found their way into the hands of collectors and other Camaro faithfuls.

Upscale Explorer

Already dominant in the mainstream compact sport/utility market, Ford's Explorer will go after a bigger chunk of the luxury end of the segment with a special edition due for mid-'93 introduction as a 1994 model.

Beneath its monochrome exterior treatment, special trim, special wheels, running boards and fog lamps, the Explorer Limited will be essentially the same as the rest of the model line, with the possible addition of an air spring system similar to the

one used on the Lincoln Continental.

The Explorer's standard 145-hp 4.0-liter V6 will supply power, and the Limited will be offered with both 2- and 4-wheel drive.

Interior amenities will include leather upholstery, upgraded carpeting, an antitheft system, power front seats with a memory feature, Ford's premium JBL sound system, and an overhead console with reading lamps, temperature readout, a compass and storage for small objects.

Unveiled at January's Los Angeles Auto Show, the Explorer Limited is designed to respond to the challenge of Jeep's Grand Cherokee, and also to attract more female buyers.

Due for production startup in early February, the Explorer Limited package will probably command a price premium \$2000 more than current models. Look for pricing to start at about \$24,500 for the 2wd edition and a little over \$26,000 for 4wd. **PM**

SUPERBIKE!

(Continued from page 43)

pensive material developed for satellites) was used to form the blade.

The monoblade incorporates narrow, wing-shaped outrigger struts that support the handlebars. At the start, when the rider needs leverage to accelerate, he grasps streamlined knobs on the outrigger ends. Once up to speed, he switches to a pair of carbon-fiber elbowpads and tube aerobars that sharply lower his torso into the maximal aerodynamic position.

The 3-spoke front wheel and disc rear wheel are both made of carbon fiber. The bottom bracket, wheel hubs and axles are titanium, an inert metal that doesn't react galvanically with carbon fiber, which conducts electricity. The chainset uses a solid aluminum chainring and titanium cranks.

The bike used by Boardman in the Olympics weighed 16.8 pounds, which is about average for a typical pursuit bike. What's remarkable about it is that its coefficient of drag value is about half that of its competitors.

Power is supplied through a rear gear-mounted outboard of the monocoque. This allowed the sprocket to be changed without taking off the wheel and the chain to be removed without breaking a link.

The rider is still the bike's biggest source of drag, and to deal with this Lotus built the bike specifically to fit Boardman's physique and riding style and to maximize airflow to his lungs. Lotus also produced a special tear-drop helmet to smooth the airflow over Boardman's back.

Before the Olympics, Hill speculated that the Lotus Sport would cut 10 to 15 seconds over 4000 meters. In a race that lasts about 4½ minutes, this is a significant edge.

While the rider remains the most significant part of the race equation, the Lotus Sport made a big difference. Boardman placed just ninth in last year's world championships.

The Lotus Sport sets a new standard for aerodynamics in pursuit bike design, but what about other types of racing? If Lotus could fit a shifting gearset and brakes to the monocoque, Greg LeMond would undoubtedly be among the first to place an order.

And Lotus is working to make this a reality. Immediate plans call for Lotus to make replicas of the gold-medal winner for pursuit racers. Cost will be a cool \$20,000 (compared to about \$8000 for a standard bike). Then, Lotus intends to continue development with an eye toward alternative applications, including production bicycles that will place Lotus as far in the forefront of bicycling technology as it is in Formula One racing. **PM**

Easy to wear. Hard to resist.
STETSON FITS.

© Coty, NY 1989

THE BEST BUYS IN SPIRAL STAIRS!

METAL

OAK

VICTORIAN



*F.O.B. Broomall, PA. Other Diameters, floor-to-floor heights, and Welded Units available. Made in the U.S.A.

EASY-TO-ASSEMBLE-KITS (Metal)
Kits in stock for immediate shipping or pick-up!

NOW! SHOWROOM/WAREHOUSE LOCATIONS IN:

Broomall, PA (215) 544-7100
Pomona, CA (909) 598-5766
Sarasota, FL (813) 923-1479
Houston, TX (713) 789-0648
Chicago, IL (708) 952-9010
Stamford, CT (203) 325-8466

Call or Write for Free Color Brochure:
Toll Free: 800-523-7427 Ext. PM23

Dept PM23, Box 547, 400 Reed Rd., Broomall, PA 19008

Specify: Metal Oak Victorian

Name

Address

City State Zip

MasterCard • Visa • Amex • Discover

From the Leading Manufacturer
of Spiral Stairs

THE IRON SHOP

©The Iron Shop 1992

ELECTRONICS

NEW BUSINESS TOOLS

BY FRANK VIZARD, Electronics Editor

● There was a time when a businessman could safely define the workplace as an office with four walls. Today, however, the business person is likely to be working in a lot of other places, whether it be a client's office, a hotel room, an airplane or at home. For many, the office is where you hang your corporate hat, but it's also where the chair rarely gets warm.

Paralleling this trend is a new batch of electronic business tools designed to make you work more effectively, even if you're away from the normal support services supplied by an office.

One of the most innovative new products now available is Sony's portable Multimedia Player, listing for about \$1000. Measuring about 7 x 2 x 6 in. in size and weighing about 2 pounds, this CD-ROM machine is designed for both personal and business use.

What this player does is give you access to a ton of information without having to be tied to a personal computer. The key is a technical standard called CD-ROM XA. The XA stands for "Extended Architecture". This standard gives the player a lot more wallop than a normal CD player or even an older CD-ROM player.

One big advantage of CD-ROM XA is its storage capability. One CD-ROM XA disc can hold more than 600 megabytes of information. This translates as:

- more than 300,000 pages of text
- 39,000 graphic images
- 70 minutes of high-quality audio



Going portable: Sony's Multimedia Player (top) and Apple's Duo computer (above).

● 16 hours of compressed audio suitable for narration or explanation

● or some combination of the above.

CD-ROM XA also allows audio to be interleaved with text and graphics more effectively. Audio and visual information

can be played back in a continuous stream, with synchronized sound and visual images for the smooth delivery of information.

A large number of software developers are already committed to developing reference works and other commonly used business material for the Sony player. These discs will bear a "Multimedia" or MMCD designation. Among the 50 or so titles available will be a quarterly version of *Newsweek*, *The Physician's Desk Reference*, *Secrets Of Power Negotiating* and *A Corporate Guide To The Environment*.

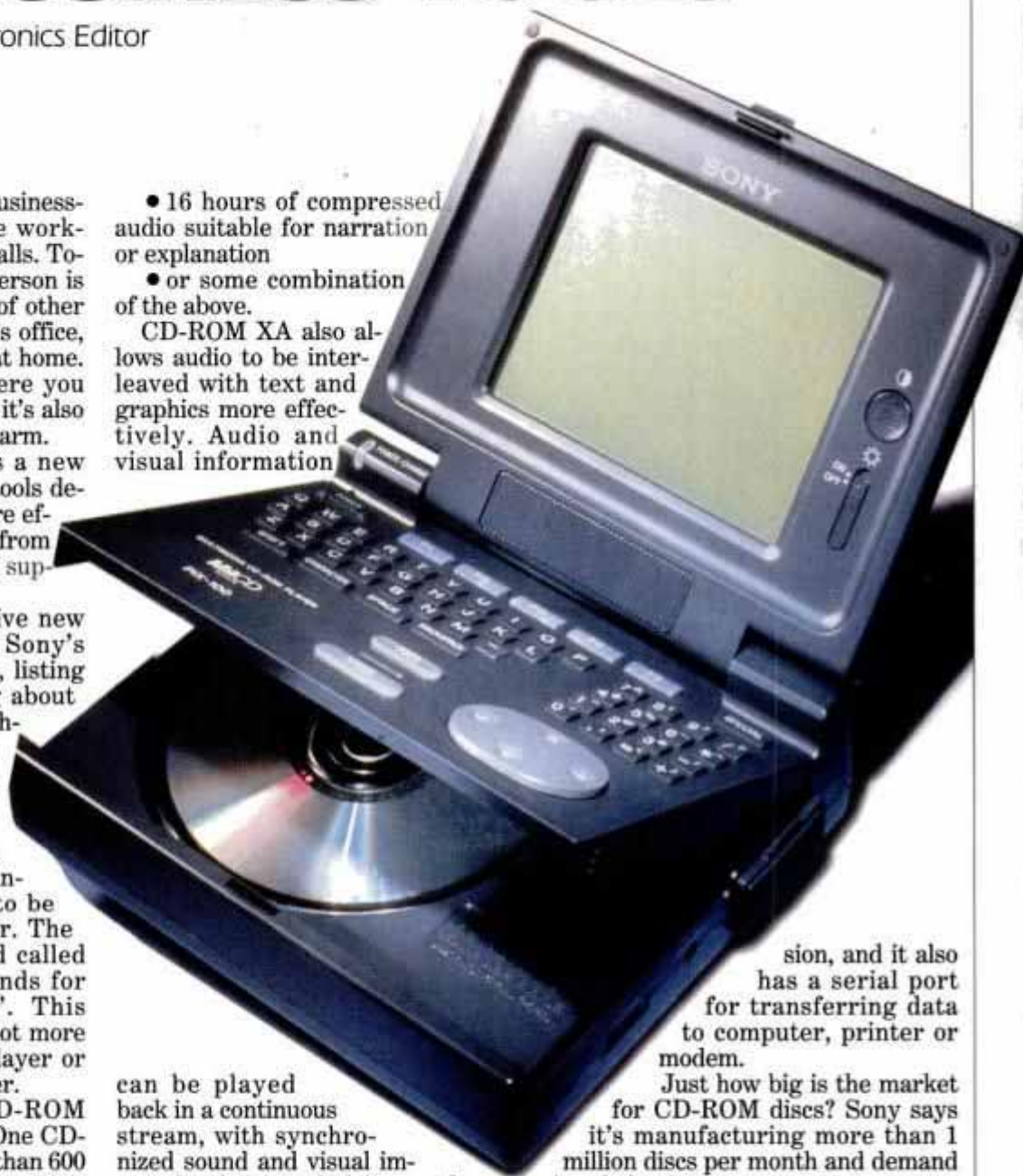
More importantly, perhaps, companies can develop their own software, putting databases, parts manuals and sales presentations on CD-ROM XA discs. The Multimedia Player can be connected to a televi-

sion, and it also has a serial port for transferring data to computer, printer or modem.

Just how big is the market for CD-ROM discs? Sony says it's manufacturing more than 1 million discs per month and demand is only beginning.

Sony, however, will not be alone in the portable field. Philips is introducing a portable CD-I (Interactive) player targeted for business use. While technically different, CD-I is similar to CD-ROM XA in terms of how it is used. CD-I also offers the promise of full-motion video in the near future. In addition, the Philips player uses a color screen while the Sony model is black & white. Material displayed on a television through the Sony player does appear in color, though. Otherwise, the two units are very competitive.

Software makers, however, will likely develop titles that will work with either platform. A case in point [\(Please turn to page 103\)](#)



is the *Mayo Clinic Family Health Book*. This \$99 title will be available for CD-ROM XA devices and CD-I machines. This disc demonstrates the capabilities of CD-ROM XA and CD-I very well. Access the anatomy listing, for example, and you'll see a sequence in which skin dissolves to muscles, which dissolves to organs, which dissolves to the skeleton.

From Disks To Cards

Another portable approach comes courtesy of Apple Computers Inc. The company's new Macintosh Duo makes the transition between the office and a secondary location easy. The heart of the system is a new version of Apple's popular Powerbook laptop computers, either model Duo 210 or Duo 230. These laptops, however, can be inserted inside a larger, more traditional desktop personal computer, complete with large display and keyboard. The transition is seamless—no cords to connect or complicated programming instructions to follow. Taking work home from the office is now a snap. Such convenience does have its price: Expect list prices for the Duo package to be well above \$3000.

Laptops themselves are also destined to become more versatile. This new versatility is in large part due to a standardized approach to data storage with the unwieldy name of PCMCIA. New laptops and electronic notebooks will come equipped with a slot into which credit-card-size PCMCIA cards are inserted. These cards can hold 100 megabytes of information but consume 1/25th the power of hard disk drives.

PCMCIA cards are also shock-proof, making them perfect for mobile applications. Special functions, like a fax/modem application, can be stored on individual cards. With special functions stored on external cards, the actual machine can be made smaller than it is today.

Another device that uses IC cards for memory storage and special applications is the Sharp Wizard series of handheld organizers. The latest incarnation of the pocket-size Sharp Wizard is the OZ-9600, listing for \$649. Like its top-of-the-line predecessor, the OZ-9600 has 256KB of memory and a QWERTY-style keyboard for easy typing. The OZ-9600 does take advantage of these features better than ever before, and adds a few new wrinkles.

The most obvious new feature is a display screen that you can write on with a special pen. Access the Scrapbook mode and you can jot down handwritten messages, draw maps

or create graphic images. While this feature adds versatility, be advised that graphic images eat up a lot of memory. You may want to monitor the amount of information in this file more carefully. Sharp says the OZ-9600 will get 80 hours of life from four AAA batteries. Incidentally, "electronic ink" can also pour from your finger if the pen isn't available.

Another nifty feature is a word-processing mode. Material can be presented in a variety of ways and you can use multiple type fonts. Completed documents can be printed directly from a computer printer or be downloaded to a PC using a separately purchased infrared adapter. An optional modem is also available.

The OZ-9600 does have its own infrared transmitter/receiver built into the machine, allowing data to be exchanged easily between Wizards. This wireless infrared link has a range of about 3 ft.

Data is also more efficiently orga-



Sharp OZ-9600 Wizard can draw graphic images and store them electronically.

nized in a system of folders arranged on-screen like the open drawer of a file cabinet. These folders can be labeled as you wish. All data on a subject—telephone numbers, appointments, letters, graphic images—can be accessed through one file.

Computers That Listen...

While small is beautiful, the emphasis is not totally on downsizing for mobility. Just around the corner are computers that respond to a wide range of voice commands. While this has been done on a limited basis in the past, the problem has been that each computer must be trained to recognize the operator's voice. This process is time-consuming and effectively means that only one person can operate the computer.

IBM has developed a voice-recognition system that is speaker independent—that is, it responds to any user's voice. The analog wave form of a voice command is converted to a digital format for processing. The amazing part is that IBM was able to configure the parameters to be very wide ranging. The vocabulary is derived from 17,000 voice and accent samples. The effectiveness of this model was evident in one demonstration in which the computer easily recognized the voice commands of a heavily accented non-native English speaker. The demonstration was run on a 486 desktop computer.

As it stands now, the IBM system has a vocabulary of 20,000 words with about 1000 available per screen application. You can also add words of your choosing to the vocabulary. IBM won't be selling the technology directly. It will be sold to individual software developers who will devise specific applications.

...And See

While IBM wants computers to listen, the David Sarnoff Research Center in Princeton, New Jersey, wants computers to see. A new computer vision technology developed by Sarnoff, called Smart Sensing, allows a computer, coupled with an electronic eye, to recognize objects in real-time—something even the most powerful supercomputers have heretofore been unable to do. This technology would allow self-guided robots or cars to recognize obstacles in their path and steer clear of them.

Smart Sensing, to be marketed by a new subsidiary called Sensor Inc., combines and extends many existing technologies: object recognition, motion tracking, image compression and fusion and optical character recognition. Instead of processing a complete visual image—something that would take vast amounts of memory—Smart Sensing works by isolating and selectively processing key characteristics of a scene. These keys include movement, shapes, colors, letters and face patterns. The processing occurs at speeds thousands of times faster than any existing technology. In short, this system performs much like the human eye.

Smart Sensing technology will also be used for finding and retrieving video files for multimedia applications. The technology's image-recognition system makes it easy to find pictures that would otherwise have to be described in great detail. Sarnoff believes this technology will be as ubiquitous as microprocessors in 10 or 20 years.

IBM

DETROIT SPY REPORT

BY JIM DUNNE, Detroit Editor



Mustang Makeover

● Ford will have something old and a lot new in the design of the next-generation Mustang, due in the 1994 model year.

The old is visible in these prototype spy shots. Ford will resurrect the rear quarter panel air scoop, a design touch that was a trademark of the first Mustang. And the roofline will have a curve similar to that of the original GT 350. Wheel covers will carry the galloping pony logo. And underneath the sheetmetal is the same basic platform—complete with rigid rear axle and front strut suspension—that Ford has used since 1979.

But the drivetrain is expected to be as new as the revised body style. Ford will drop its most muscular engine—the 300-hp dohc 32-valve 4.6-liter Mod II aluminum V8—under the Mustang hood and bolt it to a 4-speed electronically controlled automatic transmission. Also, look for dual airbags, ABS and traction control.

Tempo Update

Judging by this development prototype, the 1994 Ford Tempo will be a near copy of the Ford Sierra model in-



The 1994 Tempo is a derivative of the European Ford Sierra.

produced in Europe last year.

The body appears to be larger than the current Tempo/Topaz line, but much of the difference is in the rounded surfaces of the fenders and roof. Up front, the Tempo will have a typical Ford grille with body-color details and the Ford oval in the center.

Ford of Europe offers a hatchback 4-door body design of the Sierra, but look for the U.S. version—both Tem-



1995 Continental has a heavily revised chassis and drivetrain.

po and Topaz—to be offered only as a formal 4-door sedan.

Continental 1995

Ford will also introduce this revised version of the Lincoln Continental in 1994 as a 1995 model. While exterior styling changes seem minimal, the car will be completely new inside and out.

The biggest change will be in the drivetrain. Continental will drop the 3.8-liter V6 engine and get a 200-plus-horsepower version of the 4.6-liter V8. Front and

rear tracks will be wider—the front to accommodate a completely new suspension with upper and lower control arms and a lower cowl height.

All important chassis and body dimensions will be larger as Lincoln positions the Continental to compete with Cadillac's new-for-'94 De Ville.

Electric Simulator

General Motors has a simulated electric car undergoing research in its engineering section. The car is really a gasoline-powered Buick Reatta. But it is modified to imitate an electric vehicle.

It's all done with a computer—no extra batteries at all. You have to plug in an electric cord when the computer says the "batteries" are getting low. And if you drive fast or make quick starts, the computer subtracts an extra "charge" from the batteries.

Still, you have to keep an eye on the gas gauge, since the car is powered by a standard 3.8-liter V6 gasoline engine. My first experience shows that the battery drops down to half-charge quickly—in less than 40 miles. Then it's time to recharge. GM recommends that the batteries be recharged when they're down to 50% charge, since draining them further will shorten their lifetime.

Driving the GM simulator reminds me of the problems I had when I smoked cigarettes. As a smoker, each

time I left the house I'd have to check my pack. How low was my supply? Where could I stop to get another pack?

Electricians make you think along the same lines. How far am I going on this trip? Where can I get a quick recharge? The fuss with cigarettes was one of the reasons I quit smoking. The fuss with electric cars is a similar problem that I don't care to face again.

Pickup Power

Chrysler's new T-300 pickup truck may force Ford and GM to put more power in their truck lines. The T-300 is expected to offer an optional V10 engine that puts out upward of 250 horsepower and 400 ft.-lb. of torque.

Ford and GM have V8s right now capable of matching that output. The big question is whether Toyota will join the power derby with its new T-100 pickup. At present, the new truck, which nibbles at the edges of the full-size class, doesn't have a V8 engine. However, insiders are expecting to see more muscle in the new Toyota in the next couple of years.

Rockin' Olds

John Rock is the new general manager at Oldsmobile. The last name is fitting. Rock has put the division and its dealers on notice: Sell more cars and trucks (Bravada, Silhouette) or we'll let someone else do it.

Rock is determined to turn Oldsmobile around, even if it means trimming the Olds product lineup. Already, the Trofeo is history (pre-Rock), and the Ninety Eight and Silhouette minivan are on the bubble. Bravada, with its upscale features and full-time 4-wheel drive, may go to other GM divisions. Yes, Olds is on notice. You might say the division is between Rock and a hard place.

Honda Minivan

Yes, Honda will produce a passenger van. That's the word from Honda executives at the 1993 model preview.

Honda product planners figure that the U.S. minivan market has room for another vehicle, and the hot minivan market is a good place for Honda to expand its sales. Honda's dealers are enthusiastic about the idea.

The minivan will probably be based on the next-generation Honda Accord, expected to be both bigger and more powerful, with a V6 engine.

Spirit Of LH

The Dodge Spirit and Plymouth Acclaim will be the next Chrysler products to feature the LH design concept. Due for the 1995 model year, the

midsize sedans will have the cab-forward front-end design, with wider track and stretched wheelbase.

Completely restyled Spirit and Acclaim prototypes are just now showing up on Chrysler proving grounds. To hurry development along, Chrysler is testing new front-drive and front-suspension components on current Spirits, rather than waiting for all-new prototypes to be built.

LH And GM-10

The Chrysler Corp. claims that its LH models break new ground in car design. The Eagle Vision, Dodge In-

trepid and Chrysler Concorde feature styling that other carmakers are likely to copy.

Confirmation of that comes from a General Motors source. The next generation of GM-10 cars—Pontiac Grand Prix, Chevy Lumina, Olds Cutlass Supreme and Buick Regal—will have the same cab-forward shape as Chrysler's LH cars, according to our spies. Other features include a chassis with wheels out to the extremities, a longer wheelbase and a large windshield. GM's midsize show cars are already tipping off these changes. **PM**

Sleep Better On An Airbed



• Adjust Firmness to Fit Your Exact Needs

• Research shows 94% of back pain sufferers report Select Comfort gives them the back support they need to get a better night's sleep.

• Unique air-cushion design contours to your body, providing superior back support and comfort.

Revolutionary Air Support System.

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 the firmness whenever you like to meet your exact preference.

Variable Firmness = Great Sleep.

You control the firmness of your bed—simply by pushing a button. Change the firmness as often as you like. Make your mattress hard as a board, or soft as a feather bed. The choice is yours.



Select Comfort provides proper back support and contours to your body, distributing weight evenly.



Innerspring mattresses create pressure points and uneven support.



Waterbeds rely on displacement and can cause a "hammock effect," bending your spine unnaturally.

Adjust Your Side Separately.

Inside the mattress are two air chambers. You can adjust your own side independently. With Select Comfort, you satisfy your own needs without compromise.

Try Risk-Free for 90 Nights.

Sleep on a Select Comfort for 90 nights. If you are not completely satisfied, return it for a full refund.

Discover why 96% of Select Comfort users recommend it to their family and friends.

"I am a doctor and often come home exhausted. This mattress is the most comfortable I've tried."

Dr. Connie Horn, M.D., Clarksville, OH

"The best mattress I've seen in respect to total body and especially spine support."

Dr. W. F. Lenz, Mankato, MN

"For the first time in years, we wake up without aches and pains and have more energy!"

Mr. & Mrs. Dennis Clevenger, Lawrenceville, GA

Call now for your **FREE VIDEO**

and FREE Brochure

1-800-831-1211

Select Comfort
CORPORATION

9301 75th Ave. N. Dept. 1156
Minneapolis, MN 55428

© Select Comfort Corp. 1992

Dept 1156

A NEW BALLOON

BY ABE DANE, Science/Technology Editor



● Diaphanous plastic bubbles floating at the very edge of the atmosphere may one day take the place of vastly more expensive satellites. The bubbles, formally known as superpressure balloons, could keep payloads aloft for years at a time, and would cost next to nothing compared with conventional spacecraft.

The concept behind these high-flying gasbags is simple. You take an envelope of inelastic material, fill it with enough helium to get to the desired altitude, then let it go. Once it rises to the limit of its buoyancy, it will stay there indefinitely. Unlike normal zero-pressure balloons, superpressure balloons don't lose or gain altitude with changes in temperature, because the inelastic envelope prevents the helium from expanding. When the sun shines, all that happens is that helium pressure builds up against the envelope. There is no

change in the balloon's size, and thus no change in its density or altitude.

Superpressure balloons, like conventional zero-pressure types, can reach impressive heights. The current record for a balloon of any type is 176,000 ft., which takes you above all but a fraction of 1% of the atmosphere. But zero-pressure balloons expand and contract with changes in temperature. That means that in order to hold a constant altitude, they have to vent gas during the daytime and drop ballast at night. Eventually, one or the other runs out and the mission is over.

While the advantages of superpressure balloons have long been known, the problem has always been that they're damnably difficult to make. The envelope must possess a seemingly impossible combination of strength, light weight and resistance to stretching. Until recently, they

were so expensive, fragile and difficult to handle that they found very limited use. But Winzen International, a San Antonio, Texas, maker of high-altitude research balloons, seems to have pieced together the technologies to solve the problems and opened up a whole new range of uses for superpressure balloons.

Their first step was to find a better material for the envelope. Earlier superpressure balloons had relied on Mylar, which could not be manufactured without microscopic pinholes, and so had to be used in laminated sheets. In the late 1980s, Winzen ran across a unique nylon film produced in Japan as a wrapping for high-value items. By stretching it along two perpendicular axes during manufacturing, the maker could turn out sheets a quarter of the thickness of a human hair, but able to withstand 20,000 pounds per square inch.

With a grant from the Defense Advanced Research Projects Agency (DARPA), Winzen set to work on fashioning it into a small trial balloon. A test flight in 1989 proved the basic concept, but pointed out problems with the bonding technology then available for sticking the balloon's parts together. The miles of seams that go into even a small balloon not only have to be able to withstand tremendous stress, but they have to do it while subjected to temperatures ranging down to -70° F. Complicating matters was the fact that the nylon's biaxial strength would be destroyed by exposure to high temperatures, which eliminated commonly used hot bonding methods. So Winzen came up with its own pressure-sensitive adhesive and tape-laying equipment, which has been used on the subsequent prototypes.

Another key development was finding a way to attach the payload to the balloon without overstressing the envelope or adding too much weight, a task made difficult by the balloon's spherical geometry. Winzen settled on a load line running up through the center of the balloon. The line is held at one end by a fixture set at the balloon's top, where the gores come together like segments at the stem of an orange. It then passes through a similar fixture at the bottom and attaches to the payload.

Two successful flights last year proved the new design. A 26-ft.-dia. balloon launched in August carried a 30-pound payload to 64,000 ft. In October, a 76-ft. balloon reached 110,000 ft. with a 50-pound payload.

At this point, Winzen director of flight testing John Crenshaw says they're ready to begin serial production of the balloons for paying customers. Eventually, he expects they'll turn out balloons that can lift thousands of pounds and stay airborne for four years at a stretch. The potential applications, Crenshaw believes, are numerous. "If you don't require the zero g and the hard vacuum, you can do anything with a balloon that you could do with a spacecraft," he says. That includes the monitoring of such atmospheric phenomena as the ozone hole and global warming, and emergency communications relays. One of the more exciting long-term prospects is a communications system comparable to Motorola's ambitious Iridium project (see *Tech Update*, page 17, Dec. '90). With balloons replacing the vastly expensive constellation of satellites envisioned by Motorola, people would still be able to talk from simple handsets anywhere in the world, but at a much lower price. **FM**

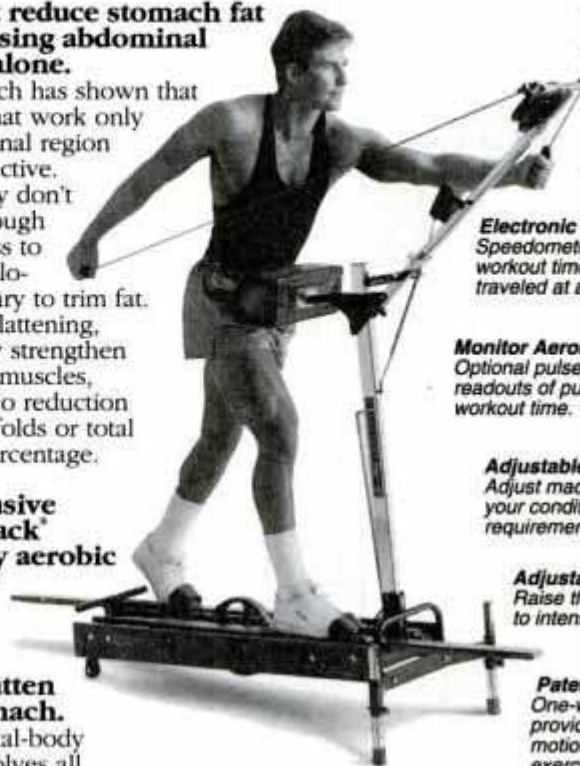
Why it takes legwork to flatten your stomach.

You can't reduce stomach fat by exercising abdominal muscles alone.

Research has shown that exercises that work only the abdominal region are not effective. They simply don't involve enough muscle mass to burn the calories necessary to trim fat. Instead of flattening, they merely strengthen underlying muscles, providing no reduction in girth, fatfolds or total body fat percentage.

The exclusive NordicTrack® total-body aerobic exerciser is the most effective way to flatten your stomach.

The total-body motion involves all your major muscles. Which means you burn more body fat in less time than with any other in-home exercise machine. And while you're at it, you're toning and defining those muscle groups, as well. So you feel as good as you look.



Adjustable Arm Tension
Adjustable upper-body exerciser works the major muscles of the abdomen, shoulders, back and arms for maximum aerobic conditioning.

Electronic Feedback
Speedometer displays elapsed workout time, speed and distance traveled at a glance.

Monitor Aerobic Efficiency
Optional pulse meter provides digital readouts of pulse rate and elapsed workout time.

Adjustable Leg Tension
Adjust machine to precisely meet your conditioning and weight-loss requirements.

Adjustable Legs
Raise the front of the machine to intensify workout.

Patented Flywheel
One-way clutch mechanism provides continuity of motion, making vigorous exercise more pleasant and easier to sustain.

Non-Jarring Motion
Smooth, jarless aerobic motion ensures maximum workout efficiency while minimizing the risk of injury to knees, shins and back.

Free information.

Call today. We'll send you a free brochure and video that describe how NordicTrack can flatten your stomach and make you look and feel your best.

Models priced from \$299⁹⁵ to \$1,299⁹⁵

30-day in-home trial

NordicTrack

A CML Company

The World's Best
Aerobic Exerciser®

©1993 NordicTrack, Inc., A CML Company

Call for a
FREE VIDEO
and Brochure

1-800-328-5888 Ext. 275B3

or write: NordicTrack, Dept. 275B3
104 Peavey Road, Chaska, MN 55318

NordicTrack reserves the right to change prices and specifications without prior notice.

All rights reserved.

COVER IT
INSTANT GARAGES
ALL WEATHER SHELTERS

STARTING AT
\$249

Instant Protection for: Cars, Trucks, Boats, RV's, Motorcycles, Paintbooths, Docks, Pools, Workshops, Government and Industrial Contracts, Sandblasting, Camp or Temporary Shelter, Walkways, Hot Tubs, and More! **HEAVY DUTY** Steel Frame. Durable Dupont® Cover with Zipper Door. Sizes available from 8' to 60' Wide, 30' High, Any Length. Withstands High Winds, Sun, Sap & Heavy Snow. Assembles and Anchors Easily. No Property tax or permit required. Covers last up to 20 Years.
WE SHIP TO YOUR DOOR!

BUY FACTORY DIRECT AND SAVE!

CALL (800) 932-9344 } EXT. 202
NOW (203) 732-1900 }
FAX# (203) 735-0556



30 DAY MONEY BACK GUARANTEE 2 YEAR WARRANTY

FREE DOORS!
with every purchase

12 x 20 x 8 \$469

Survived
Hurricane Andrew!
Canadian Weather Tested

DEALERS AND
EXPORTERS WELCOME

MUST LIQUIDATE!

BUY FOR JUST CENTS ON THE DOLLAR!

HIGHEST QUALITY PRODUCTS AT THE LOWEST LIQUIDATION PRICES!

JOE WEIDER® Executive Trainer! LOVE THAT BODY!

3 position incline plus decline back rest for a variety of upper body exercises.

Professional style vertical bench press with unique cam action for the ultimate bench press — safe and super comfortable. Cam action provides super smooth resistance throughout the movement.

Compact stylish unit fully shrouded in durable plastic takes only 4' x 2' of floor space and fits comfortably in home or office.

Flip up rowing attachment for horizontal rowing in a comfortable seated position.

Special roller for resistance feature for performing incline sit-ups in total comfort.

Leg extension / curl attachment for leg and abdominal exercises.

The unique lever design of the weight arm means you get an extra 30% of resistance from your weight plates.

Plate loading easy resistance adjustment. Takes up to 150 pounds in standard weight plates. Includes 40 pounds in plates. Very convenient and safe yet demanding enough for the professional athlete or the beginner.

OK! You want to just do it! You want to have the body that makes you look fantastic! But you're not about to spend thousands on a fancy machine with rubber bands when you can get a real weight machine for this **LOW LOW LIQUIDATION PRICE!** Here it is, your dream come true!

Includes complete **JOE WEIDER training programs** for many levels of health and fitness. **JOE WEIDER is one of the oldest and most respected names in physical fitness.** Consult your library or ask your fitness friends!

Retail List \$299.00
OUT THEY GO!
\$158
plus \$25 S/H each or 4 monthly payments of \$45.75*
Item #C5633-7682

IBM® PS/2 Model 50Z

IBM VGA COLOR MONITOR!

IBM QUALITY! IBM DURABILITY! IBM RELIABILITY!

30 MB HARD DRIVE!



Why even consider a clone when you can own a 100% IBM PS/2 Model 50Z for just 20c on the dollar! Don't pay more when this system does it all! Spreadsheets, Word Processing, Database Management, Desktop Publishing, Accounting, Networking, Games and More! Compare features, performance, quality and price anywhere and you will call 1-800-438-COMB!

- Genuine IBM quality!
- 12" IBM VGA .28 pitch Color Monitor included!
- 1 MB RAM & 30 MB Hard Drive!
- 3 1/2" 1.44 MB Floppy Drive!
- 80286 Microprocessor at 10 MHz!
- 101 Key Enhanced Keyboard!
- 3 Expansion Slots!
- Serial, Parallel and VGA Ports!
- MS-DOS 5.0 Already Loaded!
- Factory renewed by IBM!
- Includes Limited Warranty!

Original List \$3645.00
OUT THEY GO!
\$698
plus \$55 S/H each or 4 monthly payments of \$168.25*
Item #C5977-7682



PERFORM:

- Leg Extensions
- Prone Leg Curls
- Rowing
- Situps and Leg Raises
- Bench Press
- Dumbbell Shoulder Press
- Incline Presses with Dumbbells
- Dumbbell Squats
- Supine Dumbbell Flies
- Abdominal Crunches
- Close Grip Triceps Press
- Curl Grip Rowing
- Seated Lateral Raises
- Barbell Curls
- Rear Triceps Extension
- And Many, Many More

RYOBI® 1/2 HP GAS-POWERED RECIPROCATING SAW!

No Cords, No hoses, no hassles! The power is in your palm! This is a brute-force powerful, commercial-grade saw, built to operate all day long on drywall, plaster, pipe, metal, cable, lumber. • Variable speed control. • Adjustable front shoe assembly for variable depth cutting. • Tool kit and blades included. • Uses standard 1/2" universal shank blades. • Up to 2000 strokes per minute. • Weighs only 12 pounds • 15.9 cc, 2-cycle engine



Mfr. List \$518.00
OUT THEY GO...
plus \$7 S/H or 4 monthly payments of \$39*
Item #C3615-7682

\$149

MELITTA® COFFEE MAKER & WHOLE BEAN GRINDER

All-in-one convenience! Lets you grind whole coffee beans or brew pre-ground coffee. Funnel ground coffee directly into the basket, ready for brewing the freshest, most flavorful coffee you have ever tasted! Has drip stop feature, removable water reservoir, hidden cord storage, warming plate, filters, scoop, recipe book and 5 cup carafe included. One Year Limited Manufacturer's Warranty.



Retailer for \$225
OUT THEY GO...
plus \$7.50 S/H or 4 monthly payments of \$16.38*
Blk: #C4423-7682
Wh: #C4410-7682

\$58

WHISTLER® SPECTRUM 2 RADAR DETECTOR

Pulse Protection • Photosensitive Digital Display indicates presence and strength of standard and pulse radar transmissions. • X and K Band Differentiation Signals • Quadradyne Circuitry - triple conversion superheterodyne • Variable Filter Setting • Audio Muting with Visual Reporting • Full Range Volume Control • Highway and Filter Modes • Dark Mode • Includes accessories • Limited 3 Year Factory Warranty! • Not shipped to VA or DC



Mfr. List \$299.95
OUT THEY GO...
plus \$5.50 S/H or 4 monthly payments of \$18.38*
Item #C4409-7682

\$68

SIMMONS® 600 POWER REFRACTOR TELESCOPE

Large 6 x 30 Wide Angle Finder Scope • 800 mm Focal Length • 60 mm Objective Lens • Three Eyepieces: F 4mm, F 12.5mm, F 20mm • 1.5x Erector Lens • 3x Barlow Lens: Triples the Power of Any Eyepiece • Rack and Pinion Focusing • Chrome Declination Rod • Tripod with Accessory Tray to hold extra eyepieces & filters • Diagonal Mirror • Control Knob for Accurate Elevation Adjustments • Lifetime Limited Factory Warranty!



Mfr. List \$349.95
OUT THEY GO...
plus \$9 S/H or 4 monthly payments of \$34.25*
Item #C5129-7682

\$128

KEROHEAT® OMNT230 KEROSENE HEATER

For about \$1.50 (2 gallons of kerosene) you can safely and economically blast out 22,000 BTUs of heat for 12 hours! No matches or stinky mess to start... just push the electronic ignition button! (Ignition requires two D Cell batteries.) • 19" x 19" x 27" • Only 28 lbs. • Automatic safety shut off • EZ to read fuel gauge • Built in drip tray • Wick stop control • U.L. listed • Includes fuel siphon and batteries • Refurbished for peak performance



Orig. List \$229.00
OUT THEY GO...
plus \$12 S/H or 4 monthly payments of \$27.75*
Item #P8639-7682

\$99

CARRIER® ELECTRONIC AIR CLEANER

Four-Way Cleaning System: Entry Filter Removes Larger Particles, Electromagnetic Cell Traps Particles, Charcoal Filter For Thorough Cleaning, Negative Ion Generator Freshens Air • For wall, cabinet, or tabletop use. • Removable Grill, Entry Filter & Electromagnetic Cell cleans in dishwasher • 15" x 4" x 10 1/2" • Charcoal Filter is easily replaced • 3 Speed Fan • Includes One Year Limited Carrier® Factory Warranty!



Mfr. List \$149.00
OUT THEY GO...
plus \$5.50 S/H or 4 monthly payments of \$16.13*
Item #C3618-7682

\$59

COMB 1-800-438-COMB

AUTHORIZED LIQUIDATORS®
COMB CORP., 720 Anderson Avenue
St. Cloud, MN 56395

(1-800-438-2662)
Segment #4321246



*C.O.M.B.'s Payment Plan includes Shipping and Handling. Add 6.5% sales tax for MN delivery. Add 8.25% sales tax for TN delivery. Payment Plan available for credit card purchases over \$40 only. Credit card interest charges may apply. All merchandise backed by C.O.M.B.'s 30 Day 100% Satisfaction Money-Back Guarantee.

Hemmings Motor News
World's largest collector car marketplace

Over 800 pages each month filled with thousands of ads for old cars, parts, services, supplies, literature & more. Special Introductory Offer: **NINE GIANT ISSUES**

Subscribe Today! **ONLY \$19.95** (41¢ in Canada)

U.S. Funds
Call 800-241-4663

for subscription offer #T01256 by MC/VISA, or send payment to:
Hemmings Motor News
P.O. Box 100-S08603, Bennington, Vermont 05201
VERMONT RESIDENTS ADD 1% SALES TAX. CANADIAN RESIDENTS ADD 7% SALES TAX.

Satellite-TV FREE
56 Page Catalog Buyer's Guide

100% Satisfaction Guarantee

Systems from \$479

- All Major Brands
- Complete Systems
- Accessories.
- Huge Savings
- Easy Installation
- Complete Instruct.

Let Us Help You Select Your New Satellite TV Entertainment System

Over 40,000 Satisfied Customers

1-800-334-6455
Int'l 218-730-8231 Fax 218-730-8278
SKYVISION INC.®
1020 FRONTIER DRIVE
FERGUS FALLS, MN 56537

YOU CAN INSTALL OR UPDATE YOURSELF!

The Old Joint Jigger

★ COMPUTER MACHINED BILLET ALUMINUM & STEEL CONSTRUCTION

★ QUICKLY ADJUSTS FOR ANGLE NOTCHES TO 45° IN ANY 5/8" - 2" ROUND TUBING

★ USES COMMON BI-METAL HOLE SAWS (NOT INCL.)

★ HARDENED STEEL ARBOR FOR ANY 1/2" DRILL OR DRILL PRESS

★ PRECISION, QUALITY TUBING NOTCHES WITH AN AFFORDABLE FIXTURE

★ ALL MAJOR CREDIT CARDS OR C.O.D. UPS SHIPPING

\$279.95
(Shipping incl. in lower 48 States)

RTN ★ 1000 DALE WILCH SALES & MFG.

P.O. Box 12031
Kansas City, KS 66112
(913) 788-3219 • (913) 788-9682 FAX

WARNING: DO NOT BE PRODD BY OTHERS OPERATING. ALL THE TOOLS WITH YOUR SATISFACTION GUARANTEED.

ELECTRIC WONDER

EMX (Environmental-Moto-Cross) is an all electric scooter perfect at racing events, car lots, auctions, etc. Two 12v gel-cells deliver hours of riding time. On-board recharger. Folds for EZ transport. Top Speed: 18 mph Wheelbase: 31.25" Weight: 98 lbs.

\$1,995*

2 EMX models:
EMX Sport (stand-up)
EMX Custom (seated)

BADSEY
Design of Equipment Inc.

CALL FOR FREE COLOR BROCHURE

1-800-9-BADSEY

Is your Cable Company Alienating You?

Say NO to unearthly rental fees!

Owning your cable equipment saves you the high cost of monthly equipment rental charges, and gives you control of your TV.

We have the *Best* in

CONVERTERS and DESCRAMBLERS!

Everquest • Panasonic • Jerrold • Zenith • Pioneer
Scientific Atlanta • Oak • Eagle • Hamlin • Tocom

1 800 624-1150

AMERICAN EXPRESS DISCOVER VISA MasterCard

FREE Catalog! **MP Electronics** **CALL TODAY!**

P.O. Box 241296 • Omaha, NE 68124-5296

NORDIC FLEX Gold

ADVANCED DESIGN FOR A SUPERIOR WORKOUT

NordicFlex Gold™ advances the science of strength training to bring you truly revolutionary results.

GET A FASTER WORKOUT, FASTER RESULTS. NordicFlex Gold uses its patented isokinetic resistance mechanism that automatically adjusts to the amount of force you apply. You spend 40% less time between exercises than Soloflex*.

And research proves isokinetic resistance builds lean muscle 70% faster than rubber band systems or free weights.

The ergonomically correct linear exercise motion isolates the muscle group you want to build for maximum results.

Plus, the NordicFlex World Class™ Edition offers additional features to enhance your workout including the electronic performance monitor.

FREE Video and Brochure
Call 1-800-445-2360 Ext. 0K1B3

or write: NordicTrack, Dept. 0K1B3
104 Peavey Road, Chaska, MN 55318

Send me a free brochure Also a free VHS videotape

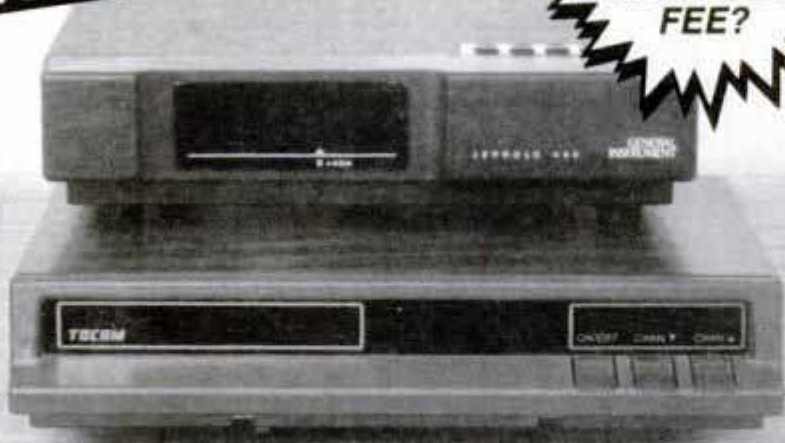
Name _____
Street _____
City _____ State _____ Zip _____
Phone () _____

30-day in-home trial
Best of all...it's from NordicTrack!

© 1993 NordicTrack, Inc., A CMI Company • All rights reserved. *Registered trademark of Soloflex, Inc.

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. 30 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**

NO ILLINOIS ORDERS ACCEPTED

Note: Decoders and Descramblers must not be used without authorization by your local cable operator

STORAGE BUILDINGS WORKSHOPS & MORE MANUFACTURER DIRECT LIMITED OFFER



EASY DO-IT-YOURSELF CONSTRUCTION
PACKAGES INCLUDE STEEL FRAMES,
SHEETING AND HARDWARE
FEATURED PACKAGES INCLUDE:
12'-0" BAY SPACING
40 psf Snow Load, 20 psf Wind load
CERTIFICATION AVAILABLE

30x36
Value \$6,181
NOW \$3,169

36x48
Value \$9,763
NOW \$5,016

40 x 60
Value \$13,942
NOW \$7,293

46x72
Value \$18,875
NOW \$10,316

Other sizes available

MIRACLETRUSS
1-800-843-8275
FAX 612-544-1835

Made in America

PM

GREAT ENCOURAGEMENT FOR SHIPWRIGHTS!



All gentlemen shipwrights and able-bodied modelists who have a mind to provide for themselves amusement and satisfaction through the traditional craft of ship modeling, an opportunity now offers to acquire, through the minimal cost of one Colonial Dollar (\$1.00), a catalogue of fine and unique ship model kits, plans, books and fittings from the renowned company of Model Shipways located in Mt. Pocono, in the state of Pennsylvania.

MAIL THIS COUPON TODAY!

Send \$1.00 for a catalog to:

MODEL EXPO, INC., Dept. PM23
PO Box 1000, Mt. Pocono, PA 18344

Name _____
Address _____
City _____
State _____ Zip _____

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
Mail, Experimenter Book . . . \$11.95
All New Catalog/Kit Info. . . \$10.00
SPECIAL! All 3 Items: Only \$19.95
Add \$2 postage. Foreign add \$5 U.S.
Credit card order line: 1-800-933-4346

HELICRAFT
P.O. Box 50
Riderwood, MD 21138

At Least a New Amazingly Simple GAS TURBINE JET ENGINE



Build from easy to follow plans.
Length 18", Dia. 8 1/2", Wt. 18 lbs.
Fuel: Gasoline or Kerosene
Screaming Demon develops 20 H.P. Ideal project for serious-minded hobbyists, students, scientific and industrial arts classes. Make on 9" metal cutting lathe with milling attachment. For use on small racing boats, midget cars, etc. Full size assembly drawings with critical dimensions, bill of materials and photos. Price \$34.00 No. C.O.D.

SAVOY SCIENTIFIC SANTA MONICA, CALIF. 90408

BE A LOCKSMITH

EARN WHILE YOU LEARN—SEND FOR FREE BOOK
Big opportunities. Big profits. Earn quickly. Full or part time. Learn at home, it's easy. Do real jobs while you learn. All Tools—Materials Supplied. Approved by NJ Dept. of Education. Send name and address for FREE book. No salesman will call.

LOCKSMITHING INSTITUTE CTI COMMERCIAL TECHNICAL INSTITUTE
Div. Commercial Technical Institute
116 Fairfield Road, Fairfield, NJ 07004
Dept. 110-023

MOLDS



for making Ornamental
Concrete Items

Book about Aluminum Molds including over 425 designs, prices and production trade secrets from the world's largest mold manufacturer.

Book
only
\$10

CONCRETE MACHINERY CO., INC.
P.O. Box A99, Hickory, NC 28603

FREE ENERGY!

Fuel-less Motors & Generators / Vapor
Carburetor Triples M. P. G.
Amazing Principles & Details:

FREE
INFO:

H & A INDUSTRIES
Route 2, Box E-35 Dept. PM
Bowling Green, MO 63334

**VOLKSWAGEN
RESTORATION PARTS**
■ BUG ■ GHA ■ TYPE 3 ■ SUNROOF
■ BUS ■ RABBIT/GOLF ■ CONVERTIBLE
FREE CATALOG
WEST COAST METRIC, INC.
(800) 247-3202
FAX (310) 325-9733
24002 FRAMPTON AVE., PM
HARBOR CITY, CA 90710

CABLE TV DESCRAMBLERS ★ CONVERTERS ★ and ACCESSORIES.

**SAVE MONEY.
DON'T RENT!**

PANASONIC, JERROLD, OAK,
PIONEER, SCIENTIFIC ATLANTA
AND MORE. LOWEST PRICES. FREE CATALOG.
CABLE READY COMPANY (800) 234-1006

PRIME TIME
CABLE COMPANY

**CABLE TV
DESCRAMBLERS
Converters, Accessories.**

Name Brands • Great Service
Immediate Delivery
Lowest Prices

★ Call For
FREE Catalog: **(800) 777-7731** ★

Eureka!
You've invented something!
Now What?
Exhibit at
**America's largest
invention show
INPEX™ IX**

Contact: The Inventors Advertising Agency™
800-IAA-0871/FAX (412) 288-4546

TIP Turbine Paint Sprayer
HVL P-High Volume, Low Pressure

TP-77 pumps out 60cfm @ 4-5psi. Eliminates up to 80% overspray. Heated air reduces moisture. Eliminates runs. With 1qt. cup, gun, nozzle, cart, 30ft. hose & turbine. Wt. 45 Lbs. U.S. made. Requires no air compressor. Plugs into 110 volt, 1 yr warranty. \$599. Call or write for FREE Catalog.

\$599 PPD, UPS US 48
TIP Tools & Sandblast Equipment, Dept. PM,
7075 Rt. 446, P.O. Box 649, Canfield, OH 44406
1 800 321-9260 Fax 216-533-2876 VISA/MC

NEW All-Hydraulic MAGNATAC.
No Belts ... ALL-HYDRAULIC DRIVE!
Use for excavating, clearing, landscaping, gardening, logging...or work for others for Extra CASH!

- CATALOG \$1.50
- VIDEO - New .. \$9.50
- Technical Manual.. \$8.50

STRUCK-KIT • Box 307 • Dept. PM23
CEDARBURG, WISCONSIN 53012

***** PRESENTING *****
**CABLE TV
DESCRAMBLERS**
***** STARRING *****
JERROLD, HAMLIN, OAK
AND OTHER FAMOUS MANUFACTURERS

- FINEST WARRANTY PROGRAM AVAILABLE
- LOWEST RETAIL / WHOLESALE PRICES IN U.S.
- ORDERS SHIPPED FROM STOCK WITHIN 24 HRS
- ALL MAJOR CREDIT CARDS ACCEPTED

FOR FREE CATALOG,
ORDERS & INFORMATION **1-800-345-8927**

PACIFIC CABLE CO., INC.
7325 1/2 Reseda Blvd., Dept. 1770
Reseda, CA 91335

STREET ROD KITS
V8 Power

'34 Classic Cabriolet



'34 Classic Coupe



'33 Classic Vicky



GREAT BODIES ... ALL THE RIGHT EQUIPMENT ... STREET SMART ... Designed for Easy Assembly. The Innovative One Piece Fiberglass Body, Steel Frame and State of the Art Components Make the '34 CABRIOLET, '34 COUPE AND '33 VICKY The First Complete Street Rod Kits available. To receive a Complimentary Brochure Write to Classic Motor Carriages, Dept. PM, 16650 NW 27th Ave., Miami, FL 33054 or call Toll Free 1-800-CLASSIC. 015-B-3.

FREE SCIENCE RESOURCE CATALOG

America's best known source of scientific products for the technical hobbyist, student and science educator.

- Magnifiers & Optics
- Science Kits & Toys
- Magnets & Surplus
- Weather & Solar
- Science Discovery
- Photographic
- Microscopes • Telescopes

Discover creative science fair project ideas in our new 112 page science resource catalog that features over 3200 scientific products. Write for your FREE copy.

Build A Working 4 Cylinder Turbo Demo Engine.
See through turbo charger has movable impellers, real rubber fan belt and timing belt. Includes lights for "firing" spark plugs, moving pistons, connecting rods, operating distributor and moving crankshaft and camshaft. Optional high performance parts included. Engine model is 12" long, molded in blue, red and silver plastic. Comes complete with instructions (plastic glue is not included).
MH38, 910 \$49.95

Go Fishing With This Mighty Magnet.
Lift up to 200 lbs. Fun to use around docks and bridges. A must for a boat, it helps retrieve metal objects that fall overboard. You'll be amazed at what you pull up. Wt. 2 lbs., measures 4x3x3 1/4". Made with a Poly-Vinyl Chloride coating to resist corrosion and chipping. MH71, 135 \$33.95

For phone orders call 1-609-547-8880.
Mon.-Fri. 8AM-8PM; Sat. 9AM-4PM EST. Major credit cards accepted. Product orders add \$2.50 for postage and handling. **45 day money back guarantee.**

Edmund Scientific Co.
Dept. 13A1, C913 Edscorp Bldg., Barrington, NJ 08007

NH Northern
Where the Pros and Handymen Shop
1-800-533-5545
Sale Prices Good Thru 2/28/93 Key #26410

Hidden Fence Pet Containment System
High-tech way to keep your pet in your yard! Lets him move about your property. Uses underground wiring that you can't see! transmitter, receiver/collar, 500' of insulated boundary wire, flags and more.
Item# 3665
Sale **\$339.00**



HOMELITE

2" Water Pump
8,400 gallons per hour. 3 HP Briggs engine. 28' max lift. 94' head. 2" suction and discharge. Item# 10996
Sale **\$162.00**



Backpack Sprayer
70 PSI. For weed and pest control, spraying, even painting! 4 gallon polyethylene tank. 3 gallon capacity. Wand, nozzle and 36" hose included. 22 1/2"H x 14 1/2"W x 8 1/2"D. Item# 2510
Sale **\$62.00**



20 Gallon Parts Washer
Rugged steel construction. Circulates up to 50 GPH. Fusible link cover. 110V. 36" H. Item# 15946
Sale **\$119.00**



Tow-Behind Sprayer
Sprays fertilizers, herbicides and insecticides from a 12 V pump. 55 PSI. 1.8 GPM. 15 gallon capacity. Two spray tips on 42" boom give you an 80" spray pattern. 7 Amp max. draw. 27"H x 52"L x 27"W. Item #2692
Sale **\$239.00**

1500 PSI Pressure Washer
3 1/2 HP Briggs and Stratton engine. Pump delivers 2.2 GPM at 1500 PSI. Item# 157159
Sale **\$379.00**



Gas Engines
Thousands of vertical and horizontal engines in stock.

Reversible 2 HP Electric Motor
Full load Amps: 24 at 115 V, 12 Amps at 230 V. 3600 RPM. Item# 16168
Sale **\$89.00**

Reversible 5 HP Electric Motor
25 Amps at 208 V, 23.5 Amps at 230 V. 3600 RPM. Item# 161551
Sale **\$149.00**

Horizontal

5 HP Sale **\$139.00**
8 HP Sale **\$209.00**
10 HP Sale **\$254.00**

Lowest Prices - 1000's in Stock!

4000 Watt Generator
8 HP Tecumseh engine has cast iron sleeve. Two 120 V and two 240 V outlets. Item# 16425
Sale **\$409.00**



Send or call for your FREE Discount Catalog!
ORDER TOLL FREE
1-800-533-5545
Fax: 1-612-894-0083

Name _____
Address _____
City _____ State _____ Zip _____

Key #26410 SEND TO: NORTHERN,
P.O. Box 1219, Burnsville, MN 55337-0219



Save Money

on Solid Hardwood Furniture
DO-IT-YOURSELF KITS

Now, you can furnish your home with the very finest solid cherry and oak furniture, and clocks, at a fraction of retail cost.

Imagine a bedroom in solid cherry at a cost of hundreds, instead of thousands.

Picture your living room in Queen Anne Styling. Tables, lowboy, secretary desk. All this from easy-to-assemble kits and easy-to-apply finish.

All parts pre-cut. All frames, doors pre-assembled for you.

Thousands of satisfied customers.



Send \$1.00 for Color Catalog

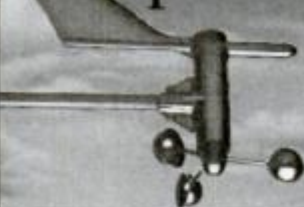
Name: _____
Street: _____
City: _____
State: _____ Zip: _____



WORLD'S LARGEST MANUFACTURER OF GRANDFATHER CLOCK AND FURNITURE KITS

Dept. 4610 Emperor Industrial Park
Fairhope, AL 36532
Tel: 205-928-2316

In case of weather, push button.



Now you can have complete weather information literally at your fingertips with the Weather Monitor II. Sophisticated in design, yet easy to operate, it's as miraculous as the weather itself.

FEATURES INCLUDE:

- Inside & Outside Temps
- Wind Speed & Direction
- Inside Humidity
- Time & Date
- Barometer
- Wind Chill
- Alarms

- Highs & Lows
- Instant Metric Conversions
- Outside Humidity & Dew Point Option
- Rainfall Option
- Optional PC Interface



WEATHER MONITOR II

THE PROFESSIONAL HOME WEATHER STATION

Order today: 1-800-678-3669 • PM626X

M - F 7 a.m. to 5:30 p.m. Pacific Time • FAX 1-510-670-0589
MC and VISA • One-year warranty • 30-day money-back guarantee

DAVIS INSTRUMENTS 3465 DIABLO AVE., HAYWARD, CA 94545

Distributors WANTED



Start Your Own Business by Capitalizing on the Exploding Growth of Steel Framing in Home Construction

Experts Agree, the Potential for Steel Framing in Today's Residential Construction Market is UNLIMITED, and Expanding Rapidly. Join Tri-Steel, the Industry Leader.

- It's Easy to Start with:
- *Low, 100% Refundable Investment
 - *4 Unique Programs
 - *No Franchise Fees
 - *Training Manuals
 - *Financing Available
 - *Clearspan Interiors
 - *Hands-On Training
 - *Technical Support
 - *Construction Assist.
 - *Commercial & Smaller Buildings
- Tri-Steel Homes feature:
- *Bolt-Together Construction
 - *Fast, Simple Erection
 - *9" Thick R-30 Insulation
 - *100 Standards Models or Custom Designs
 - *Environmentally Preferred Materials
 - *High Strength for better Protection against Fire, Termites, High Winds and Earthquakes (Seismic 4)
 - *And Much, Much More

Call Today to Order a \$19.95 Video Tape or FREE Information Packet:



1-800-TRI-STEEL

(817)497-7070 Fax: (817)497-7497

5400 S. Stemmons Freeway, Denton, Texas 75205

BUILD A BETTER BUILDING

LARGE SAVINGS INVENTORY CLEARANCE

FREE storage up to six months



Easy Assembly Save \$\$\$

• STRAIGHT SIDED • CLEAR SPAN • THICK STEEL

GUARANTEED LOWEST PRICES

- 20' x 32'
- 25' x 44'
- 30' x 50'
- 35' x 56'
- 40' x 88'
- 40' x 102'
- 45' x 180'
- Other sizes available

FACTORY DIRECT NO CHARGE 1-800-658-9422

PIONEER STEEL BUILDINGS - Since 1960

WOOD HEAT

WOOD FURNACES HEAT YOUR ENTIRE HOME

Call 1-218-326-6786 or Write

Charmaster®

2307A HWY 2 W. GRAND RAPIDS, MN 55744

GO KARTS

FUN KARTS • MOTOBIKES ALL TERRAIN KARTS ENGINES • KITS • PARTS

88 PAGE CATALOG \$3.99 Order the catalog by phone on VISA or MasterCard or mail \$3.99 to address below. Catalog sent by 1st Class Mail.



LARGEST SELECTION DISCOUNT PRICES

KW KART WORLD

1488 MENTOR AVE., PAINESVILLE, OHIO 44077

PHONE (216) 357-5589

WATER BALLOON LAUNCHER 120 YARDS!! ONLY \$12

EASY TO USE



FANTASTIC OUTDOOR FUN FOR ALL AGES TO ORDER: Call Toll Free 1-800-441-1047 VISA/MC - or send check to: BLASTER - 13218 Jessica Dr., Spring Hill, FL 34088 Every Order Shipped next Day!

Made in U.S.A. \$3.00 P & H MONEY BACK GUARANTEE

Enlarge Project Designs

Craft Projector is Simple! Fast Accurate!

Adjustable lens enlarges by fractions up to 27x times the size you want! Copy unlimited ideas for craft designs. Enlarge patterns, designs, portraits, still lifes, landscapes, photos, slides, designs on coins and jewelry. Projects in exact colors. Does not damage original. Simple instructions. Uses household current and 60 watt bulb. Send \$19.95 plus \$4.95 for shipping. 30 day money back guarantee. Norton, Dept. GT-463, Box 2012, New Rochelle, NY 10802



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.

\$19.95 EACH Qty. Disc. Avail.



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.

Call 407-725-1000 or send \$19.95 + \$1.00 shipping per item to: USI Corp., PO Box #12-2052, Melbourne, FL 32902 CDD's OK.

CABLE TV DESCRAMBLERS CONVERTERS ACCESSORIES

SAVE \$\$\$ DON'T RENT

30 DAY MONEY BACK GUARANTEE PANASONIC, OAK, JERROLD, ZENITH, SCIENTIFIC ATLANTA PLUS MORE!!!! LOWEST PRICES!!! AAA Electronics

CALL 1-(800) 258-9512

Learn Tool Sharpening for Profit

Get Started now. FREE Lifetime Security Kit tells how to make an extremely good income. Send coupon to: Foley-Belsaw Company Dept. 21172, 6301 Equitable Rd. Kansas City, MO 64120-1395



Name _____
Address _____
City _____ State _____ Zip _____

Since 1926

CABLE TV DESCRAMBLERS

Jerrold Scientific Atlanta Oak Zenith-Toocom

1-800-729-1776

FREE CATALOG

FRIENDLY, COURTEOUS SERVICE!

Now CARRYING VCR's, T.V.'s, HOME & CAR AUDIO

TKA ELECTRONICS

7914 WEST DODGE RD #334 OMAHA, NE 68114



STEEL RUST REPAIR PARTS

Restore your car, van or truck to showroom condition with TABCO parts. Over 100,000 domestic and foreign parts, available for immediate delivery.

Send \$5 for illustrated, 150-page catalog with instructions to install TABCO parts. Refundable with order. Shipped 1st Class. Dealer inquiries invited.

TABCO (216) 248-5151
FAX (216) 248-8979

30500 Solon Industrial Pkwy. Dept. PM Cleveland, OH 44139

HERNIA APPLIANCES FOR COMFORT!

You can enjoy heavenly comfort night and day at work or at play! Send for FREE illustrated booklet.



BROOKS APPLIANCE COMPANY

777 State Street, Marshall, Mich. 49068

AMAZING SHOVEL EXTENSION HANDLE

- reduces bending of back
 - for snow shoveling or gardening
 - quick installation
 - adjustable angle positions
 - strong plated metal
- \$9.99 + \$5.00 p/h. check/m.o.
ITD mfg. P.O. Box 244
141 Woodbridge Ave., Dept M
Woodbridge, Ontario, Canada L4L 1B1
Canadians apply applicable sales tax. 4-6 Wks. Del.



CRACK REPAIR OVER A FOOT LONG

Be Your Own Boss **Patented Process** **HUGE DEMAND!** **Just Look Around You!** **Eliminate Your Own Future!**

Ultra B-O-N-D, Inc.
1 (800) 347-2820
11151 Pierce Street, Riverside CA 92505

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

BUILD THE AMAZING AUTOMITE

Your Personal Conservation Car

- 90 MPG! • Easy & inexpensive to build
- Fully enclosed, all-weather cab

For Shopping! For Commuting!
For Fun!

COMPLETE DETAILED PLANS
Only \$12.95 ~~add \$2 post.~~

Order from: MASTERWORKS • PO Box 511-P • Fallston, MD 21047

CONVERTERS DESCRAMBLERS TEST MODULES

Se Habla Español
BEST WARRANTIES/BEST GUARANTEES
#1 IN CUSTOMER SATISFACTION
FOR FREE CATALOG OR TO ORDER CALL:

1-800-833-2915

For Technical Assistance or Information
call: 407-336-8538
NU-VUE ELECTRONICS
1861 Savage Blvd., #105, Port St. Lucie, FL 34953

Small Engine Technicians In Demand

Get Started now. FREE Lifetime Security Kit tells how to make an extremely good income. Send coupon to:

Foley-Belsaw Company
Dept. 52214, 6301 Equitable Rd.
Kansas City, MO 64120-1395

Name _____
Address _____
City _____ State _____ Zip _____

Since 1926

Maurice's FLYING PIG™

Real Old South Barbeque delivered to your door in 2 days or less, ready to heat and serve.

1-800-MAURICE

Gift wrapped free!

Maurice's Gourmet Barbeque™
PO Box 6847, West Columbia, SC 29171 USA
Write for FREE catalog!

RACKLOCKER

CALL FOR FREE BROCHURE (408) 988-4002
IRONMASTER INC. SANTA CLARA, CA.

Lock Down Security Easy Opening

All Steel Construction 1200 LB. Lumber Rack

LEARN COMPUTERS!

Home study. Become a personal computer expert at home and in business. Learn at your own pace. Exciting and easy to follow. Send or call today for free literature.

800-223-4542

Name _____
Address _____
City _____ State _____ Zip _____

SCHOOL OF COMPUTER TRAINING
2245 Perimeter Park
Dept. KB129, Atlanta, Georgia 30341

TECHNICAL BOOKS

Discover hundreds of unusual, high-quality technical books that you'll NEVER see in any book store! Both newly written & reprints of rare old books! Your satisfaction guaranteed! Here are just a few—

BUILD A METAL LATHE!

BUILD A METAL LATHE
Build a precision 7" metal cutting lathe without the need of precision tools! Cuts to 1/1000". It's true! Prototype cost about \$50! Definitely not a toy! Detailed paperback! Best seller! Order a copy! Book 177 \$7.95

LATHE HANDBOOK

Fantastically illustrated handbook from 1925 delivers hints and tips to help you be a better machinist and have more fun with your lathe! Worth having! Inexpensive! Fun to read!

Book 20838 \$6.95

CHARCOAL FOUNDRY

Build a furnace from a five gallon pail that can melt aluminum, pot metal and brass using grocery-store charcoal. Cast machine parts, ingots, art objects. All the secrets!

Book 163 \$6.95

POUND METAL!

BLACKSMITH SHOP & IRON FORGING
From 1906! Complete text on forging of iron with hammer and anvil. Make bolts, tools, even steam engine repairs! Details on all tools and procedures. Great illustrations. Order a copy!

Book 4074 \$6.50

MFG OF WHISKEY, BRANDY & CORDIALS
Very rare inside 1937 industrial handbook written for other distillers. How to make Scotch, Gin, vodka, and much more. Good stuff! No moonshine! Secrets you're not supposed to know!

Book 20935 \$8.95

DO-IT-YOURSELF VACUUM FORMING

Build all the equipment to do professional quality vacuum forming. Low cost! Heavy duty. Written by industrial expert. You can do it, too! Hot seller!

Book 1308 \$9.95

EXPERIMENTAL SCIENCE BY GEORGE HOPKINS

Reprint of classic 1906 two volume set. Wall-to-wall scientific equipment and experiments. From homemade camera and phonograph to telephone and Geissler tubes. Heavily illustrated! Fantastic science fair projects! Over a 1000 pages! Catalog has complete details!

Book 926 \$34.95

WRITE FOR CATALOG!

Hundreds of books! Write for your copy of Lindsay's big Technical Books catalog and see what you've been missing! Send \$1.00 [US & Canada] or \$4.00 foreign airmail. Write today!

LINDSAY PUBLICATIONS

PO Box 538-EMW, Bradley IL 60915

Send the books I've marked. A check, money order, or my Mastercard/Visa card numbers are enclosed in payment. And send a catalog at no charge.

Send just a copy of your latest catalog. A dollar is enclosed.

Name _____
Address _____
City _____ St _____ Zip _____

Autotechnologies

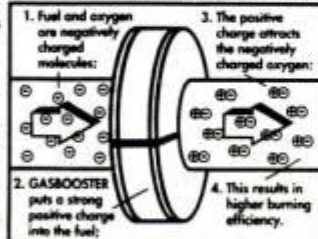
AUTOTECHNOLOGIES IS AN AUTHORIZED GASBOOSTER DISTRIBUTOR

GASBOOSTER™

Better Mileage,
More Power,
A Cleaner Environment.

SAVECO'S GASBOOSTER is a simple, scientific way to save money while enjoying better power and performance from your vehicle. Once the improved combustion provided by the GASBOOSTER has had time to clean out the carbon and varnish build-up in your engine, you'll see an improvement in your gas mileage. Install the GASBOOSTER once, and you'll have improved performance for the life of your vehicle.

GASBOOSTER works by magnetically charging your vehicle's fuel as it passes through the fuel line to the engine. The Magnetized, Charged fuel then disperses & burns more evenly in the combustion chamber resulting in better mileage, more power, and less pollution. GASBOOSTER installs easily using no tools. Nothing to hook up. Simply clamp it onto the fuel line leading into the carburetor or fuel injector using the tie provided. GASBOOSTER is Cutting Edge Technology. **MADE IN THE U.S.A.**



AUTOTECHNOLOGIES

P.O. BOX 1440-PM2 GRANBURY, TX 76048-8440

YES I WANT GASBOOSTER(S) I'VE ENCLOSED \$24.95 ea. PLUS \$2.00 ea. S/H. FOR A TOTAL OF \$ PLEASE SEND THEM TO:

Name (Please print) _____
Address _____
City _____
State _____ Zip _____

Now you can do something about the weather

Low as \$149

Our new Home Weather Station helps you plan your day, safeguard your family and property by alerting you to local weather conditions that often vary from distant forecasts. Tells you to: Warn loved ones when wind chill threatens frostbite... Secure outside belongings against unexpected gusts... Protect plants when an alarm signals dangerous heat or cold... Increase watering when rainfall is too low—and much more.

Designed to far outlast all others, the ULTIMETER II gives you over 20 most-wanted features including:

- Wind Speed and Direction
- Temperature • Chill factor
- Alarms • Highs/lows/times/dates • Metric/English
- Quick-Mount (no tools)
- masthead mounting • Fast, easy "Point & Plug" direction calibration (pat. pending) • Optional self-emptying rain gauge • 30-day money back guarantee • One-year warranty

Home Weather Station only \$179
As above, without wind direction sensor \$149

Del. in US, add \$8.25 shipping & insurance. NJ res. add 6% tax.

VISA/MC phone orders: 800-USA-PEET (872-7338).
Or send check, m.o. or credit card no. and exp. date to:

PEET BROS. COMPANY 601-302M Woodland Rd.,
W. Allenhurst NJ 07711

Free Brochure Our 17th Year ©1992 Peet Bros. Co.

BUILD A BIKECAR

The Amazing Mini Car You Can Build with Bicycle Parts!
Electric Motor and Pedal Powered! Fun to Drive!
Easy to Build!

Save Gas Have Fun
To Order send \$12.95
SEND TODAY!
Card Orders
Send all Numbers
Exp. Date Signature

Full Illustrated & Detailed
PLANS \$12.95
Satisfaction Guaranteed or Your Money Back. Check, M. Order
BIKECAR CORP. Via. M-Card
P.O. BOX 72, OCALA, FL 34478

SHOP - TASK

MILL • LATHE • DRILL

The Original Home Machine Shop
Designed in USA by Shoptask

3 Models to Choose
Best quality, best price
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

Product Design Revolution!

No portfolio required for undergraduate admission. A faculty of working professionals. San Francisco, renowned for creativity, natural and cultural resources, and revolution. BFA/MFA programs year round. You wanna do it? This is the place. Call for video and catalogue.

The Academy of Art College
540 Powell Street • San Francisco, CA 94108
1-800-328-2100 ▲

WHY RENT? SAVE! SAVE!

CABLE TV DESCRAMBLERS

JERROLD • OAK • HAMLIN • ZENITH
PIONEER • SCIENTIFIC ATLANTA

READY-TO-SHIP!
6 MONTH WARRANTY! ABSOLUTELY
LOWEST WHOLESALE / RETAIL PRICES!
MASTER CARD • VISA • AMEX • C.O.D.
FREE COLOR CATALOG!
1 (800) 950-9145

JP VIDEO 1470 OLD COUNTRY ROAD, STE-315
PLAINVIEW, NY 11803
NO NY SALES - PM

LAST CHANCE AT 92 INVENTORY

SAVE Up To 40%
20x30
25x50
30x40
40x60

Buy Factory Direct
800-888-4606

STEELMASTER

Affordable, Personal HELICOPTER

Revolution Helicopter
Mini 500

• Easily Built In One Week
• 435 mph Top Speed
• Go Anywhere!
• Revolution Helicopter
• 1200 PM 2 1/2 hrs. ship
• 1200 PM 2 1/2 hrs. ship
• 1200 PM 2 1/2 hrs. ship

ORDER NOW!!
Customer Service or Questions
(816) 792-1011

Complete Info Package \$15
12 Hour Action Video \$30
PAL Business Form Video \$45
(Package orders add \$15 for S/H)

Credit Card Orders Only: 1-800-63-ROTOR

Stunt Kites

Free 80 Page Color Catalog
Start with an easy-to-fly beginner's kite or experience the thrill of control at 120 MPH!
Send for our free Catalog and choose from hundreds of unusual and innovative kites.

Into The Wind • (800) 541-0314
1408-M Pearl St., Boulder, CO 80302

EARN \$60,000 YEARLY

Repairing (not replacing) stone damaged windshields and plate glass. Learn how a 3 minute repair can earn you \$1200/week!
CALL NOW! FREE REPORT! 1-800-695-6224
NVS/OPTIKLEER, LYNN, MASS. 01904

CABLE T.V. EQUIPMENT

Why Pay High Rental Fees?

Replacements for all models. 60 day unconditional money back guarantee. Low Prices. Ship within 24 hours. S.S.A.E. for free catalog. Visa, MC, C.O.D. Let our experience work for you.

1-800-243-3967
SKYLINE SYSTEMS INC.
114 S. Euclid Ave.
Park Ridge, IL 60068

Bargain Books

Save up to 80% on publishers' overstocks, imports, remainders. Choose from up to 8,000 titles including 600-1,500 new arrivals each month. Science & Mechanics, Do-It-Yourself, Biography, History, Literature, Gardening—something for everyone. Fast shipment, moneyback guarantee. Write for **FREE CATALOG!**
Hamilton Box 15-824, Falls Village, CT 06031

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
7986 Hightower Trail
Lithonia, GA 30058
24 Hour Demo/Info Request Line (404) 482-3485 Ext 61
Singer's Supply • We Have Anything & Everything For Singers

Gas Refrigerators by Serwel

• No electric needed
• Reliable
• Quiet

Lafman's, Box 41, Dept. 1HCC, Kidron, OH
Call or Write: 44636-0041 (216/857-5441)

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

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. VB129, Atlanta, Georgia 30341

CLASSIFIED ADVERTISEMENTS

Dorothy Nolan, Classified Manager

Rates: \$11.00 per word. 10 word minimum.

Bold Face Type—\$1.00 extra per word. (First word automatically set in Bold Face Type). **Gray Background**—Flat rate of \$54.00 per advertisement. **Centered Headlines** (5 words or less)—\$54.00 per line. Our **APRIL** issue closes on **FEBRUARY 5TH**. (On sale date is **MARCH 15TH**). All advertising is payable in advance by check, money order or credit card. Advertisers wishing to charge their MasterCard, American Express or Visa accounts, please be sure to include number and expiration date. Send order and remittance payable to: Popular Mechanics, Classified Advertising, 224 West 57th Street, New York, NY 10019. Be sure to indicate classification under which advertisement is to appear.

Advertisers using a P.O. Box number must furnish complete name and street address for our records. To avoid delay in the publication of your advertisement, please send samples and descriptive materials with your request if your advertisement does not state clearly what is being offered. For additional advertising information call 1-212-649-3167 or FAX: 1-212-586-5562.

**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

SAVE Your Cash—Barter. Free Details: The Barter Classified, Box 752, Oostburg, WI 53070

"SHARPENERS REPORT" Monthly Newsletter. Valuable Tips—Sources—Buy/Sell Used Equipment. Free Brochure. Skog Company, Dept. PM2, P.O. Box 22559, Minneapolis, MN 55422

"ANARCHIST COOKBOOK" Available again! \$25, delivered. Barricade Books, Box 1401-X, Secaucus, NJ 07096.

FREE BOOKLETS: Life, Death, Soul, Resurrection, Pollution Crisis, Hell, Judgment Day, Restitution. Bible Standard (PM), P.O. Box 67, Chester Springs, PA 19425.

INVESTIGATORS Information Sources. Reverse Directories, Unlisted Phone Numbers, Tracing Auto License Plate Numbers. Skip Tracing. 300 Sources. \$12.95 Plus \$2.50 S/H. Griffen Publications, 22335 Marine View Drive So., Suite 268, Des Moines, WA 98198

IMPOTENCE: From causes to treatment. Send \$12.95 to Book. P.O. Box 7275, Lake Worth, FL 33466

MONEY MAKING OPPORTUNITIES. Free exciting book catalog **CHRISTIE BOOK & PUBLISHING CO.**, Dept. 101, 225 Laurel Ave., Rochester, NY 14624

WIN CONSISTENTLY AT ROULETTE! Mathematically proven system. For instructions, send \$5 to: SDA-RM2, POB 68063, Raleigh, NC 27613.

SAVE Money—Install Phone Jacks Like The Pro's. Detailed Booklet \$12.00. ORDCO, P.O. Box 18112, Irvine, CA 92714

STOP MAILBOX DAMAGE! Simple, inexpensive design prevents damage from vehicles and vandalism. Build your own, then earn fast income by installing for others. Illustrated instructions \$5. Samaritan Publishing, P.O. Box 109, Montgomery, MN 56069.

EASIEST VCR Hookup Guide... \$3.99 - Postmark: 6739 Sunset Strip, #139PM2, Sunrise, FL 33313

WHEN WAS THE WORLD CREATED? CAN WE KNOW WHEN IT WILL END? Bible exposition reveals startling answers, much more. Free Details: Box 23241-PM, Toledo, Ohio 43623

HOW TO REMODEL YOUR KITCHEN AND SAVE A FORTUNE. Illustrated manual, trade secrets revealed **FREE DETAILS.** 8930 State Rd. 84, Ste 146P, Davie, FL 33324

SAVE THOUSANDS Sell your house without an agent. Our book explains everything. Simple and concise. \$14.95. Money-back guarantee. Corollary Publishing, 4431 Lehigh Rd, Suite 393, College Park, MD 20740

CREDIT CARD SECRETS REVEALED—How to Save Thousands of Dollars in Finance Charges and Get Out of Credit Card Debt. New Booklet \$9.95. Sandell, Box 121, West Berlin, NJ 08091

FUEL FROM WATER. Energy independence with hydrogen. Amazing free report. Merit, Box 694, Louisville, KY 40201

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

MAGAZINES

NATURISM LIFESTYLE: FAMILY RECREATION. Videos, magazines. New '92 releases. Color catalog \$3. Natuurlijk-PM, Box 527B, Santa Monica, CA 90409

CATALOGS

GIFTS. Free catalog. Mailbox Selections, 1548 Carlisle Pike, Hanover, PA 17331.

"SMALL ENGINE PARTS" catalog \$1. Smith's, 513W Spring, Weatherford, TX 76086

SELF PROTECTION! Crime is on the increase. Send \$2 (Refundable) for catalog of low cost personal security products. PineTree Products, P.O. Box 686, Barnegat, NJ 08005

AUTOMOBILES

\$225 DAILY "CHROME PLATING" Auto Parts, Motorcycles, inexpensive, easy. (Free) information. Chrome Finish, Box 2285, Waldorf, Maryland 20604

RADAR JAMMER
"NO MORE TICKETS." New Technology Makes Cars Invisible To Radar Yet 100% Legal \$195.00. Call Phantom Technology 1-800-8RADAR2.

GOVERNMENT SEIZED Vehicles from \$100. Fords, Mercedes, Corvettes, Chevys. Surplus. Buyers Guide. (1) 805-962-8000 Ext. S-20024

DID YOU KNOW Vinegar will dissolve silicone sealer? 100 Automotive problem solvers. Save time, aggravation. For pro and amateur mechanics. \$5.50. AUTOSSET, P.O. Box 52, Lodi, Ohio 44254

INSTANT windshield defroster, **RAPID** de-icer. Never scrape any car windows again. At home or work. Guaranteed as advertised. \$9.95. Alico, 1135 W. Main, Ashland, OH 44805

REVOLUTIONIZING CAR THEFT PREVENTION SYSTEM. Free Information, Send SASE: David Caudle, POB 871, Morrow, GA 30260-0871

DRUG RAID SEIZURES: Buy Dirt Cheap! Cars, Trucks, Boats, Computers. Seizures, Box 51488-AT, Ontario, CA 91761

TIRED OF POINTS TYPE IGNITION? Convert Your Early Ford To Electronic Ignition Easily And Inexpensively. Call For Details. 1-206-521-3265

PROTECT YOUR AUTOMOBILE from theft inexpensively. Free information. Nelson Research, 19001 Hale Mountain Road, Dept PM, Canehill, Arkansas 72717

GASOLINE POLARIZER. Fully Assembled, Easily Installed, Reduces MPG! Heron, POB 237, Monsey, NY 10952

STOP! Don't Buy A Used Car Without Reading "How To Inspect A Used Car"! Send \$2.00 to: Tardi Enterprises, 205 Prospect Avenue, Bayonne, New Jersey 07002

TAURUS/SABLE OWNERS: Monthly publication gives mechanical-electronic advice, owner feedback, problem areas and solutions. Free brochure. Taurus Technical Talk, Dept A, Box 741524, Dallas, TX 75374-1524.

"HOW-TO BUY" New Cars \$100.00 Over Dealer's Wholesale Cost! Newsletter \$2.45 Payable to: "Jerry Ferrendino", c/o Car Advisors, 160 Overlook Drive, Ludlow, MA 01056.

ELECTRIC VEHICLES

BATTERY CHARGERS for EVs 72 - 120 VDC 30 lbs **\$450.00** Complete **HONDA CRX ELECTRIC CONVERSION KITS** from **\$3,900.00** **CYBORTRONICS**, 17 Hammond, Suite 409, Irvine, CA 92718. (714) 855-3953.

AUTO SUPPLIES & EQUIPMENT

ALTERNATOR Generator Rebuilding Book. Details: HV Technologies, 7505 Barkentine, Las Vegas, NV 89128

ALTERNATOR & STARTER REBUILDING KITS! It's easy, detailed instructions. Most kits \$14.95. A & S Kits 1-800-925-8096 Money Back Guarantee! P.O. Box 514, Belen, NM, 87002

MOBILE HOMES

22 NEW, MONEY SAVING, MOBILE HOME REPORTS. Free Catalog. D.S. Manuscripts, PO Box 1309F, Venice, FL 34284-1309

MOTORCYCLES, MOTORSCOOTERS & GO-KARTS

GO KARTS, Minibikes & ATV's. Assembled, Kits, Parts, Engines. Discount Prices. Large Selection. 88 Page Catalog \$3.00. 216-357-5569. Kart World, Dept C., 1488 Mentor Ave., Painesville, Ohio 44077.

MINIBIKE Or Go Cart Plans Easily Built Specify Which Plans You Prefer \$7.00 each. Cartco, P.O. Box 360, 6389 Mayfield Road, Chesterland, Ohio 44026

AVIATION, HANG GLIDING

AIRPLANE, Hang Glider Design Brochure \$1.00. McCoy Aircraft, Box J, Suite 243, Manhattan Beach, CA 90266

BUILD YOUR OWN WOOD ULTRALIGHT AIRPLANE. No License Needed. Over 1000 Sold. Kits And Plans. Info \$6.00. Team, 10790 Ivy Bluff Road, Bradyville, TN 37026

BUILD The World's Most Inexpensive Two Place Kit Helicopter. Proven Reliability For The Last Thirty Years. Info Pack With Video - \$35.00. 1-800-827-3953. Cobra Helicopters, P.O. Box 396, Danville, Indiana 46122

AIRBOATS. Hovercraft, Airdrives, Propellers, Hulls, Engines, Plans, Accessories. Catalog \$5.00. Arrowprop, Box 610M, Meeker, OK 74855

BOOMERANGS ... HI-TECH DESIGNS! Incredible Returns. Amazing Fun. **FREE CATALOG.** BoomerangMan, 1806-1 N. 3rd, Monroe, LA 71201-4222.

HOVERCRAFT

SCAT Parts Catalog \$5.00 Refundable. GPL, 2859 Cormorant, Delray, FL 33444-1068

(Continued on next page)

HOVERCRAFT

(Continued from preceding page)

DEALERSHIP information \$11. Kits, VW Plans. Neoteric, Terre-Haute, Indiana, 47807-2394. (812) 234-1120.

QUIET New Fast Hovercraft. Catalog \$2. Box 281M, Cordova, IL 61242

HOVERCRAFT plans, 3 to 160hp. Information, \$5 (refundable). Sevtec, Box 846, Monroe, WA 98272

SKATEBOARD HOVERCRAFT Video And Plans \$24.95. Technico, Box 973, Kalkaska, MI 49646

NEW MEXICO S.C.A.T. Parts, Service, Technical Assistance. Hovercraft & Rescue Systems. POB 90575, Albuquerque, NM 87199. 505-828-2273. Retro-fit/up-grades Available. Call for Details & Information.

CB'S, RADIO & HAM EQUIPMENT

POLICE-FIRE SCANNERS, CB'S, MARINE 2WAY, ANTENNAS, HPR, BOX 19224PM, DENVER, CO 80219

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 Tranceivers, Auto Alarms Catalog \$2.00. Rays, Box 14862PM, Ft. Worth, TX 76117-0862

ELECTRONICS

TINY MATCHBOOK VIDEOCAMERA, Under \$200!!! Tiny TV Transmitters! R/C Airborne, Helicopter Microvideo! Surveillance! Catalog, \$3.00. SUPERCIRCUITS, 13015 Debar Drive, Austin, TX 78729

CATCH THIEVES. Complete plans for device. Activates alarms, pagers, VCR camera, telephones. Easy assembly. Portable. Cover large areas. \$5.95. CBR, P.O. Box 16825, St. Petersburg, FL 33733

BUGGED? PHONETAPPED? Free Catalog Counter-Surveillance Equipment tells you Fast! 1-800-732-5000

WATCH Telememo Calculator Countdown Alarm Stopwatch World Time, Light, Date, Chime \$30.00. P.O. Box 17758, Philadelphia, PA 19135

SEXY? The Real "SPYSMART". NO JUNK, Good Electronics, Transmitters, NightVision, Surveillance, Cellular, Catalog \$5.00. OPERATIVE SUPPLY, P.O. Box 2343M, Atlantic Beach, N.C. 28512

LONG PLAY CASSETTE RECORDERS, Voice Activated, 12 Hours/Cassette. Other Surveillance/Countersurveillance Devices. Catalog \$3.00. Productive Electronics, Box 930024, Norcross, GA 30093

SATELLITE - TV

FREE DETAILS! INSTALL IT YOURSELF! Complete systems, upgrades. Orbitek Satellite Communications, Box 264-M2, Bohemia, New York 11716-0264. (516) 589-1292.

SUPER LOW PRICES. FREE U.S.-INTERNATIONAL CATALOG. SATMAN 800-472-8626

SATELLITE TV Factory Direct. 24 HOUR PRICING HOTLINE 516-763-6842. ORDERS AND INFORMATION 305-344-6000. ECHOTRAK

FREE Catalog - Lowest prices world wide. SKYVISION, 1022 Frontier, Fergus Falls, MN 56537. 1-800-334-6455.

TV, VIDEOS & VIDEO EQUIPMENT

NOTICE: USE OF CERTAIN ITEMS IN THIS CLASSIFICATION REQUIRES STATION AUTHORIZATION.

CABLE, WIRELESS AND SATELLITE DESCRAMBLING. All New 1992 Edition. Turn-ons, Circuits, Bypasses. \$15.95. VIDEOCIPHER HACKER'S MANUAL Includes Plus. New. \$15.95. SCRAMBLING NEWS, 1552 Hertel, Buffalo, NY 14216. (716) 874-2088. Catalog \$1.

DESCRAMBLER KITS. Complete cable kit \$44.95. Complete Satellite kit \$49.95. Add \$5 shipping. Free Brochure. Summit PM, Box 489, Bronx, NY 10465

CABLE TV EQUIPMENT

CABLE T.V. Signal Theft how it can go undetected, \$10. Backstair Library, 23205 Grallot, Eastpoint, MI 48021

CABLE Test Chips. Puts cable box into full service mode! \$29.95 to \$59.95. 1-800-452-7090, (310)867-0081.

CABLE CONVERTERS, ACCESSORIES BELOW WHOLESALE! Immediate delivery from giant stock! COD orders only. 1-800-995-1749

TOCOM'S-DPV72-S-DPV872'S All Your Cable Needs Best Prices. 1-800-942-6649

TRADE-IN YOUR OLD UNIT. New Jerrold Systems Works Everywhere. Lifetime Warranty. \$99.00. 1-800-864-3840.

CABLE DESCRAMBLERS! Build Your Own Descrambler for LESS than \$12.00 in SEVEN EASY STEPS. RADIO SHACK Parts List and FREE Descrambling Methods. That COST NOTHING To Try. Included. Send \$10.00 to: Harry White, P.O. Box 1790, Baytown, Texas 77522

"CABLE T.V. CONVERTERS" Jerrold®, Zenith, Pioneer, Oak, Scientific Atlanta, And Many More. 12 Years Experience gives Us The **ADVANTAGE.** VISA/MC, AMEX, COD. Advantage Electronics, Inc. 1-800-952-3918, 1125 Riverwood Dr., Burnsville, MN 55337

CABLE TV DESCRAMBLERS. BARGAIN HEADQUARTERS! We'll Beat Any Price. All Brands. Money Back Guarantee, 1 Year Warranty. **EZ ELECTRONICS 1-800-497-8273.**

CAMPERS & TRAILERS—KITS, PLANS

BUILD YOUR OWN - Travel Trailer - Fifth Wheeler - Motorhome - Camper - Pickup Cover - Plans - Patterns - Kits - Catalog \$1. Glen-L, 9152 Rosecrans, Box 1804/RV3, Bellflower, CA 90706.

172 TRAILER PLANS Motorcycle, Utility Car, Construction—Strong, Streamlined, Easily Built. Catalog \$4.00. (Refundable). Tag-Along, Box 15107, Salem, OR 97309

BOATS, OUTBOARDS, TRAILERS, & KITS

PRECUT BOAT KITS - PLANS - PATTERNS - AMERICA'S LARGEST SELECTION - 6'70" - Powerboats - Sailboats - Trimarans - Dinghies - Houseboats - Hydroplanes - Tunnel-hulls - Duckboats - Canoes/Strippers - Kayaks - Dorries - DISCOVER no dryrot epoxy boatbuilding - **HUGE ILLUSTRATED CATALOG \$3.00** (Airmail \$5.00). Book "Amateur Boatbuilding", \$6.00. - Free Epoxy/Fiberglass/Supplies Catalog - **CLARKCRAFT**, 16-6 Aqualane, Tonawanda, NY 14150

BOAT PLANS - PATTERNS - KITS - Unsurpassed selection - 7'55" - Hydroplanes - Canoes - Kayaks - Rowingboats - Duckboats - Dorries - Sailboats - Houseboats - Quick/simple Stitchenglu. Tremendous savings! 168-page DESIGN BOOK - \$4.00. Includes Free "Boatbuilding Supplies" catalog. "Epoxy Manual" \$2. **GLEN-L**, 9152 Rosecrans, Box 1804/PM3, Bellflower, CA 90706. 310/630-6258.

EVINRUDES—NEW 1991 Bargains - Top Brands ... all sizes ... \$2.00 handling ... Scott McCulloch parts ... Electra Marine, 610 Merrick Road, Lynbrook, New York 11563. INFLATABLES.

FIBERGLASS Repairs are Easy. Step by step instruction how to repair structural damage, wood rot & gelcoat refinishing. Faxline service for special problems. Send \$10. today to: Tempest Boats, Box 118, Caledon East, Ontario, L0N 1E0 Canada.

ATHLETIC EQUIPMENT/BODY BUILDING COURSES

BIGGER, Powerful Muscles Faster!! Free Booklet. Dynamethod. P.O. Box 591-M, Temperance, Michigan 48182

SUPER Big Muscles!! Guaranteed! Free Package! Marshall Research, P.O. Box 1893, Council Bluffs, Iowa 51502-1893

LOW-COST STEPPER. Build yourself. Free Details. ENCE, P.O. Box 2546, St. George, UT 84770

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.

SPORTING GOODS AND EQUIPMENT

SPORTSMAN'S Combo-Pocket Workshop, (Pliers/Eleven Different Tools), Mini-Flashlight, Lock-Blade Knife. \$29.99. Robert Roo, Box 290196, Sequoia Suite, Brooklyn Center, MN 55429. Further Info SASE. Thank You!

GUNS, DECOYS, HUNTING

AMMUNITION: BUY DIRECT AND SAVE. Complete line of Hansen cartridges. Vintage European and popular American rifle and handgun calibers; For price list and ordering information, send \$1.00 to: Oklahoma Ammunition Co., 4310 W. Rogers Blvd., Skiatook, OK 74070. (918) 396-3187.

TOOLS FOR SALE

BOLTS, SCREWS, TOOLS, WHOLESALE, DIRECT. Guaranteed. Catalog \$2.00 (Refundable). Camelot, Dept. 44, Box 65, Bristol, Wisconsin 53104

DISCOUNT and hard to find tools, wholesale prices, hundreds of items, catalog \$3.00. (Refundable). J and F, Box 70372, Dept. P, Ft. Lauderdale, FL 33307

HANDY 11-in-1 Pocket Tool, \$19.95! Money Back Guarantee. Horizon Sales, 114-W, 11th, Greenville, NC 27834.

MACHINERY, TOOLS & SUPPLIES

NEW Catalog - HUNDREDS of plans - **FREE** tap drill chart - Steel - Brass - Aluminum - Shop Supplies - Computer Control your machines Send \$2.00 - CEI, RR#1, Box 163PM, Cameron, IL 61423

METAL & Woodworking Machinery. Full Line Catalog \$1.00. Blue Ridge, Box 536-V, Hurricane, WV 25526. 1-800-872-6500.

HOBBYISTS improve your **LATHE** with the ultimate tool-post system! KRF, Box 783C, St. Joseph, MI 49085. 616-429-7050

FOUNDRY SETS Supplies, Brochure \$1.00. Pyramid Products, H.O.C.-1 P.O. Box 21, Niland, CA 92257. (619) 354-4265.

LATHES - INDUSTRIAL/HOBBY FROM \$350.00, METALS, SUPPLIES. LARGE CATALOG \$2.00. CAMPBELL TOOLS, 2100-D SELMA RD., SPRINGFIELD, OHIO 45505. 1-513-322-8562.

4' METAL Cutting Lathe \$121.70. Taig, 12419 Nightingale, Chandler, AZ 85249

LUMBERJACK chain saw sawmills - power-feed. Brochure \$2.00. Brown Engineering, Box 40, West Point, CA 95255

ENERGY SAVING

AFS RADIANT BARRIER - EASY INSTALLATION Energy Savings - Non-Toxic - Everlasting Home Comfort. Reduce summer attic heat by up to 30%. Helps prevent winter heat loss. Government tested and approved. Brochure and product sample - Send \$1.00. **AFS-ADVANCED FOIL SYSTEMS-** (800) 421-5947, 4471 E. Santa Ana St., Suite F, Ontario, CA 91761

HEAT

BY MULTIFLEX BURNERS

CONVERT a used oil gun. Operates efficiently on any flammable liquid. Waste oil - Transmission fluid - Solvents - Conventional fuels. For Industry - Home - Pool - Garage - Greenhouse - Hot tub. Simple design! Inexpensive to build! Kits and parts available with plans. \$35.00. Multiflex Burners, RR#2, Box 2376A, Factoryville, PA 18419

SOLAR & ALTERNATE ENERGY

SOLAR Collectors You Construct. Send Stamp. 10909-PMM Hayvenhurst, Granada Hills, CA 91344

NEW! BUILD AMAZING LIQUID PISTON ENGINE from pipe fittings. Easy plans, Free information. ABCO, Box 306-M2, Seminary, MS 39479

SOLATHERM

SOLAR WATER HEATING SYSTEM

SAVE Thousands. Build yourself using Engineering Firm's Blueprints. Detailed instruction manual. Parts List. Technical Support. Call 1-800-845-3363 **FREE BROCHURE.**

GIANT SOLAR PANELS \$44.00 EACH! Excellent Prices/Solar Equipment/Accessories. Free Information/S.A.S.E., Catalog \$3.00: Quad Energy, Box 690073, Houston, TX 77269. (713) 893-0313.

HOME CRAFTSMAN

MAKE WOODEN TOYS, whirligigs, banks, door harps, dollhouses, clocks, music boxes, weather instruments, crafts, furniture with our plans, kits, supplies—Catalog \$1.00—(800)-848-4363—Cherry Tree Toys, Belmont, OH 43718-0369

STAINED GLASS, tools, supplies, books, more. Catalog \$1.00 AmeriGlas - MPM302, Box 27668, Omaha, Nebraska 68127-0668.

PLANS, BLUEPRINTS, PROJECTS

CD STORAGE Ingenious design, simple to build. Holds VCR and cassette tapes also. Plans \$3.50 & SAE. Box 792, Grand-Mere, Quebec G9T 5L4

BUBBLE Machine, Complete Plans \$5.00. W. Ross, 6121 Hunt Club Rd., Eikridge, MD 21227

NEW! Build shop equipment of PVC Pipe. Information. G.F. Mullineaux, P.O. Box 77, Ottego, NY 13825

(Continued on next page)

PLANS, BLUEPRINTS, PROJECTS

(Continued from preceding page)

DOCTORS buggy kit, complete \$1,500. Instructional video for assembling kit, \$19.95. FCW, RR2, Box 70, Copeland, KS 67837. (316) 668-5626.

HOW TO BUILD GROW ROOMS Grow amazing plants. More information \$1 - Dennis Filingeri, 1 Robert Treat Dr., Suite B, Milford, CT 06460

PLANS For Beautiful Wood Display Steam Locomotives. \$1.00 for Brochure. Steamer Plans, Dept PM, 4341 Avon, Independence, MO 64055

BUILD Beautiful Arbors, 4 Styles, Trellis With Benches, 3 Styles. Plans, Material list, Detailed instructions, \$19.95 plus \$2.50 Shipping and Handling. B. Johnson, 29205 St. Croix Trail, Shafer, MN 55074

"BEAUTIFUL POST BEDFRAME" Build for under \$50.00, sell for \$300.00. Finish Southwest or any style. Plans \$3.00 to: L.E.F., Box 2073, Alpine, CA 91903

MICROWAVE Operation Tester Make For Under \$5.00, Send \$4.00. JF Plans, Box 316, Loveland, Ohio 45140

KILLER 1351b Tower Speaker System Featuring Twin 15 Inch Woofers. Complete Plans and how to \$12.95. CAP Ent., P.O. Box 162, Plainfield, CT 06374

ECONOMICAL HOUSE PLANS for low cost homes. Catalog \$5.25. Economical House Plans, 1223 Lawrence Ave., Eddystone, PA. 19022-1453

LOG CABINS

JUST For You! Information Service About Log Homes. \$9.95 Cassette Or Free Details. Becker's Frontier, 34285 Kale Avenue, North Branch, MN 55056.

FOR THE HOME

HOME SECURITY - Alarm Warning Decals Scare Off Burglars. \$7.95 For Ordering Information SASE. P.O. Box 643PM, Sterling Hts., MI 48311-0643

TRIPLE THE RANGE OF YOUR CORDLESS TELEPHONE with the range master outside antenna, \$50.00 Delivered and Guaranteed. Free Brochure Call (512) 929-8181.

ROOFING

STOPPING FLAT ROOF PROBLEMS SINCE 1978 LIQUID APPLIED FIBERGLASS REINFORCED ACRYLIC ROOFING SYSTEM. WATERPROOFS ASPHALT, METAL, NEW SHEATHING. CALL POLAR SEAL® 1-800-343-7563. "WEEKDAYS 8-5 CST"

GUIDE TO REROOFING Complete Step By Step Comprehensive Booklet. \$9.95 + \$1.05 S/H To: B.P. Custom Roofing 721 Newport Ave., Suite C, Long Beach, CA 90804

HOME BUILDING & REMODELING

TRADE SECRETS REVEALED!! SAVE \$1,000'S on Home Improvements FREE FACTS, Call 1-800-947-3835.

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. 93B/PM, 4915 Dean, Woodstock, IL 60098.

PRACTICALLY MAGIC PLASTIC™ Fantastic new material for repairing, molding, creating. REUSABLE. Sample, information \$3.00. Elemental-M23, Box 2099, Springfield, VA 22152.

RUBBER, plastic compounds, techniques, sources. Free information: Castcrafter, Box 16586 (A2), Memphis, TN 38186-0586.

AIR CONDITIONING & HEATING

REFRIGERANT RECOVERY SYSTEM-Light! Reliable! Fast! Cheap! Best! Kit Form \$479. Info \$3. Widmer AC/RPM, Rt. 2, Box 1035, Sanger, TX 76266. 817-458-5329.

DO IT YOURSELF

BELT BUCKLES for coins, stones, jewelry mountings, cut stones, clock works. Wholesale catalog \$1.00. Eloxite, Box 729, Wheatland, Wyoming 82201.

WATERCANON Shoots 50ft! Ten easy steps! Send \$5/SASE. SECO Services, P.O. Box 391072, Mountain View, CA 94039

LAZY Mans Way To A Flat Stomach Soon To Be Sold Nationwide By Inventor For \$399.00 Build it Yourself For Under \$40.00. Plans \$19.95. 2108 N Wilson Way, Stockton, CA 95205

METALWORKING!! Book catalog FREE ... BLACKSMITHING - CASTING - ELECTROPLATING - LOCKSMITHING - MACHINING - WELDING. Corbin, 7954 Transit Road, Suite 143M, Williamsville, New York 14221-4117

BUILD your own barrel BBQ! Illustrated instructions. Guaranteed. \$4.95. TSS, Dept. FN, Box 70023, Shawnee Mission, KS 66207-0023.

STEEL FRAME HOMES - Fast/Easy Construction, Strong, Economical. Tough Steel Homes. (817) 294-6063.

ARTS, CRAFTS, SUPPLIES

"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 \$1.00. Eloxite, Box 729, Wheatland, Wyoming 82201.

MINI-quartz clock movements as low as \$1.75 complete! Posters, epoxy, videos, kits, plans - over 2000 items! Wholesale catalog \$3.00 (credited) Steebar, P.O. Box 463-P, Andover, NJ 07821-0463.

MODELS, MODELS SUPPLIES

STEAM Engine, 1" Bore Behaves Like Big Engines. Runs On Low Pressure. Blueprints & Instructions \$20.00. Scribe Company, POB 221044, San Diego, CA 92192

STEAM Engine Kits. Machining And Ready To Assemble. Stamp For Free Brochure. Graham Enterprises, Box 15230, Rio Rancho, NM 87174

MAGIC TRICKS, JOKES, VENTRILOQUISM

VENTRILOQUIST Supplies, Instruction. Information FREE! Dummy Catalog \$2.00. Maher, Box 420-PM, Littleton, Colorado 80160.

FREE! Four Sensational Catalogs. **MAGIC**, Jokes, Novelities. Worlds Best Selection. **HUEY'S**, POB 505, Wallis, TX 77485

FREE! World's Leading Novelty Catalog. 1600 Jokes, Tricks, Science, Sports, Hobbies. Johnson-Smith, F-01, Bradenton, FL 34206-5500

CREATE OPTICAL ILLUSIONS! Amazing 3-D Drawing Device with Viewer, \$6.95. Wilder Products, Box 392, Bridgewater, CT 06752

AUCTIONS

PROFITABLE GOVERNMENT AUCTION GUIDE, ANY STATE \$5.00 to: Auctions, POB 80, Thompsonville, IL 62890

ANTIQUES, RELICS, ETC.

FREE List to Serious Collectors. 300,000 Indian Artifacts, Spears, Pots, 50,000 Minerals And Fossils. Caddo Trading, Box 689, 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. E23PM, Jamestown, NY 14701-0019

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

"PENNY Stamp Approvals." Regardless Catalog. Kloster, 4164 52nd St., San Diego, CA 92105

HORSE RACING Set Romania 29c Request Approvals Kenos Stamps, 118 S.E. Whitmore Drive, Port St. Lucie, FL 34984

1,000 Stamps, \$2.95. Guaranteed Worth Over \$30 at International Catalog Prices! All-Different. 55 Countries! Money Back. Other stamps to buy or return. Kenmore DM-774, Milford, NH 03055

UNITED STATES 10 Mint Commemoratives 10c. Approvals. Cornetta, POB 1509-M, Lake Placid, Florida, 33852

ISRAEL 15 Different 10c Approvals. Sam Chazen, Box 666, Delray Beach, Florida 33447

FREE Worldwide Packet, Penny Approvals. Froehlich, Box 177DA, Pine River, WI 54965

THIS IS A SCREENED AD!

LET Your Advertisement Achieve The Same Effect! For An Additional \$54.00 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.

PLAYS, SONGS, MANUSCRIPTS

CASH Royalty! Songs Composed From Your Poems. Broadway Music Productions, Box 7438, Sarasota, FL 34278

RE-UPHOLSTERING VIDEO TAPES

LEARN TO REUPHOLSTER "step-by-step videos" Information: Tomlien, P.O. Box 93, Mayo, MD 21106. Call/Fax 410-966-4225.

MUSIC INSTRUCTIONS & INSTRUMENTS

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 405, Warren, MI 48090. Catalogs 313-755-6060-800-325-1832

SELF IMPROVEMENT

STOP SMOKING - Nicotine transdermal. Doctor invented method. \$12. PhLaB, P.O. Box 1053P, Galesburg, IL 61402

QUIT SMOKING FOREVER, Now available, guaranteed money back, send \$16.00 to: Pacific Research, 4125-D McHenry, Modesto, CA 95356

EDUCATION & INSTRUCTIONS

INVESTIGATION CAREER. Quick home study. Become a professional. (800) 272-6680.

BECOME A PARALEGAL HOME STUDY, P.C.D.I., ATLANTA, GEORGIA. FREE CATALOGUE. 800-362-7070 DEPT. LB127.

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.

GREAT PAY AND EXCELLENT TRAVEL BENEFITS. FAA Certified Airframe and Powerplant Mechanic Course takes just 14 months. Offering a top quality, accredited program at a lower cost. Financial aid available to those who qualify. Housing available. **TWO LOCATIONS IN TEXAS**. Call for information packet. 800-678-0700

NONRESIDENT UNIVERSITY DEGREES. Bachelor's, Master's, Doctorates. Accredited, inexpensive, fast. Credit for life experience. Free sixteen page booklet. Dr. John Bear, Costedat & Bear Book Sales, P.O. Box 826PM, Benicia, CA 94510. (800) 835-8535.

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)

BE A LOCKSMITH. Money-making Career Opportunity. Send for a Free Book to the Locksmithing Institute, Dept. 310-023, Fairfield, NJ 07004

LOCKSMITHING, Universal School of Master, Correspondence and Shop Training. Box 214652PM, Sacramento, CA 95821

FREE Tracts. You Multiply, Christianize Cities. 1709 Fredricksburg Ave., Lakeland, FL 33803

MONEY FOR COLLEGE. SERVICES GUARANTEED. FREE DETAILS. STUDENT ADVISORY SERVICE, BOX 1647, LAKE WORTH, FL 33460. (800)727-2258 EXTENSION 2943.

FREE CAREER GUIDE. Earn more money with Success Proven Correspondence Diploma Courses. Granton Institute, 263A Adelaide Street, West Toronto, Canada M5H 1Y3

FREE VIDEO external BA/BS, MS/MBA, PHD/LAW. Accredited, financial aid. (800) 688-3542 La Salle University, Dept. #617, Mandeville, LA 70470-4000

UNIVERSITY DEGREES without classes. Accredited. Bachelor's, Master's, Doctorates. Free revealing Facts! Thorson-PM2, Box 470886, Tulsa, OK 74147.

SURVIVE TECHNOLOGICAL ERA. Sharpen your thinking. Home mathematics course. Professor Tonne, 1946-PM Edinburgh, Atlanta, Georgia 30307-1114

HOW TO GET CRUISE SHIP JOBS \$5.00. CEP, 5150 Fair Oaks Blvd. #101-308, Carmichael, CA 95608

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, MD (Harvard), President, Columbia Pacific University, Dept. 2F82, 1415 Third Street, San Rafael, CA 94901. Toll free (800)227-0119; California: (800) 552-5522; or (415) 459-1650.

SCHOOLS

WORLD WIDE COLLEGE OF AUCTIONEERING, INC. (formerly Reich) Term soon. Free catalog. **COL. GORDON E. TAYLOR**, Box 949, Dept. 19, Mason City, IA 50401. 515/423-5242

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.

HELP WANTED

EASY Work! Excellent Pay! Assemble Products At Home. Toll Free 1-800-467-5566 Ext. 5038.

OVERSEAS. To \$1000 Daily! FREE list. ZINCPO, Box 585, Dearborn, MI 48120

GUARANTEED Work! Top Pay! Assemble easy products at home. 1-800-377-6000, ex7030.

OVERSEAS ... \$30,000 - \$75,000+. Free Report! Employment, Box 5730-AN, Lighthouse Point, FL 33074.

\$329.84 Weekly, Assembling Our Products At Home. Toll-Free Information: 1-(800) 333-3294.

FREELANCE READERS NEEDED! \$30,000/Year Income Potential. Details: 410-637-5594, Ext. 70. 24 Hours.

WORK AT HOME! EXCELLENT PAY! Easy Product assembly! Toll Free 1-800-873-6365 Ext. 5011.

NEW PRODUCTS

STOP CROOKS COLD! New magnetic impulse padlock. Virtually pick-proof. Two keys included. Send check for \$12.95 to: InterProd, P.O. Box 32248, Raleigh, NC 27622.

FOR INVENTORS

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 11746-4879. (516) 499-4343

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-two 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** 800-367-7749 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.

INVENTORS! Can you patent and profit from your idea? Call **AMERICAN INVENTORS CORP.** for free information. Serving inventors since 1975. 1-800-338-5656.

PATENT SEARCHES. FREE Details. PatentFinders, Suite 185-B, 3220 N Street, N.W., Washington, D.C. 20007.

ACCUSEARCH Specializes in Thorough, Prompt, Inexpensive Patent Searches. 1-800-999-5498.

REGISTERED PATENT ATTORNEY, D.A. Kettlestrings. Free Information. 1-800-966-7577

HAVE AN IDEA? INVENTORS for **FREE INFORMATION PACKAGE/FREE REVIEW**, call **FREEDOM MARKETING INC.** 800-932-4298.

INVENTORS Don't Be Fooled - Call Our Inventors Club 1-800-466-1793.

AVOID "SCAMS" - Free Government reports exposing invention marketing companies. 1-800-428-5779.

LOW COST PATENT SERVICES By Experienced Inventor/Engineers. Your Idea May Become A Profitable Invention. Free Information. **"INVENTORS HELPER,"** P.O. Box 276, Bergenfield, N.J. 07621

FREE help for inventors! No charge for protection forms and information kit. Affiliated Inventors Foundation. 1-800-525-5885.

TRADEMARK and Copyright application information \$10.00. JLE, 13815 NW Milburn, Portland, OR 97229-5713

INVENTIONS, ideas, new products. We submit to industry. Call 1-800-288-IDEA.

INVENT SOMETHING? Free Eureka Solutions International invention/idea package provides unique marketing information. 1-800-547-7885.

INVENTORS! Comprehensive Patenting/Marketing services can help you profit. **FREE ADVICE!** Call **ADVANCED PATENT SERVICES**, 800-458-0352.

INVENTORS: If you have an invention for sale or license, write for free booklet explaining how we can help you. Kessler Sales Corp., C-5-FI-3, Fremont, Ohio 43420.

INVENTORS' Digest. America's Only Inventors' Magazine. \$20/year. Satisfaction guaranteed. Free patent manual. 1-800-525-5885.

PATENT Search. Rapid Patent, The World's Largest Private Provider Of Patent Documentation, Located Next To The U.S. Patent Office. Offers Low Cost Manual And On-Line Computerized Patentability Searches. Fastest Service. Satisfaction Guaranteed. For Information And Estimated Costs Call 1-800-336-5010 Ext. 31

INVENTORS-NEVER DIVULGE IDEAS TO STRANGERS! Avoid ripoffs - save thousands! Revolutionary protection/marketing method! Nonprofit organization. Free information 24 hours: 1-800-846-3228.

ALL New Ideas/Products Free Patenting, development, licensing package, call Davison & Associates 1-800-677-6382.

INVENTIONS WANTED

INVENTIONS DEVELOPED & MARKETED. Licensed Professional Patent Engineer. U.S. Patent Office Former Examiner. Manufacturers Representative. Patmart, Suite 702PM, Woolworth Bldg., New York, NY 10279.

ATTENTION! No fees to inventors! Call Inventors Awareness Group for free brochure. 1-800-288-3938.

LEARN how to offer your invention for sale or license. Free booklet outlines procedures, royalty rates, requirements. Kessler Sales Corporation, C-5-IW-3, Fremont, Ohio 43420.

REAL ESTATE

BIG Profits Nationally, Real Estate Foreclosure, Repos. Free Report, Al, P.O. Box 490, Danville, CA 94526-0490

CALIFORNIA Land. \$50 Down. \$50 Monthly. PM, Box 35291, Los Angeles, 90035.

COUNTRY REAL ESTATE CATALOG—United National's **NEW** catalog features over 200 pages of the best country real estate bargains across America! Wilderness lands & retreats, farms, ranches, historic homes, waterfront properties & more. Send \$4.95 to: **UNITED NATIONAL REAL ESTATE**, 4700-PM Bellevue, Kansas City, MO 64112. Or call 1-800-999-1020, Visa/MC accepted.

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 HOMES from \$1 (U repair). Delinquent tax property. Repossessions. Your area (1) 805-962-8000 Ext. GH-20024 for current repo list.

GOV'T LANDS

GOVERNMENT Land now available for claim. Up to 160 acres/person. Free recorded message: (707)448-1887. (4KZ3)

BUY IT WHOLESALE

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

CLOSEOUT Jewelry & Craft Supplies. (Catalog 50¢). Roussels, 107-1631 Dow, Arlington, MA 02174-7199

VACUUM CLEANERS "Discount Prices" New Rainbow \$699.95 Nozzle \$149.95. Kirby, Filter Queen, Tri-Star, Panasonic, Royal, Oreck; ABC Vacuum Warehouse, 6720 Burnet-PM, Austin, TX 78757. (512)459-7643.

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

WORLDS FINEST WATCHES. Top Quality Replicas. Below Wholesale Prices. Brochure. 1-800-553-4334.

MAKE BIG PROFITS, over 2500 items. \$3.00 brings giant catalog refunded with first order. Harbor Products, 3809 Powner, Dept. 210, Cincinnati, Ohio 45248

RUBBER STAMPS

MAKE Rubber Stamps. Highly Profitable. Free details. Stamper, POB 22809 (GX), Tampa, FL 33622

PRINTING PRESSES, RUBBER STAMP OUTFITS

TYPE for printing and stamps. Catalog \$2.00 deductible. Quaker City Type, R.D. 3, Box 134, Honeybrook, PA 19344

PRINTING Presses, Type, Supplies. List \$1.00. Turnbaugh Supply, Mechanicsburg, PA 17055

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. 658, Chicago, 60603.

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

BURIED TREASURE - Sensitive equipment allows locating from distance. Brochure free. Simmons, Box 10057-MA, Wilmington, NC 28405.

PROFITABLE OCCUPATIONS

FREE information Starter & Alternator Rebuilding. Box 422, Seymour, TN 37865

PLASTERCRAFT ... Profitable Home Business 3000 Molds Available. Details. Lynnette, 6251C Mentpark, Mentor, Ohio 44060.

EARN \$1000's Contracting Masonry, Concrete, Drywall. I contracted over \$25,000,000. Free information: Contracting, 21918 Hempstead Hwy., Houston, Texas 77040

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. H2703, Woodland Hills, California 91367

\$225 DAILY "CHROME PLATING" Auto Parts, Motorcycles, inexpensive, easy. (Free) information: Chrome Plating, Box 2285, Waldorf, Maryland 20604

\$750 Daily From Your Answering Machine, Voice Mailbox. Message 904-462-7826. PlantBiz, POB 1290-M, Alachua, FL 32615

HOMEMADE Money! Free catalog reveals 33 fun, easy homebased businesses. Guaranteed. Write: Ideal Publications, Box 2127, Orangevale, CA 95662-2127

BE YOUR OWN BOSS. REPAIR CRACKED WINDSHIELDS. It's easy. We'll teach you how to start and run your own business. Keep all the money you earn. Patented Equipment. **FREE** valuable report. Call 1-800-321-2597. Glas-Weld Systems, Inc., Box 5755-D, Bend, OR 97708

#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, 911-PM Bryant Place, Ojai, CA 93023

\$36,400 A Year, Part Time. Office Cleaning Business. No Investment. Not Available in NH Free Details: Rob, Box 3112, Manchester, NH 03105

ATTEND America's largest invention show. Over 1000 inventions from 21 countries. May 1993. 412-288-1343.

START LEGITIMATE Highly Profitable Mailorder Business. Send \$2 to: CD Limited, P.O. Box 4101, Wheaton, IL 60189-4101

BECOME A REAL ESTATE APPRAISER. \$100,000 Potential. Home Study. Earn Professional Designation. P.C.D.I., Atlanta, Georgia. Free Literature. 800-362-7070 Dept. RB127.

BUMPERSTICKER Printer. Cheap, simple, portable. Free details. Bumper, POB 22791 (GC), Tampa, FL 33622

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 77520-4157

(Continued on next page)

BUSINESS OPPORTUNITIES

(Continued from preceding page)

RECYCLE METALS. NO, NOT BEER CANS! Easy \$458 weekly! Free information. Recycler, Box 681804, Franklin, TN 37068-1804

PIANO Tuning quickly learned with home study courses. Diploma granted. American Tuning School, 17050 Telfer Drive, Morgan Hill, Calif. 95037.

MAKE YOUR DREAM COME TRUE, EARN \$75,000 YEARLY REPAIRING CRACKS IN WINDSHIELDS AND PLATE GLASS. NOT REPLACING THEM. CALL 1-800-826-8523 (US/CANADA): THE GLASS MECHANIX INC., 5313 NOB HILL ROAD, SUNRISE, FL 33351

\$392.00 From Square Foot Plywood. (Huge Demand) \$1.00. (Refundable). Woodwin-PM, POB 859, Bridgewater, Mass. 02324-0859

LEARN Sewing Machine Repairing. Men, Women. Lucrative Profits. Gresslin Correspondence School, Box 5104, Spencer, Iowa 51301.

NEW! GROW EXPENSIVE PLANTS. SELL FOR 2,000% PROFIT. Free information. Growbiz, Box 306-M2, 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 401092-M, Hesperia, CA 92340

BIG PROFITS! REPAIRING WINDSHIELDS and plate glass. \$70,000 yearly. Call 1-800-441-4527 for FREE details. Glass Technology, Inc., Dept. 2P, 434 Turner Dr., Durango, CO 81301

\$40,000 ON 1/2 ACRE! New Hydroponics - inexpensive, pleasant, practical! Free information. Robin's, Box 681804, Franklin, TN 37068-1804

\$1,000 WEEKLY AIR TOOL REPAIRING. Instructions, Parts and Tools Wholesale. Free Details. Box 534, Wichita Falls, TX 76307

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. 20-50, Chatsworth, CA 91311-4991.

\$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.

GET RICH! Secret law smashes debts—brings Cash, Credit!! Details 50¢ (coin). Wealthkit/B, Box 32398, PBG, FL 33420

\$300.00 PER DAY for MAILING LETTERS! Details 50¢ (coin). Money-makers/B, Box 32368, Palm Beach Gardens, FL 33420

\$400.00 DAILY from your telephone answering machine!! Never talk to anyone! Details 50¢ (coin). CommTech-B, Box 32398, Palm Beach Gardens, FL 33420

NEON, COURSE WITH FREE VIDEO! NEONICS, BOX 4410, ARLINGTON, VIRGINIA 22204

NEW! 2000% PROFITS - in Moldmaking/Casting. Free information. Castcrafter, Box 16586(M2), Memphis, TN 38186-0586

\$2,000 DAILY From Your Telephone Answering Machine! I've made over \$1,000,000 using mine! (303) 674-2219. Recorded Details.

\$200 - \$500 weekly—AT HOME!! No gimmicks—Details 50¢ (coin). Homeworkers-B, Box 32397, PBG, FL 33420

RECYCLE! (AMAZING PROFITS MADE) Reconditioning Automobile Batteries! (Free) Information! Battery Outlet, Box 3300PM, Hickory, N.C. 28603-3300.

BUY Wholesale! Direct from factories. Hong Kong, Taiwan, Philippines. Free Report. Key-Ways, Box 86884-PM, Portland, OR 97286

RECORD VIDEOTAPES ... At Home. \$5,000 Monthly Possible. No Pornography. Free Details. Write: CMS Video Company, Dept. 17, 210 Lorna Square - #183, Birmingham, AL 35216.

COUNTERTOPS: Spot Repair Burned and Damaged Areas WITHOUT REPLACEMENT! Quick, easy to \$800/day. Change Countertop Colors WITHOUT REMODELING! Details Free! 206/256-9742. Renew-All, Box 4506-PC, Vancouver, WA 98662.

WANT to stay home and make money? Write to: Diamond, 5025-C Rapido, Houston, Texas 77033.

MAILORDER MAGIC! NEW profit ideas revealed! Free information! Colvin, 1696F Lawhorn Road, Cassatt, SC 29032

\$1804 MONTHLY Buy/sell used cars (spare-time) FREE Details. Autonet, 507 Oak Drive, Friendswood, TX 77546

MAKE Thousands at the BEACH Doing What Others Aren't! FREE Details. Switzer, POB 555786, Orlando, FL 32855.

MAKE homemade "How-to/opportunity" booklets. Mine have earned \$436,097. Money never stops. Free information. Booklets, 507J Oak Drive, Friendswood, TX 77546

\$320,000 YEARLY SELLING BOOKS BY MAIL. RECRUITING BUSINESS ASSOCIATES. TPCF, BOX 4113, TORRANCE, CA 90510

I RETIRED and earned over ONE MILLION DOLLARS selling part-time with no investment, no deliveries, and no collections. INFORMATION \$4.00. Wait Boyle, Dept 410, 511 Bermuda Run, Bermuda Run, North Carolina 27005

21,497 Products, Direct. TAIWAN, PHILIPPINES, HONG KONG!! Samples, Small lots, Freebies! Box 739-PM2, Shalimar, FL 32579-0739.

STAY HOME, MAKE MONEY. \$100s daily possible. Quick, easy. Guaranteed. Recorded message reveals details: (612)649-4800 (J30)

33 PROFITABLE HOME BUSINESSES no capital or experience—FREE CATALOG. Info-Trader, 3703 S.-PM 1100E., Hartsville, IN 47244

BIG MONEY REPAIRING AUTO WINDSHIELDS. Supplies and information. Grubbs Glass Patch, P.O. Box 243, Monticello, AR 71655. 1-800-243-2213

BE A DETECTIVE, professional secrets revealed. FREE catalog. NORTHWEST, 14431pm Ventura Blvd., Sherman Oaks, CA 91423

SECRET MILLIONS FOR YOU! Incredible Wealth Loopholes Revealed. Be One Of Lucky Few. Free Exciting Details: Trimax, Box 1767PM, Eau Claire, WI 54702

MAILORDER OPPORTUNITY: Start profitable home business without experience or capital. Information free. Mail Order Associates, Dept. 473, Montvale, NJ 07645.

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.

JOIN HOME-WORKER'S ASSOCIATION — Get "Guaranteed Legitimate" home-employment offers! (Many Choices!) Write: Association - PM293, Alexandria Bay, New York 13607-0250

VALUABLE Financial Report: How To Make Money At Home With Your Computer. By: S. David Sevin, \$6.95. Global Publishing, 800 McDonell, Columbus, Ohio 43230-1620

\$1000'S weekly possible! Automotive, Home Tools, Other Products, \$5.00. R. Baum, Box 68-A, Trenton, IL 62293

FREE REPORT — How To Get \$25.00/Pound For Your Scrap Aluminum. Write: Ameriscrap - PM293, Alexandria Bay, New York 13607-0127

TRASH IS CASH! \$1,000 Daily Possible. We Do It. Report Reveals Market Secrets. Rush \$5.00 To: Brian, Box 918H, Point Roberts, WA 98281.

ALMOST SINFUL PROFITS! Instant home moneymaking kit. Details, LSASE. Hot Profits, Box 7423, Trenton, NJ 08603

TYPING - Hand Addressing. \$500 Weekly Possible. Write: National, Box 104 - PM, Island Park, New York 11558.

START your own profitable Mailorder business. Free details. I&I, Box 1831A, Kingsville, TX 78364-1831.

"MAKE THOUSANDS AS SCRAP GOLD BUYER" 18 Page Report \$10. Goldblizz, 177 Telegraph Road, 397A, Bellingham, WA 98226

\$250.00 Daily Recovering Pool Tables, Manual \$12.95. Bilco, 1304 Algonquin, Suite 112, Algonquin, IL 60102

FREE INCOME

FROM Ultra International Corp. worldwide family income system. Worth thousands! "Pay one time club membership fee!" Entire system benefits are yours. No extra charge. It's recession proof, tested and proven. Rush LSASE for FREE INFO PAK, JR Investment Services, Inc., PO Box 310P, Isabella, MO 65676

NEW ORIENT TRADE DIRECTORY \$17.50 or S.A.S.E. for details. T.M. Rose, 6797 "D" Court, Springfield, OR 97478-7147

DISTRIBUTORS NEEDED for a new line of high-tech security alarm products. FREE INFORMATION. SSB, 312 E. Foothill, Washington, UT 84780

START A NEW CAREER! YOUR OWN BUSINESS! Where, What, Why, And How Much? Send \$7.00 for Manual. Info-Plus, P.O. Box 278, Bethany, CT 06524

SECRET Plan Brings You \$930.00 Week Through Absolutely Free Valuable Products! Guaranteed Demand! Rush \$3.00 Shipping: Gorlick, 334 Two Mile, Tonawanda, N.Y. 14150

BIG PROFITS IN AUTO SECURITY. NO EXPERIENCE NECESSARY. 1-800-238-2155. 24HRS.

WE'LL Pay You To Type Names And Addresses From Home. \$500.00 Per 1000. Call 1-900-896-1666 (\$1.49 min/18hrs.+) or Write: PASSE - XPM293, 161 S. Lincolnway, N. Aurora, IL 60542.

15,000 PRODUCTS. BUY LOWEST Prices Direct From Factories. Free Report. RECO, 40023 Vernon Road, Gattman, MS. 38844

RECONDITION AUTOMOBILE BATTERIES! Low investment, Profitable, Homebased, Easy. Free Details. Batteries, Box 2738PM, Zanesville, Ohio 43702.

PROFIT From Your Pickup! Money Never Stops! EXCITING FREE EXAMPLE! Bielkiewicz Publishing, Box 175A2, Greenfield Center, NY 12833-0175.

OPERATE HOME BABY SHOE Bronzing business. Potential unlimited! Kits, Supplies, Store Displays. FREE information 1-813-655-0346

PRICELESS information about 1,000 opportunity offers. How to judge for yourself. Play it safe! Details from Cypress Books, Box 8638-A, Fort Worth, Texas 76124.

OWN A Computer? Now You Can Make Top Money At Home. Learn How. Opportunities, Box 4035-P, Orange, California 92613-4035

PERFECT HOME BUSINESS! Market books, tapes, software worldwide by mail. Residual income. No inventory. Details, full color catalog \$1.00. Foster, Box 308-PM, Oakhurst, NJ 07755. (908)988-6896

PRIVATE INVESTIGATION TRAINING! BIG INCOME! OWN BOSS! FREE INFORMATION. PROBE, BOX (PM) 2133, BEVERLY HILLS, CALIFORNIA 90213-2133.

DISCOVER SUCCESSFUL MINI STORAGE SECRETS. Create, market, operate. Free details. Action, Box 21M, Sturgeon Bay, WI 54235-0021

START your own business at home. Free information. Warren's, 5866E Callister, Sacramento, CA 95819

ASSEMBLE Products At Home. Many Opportunities paying High Weekly Profits available without investment. Businesses-B, Box 9008, Baldwin, New York 11510-9008

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.

MONEYMAKING OPPORTUNITIES

FREE POPULAR MAILORDER MONEYMAKING BOOK! Reprint/resale rights included. Outstanding opportunity with unlimited income potential. \$1 (refundable) brings details. Advantage Publishing Company, POB 619-P, Redan, GA 30074

"HOMEMADE MONEY." Turn crafts into cash! Easy, fun. Write: PJ Enterprises, Dept P2, 3802 West Barnes, Phoenix, Arizona 85051

FORTUNES ARE ATTAINABLE. Start achieving Success and Financial Independence today. (Free) information. Fathom Enterprises, P.O. Box 1116, Southold, NY 11971

(Continued on next page)

MONEYMAKING OPPORTUNITIES

(Continued from preceding page)

PROVEN INCOME PROGRAM. Earn 897% Markup. Ideal home business. Shurwood, Box 3874, Walnut Creek, CA 94598.

SECRET SOURCES OF BARGAIN PROPERTIES!!! Send \$5 to: Diversified Services Agency, 415 Conant St., Box 8773, Maumee, OH 43537

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

RECESSION PROOF! Home Repair Business. Complete Booklet - How To Start, What To Charge. Great Income! \$9.95. GHM, P.O. Box 44024, Tucson, Arizona 85733

YOUR special knowledge in any field could qualify you as a paid expert court witness. Monthly newsletter tells how. For a free test and information write to: The Expert, Box 15242, Portland, OR 97215

EASY Business. Earn \$1,000's Weekly. Free details. Write or send stamped addressed envelope: Toddco, 4219 W. Olive Avenue, Burbank, CA 91505

EXCELLENT Income Full or Part Time! Professional Knife Sharpening! **IT WORKS!** Video Cassette shows Easy Step-By-Step Instructions and More! Low Start-Up Cost and Overhead: \$49.95 plus \$4.50 S&H. Clean-Cut Knife Service, 4805 S.E. 99th, Portland, Oregon 97266. Not Available in Oregon.

EXCITING Home Money Making Opportunities! \$2. J.J. 14200 Centreville Square, Suite 125PM1, Centreville, VA 22020

CASH For Exercise And Educational Videos. Information and Shipping Instructions \$2. Educational Services, 1110 Bexley, Marion, Ohio 43302

AUCTION: BUYING REAL ESTATE At ... Free Information! M&M Publishing, Box 253, Lexington, MA 02173

MAILORDER OPPORTUNITIES

MAILORDER Millionaire Reveals Money-making Secrets. Free, exciting cassette: Mel Powers, No. Hollywood, California 91609

EXCELLENT MAILORDER PROFITS. Free details. Lake's, 410-B, O'Connor Drive, Toronto, Canada. M4J 2W3

BALDING

GROW Hair 4 Months. New Discovery! Box 1012-C, Makati 1250, Philippines. Brochure \$1.00.

HAIRPIECES FOR MEN

HAIRPIECES Save \$ Write Perry King, 2730 Octavia St., San Francisco, CA 94123

BUY Hairpieces Direct and Save. Quality Imports, 3106 9th St. N. #134, Naples, FL 33940

HAIRPIECES - Quality - Discounted prices! Write: 1926 South PCH, Redondo, Calif. 90277.

OF INTEREST TO ALL

FREE PRIVACY CATALOG. Cash income opportunities. Secret loans. New identity. Eden, Box 8410-PC, Fountain Valley, CA 92728. 1-800-338-8484

ROLL TOP LUNCH BAGS-100% Nylon, Washable, Reusable. 3/\$8.95. Send to: JD Kat, 676 New Haven Ave., Suite 2, Derby, CT 06418

THE NITELIGHTER PEN. Built-in flashlight. Write easily in the dark with the light that writes. Batteries included. \$10.95 + \$3.00 S&H. Carlson's Cache, 25675 100 St., Zimmerman, MN 55398

BLACKJACK Players. Make \$100 hourly. Guaranteed method. Free Report. 1-800-842-0783.

IF YOU'RE having problems financing college, we can help. Money back guarantee. Low rates. (800) 392-4634.

EYE OF THE TIGER! JUNGLE SURVIVAL KNIFE. Stainless steel, sheath, all accessories. **LIFETIME GUARANTEE.** \$15.95 check or money-order. Irish Enterprises, Box 444, Rutland, Ohio 45775

GINP THINK-TANK FAILS ALL UNIVERSITIES' ESSENTIAL ACCREDITATIONS: Non-Technical. Pseudo-Knowledge. Non-Pseudo-Knowledge. \$28.00. Box 40538, Redford, MI 48240.

FORBIDDEN (rare) devices and knowledge sourcebook. Write: #365-X2, Penfield, NY 14526-0365

TRANQUIL SOUNDS OF THE OCEAN Audio Tapes \$19.95. Tranquil Ocean, P.O. Box 2394, Ventnor, NJ 08406.

HURRICANE/EARTHQUAKE PROTECTION. Before You Build Send For Copyrighted System Designed To Prevent All Damage. \$2.00 To: Kelly, P.O. Box AA474, Blaine, WA 98231

LIVING Will protect your family's estate and your own right to avert extensive life support systems. Enables your representative to consult with physician, hospital. Kit includes documents and detailed instructions. \$9.95 + \$2.40 shipping. K. Bina, Box 995, Westminster, Calif. 92683

KEYLESS, Pickproof, Solid Cast, Non-Corroding, Magnetically encoded padlock. 36 centimeter. \$9.00 S/H \$3.00. Taffel Enterprises, 17011 Pinehurst #C, Huntington Beach, California 92647.

OF INTEREST TO MEN

SPORTS-SPORTS-SPORTS Pro choices by Pro handicappers the best action. 1-900-438-0314. \$20.00 per call.

GOVERNMENT SURPLUS

DRUG RAID SEIZURES: Buy Dirt Cheap! Cars, houses, boats, computers: Seizures, Box 51488-A, Ontario, CA 91761

LOANS BY MAIL

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

SIGNATURE Loans Must Have Checking Account & Steady Job. 1-800-445-0680.

LOANS BY MAIL. Free Application! Quetzal Co., Box 537, Walla Walla, WA 99362

BORROW \$100-\$100,000! Fast! Confidential! Glendale, Box 260279, Plano, TX 75026 - 1-800-444-6599

FEDERAL LOANS for small business now available. 1-800-777-6342 for free details.

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. Associates-AX, Box 9008, Baldwin, New York 11510-9008

PERSONAL

HOW to get a girlfriend in three dates! Booklet shows you how. \$6.50 to: Century Relationships, Box 650495, Fresh Meadows, New York 11365

COLLEGE DEGREES, High School Diplomas. Authentic looking novelty. Free Catalog. Dept. PM-142, National Certificate, 126 13th St., Brooklyn, NY 11215. (718) 768-6803 (24 Hours) FAX 718-965-3400

REMAILING SERVICE

CONFIDENTIAL Mail Receiving. Forwarding Worldwide. MailPost, 2421-M Pratt, Chicago, Illinois 60645. (312) 764-0100.

FREE! REMAILERS LIST, AGENTS NEEDED. PS, Box 29658, San Antonio, TX 78229

MISCELLANEOUS

ROACH BAIT non-poisonous to mammals. Send \$5.00. Debugged, Box 1004, Manchester, NH 03105

WANTED MISCELLANEOUS

BUYING Tungsten Carbide, Moly, Tantalum, Gold, Silver, Platinum 1-800-321-6914.

GOLD, Silver, Platinum, Rhodium, Tantalum, Samples Evaluated Free. Ore Assaying Service. Call Wholesale Terminal Toll Free: 1-800-932-1010

FINANCIAL

GET FREE CASH! Private grants. Foundation giveaways. Loans. Millions available. Sources, Box 5529-A, Diamond Bar, CA 91765.

ERASE BAD CREDIT obtain Visa/MC-Amazing Recording Reveals Details 1-800-484-7540 Code 6893 (24 hrs).

ARE YOU SICK Of Being Denied, Rejected, And Refused Credit Cards? Secrets To Easy Credit Repair Revealed. Information Free. Venus Enterprises, 568 N. 17th St. Dept. F, San Jose, CA 95112.

COMPUTER-Erase bad credit free instantly, legally. Free details: Gold(PM), 13950 Ventura, Sherman Oaks, CA 91423

HEARING AIDS

HEARING AIDS - GUARANTEED LOWEST PRICES! No huge commissions. Home trial, terms. All makes. We're the oldest, biggest, best. Custom instrument specialists. Free information, 1-800-323-1212. Lloyds-PMC.

FREE Hearing Aid Catalog. All Models. Huge savings! No salesman will call. Rhodys, Dept. 31B, Brookport, IL 62910. 1-800-466-3100.

FREE HEARING AID CATALOG-HUGE SAVINGS By Mail, **FREE** 30-day Trial. Amazing Technology. 531 Main Street Suite 335-M2, El Segundo, CA 90245. Call 1-800-382-0002

CONTACT LENSES

WHOLESALE Contact Lenses. All Brands. Example: Disposables-\$17.00. Bausch & Lomb Softlens-\$11.00. 1-800-521-3511.

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

SPECIAL SERVICES

INFORMATION. On anything. Ferguson Research Specialists, 60-15 Woodside, Woodside, New York 11377.

HERBS

NEW herbs for diabetics, cancer, aids victims. Sample \$2.00. Sto. Nifo Botanicals, Box 1976-PM, Manila, Philippines.

HEALTH, VITAMINS

"ORIENTAL MAGNETIC HEALERS" For Blood Circulation, Muscular Pains, sores. 20 Piece Package, Only \$14.95 Includes Shipping. "Money Orders Only" Sanyu Corporation L.T.D., 1-31-13-101 Setagaya Setagaya-ku Tokyo, Japan 154

LOWER YOUR CHOLESTEROL NOW! Outstanding audio tape and 94 page book compiled by Dr. Art Ulene. Results in 30 days! Only \$16.95. D.B.W. International, P.O. Box 451, Big Bear Lake, CA 92315.

REVERSE HAIR LOSS, GRAYING! Guaranteed natural home remedy. Free brochure. 1-800-477-9006

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

HOME CANNERS-Order everything you need: canners, jars, Rubber rings, spices, more. Send \$1.00 for catalog. Home Canning Supply, P.O. Box 1158-PM2, Ramona, CA 92065

RECIPES, COOKING, ETC.

EASY Minute Microwave FUDGE. Old-fashioned taste. \$3.00 SASE. 1806-Oakdale, Cairo, GA 31728-3582

UNCLE LEW'S FABULOUS PANCAKE RECIPE. Send \$3.00 + SASE to: Uncle Lew, Box 1004, Manchester, NH 03105

ULTIMATE CHOCOLATE Cake Recipe. LSASE \$2. Maya, Box 580, Archer, FL 32618.

HURRICANE INIKI RELIEF RECIPES!

"COOKING Out, Island Style" Recipes for Hawaiian Barbeque. \$10 to: KPCCo., Dept. P02-0100, 6155 Kala Kea Place, Kapaa, Hawaii 96746-8643. Proceeds Benefit Kaula's Hurricane Relief Efforts.

DADS Peanut Brittle Recipe. Send \$2.00 SASE. D. McNeely, P.O. Box 76, St. Paul, Ind. 47272

PIZZA LOVERS Delicious Recipe **FOR PERFECT PIZZA,** \$3.00 SASE: Jim's Gourmet, 555 Saturn Blvd., #B231, San Diego, CA 92154

WINEMAKING, BEERMAKING, ETC.

FREE! LARGE INFORMATIVE CATALOG. Cottage Brewing, Box 14098-R2, Rochester, NY 14614.

BEERMAKERS-Winemakers Free Catalog. Fast Service. Free Recipes. Cellar-M, Box 33525, Seattle, WA 98133, 800-342-1871

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. Simplex, Box 11476P, Minneapolis, Minnesota 55411

WINEMAKERS - BEERMAKERS - Free Illustrated Catalog - Fast Service - Large Selection - Visa/Mastercard - (816) 254-0242 - Kraus, Box 7850-L, Independence, Missouri 64054.

FREE BEERMAKING BOOK-Catalog. Finest Equipment. Ingredients. Fast Service! 1-800-852-9545.

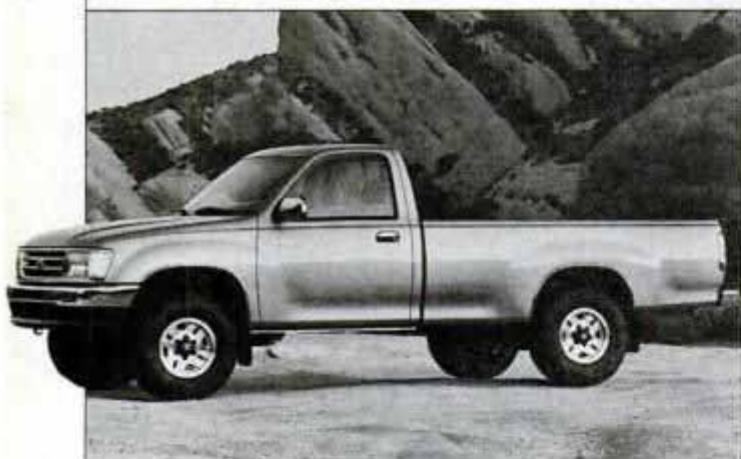
OLD Kentucky moonshiner's homebrew recipe. Send \$2.00 to: Albert's Recipe, 710 Ringstaff Rd., Grand Rivers, KY 42045.

BEERMAKERS - Lowest Prices - Free Illustrated Catalog And Instructions - Fast Service - Extensive Selection - Beginner Kits. 1-(800)-5-BREW-HA, Brewhaus, 10521 Springvale Forest, Great Falls, Virginia 22066

FREE. Homebrewer's catalog. Brewery, 1300 Quincey, Minneapolis, MN 55413. 800-347-4042.

NEED HELP Figuring the Cost of your Advertisements?? Call us at 212-649-3167 or send us a FAX (212-586-5562) and we'll FAX Back with a Price Quote.

COMING NEXT MONTH



America's First Bullet Train

Our cover story takes you on a ride on the fastest train in the U.S.—Amtrak's new 125-mph X2000. Tilt-axle technology enables the train to take curves at speeds 40% faster than ever before.

Country Cupboard

Add attractive storage space to your dining room with our easy-to-build country-style cupboard. It fits in a corner and adds rustic charm to any room.

Anatomy Of A Stock Car

Here's an inside look at what makes a NASCAR Winston Cup stock car tick. You'll learn what really makes the racer's edge. And don't miss our special collector's stock car poster.

Premier Pickups

We stack Toyota's new T100 big pickup against the best-selling V8-powered Ford and Chevy full-size pickups.

Home Muscle Machines

Build your own hardbody with a home fitness gym. Mr. America evaluates five models, ranging from \$300 to \$1300.

New Wine Holds The Alcohol

The latest wrinkle in wine technology is non-wine, or wine without the alcohol. We show you how it's made and tell you how it tastes.

Keep Your Tile In Style

Keep ceramic tile looking like new with our complete guide to tile maintenance, including tips on regrouting and cleaning.



**“Better hearing did more
than improve my game.
It improved my life.”**

Arnold Palmer

© 1993 Rayovac Corporation

“If you notice a problem with your hearing, don't be discouraged. Over 6 million Americans enjoy better hearing by wearing a hearing aid. And the battery we depend on most is made by Rayovac.”

“Rayovac batteries really are better.”

“I noticed a difference the first time I tried them. Rayovac batteries can help you get the most out of your hearing aid, too. And that can help you get the most out of life.”



RAYOVAC[®]

When Performance Really Counts.

KEEP YOUR HATS ON.

Finally. The waiting is over. The all-new Toyota T100 is here. And not only is it bigger in virtually every way than our legendary Toyota Compact Trucks, it features a cab roomy enough for comfortable 3-across seating. And yes, you can even wear your hat. More importantly, though, is the strong sense of confidence you get when you sit behind the wheel of the Toyota T100. You

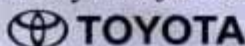


More to love: size relation shown between new Toyota T100 and Toyota's Compact Truck.

The list of performance technology found in the Toyota T100 starts with a 3.0-liter electronically fuel-injected (EFI) overhead cam V6. There's an advanced rack-and-pinion steering system.** An independent front suspension with torsion bars. Even a rear wheel Anti-lock Brake System (ABS)[†] is standard. All of which makes the Toyota T100 perform and handle far better than you ever dreamed a truck this size could.

So grab your hat and head on down to your Toyota Dealer. And try a Toyota T100 on for size. Or just call 1-800-GO-TOYOTA and we'll send you a free brochure.

"I love what you do for me."



A dash of style: all the gauges and controls are right where you'd put them yourself.

notice how the gauges are large and easy to read. How all the controls are right where you'd put them yourself. The steering wheel tilts* into a very comfortable position. Even the fold-down center armrest feels just right.

Of course, there's more to a truck than what's inside the cab. Especially this truck.

Three's company: every Toyota T100 features 3-across seating.



INTRODUCING THE TOYOTA T100.

*Tilt wheel standard on T100 SR5 models, optional on T100 Standard models.
 **On 2-wheel drive models only. 4WD models equipped with recirculating ball.
 †Operates in 2-wheel drive mode only.
 Buckle-Up! Do it for those who love you.
 © 1993 Toyota Motor Sales, U.S.A., Inc.