

Popular Science®

\$1.50
MARCH
1981

The **What's New** magazine

SATURN'S SECRETS

The week that stunned scientists

Tilt-engine V/STOL

speeds like a plane,
lands like a copter



Dany Ellis

Tough '81 Ford Pickups.

**FORD FIRST: 21 MPG*
WITH 2,530 LBS. PAYLOAD**



Ford, the pickup designed for the needs of the 80's, is first again. First with 21 estimated MPG in a six-cylinder pickup with payloads as big as 2,530 lbs. And first with new advances like V-8 Automatic Overdrive.

Choose from tough, efficient regular Fords. Roomy SuperCabs. Rugged Six-Wheelers. The only standard-size 4x4's with independent front suspension. America's best-selling pickups are first where it counts.



First truck V-8 Automatic Overdrive option

Only from Ford! New automatic transmission shifts into overdrive at about 45 mph . . . automatically. Available with 5.0L V-8.

21 EPA EST. MPG* **29** EST. HWY.*

F-100/150 with 4.9L (300 CID) Six

First Ford 21 MPG Six*

Only the tough '81 Ford has an estimated MPG this high with payloads as big as 2,530 lbs.

798 EST. MILES* **1102** HWY. MILES*

LWB Styleside with optional tank

First in driving range*

Only Ford has this estimated range. Standard and optional 19-gal. tanks, total 38 gals.

*With 4-speed overdrive option. Compare these estimates with others. Your mileage may differ depending on speed, distance and weather. Actual highway mileage, range and California ratings less. Ford's mileage ratings together with the largest fuel tank of any pickup give the longest range.



First design for the 80's

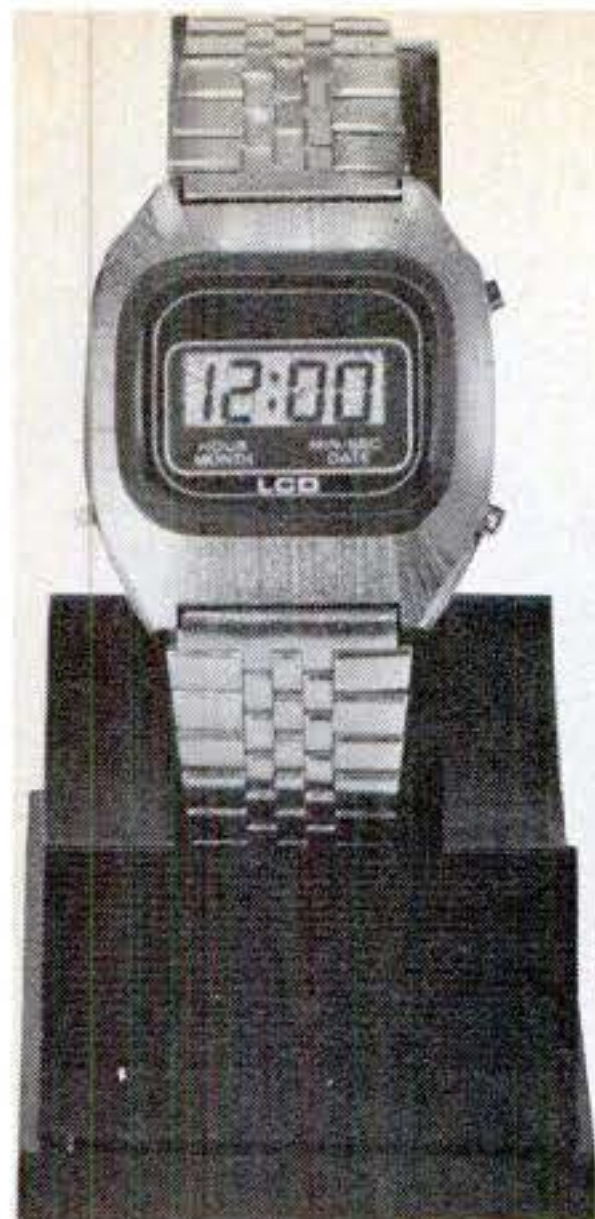
Totally redesigned last year, Ford pickups are roomy and inviting inside . . . trim and aerodynamic outside for extra efficiency.



**FIRST IN TOTAL TRUCK SALES
SINCE 1970**

Based on R.L. Polk & Co. registrations.

FORD



a \$5 LCD digital

NOW WITH STOP WATCH

WATCH

Try only 10 DAK high energy 90 minute cassettes risk free for just \$2.19 each and get a beautiful \$69 value LCD digital watch for only \$5!

YOU CAN'T LOSE!!! IF YOU'RE NOT 100% SATISFIED, KEEP AN ML90 FREE AS A GIFT FOR TRYING OUR CASSETTES!!!

Are the very high frequencies disappearing from your cassettes as you play them? Friction within your cassettes may be erasing your crystal clear highs even as you read this ad.

DAK developed a jam proof cassette for professional high speed duplicators and in the process discovered why recordings that sound great when you make them, may sound less than great in just a few months.

Here's a chance to try DAK ML90s risk free and pick up a great LCD watch complete with stop watch for only \$5!

YOUR TIME IS PRECIOUS

Imagine yourself just finishing recording the second side of a 90 minute cassette and horrors, the cassette jams. Tape is wound around the capstan, your recorder may be damaged and you've just wasted 90 minutes of your time and perhaps lost a great recording off FM.

MOLYSULFIDE

DAK manufactures enough tape for over one million cassettes per month, mostly for professional duplicators and loaders. We developed polyester slip sheets which are inside the cassette with raised spring loaded ridges to guide each layer of tape as it winds so it won't jam.

We coat the liners with a unique formulation of graphite and a new chemical called molysulfide. It reduces friction several times better than graphite and allows the tape to move more freely within the the cassette.

HIGH FREQUENCY PROTECTION

Tape is basically plastic, and as it moves within the cassette friction causes the build up of static electricity, much as scuffing your shoes on a carpet in dry weather.

Static electricity within the cassette is drastically reduced by the low friction of the molysulfide so that it won't erase crystal clear highs. A very important consideration for often played tapes.

MAXELL 'TAPE' IS BETTER

Yes, honestly, if you own a \$1000 cassette deck like a Nakamichi, the frequency responses of Maxell UDXL or TDK SA are superior and you just might be able to hear a difference.

DAK ML has a frequency response that is flat from 40hz to 14,500hz ± 3 db. Virtually all cassette recorders priced under \$600 are flat ± 3 db only from 40hz to about 12,500hz, so we

have over 2000hz to spare, and you'll probably never notice the difference, and we feel that we have equaled or exceeded the mechanical reliability of virtually all cassettes.

NOT MAGICAL OR CHEAP

DAK manufactures the tape we sell. Our tape really doesn't cost less to make. You only avoid paying the wholesaler and retailer costs and profits. When a cassette leaves other factories, it must be marked up each step of the way; even duty on some of the fine imported cassettes must be added, so with DAK tape you really only save the middlemen profits.

While Maxell UDXL 90s may sell for \$3.50 to \$4.50 each at retail, DAK ML90s sell factory direct to you for only \$2.19 each complete with deluxe all clear hard plastic boxes and index insert cards.



A rugged micro computer LCD WATCH

A \$5 LCD WATCH++STOP WATCH?

This beautifully styled slim silvertone watch is loaded with features. LCD means that the time in hours and minutes always shows without having to push buttons.

Push the button once, and you'll see the date in months and days, and push the button again and see seconds. Push the second button and the entire time section lights up for convenient night viewing.

Stop watch feature. This fine watch has a third button which starts and stops an accurate stop watch. The stop watch displays up to 15 minutes and then continues running displaying up to 15 minutes at a time. It's great for timing cassettes.

Quartz crystal accuracy means constant time within 1 minute per month. Crystals use little electricity, so the

battery should last up to a year, and is easily changed.

Stainless steel band for long life and comfort. No imitation, a first rate locking adjustable band.

It's guaranteed. This fine watch comes with a manufacturer's limited warranty, good for one full year.

DAK TAKES A RISK

Obviously giving away quality watches is not going to make DAK rich. We are betting that once you get our new 40 page catalog with over 6000 words about how to make better recordings, you will want to buy our cassettes again, and we are putting our money where our mouth is!

Customers like you are very valuable in the form of future business. We anticipate receiving over 6000 orders and over 4500 repeat customers from this advertisement to add to our list of over 80,000.

TRY DAK ML90 CASSETTES RISK FREE

Try these high energy cassettes on your own recorder without obligation for 30 days. If you aren't 100% satisfied for any reason, return only 9 of them and the watch for a refund. The cassette you test recorded is yours as a gift.

To order your 10 DAK ML 90 minute high energy cassettes at \$2.19 each and get the LCD digital watch for only \$5 with your credit card, simply call the toll free number below, or send your check for only \$21.90 plus \$5 for the watch and \$3 for postage and handling for each group to DAK. (CA residents add 6% sales tax).

DAK unconditionally guarantees all DAK cassettes for one year against any defects in material or workmanship.

Why not order an extra group of 10 DAK ML90 cassettes for yourself or a friend? We will add one free ML90 cassette to each additional group you buy and of course you can still get an LCD watch for only \$5 with each additional group you order.

DAK

This One



3QRA-QRF-BX3N



UMPH!

Taste the Umph! in TRIUMPH®

only 3mg tar



Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

©Lorillard, U.S.A., 1980

Filter: 3 mg. "tar," 0.4 mg. nicotine av. per cigarette, FTC Report Jan. 1980.
Menthol: 3 mg. "tar," 0.4 mg. nicotine av. per cigarette by FTC Method.

Copyrighted material

Popular Science

The **What's New** magazine

MARCH 1981
Founded in 1872/Vol. 218, No.3

MONTHLY®

HIGHLIGHTS **Tilt-engine V/STOL flies like a jet, hovers like a copter**
OF Vertical operation from small ships—range 1,000 miles—loft 50,000 feet. **PAGE 72**

THIS ISSUE **Saturn's secrets: the week that stunned the scientists**
Voyager left a host of theories in shambles, revealed amazing new facts. **PAGE 84**

High-tech hi-fi brings new realism to performances
Digital circuits, sonic holography . . . sound seems to surround the room. **PAGE 81**

'81 lawn mowers: PS tries 17 rider, walk-behind models
Cutting time and a mower matched to your lawn turn out to be decisive. **PAGE 118**

Prize-winning FRP designs from 10 PS readers
All of these innovative and good-looking projects are within your skills. **PAGE 110**

COVER PAINTING BY DEAN ELLIS

CARS AND DRIVING

- Mercedes gas turbine: Is 16.5 mpg in a 3,500-lb. car good enough? . . . **23**
- PS car test—U.S. compacts: Is Chrysler's K-car the new champ? **38**
- PS 3,000-mile test of the Plymouth Reliant K **48**
- 44-mpg two-seaters —Escort EXP/Lynx LN7 **67**
- What to do when your car won't start **125**

SPACE AND AVIATION

- Bulging 747: more room top-side **61**
- Tilt-engine V/STOL cruises at jet speeds, hovers like a copter **72**
- Saturn's secrets: the week that stunned the scientists **84**

NEW TECHNOLOGY

- Multihull speedsters: Cats of new stripes shatter old records . . . **78**

NEW PRODUCTS AND INVENTIONS

- Computer printer **30**
- Electronic typewriter has ultrasonic keyboard **75**
- Giant-screen TV: Low-cost adapters convert small-screen sets **90**

HOME AND YARD

- PS leisure home: triple-decker **89**
- Prize-winning FRP designs from 10 PS readers **110**
- Garden tractor delivers big-machine performance **116**
- Weed trimmer uses flexible disc **116**
- No-strain chain saw **117**
- '81 lawn mowers: rider or walk-behind? PS tries 17 models **118**

ENERGY NEWS

- How Tennessee homeowners get a solar assist **76**
- Windows tight? Now maybe it's time for insulating shades. . . . **107**

What's New DIGEST

- Laser phone **92**
- Four-wing jet **93**
- What's new in photography **94**
- What's new in boating **95**
- What's new in tools **96**
- What's new in home improvement **97**
- What's new in electronics **98**
- What's new for your car **99**

OUTDOOR RECREATION

- Bait keeper **28**
- Fly reel with brake-shoe drag **34**
- '81 camping vehicles —sleeker and lighter **100**
- Weekender sloop: Build it for under \$800 **102**
- Exotic new materials in today's camping gear **104**

ELECTRONICS

- High-tech hi-fi brings new realism to performances **81**

REGULAR FEATURES

- PS readers talk back **4**
- Science newsfront **10**
- Alternate-energy answers **14**
- Recreation roundup **52**
- New ideas from the inventors . . . **58**
- Detroit report **62**
- Look and listen **64**
- Calcu-letter **68**
- PS/What's news **71**
- Wordless workshop **115**
- Shop talk **122**
- "Say, Smokey—" **135**
- PS readers' product information . . **166**

EDITORIAL OFFICES 380 Madison Avenue, New York, N.Y. 10017

Published monthly by TIMES MIRROR MAGAZINES, INC., 380 Madison Avenue, New York, N.Y. 10017

SUBSCRIPTION SERVICE (Only mail regarding subscriptions should be sent to Boulder, Colo., address below). *New or Renewal Orders:* Send to: Popular Science Subscription Department, Boulder, Colo. 80302. One year \$11.94, 2 years \$22, 3 years \$30 in U.S. and its possessions. One year \$15.94, 2 years \$28, 3 years \$42 in Canada and elsewhere. Single copy \$1.50. *Subscription orders processed electronically. All subscription adjustments:* Write to Robert Harlan, Popular Science, P. O. Box 2871, Boulder, Colo. 80302. For change of address allow eight weeks; please give both old and new addresses. Notices of undelivered copies (Form 3579) to Mr. Harlan. Controlled-circulation postage paid at Effing-

ham and Salem, Ill. Publication number 493730. Popular Science is entered as second-class matter at the P.O. Dept., Canada. Microfilm editions are available from University Microfilms, Ann Arbor, Mich. 48106. ADVERTISING OFFICES New York: 380 Madison Ave. (10017), Tel. 212-687-3000; Chicago: 875 N. Michigan Ave. (60611), Tel. 312-337-7717; Detroit: 19075 W. 10 Mile Rd., Southfield, Mich. (48075), Tel. 313-352-8333; Los Angeles (Pacific West Coast): 3550 Wilshire Blvd., Suite 908 (90005). Tel. 213-380-1936. *Mechanics and Handicraft*® Popular Science® Copyright © 1981 by Times Mirror Magazines, Inc. All rights reserved. Printed in U.S.A.

Editor-in-Chief C. P. Gilmore
Editor Everett H. Ortner
Executive Editor Herbert Shuldiner
Art Director W. David Houser
Copy Chief David D. Vigren

GROUP EDITORS

Arthur Fisher
Science & Engineering/Special Projects
Richard L. Stepler *Consumer Information*
Alfred W. Lees *Reader Activities*

SENIOR EDITORS

Jim Dunne *Automotive*
John Free *Technology*
William J. Hawkins *Electronics*
E. F. Lindsley *Engineering*

ASSOCIATE EDITORS

Paul Bolon, Ray Hill, Edwin C. Jacobs (*Automotive*),
Susan Renner-Smith, Daniel J. Ruby, V. Elaine Smay

Copy Editor: Timothy O. Bakke

Assistant Copy Editor: Kathleen Murphy Lord

Photographer/Picture Editor: John Keating

Home & Shop Editor: Alfred W. Lees

Boating Editor: David D. Vigren

Art Editors: John F. Crowley, Richard J. Meyer

Art Associate: Hugo Salhuana

West Coast Editor: Jim Scheffer

Southeast Editor: Evan Powell

European Editor: David Scott

Editorial Assistants: Kathleen Brown (Chief),
Marita Begley, Eleanor Freebern, C. Daniel King,
Gary W. Morgan

Senior Production Manager: Henry W. Kazmirowski

Business Manager: Anna Dallas

ADDRESS EDITORIAL MAIL to
Popular Science Editorial Dept.
380 Madison Ave., New York, N.Y. 10017

We cannot be responsible for loss of unsolicited queries, manuscripts, or photos. They will not be returned unless accompanied by return postage. We welcome readers' comments, but regret that the volume of mail does not permit us to answer each letter individually.

CONSULTING EDITORS

Jim Scheffer, *Space*
Edwin A. Link, *Oceans*
Jan P. Norbye, *Automobiles*
A. J. Hand, *Photography*
Smokey Yunick, *Auto Mechanics*
Robert Gannon, *Science*
Phil McCafferty, *Projects*
R. J. De Cristoforo, *Tools & Techniques*
Richard Day, *Home & Shop*
Ben Kocivar, *Flying*
Paul Wahl, *Guns*

F. X. WILKINSON *Vice-President, Publisher*
MILTON J. NORCROSS *Circulation Manager*

Published monthly by
TIMES MIRROR MAGAZINES, INC.,
380 Madison Avenue, New York, N.Y. 10017
A Times Mirror Company

ISSN 0161-7370

MATTHEW T. BIRMINGHAM JR.
Chairman of the Board
JOHN A. SCOTT *President*
GORDON B. HALL JR. *Senior V.P.*
ARTHUR H. LOOMIS *Vice-President*
HUBERT P. LUCKETT
Vice-President/Editorial Director
GERTRUD BORCHARDT *Production Director*
JOHN FRY *Publications Development*
WARREN H. BRAREN *Circulation Director*
THOMAS J. GARRISON *Treasurer*

PS READERS TALK BACK

Address letters for this column to: Readers Talk Back, 380 Madison Ave., New York, N.Y. 10017. Because of the large volume of mail, we are unable to acknowledge unpublished letters.

Oily slips

In your article "Keep Your Diesel Healthy" [PS, Dec. '80], Richard Day states that GM never recommends SE-CD oils. How come my owner's manual is so specific that the oils recommended have both SE and CD designations?

Jack A. Conners, Bakersfield, Calif.

Contrary to what your article says, Mercedes says that fuel filters should be cleaned and replaced.

Bob Childs, luka, Miss.

Author Day replies: "In the editing process, someone whose face is now red put in that wrong advice about GM diesels and their oil and took out the photo (below) that shows the Bosch method for cleaning a diesel's fuel filter by blowing it

out. It shows a PCV hose being used, as could be done for a road fix. If the filter foams like this, it can be replaced, provided it's not past the factory-recommended mileage. The trick works on any but a spin-on filter. However, GM, for some reason, advises against cleaning filters. As for lube oil, always use what's called for by the diesel's manufacturer."

Those black pipes

As unlikely as it may seem to reader Jim DeKorne ["PS Readers Talk Back," Jan.], the color of a heat-radiating surface *does* affect the rate of radiation. Since well before the turn of the century, physicists have known that the properties of matter that account for the rate of absorption of radiation by a surface are also responsible for its rate of radiation. Because black surfaces are both the best absorbers and the best radiators, scientists have long referred to an ideal absorber-radiator as a "black body." It is no accident that automobile radiators, transistor heat sinks, and heating stoves and stove pipes are most often colored black: Black results in the highest rate of heat radiation.

Gary G. Rannefeld, Dixon, Calif.

Wordless woman

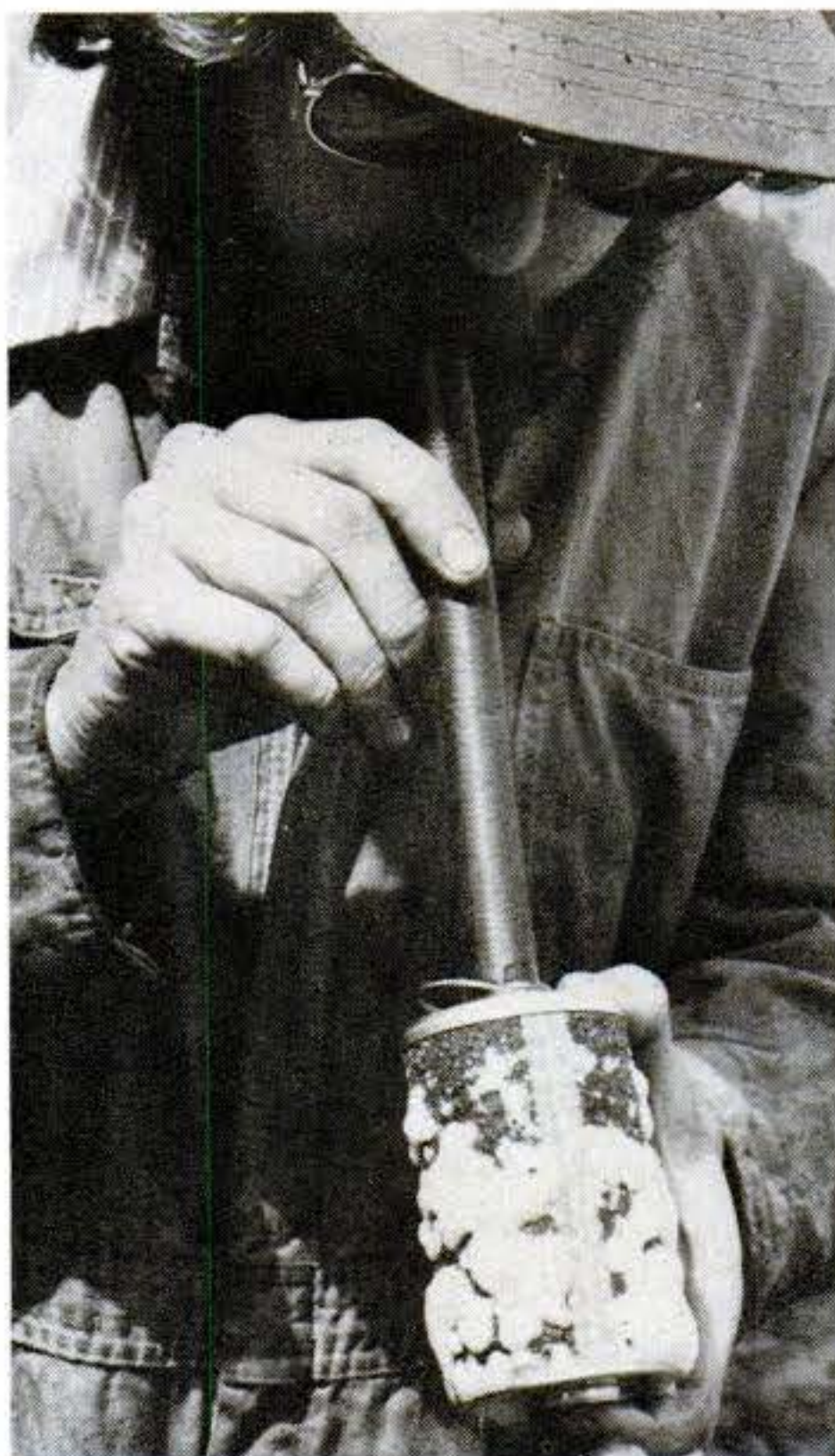
For several years I've noticed that it's always the man who solves the problem in your "Wordless Workshop" feature. I was happy to note that in your November '80 issue, the woman came up with the solution. It's about time.

Betsy Weiss, Albuquerque, N.M.

Home-built boat

Your PS Mini-Cat [PS, Feb. '80] looked so good I just had to build it. Though I'd never built anything more complicated than a pencil holder in shop class, I had no trouble following the excellent step-by-step instructions. I did make a few minor

Continued



POPULAR SCIENCE READER SERVICE

Check below to report a change of address. Or to get more mail. Or less mail.

Name _____
Address _____
City _____ State _____ Zip Code _____
It helps if you attach your address label (or copy your name and address exactly as they appear on your label) in the space above.

- MOVING NOTICE. Put your old address at left, your new one at right. (Please give us six weeks' notice.)
- UNLISTING SERVICE. Check here if you don't want to receive mail from advertisers who use the POPULAR SCIENCE list. (Be sure to attach your label at left.)
- LISTING SERVICE. Check here if you're not a subscriber but want to receive mail from advertisers who use the POPULAR SCIENCE list. (Be sure to fill in your name and address at right.)

Name _____
Address _____
City _____ State _____ Zip Code _____
POPULAR SCIENCE, P.O. Box 2871,
Boulder, Colo. 80302.

GIVE YOUR DRINKS OUR GOOD NAME.

The smooth and refreshing taste of Seagram's Gin makes the best drinks possible. Enjoy our quality in moderation.

Seagram's





The world's most innovative electronic marvels are now available with shop-by-mail convenience.

For your chance to try out a product more thoroughly than you ever could in a store, just call The Sharper Image—toll-free. You'll have a full 30 days to examine it at home, with no obligation. And a full refund (including delivery charge) if you aren't completely satisfied.

So read on—and phone home some magic.

1. World's smartest calculator alarm watch.

Megasonic combines more features that a timepiece has ever offered—regardless of price.

The sensor-touch keyboard speeds calculations and prevents errors. Everytime you touch one of its recessed keys (with any pen or pencil), a short beep tone confirms the entry—on all functions, even discounts, mark-ups and percentages.

You also get $\frac{1}{100}$ second stopwatch, 12/24 hour time format, musical appointment alarm, hourly chime, quartz-accurate timekeeping, nightlight and day/date calendar. Stainless steel band, mineral glass crystal for durability. 18 month battery, full year warranty. All for just \$89. Megasonic Calculator Alarm #325 \$89 (2.50).

2. The air ionizer with the scientific edge.

Now you can watch cigarette smoke, pollen, dust and other airborne particles disappear from your environment—for less than three cents a week.

Ionosphere™, developed by the largest maker of hospital ionizer systems, is the only unit that uses passive multi-stage circuitry for totally silent operation. It's encased in sturdy, high gloss ceramic, and hermetically sealed in epoxy resin for long life. Protective plexiglass ring completely surrounds its washable, stainless steel bristle-brush emitter. One 4" unit will purify up to 250 sq. ft., or an average 12' x 20' room. Comes with instructions, year warranty. Clean your air with the professionally proven ionizer. UL approved. White Ionizer #946 \$89 (3.50). Black Ionizer #945 \$89 (3.50).

3. It makes the sounds that soothe.

The Marsona 1200 Sound Conditioner generates the primal sounds of nature—surf, rain, and rhythmic waterfalls.

Using an advanced electronic synthesizer—not a recording—it produces "white noise", long recognized by scientists for its ability to mask out sounds that interfere with sleep, relaxation or work.

Unlike older

electro-mechanical conditioners, Marsona has no moving parts to wear out, uses less electricity than a night light. Lets you control volume and rhythm for all four sounds (high and low surf, rainfall and waterfall). Get the deep sleep and relaxation you need—get Marsona 1200. One year warranty, 7" x 8" x 5". Sound Conditioner #255 \$129 (3.50).

4. Save \$50 on the cordless phone that's clear as a bell.

This is the only cordless phone we've found that works as reliably as a conventional wired phone. So there's no reason to be tied down anymore.

It roams 500 feet away from your home or office (a range of more than 10 acres). Rechargeable, lightweight 11 oz. handset clips to belt or slips in a pocket. Lets you dial out or receive calls walking from room to room, out in the yard—even at the neighbors. Completely static-free, with astounding fidelity. Features one-touch redialing, high/low volume control, low battery warning light and intercom. Simple plug-in installation. FCC approved, meets UL standards. Converts rotary to touch dial; for all single line home or office systems.

Why pay monthly rental fees, when you can own the world's most impressive extension phone—at \$50 less than the store price. Webcor Cordless Phone #555 \$199 (3.50).

5&6. Amazing, what Realtime gives you for \$2,000 less than a Rolex.

Its quartz movement delivers ± 5 second-a-month accuracy—exceeding Swiss Chronometer standards. Its electronic circuitry never needs cleaning or repair. And its stylized bezel, supple link bracelet and magnifying date window bring to mind the peerless quality that makes Rolex watches so renowned—and so expensive.

Yet the extraordinary timekeeper pictured here isn't a \$2100 Rolex. It's a \$149 Realtime.

The deep gold luster on the bezel and bracelet comes from using generous 5 micron gold plating. Entirely Swiss-made of solid stainless steel. Tritium coated hands for low light viewing. Water tested to 165 ft.

Also available in woman's model (5)—a stunning reproduction of the \$1600 Woman's Rolex.

Both models include one year warranty, 18-month battery and gift box. Man's Realtime #247 \$149 (2.50). Woman's Realtime #311 \$149 (2.50).

7. Computerized phone dialing magic.

Auto Pulse, the first home-or-office automatic dialer to break the \$100 price barrier.

This \$79 genius lets you program up to 30 phone numbers (with up to 16 digits per memory)—and dial them at the touch of a single button. Can be re-programmed in seconds. LED readout displays numbers as they're programmed, and doubles as an electronic phone directory. Multi-line model makes office calls instant and cost efficient. Single-line home model gives you one-button access to everyday and emergency numbers. Easy plug-in

installation, never a rental fee—you own it.

Put dialing magic in the home or office at an exceptional price. Order several. Single-line Auto Pulse #234 \$79 (2.50). Multi-line Auto Pulse #235 \$79 (2.50).

8. Police radar meets its match.

In tests against the country's leading car radar detectors, the GUL Micro Scan demonstrated a detection distance significantly greater on both X and K bands.

Its large elliptical horn antenna receives signals from front, back and sides. Even detects the new short pulse KR-11 radar. Case is diecast aluminum, not plastic, so input terminals are protected from stray signals—and false alarms. And in the presence of radar, you get a double warning from both a tone and light. 4" x 3" x 4½" (easily concealed under a tissue box). Plugs into cigarette lighter; Velcro mounting for quick dashboard installation or removal. 120-day warranty.

In our opinion, the finest electronic

counter-intelligence you can buy.

GUL Car Radar Detector #131 \$95 (2.50).

9. The quartz racing watch.

This handsome new Xernus combines an alarm with a ruggedly dependable 12 hour chronograph stopwatch.

With tightly sealed mineral glass crystal, solid stainless steel case and band, double insulated buttons, it even survives the 10 atmosphere torture test: guaranteed to pass water immersion

to 100 meters (300 ft.) under water. The solar panel keeps battery charged up to 5 years. Quartz accuracy, day/date calendar, night light, and penetrating musical alarm.

Xernus Quartz Racer #378 \$69 (2.50).

30-DAY HOME TRIAL.

Credit card holders may use our toll-free numbers below. Or send check, including delivery charge (shown in parentheses at end of product descriptions). Add 6% sales tax in CA.

Please mention the 3-digit product number and this magazine.

800 227-3436

In California 800 622-0733

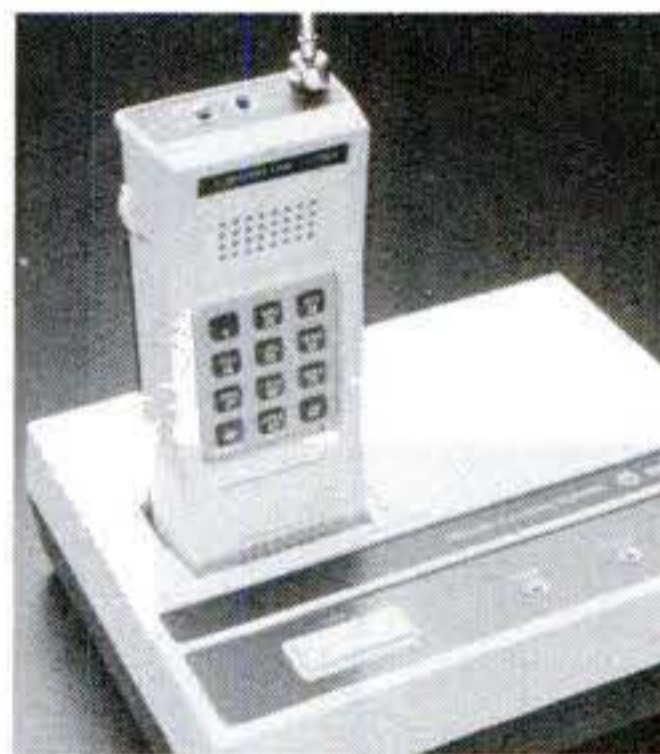
THE SHARPER IMAGE™

260 California St., San Francisco, CA 94111 (415) 788-8880

©1980 The Sharper Image. An independent company not associated with Rolex™.

Copyrighted material

MAGIC BY MAIL.



While you sleep, your Webcor remote phone has its batteries recharged by the matching beige base unit, included.

WHAT'S HE DOING!

Making a Concrete Flower Pot! . . . and SO CAN YOU!

Make and sell your own Ornamental Concrete Items. Rush \$5.00 for Book about Aluminum Molds with prices and production trade secrets direct from world's largest mold manufacturer. Over 350 designs to select from.

Send \$5.00 CONCRETE MACHINERY COMPANY Today To ➔ P. O. BOX 899 - HICKORY, N. C. 28601

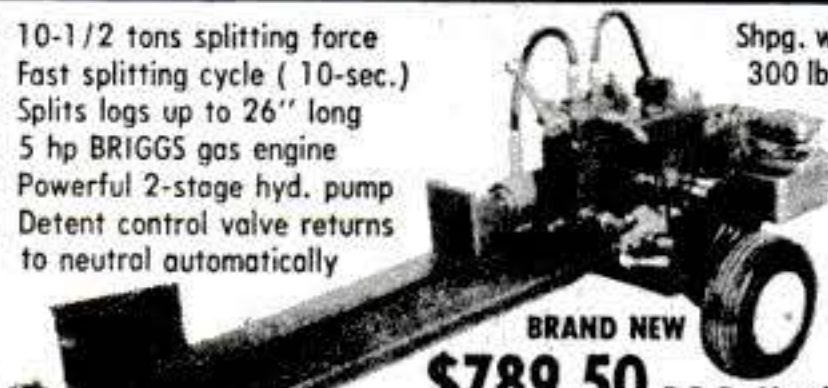


Hydraulic Log Splitter

PARTS ALSO AVAILABLE TO "BUILD YOUR OWN"

- 10-1/2 tons splitting force
- Fast splitting cycle (10-sec.)
- Splits logs up to 26" long
- 5 hp BRIGGS gas engine
- Powerful 2-stage hyd. pump
- Detent control valve returns to neutral automatically

Shpg. wt. 300 lbs.



BRAND NEW \$789.50 F.O.B. Lincoln

• Split wood for your own use, split logs for profit, earn money on rentals. Built from finest quality components.



CATALOG Send 60c Coin or Stamp

• "BUILD-YOUR-OWN". Save Money! Top quality components at lowest prices. See our catalog. 100's of other items, BIG SAVINGS!

SURPLUS CENTER PS-031 Lincoln, Nebraska Zip Code 68501

PS readers talk back

[Continued]

changes in the plans. For example, I sewed batten pockets with Velcro end closures on the sail for easy replacement if a batten broke. Lucky I did, too: Sailing off Cape Cod in a 35-knot wind, I broke five battens—but the rest of the boat held together fine.

Mark C. Matson, St. Albans, W. Va.

Susanne and Peter Stevenson's next boat is featured in this issue.

It isn't waste

C. P. Gilmore seems to feel there would be an enormous potential benefit in converting to ethanol the cellulose in wood, corn stalks, wheat and rice straw, and forest litter ["PS/What's News," Dec. '80]. Please spare me from this "breakthrough." Most of the agricultural "waste" mentioned serves a much more important purpose: It supplies humus to the soil. Humus provides minerals and increases the soil's ability to retain water. If natural minerals are not returned to the soil, greater use of chemical fertilizers—products of the petro industry—would be required. As for forest "litter," have you ever heard of the connection between forests and watersheds?

Gary C. Squires, Schuylerville, N.Y.

Kerosene costs

I am enjoying my second season of low-cost heating with a Kero-Sun heater ["Portable Radiant Heaters," PS, Jan.]. Initial cost of the unit (\$259) was fully returned during the first season, with a reduction from about \$175 a month to \$45-\$50 a month. Savings like that more than make up for the inconvenience of the slight kerosene odor (only present at start-up and shutdown) and the periodic cleaning and resetting of the wick.

Raymond J. Pellerin, Methuen, Mass.

Your author stated that kerosene is selling for 89¢ a gallon in his area [the southeast]. In Olympia, Wash., those dealers that carry kerosene sell it for about \$4 a gallon! Am I being ripped off by Olympia dealers, or is the author behind the times?

Gary Downs, Olympia, Wash.

According to Platt's Oilgram Price Service, the wholesale cost of kerosene is presently about 91¢. However, such a tiny percentage of it is sold to consumers as heating fuel that prices could vary considerably around the country. Check the availability and price of kerosene in your area before buying a kerosene heater.

Corrections: A typographical error in "Water-Powered Drill" [PS, Jan.] produced a monumental fire hose; the hose's diameter is 1½ in., of course, not 12 in.

The chart matching plastic plumbing with suitable cements in "Solvent Welding" [PS, Jan.] contained an error. CPVC cement works with all listed materials.

There are 70 atoms of U-235 in every 10,000 atoms of natural uranium, not in every 1,000 as was printed in "Do We Need the Breeder?" [PS, Nov. '80].

How To Stand Out In A Crowd Of Imitators:



BE THE ORIGINAL

... and the ORIGINAL in tongue and groove pliers is CHANNELLOCK. We invented this style of plier. We improved it with patented undercut, can't slip adjustments. Improved it again with the patented stress resisting flange. Developed ten styles and sizes from 4 1/2" to 16".

All of which is why tongue-n-groovers by any other name can't match CHANNELLOCK, the original. Be sure THAT trade name is on the pliers you buy.

CHAN NEL LOCK

CHANNELLOCK, INC. • Meadville, Pennsylvania 16335
Meet The Rest Of The Family. Send For Our Free Catalog



BUILD YOURSELF A FORTRESS. FOR THE PRICE OF A PEASHOOTER.

Today you can spend hundreds—even thousands of dollars—on a burglar alarm system. Or try to get by for a lot less, and wind up with one that doesn't do the job.

Well, now from Universal Security Instruments, Inc. comes Ultrar™, an economical alarm system that gives you many of the sophisticated features you normally find only with high cost protection. And it's available to you by mail from The Sharper Image.

Security. Only 5 minutes away.

Packed with professional features, this compact 10" x 7" x 3" system requires no expensive installation, wiring, or monthly rental charges. That's because it's fully portable. And all yours.

Ultrar uses a technology that even the smartest burglar can't fault—invisible ultrasonic (sound) waves that blanket a room as large as 600 sq. ft. with protection; and without falsing.

Remarkably, just a finger moving two inches will set it off; needless to say, the movement of an opening window or door will immediately activate the alarm (Ultrar is so sensitive, you'll need to remove pets from the room).

And you can set up the entire system in less than 5 minutes. Just by plugging it into a wall outlet and making a few simple adjustments.

If power should ever fail, or the unit be unplugged, Ultrar's built-in battery back-up is ready to take over (six C-cell batteries will provide months of service, if needed).

There's no guessing that it's working.

Ultrar is unique in being the only economical burglar alarm system that gives you a precise picture of the extent of its protection.

In its special Test Mode, you can actually walk through a room, open doors, try windows, etc., and watch your unit being triggered by these routine movements. During these tests, you get a clicking tone (with indicator light) that's less than one twentieth the volume of the regular alarm siren that's ready to greet any unwelcome guest.

This exclusive test feature insures proper placement of the unit, and the ideal adjustment of its sensitivity control.

Now for the real thing.

Ultrar is armed with the press of a single button.

This same button activates a 60 second exit delay, giving you ample time to leave. And providing you with peace of mind—whether it's for an hour, or a two-month vacation.

If an intrusion does occur, Ultrar is programmed to do one of two things: (1) Surprise the intruder (and alert the neighbors) with a siren that can't be stopped—even by unplugging the unit. (Once activated, the siren alarm continues for three minutes before automatically resetting itself in preparation for the next movement.) Or (2), it can be immediately disarmed, but only when you enter your secret 3-number code on its pressure sensitive pad.

The unit is also designed to wait 30 seconds after entry, giving you ample disarming time. And lets you know instantly, with the aid of a memory-assisted alarm light, whether or not the alarm was triggered while you were out.

The deciding factor.

The Sharper Image has been waiting two years to offer a reasonably priced protection system. And when we heard Ultrar's built-in 90+ decibel siren, we knew we had found what we were looking for.

We were further convinced by its external indoor/outdoor weatherproof speaker (50' cord and jack included), which enables you to extend this already piercing alert signal to the entire neighborhood—or make your inside warning sound twice as penetrating (system is available without additional speaker for \$20 less).

And we'll give you two full weeks to make up your mind. If for any reason you don't share our enthusiasm over Ultrar, please return it for a prompt, courteous refund. Includes 90 day warranty, warning decals, and full instructions.

ORDER NOW TOLL FREE.

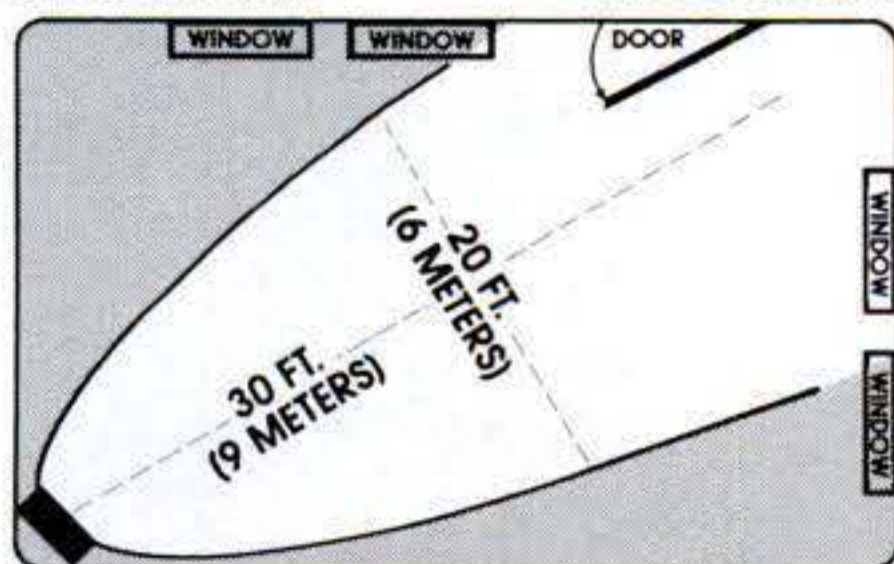
For dual siren system, order product #246 for \$109. For Ultrar without the additional indoor/outdoor speaker, order #245 for \$89. Add \$3.50 delivery, and \$6.54 or \$5.34 sales tax, respectively, in California. Credit card holders may call the toll free number below, or send check. Please mention this magazine.

800 227-3436

In California 800 622-0733

THE SHARPER IMAGE™

260 California St., San Francisco, CA 94111
(415) 788-8880



Ultrar protects any room (up to 600 sq. ft.) with an adjustable cone-shaped ultrasonic shield. May be placed near a hallway, guarding access to all doorways.

SCIENCE NEWSFRONT

By ARTHUR FISHER

Most powerful INTELSAT

A new communications satellite, with greater capacity than any previous civilian comsat, has been launched into geosynchronous orbit. INTELSAT V, pictured below, is the first of what will be a network of nine such spacecraft. Boosted into orbit atop an Atlas-Centaur rocket from Kennedy Space Center in Florida, it will be locked in position 22,300 miles above the Atlantic Ocean. The nine INTELSAT V satellites will eventually cover three oceans, the Atlantic, Pacific, and Indian. Built by Ford Aerospace and Communications Corp., the new satellite has twice the capacity of the INTELSAT IV-A now in orbit. It will provide 12,000 simultaneous telephone voice channels and two color-TV channels.

INTELSAT stands for the International Telecommunications Satellite Organization, a 105-member global system that now serves more than a billion people and carries two-thirds of all international transoceanic communications traffic—TV, telephone, teletypewriter messages, and high-speed data transmissions.

One important change in INTELSAT V is that it is a nonspinning, three-axis-stabilized design. Spin-stabilized satellites, be-

cause they are constantly rotating, present only about a third of the surface of their solar panels to the sun at one time. But a nonspinning satellite can orient its solar panels to the sun all the time, thus easing the design of the power supply. The solar "wings" of INTELSAT V stretch 50 feet from the tip and carry 17,576 cells.

Earthquake watch

For years, earth scientists have been monitoring the seepage of radon gas from the surface, among a host of other clues, in an attempt to predict earthquakes. (Radon is released by the radioactive decay of uranium in crustal rocks.) Now a General Electric physicist has proposed a new theory of how minute changes in the flow of radon through cracks and fissures in the crust could signal an impending major quake as far away as 2,400 miles. Dr. Robert L. Fleischer uses a mathematical model of the Earth considered as a body of elastic material containing a "stress center," the release of which could trigger an earthquake. His calculations show that although a fairly mild tremor of five on the Richter scale should not influence radon flow more than 60 miles away, a devastating quake, such as the one that rocked

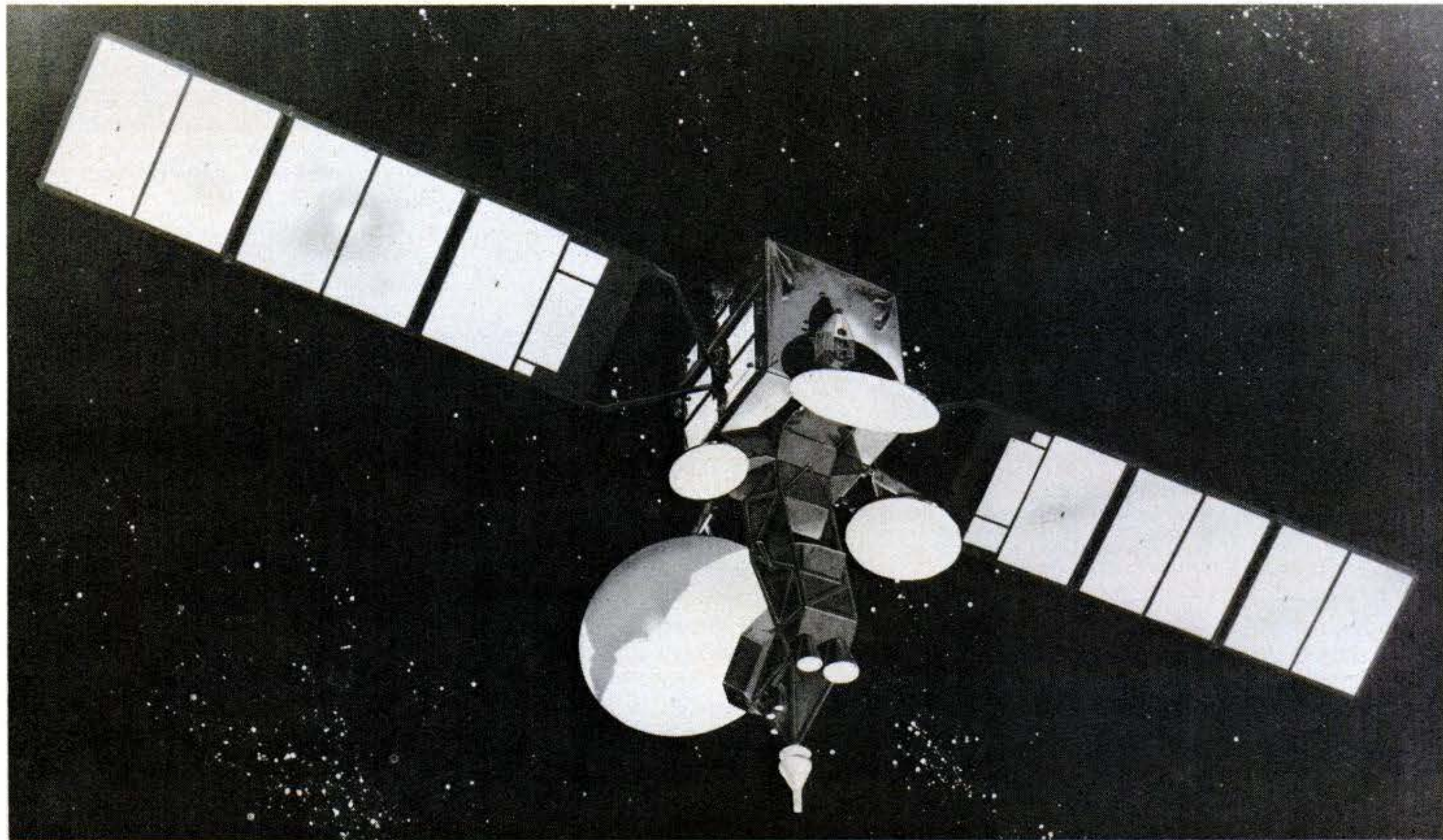


Alaska in 1979 and registered 7.7, could accelerate the flow of radon out to 2,400 miles. He suggests that an extensive network of radon-monitoring stations might be useful in pinpointing the site, magnitude, and possibly even the time of an impending quake.

Clever sun tracker

Inventor Burrell E. Hammons of Sandia National Laboratories (photo above) displays his elegantly simple sun-tracking device, recently patented by DOE, for solar collectors. Eight small solar cells are mounted on the vertical sides and horizontal base of a small square pedestal. When the device faces the sun, its shape partially shades four of the cells, and the voltages they generate are balanced. But if the orientation is not exact, unequal voltages from the cells signal drive

Continued



New Winston Ultra

Only
5 mg

**The first
ultra low tar
built on taste.**

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.



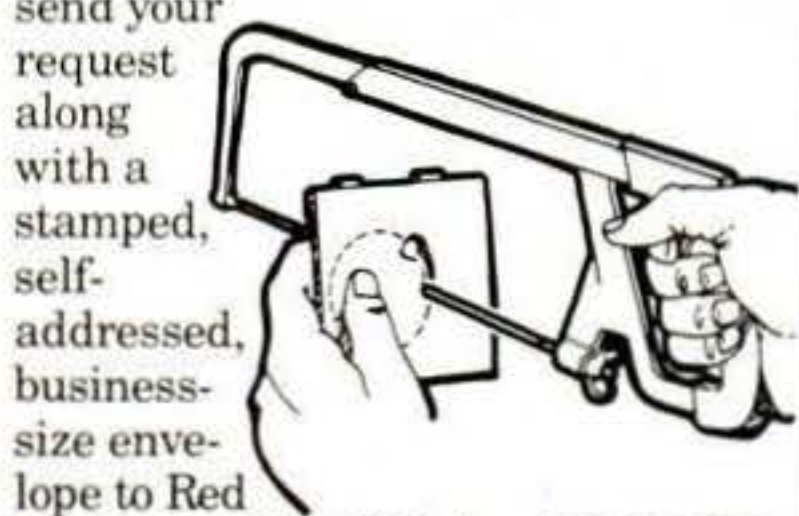
HOW TO

TILE

Ceramic tiling is fast becoming one of the most popular of all do-it-yourself projects. It's also one of the most rewarding. It's readily possible to do a tiling job yourself for a fraction of the cost of having it done professionally, and with excellent results! Red Devil makes most of the



products you'll need to install ceramic tile. And Red Devil shows you how to use them all in its free illustrated brochure "How To Install Ceramic Tile In Your Home." Get a copy at your Red Devil Dealer or send your request along with a stamped, self-addressed, business-size envelope to Red Devil, Inc., Box T, Union, NJ 07083.



Red Devil

Red Devil, Inc., Union, NJ 07083

WE'RE SOLD ON QUALITY.

Science newsfront

[Continued]



motors to shift the solar collector until the voltages are equalized. (The photo shows the device from the top, with three of the four cells on the base visible and partially shaded by the pedestal.) A ninth cell (on top in the photo) deactivates the tracking mechanism when heavy clouds pass over. The unique device can track the sun with an accuracy of better than a tenth of a degree on a clear day, and can find the sun even when the collector is facing away from it. It was first used on a Sandia-designed one-kilowatt array.

Sounding the heart

The technique called echocardiography has a long and successful history. With it, a cardiologist can use sound waves, in a system much like sonar, to create pictures of the heart in action. The procedure is painless, and requires no surgery and no overnight hospital stay. The latest advance in this field is shown being demonstrated in the photo above. Called the Ultra Imager, it was introduced at last November's convention of the American Heart Association and is a product of Electronics for Medicine/Honeywell.

The Ultra Imager adds to conventional "sound pictures" of the heart a new capability based on an advanced technology—spectral analysis fast-Fourier transform Doppler. This technique records information about the velocity of blood (gained from the Doppler effect) inside the heart's chambers and blood vessels, and rapidly processes it so that the cardiologist can immediately gauge the heart's pumping efficiency, the arterial flow, and the volume of blood pumped in a single heart-beat.

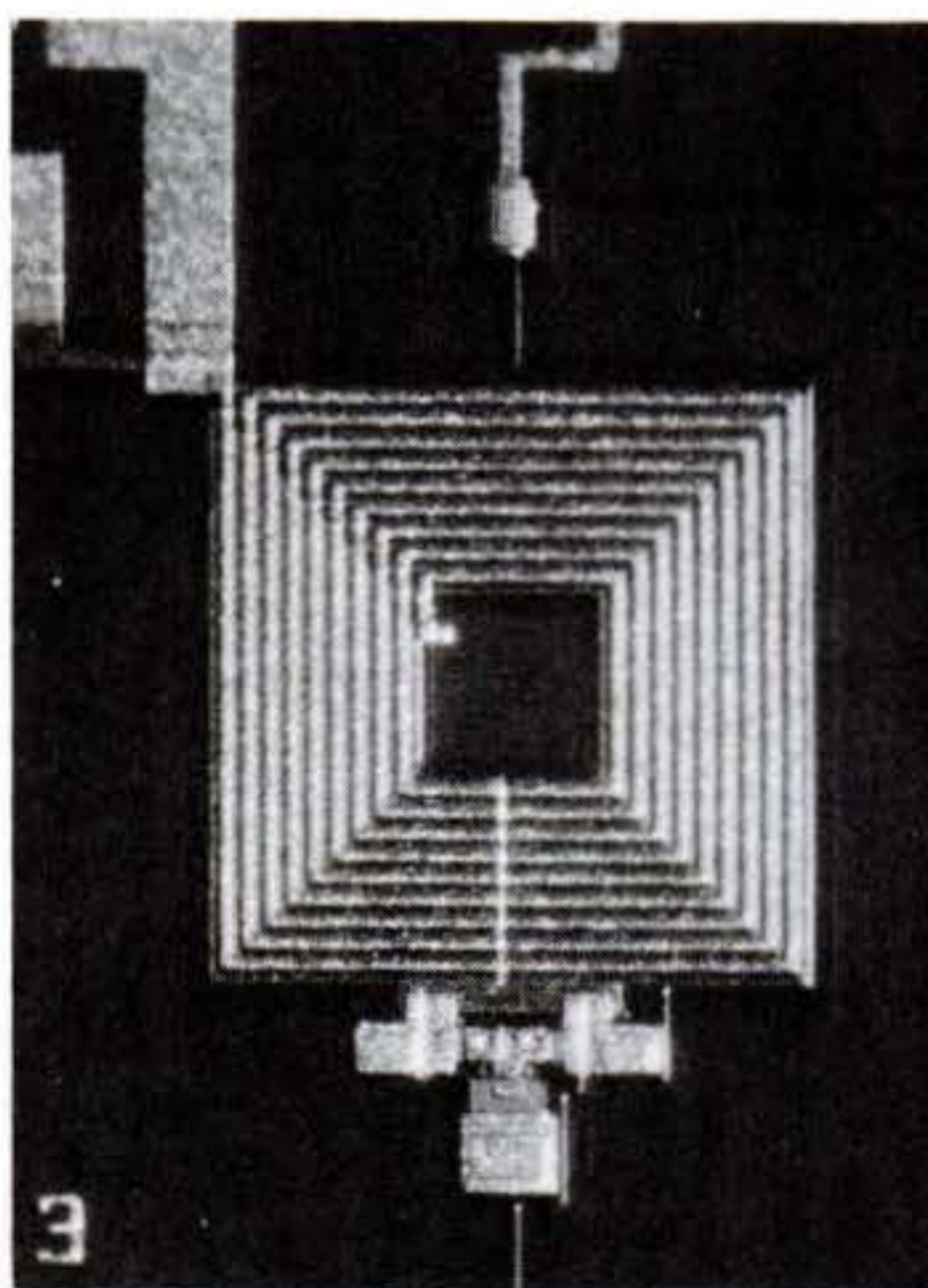
Can't-win-'em-all department

One proposed solution to the nuclear-waste disposal problem—burial in lead containers—could pose a risk greater than that from the radioactive wastes themselves, according to three scientists from

Lawrence Livermore National Laboratory. Their report cites the fact that lead is carcinogenic and mutagenic, and represents "an eternal hazard" because it does not decay. One lead canister designed by the Swedes would be more hazardous than the waste it contains in just 500 years, according to the LLL team.

Ultimate sensor?

The basic laws of physics impose absolute limits on what scientists can do, no matter how ingenious they are. The device shown below, developed by physicists at IBM's Thomas J. Watson Research Center, comes very close to those limits. Called a SQUID, for Superconducting Quantum Interference Device, it could allow measurements of changes in magnetic fields as minute as a millionth of a millionth of Earth's feeble field, when the changes occurred at frequencies above 10 kilohertz. That's 100 times better than existing instruments. E3



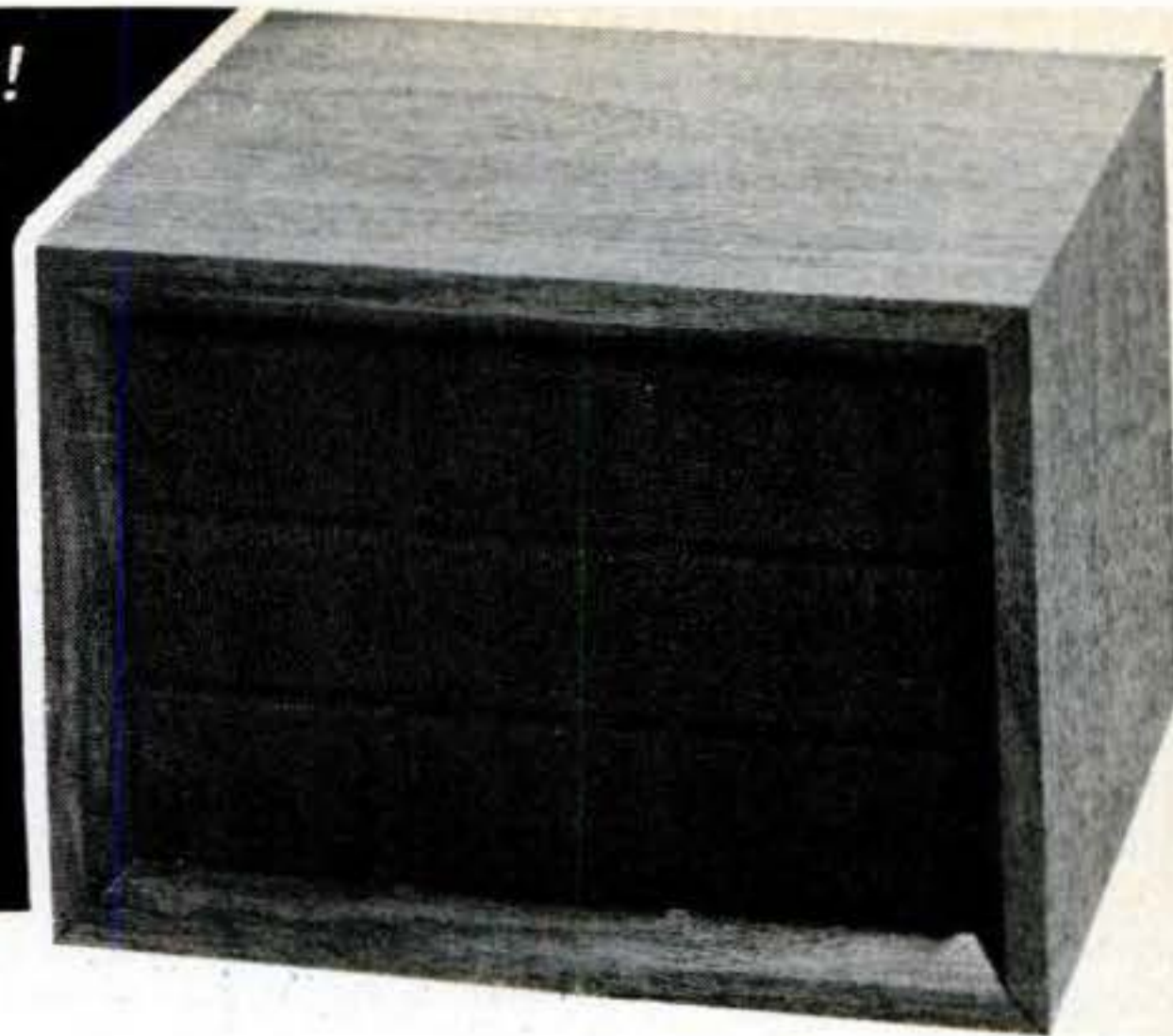
Not Just Another Limited Area Motion Detector!

guardex™

Protects Every Square Inch Of Your Building

Turns On Lights Automatically

Powerful Electronic Siren



Low Cost Computerized Burglar Alarm System Home - Office - Business

NO INSTALLATION

Just plug the Guardex 8000 alarm system in, make two simple control adjustments to suit your particular building and it works! There are no other wires to run. This totally self-contained burglar alarm can completely seal off every square inch of the surface of your building. It protects doors, windows, and what most alarms miss... your roof, walls and floors.

HOW CAN ONE SMALL COMPUTER PROTECT MY WHOLE BUILDING?

Guardex 8000 Alarm System works on the principle of audio discrimination. This, put simply, is the process of electronically separating normal everyday sounds, such as voices, telephones, etc. from break-in type noises such as breaking glass, prying metal, or forcing a door open. The Guardex 8000 protects one story homes and offices up to 2000 square feet and open commercial buildings up to 10,000 square feet. The Guardex 9300 with wireless remote sensor capability is available for multi-story homes and offices or single story with more than 2000 square feet. Call the factory for more detailed information.

TURNS ON LIGHTS AUTOMATICALLY

When the first break-in type sound is detected, the system will instantly turn on lights, radio, or other electronic equipment that you have plugged into the back of the alarm. These lights or other equipment will remain on for a period of five minutes, then automatically turn off.

POWERFUL ELECTRONIC SIREN

The Guardex 8000 alarm is equipped with a loud built-in siren. If during the five minute period the lights or other electronic equipment has been activated, a second break-in sound is detected, (it can be only a second or two after the first break-in sound) the built-in siren will start blasting for 90 seconds. At the end of approximately 90 seconds the siren will shut off and the alarm listens again. If another break-in sound is heard, the siren will come on for another 90 seconds. If no other break-in sound is detected, the siren will stay off and at the end of the five minute period the lights will shut off and the alarm instantly resets.



The rear control panel contains two standard AC plug receptacles for a table lamp, spot lights, radio, etc.; terminals for connecting optional outside siren and back-up battery (not included); entry delay time control and sensitivity control.

The Guardex 8000 Alarm System is walnut grained and disguised to look like a small stereo speaker (6³/₄" x 9³/₄" x 8") and weighs less than 6¹/₂ pounds.

EXIT AND ENTRY DELAY

The Guardex 8000 alarm has a built-in exit delay allowing you approximately one minute to lock up and leave the building before the alarm is armed. When you enter your building you may find that just your normal entering sounds activate the siren. You may delay it from starting for up to 30 seconds by turning up the siren entry delay control.

BATTERY BACK-UP

Burglars rarely cut power. However, to give you total protection from a burglar and possible power failure, our alarm has provisions for a battery back-up. (Batteries not included). 12 volt lantern batteries are available at most hardware stores.

THE BURGLARY PROBLEM

The F.B.I. statistics show that at the present rate, one out of every four Americans are going to be burglarized. That is not a very pleasant fact, but it is true. You have a greater chance of being burglarized than being a victim of a fire or automobile accident. The time is now to help protect yourself and your valuables with a Guardex 8000 alarm system.

OUTSIDE SIREN

The Guardex 8000 alarm is equipped with a loud, built-in siren, but if you desire an additional siren to mount outside or in an area away from the main alarm, they are available with 50 feet of wire for \$24.95. (Connecting terminals are provided on the back of the alarm).

30 DAY NO RISK TRIAL

This is your opportunity to purchase an alarm system directly from the factory for only **\$199.95**. Try it in your home or business for thirty days without risking one cent. Put our Guardex 8000 alarm to your own test. See for yourself! It will protect every window and door from break-in. If you are not completely satisfied, return the alarm within 30 days for a complete refund. To order your Guardex 8000 alarm, CALL TOLL FREE to charge your credit card or send your check to Guardian Electronics, Inc. in the amount of \$199.95 plus \$3.50 postage and handling. If you want the optional outside siren, add \$24.95 (California residents add 6% sales tax.)

(If you require more information, call during California business hours, Monday - Friday).



Dealer Inquiries Invited

CALL TOLL FREE
(800) 423-5499

California residents:
(213) 889-1414 collect.

GUARDIAN
ELECTRONICS, INC.

31117 Via Colinas, Dept. PS

Westlake Village, Calif. 91361

Price subject
to change
without notice.

NEW FREE BOOK DISCUSSES

HOW TO SELL YOUR INVENTION

Do you have an invention you intend offering to manufacturers on a sale or royalty arrangement? If so, by all means write for our free booklet as a guide, whether you do it yourself, or employ us to help you.

It's free for the asking and here are just some of the subjects it covers.

- How to Describe Your Invention so Manufacturers will take Notice
- The Next Step to Take if a Manufacturer Shows Interest
- Approximate Royalty Rates Manufacturers are Currently Paying
- If Your Invention is Sold Outright for Cash
- Or, Part Cash, Part Royalty
- Submitting Your Invention Before Patenting

Our reason for giving away information we've gathered over our 26 years in this business is simply that we hope you read it and employ us at our reasonable fee rather than do it yourself. But that will be for you to decide.

But understand, we are not promoters, developers, brokers. Ours is a technical service of writing descriptive materials for your invention and selecting the right manufacturers who potentially should be interested in it. The materials we prepare are your property.

We are not patent attorneys. For questions relating to proprietary rights, searches, patentability, you should consult a Registered Patent Attorney.

But back to the booklet. We want you as a client but only if, after reading it, you think you need us. Otherwise the booklet will show you how to do it yourself.

So use the coupon below or call us Toll Free. We'll rush the booklet to you. No obligation whatever. But please do not send models.

REFERENCES: Your own bank, attorney, or Chamber of Commerce.

Mail this coupon or CALL TOLL FREE 800/537-1133, Ext. 73. In Ohio CALL 419/332-6496, Ext. 73. Mail the coupon or call today.

MAIL THIS COUPON

Mr. K. O. Kessler, President
Kessler Sales Corporation,
Dept. D-73, Fremont Ohio 43420
Please mail me a copy of your FREE Booklet explaining how to go about selling my invention. It is understood that this does not obligate me in any way to use your service.

Name _____
Street Address _____
City _____ State _____ Zip _____

ALTERNATE-ENERGY ANSWERS

By JAN F. KREIDER

Jan F. Kreider is a consulting engineer specializing in the design and economic analysis of solar-energy and energy-conservation systems. He is the author of several books on solar technology, and a lecturer at the Univ. of Colorado.

Calculating air infiltration

I am attempting to calculate the heat load on my residence before installing a solar system. Heat losses through walls and windows are easy to figure, but what about infiltration?

Pat Ross, Beaverton, Ore.

There is a way to gauge infiltration in a residence. It involves measuring the amount of water evaporated from a pan (preferably slightly heated by setting it on the back of your wood stove, for example) for a period of weeks, along with twice-daily measurements of indoor and outdoor relative humidity with a psychrometer. The relative humidity figures are converted to "humidity ratios" using a psychrometric chart. The air-infiltration rate is found using this simple equation:

$$\text{lbs. of air infiltration per day} = \frac{\text{(lbs. of water evaporated per day)}}{\text{(inside humidity ratio - outside humidity ratio)}}$$

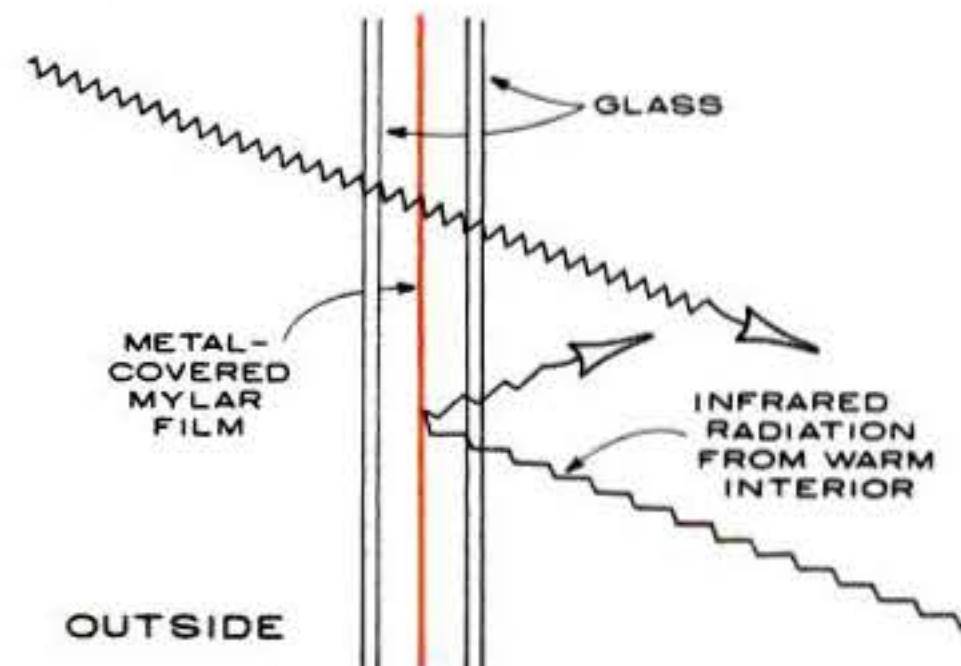
For example, if the inside conditions are 70 degrees F and 40 percent humidity and average outdoor data for the day are zero degrees F and 20 percent, the psych chart gives humidity ratios of 0.0077 and 0.0018 lb. water/lb. air. If 20 lbs. of water were evaporated per day, the formula shows that 2,660 lbs. of air were exchanged with the outdoors. This is the same as 1,478 cu. ft./hour—relatively low for a residence. Taking measurements twice a day about 12 hours apart will yield a fair average for each day. These measurements must be made every day for several weeks to get a reliable estimate.

Heat-Mirror glazing

The other day I heard a news report on TV announcing a breakthrough in insulating glass for windows. According to the description, an ultrathin transparent film is laminated between two pieces of glass. Could you report on this product?

Judge Robert Campbell, Duluth, Minn.

The product is called Heat-Mirror and is



produced by Southwall Corp. For further information write to Alex Tennant at the company (3961 E. Bayshore Rd., Palo Alto, Calif. 94303). Briefly, Heat-Mirror in its most efficient form is a double-glazed window with a thin Mylar film between, but not in contact with, two panes of glass. The film is treated with several invisible layers of metal to form a surface that will reflect thermal radiation, thereby trapping heat within a building more effectively than ordinary glass. The U-value of this product is about 0.2 compared to 0.55 to 0.60 for double glazing; therefore, heat losses are reduced by a factor of approximately three. The Heat-Mirror is completely invisible and permits solar heat to enter a window almost as effectively as if it were not present.

More on wood collectors

Your warning about wood collectors [PS, Nov. '80] came too late for me. I have all of my south roof covered with Kalwall Sun-lite, nailed directly to the rafters. I have already bought copper absorbers (water type), which I had planned to hang between the rafters. Can this plan be salvaged?

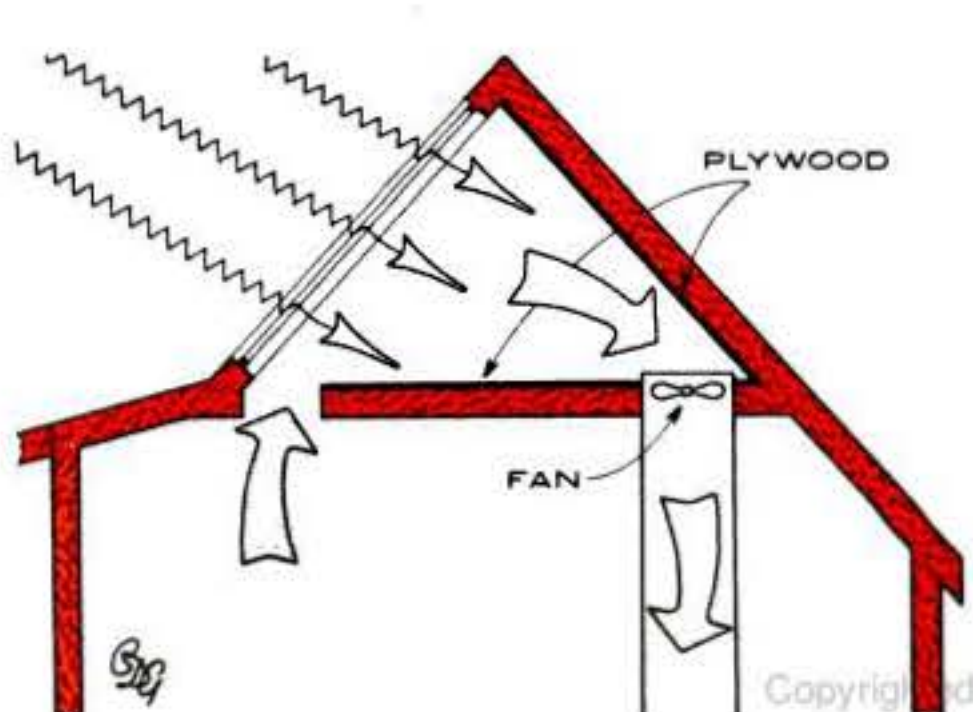
Philip Cullum, Lexington, Ky.

We are building a small solar house. Would you please send your comments on our large circulating-air-type collector in the attic? The plywood floor painted black would be our "wood collector." We're hoping our plans are safe.

Joyce McQueen, Falls City, Neb.

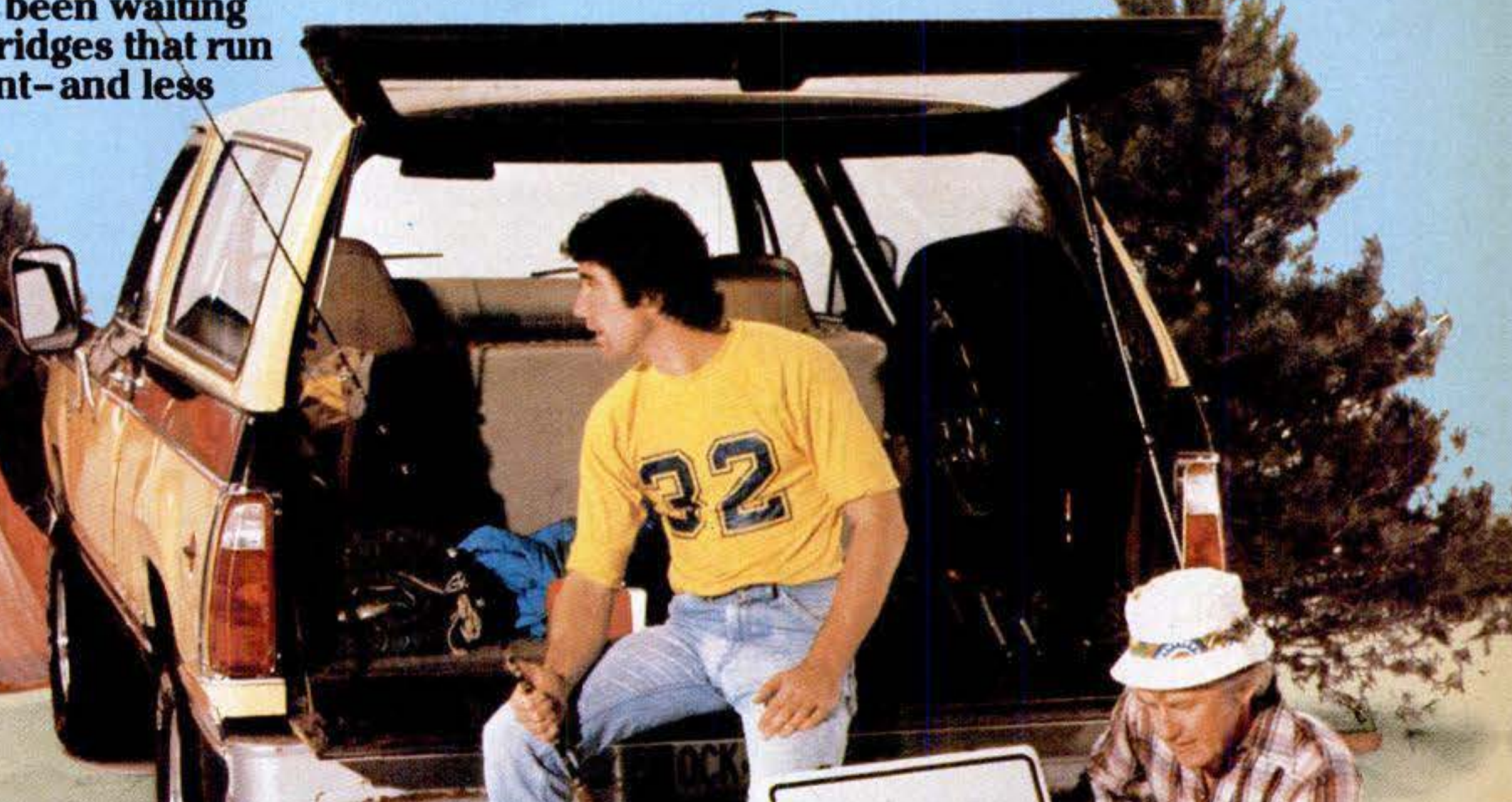
The problems with wood seem to occur when the collector is permitted to "stagnate," that is, to operate with (in the first case above) no flow of water through the copper absorber plate for an extended period. The problem is further aggravated if the back of the absorber is relatively well insulated. If your system controls can be designed to avoid extended no-flow operation in bright sun, the fire hazard can be avoided.

In air-type collectors with the flow of air
Continued



The portable electronic fridges that are changing America's lifestyle.

Outdoor lovers all over America are discovering that what they've been waiting for is already here: portable fridges that run on something more convenient - and less messy - than blocks of melting ice.



Car Fridge (P10)

Deluxe Portable (P34A)
(Doubles as a bar fridge)

Sportsman Fridge (P34)

What makes Koolatron portables tick is a tiny, space-age-efficient thermoelectric solid state module.

Koolatrons simply plug into 12-volt lighter sockets, or operate from house current with our optional 110 volt AC adaptor. Very easy. Very clean. And very convenient.

Whichever model you choose, a Koolatron portable is light, versatile and surprisingly spacious. The Sportsman Fridge, for instance, weighs only 17 lbs - less than a cooler with a block of ice.

Yet it holds up to 40 lbs. of provisions, or 48 twelve-ounce pop cans.

And with the flick of a switch, two of our three models turn into food warmers.

Take them just about anywhere, in just about anything.

Because of its aerospace-inspired solid state refrigeration modules, a Koolatron portable is unaffected by travel, vibration or tilting.

So wherever you go, you can take your Koolatron portable with you - on vacation, camping, boat trips, hunting, fishing, cottages, the office for working lunches, the rec room as an extra fridge, even shopping.

It's really like having a smaller version of your home refrigerator. And it'll do just as good a job, keeping food at normal refrigeration temperature (40° to 45°F) even in 95° weather.

The Car Fridge that's also a food warmer. \$139.00 (\$149.00 in Canada). (Model P10).

The Koolatron Car Fridge holds 17 twelve-ounce pop cans or about 15 lbs. of provisions. With the flick of a switch, it warms up to 150°F to keep hot foods hot.

Vital statistics: Blue Polypro plastic, 16" x 11" x 11½" ext., 10-litre (11 qt) capacity, weighs 10 lbs., operates from 12-volt power or with our optional 12VDC/110VAC power adaptor.

The Deluxe Portable with the works. \$199.00 (\$209.00 in Canada). (Model P34A).

For the man who wants everything - fully adjustable temperature control, low battery warning indicator and food warming switch over.

Vital statistics: Beige ABS case, 21" x 16" x 16" ext., 34 litre (36 qt) capacity, weighs 17 lbs. (See Car Fridge above for operational details.)

The Sportsman Fridge that takes the rough out of roughing it. \$179.00 (\$189.00 in Canada). (Model P34)

The Koolatron Sportsman has the same dimensions as the Deluxe but does not include the food warmer or low battery warning indicator and has fixed temperature control.

Order today without obligation!

Write or phone. We'll rush you your unit on our no risk 21-day trial basis. Each unit has complete instructions and a written one year warranty backed up by Koolatron - the world's largest manufacturer of solid state recreational

fridges. Service centres in New York, Arizona and Canada.

Phone for immediate delivery.

For rush delivery, call "toll-free" by operator-dialing us collect.

0-705-737-0842

Koolatron Industries Limited
56 Harvester Ave., Batavia, New York 14020
230 Bayview Drive, Barrie, Ontario, Canada L4N 4Y8
Or use this handy order coupon.

Koolatron		Dept. 1649
Industries Limited		
56 Harvester Avenue, Batavia, New York 14020		
Canada: 230 Bayview Drive, Barrie, Ontario L4N 4Y8		
Please send me:		
<input type="checkbox"/>	(P10) Car Fridge at \$139.00 (\$149.00 in Canada)	
<input type="checkbox"/>	(P34) Sportsman Fridge at \$179.00 (\$189.00 in Canada)	
<input type="checkbox"/>	(P34A) Deluxe Fridge at \$199.00 (\$209.00 in Canada)	
<input type="checkbox"/>	Koolatron 110V adaptor at \$39.95 (same in Canada)	
Please add \$9.00 for handling and delivery per unit. No charge for shipping adaptor if ordered with unit. Add \$3.00 for shipping adaptor only. (N.Y., Ont. and Que. residents add sales tax.)		
I understand that I may return any item undamaged within 21 days and receive a full refund if I am not satisfied.		
<input type="checkbox"/> I enclose check or money order for		
\$ _____ or please charge to my		
<input type="checkbox"/> Visa <input type="checkbox"/> Mastercharge <input type="checkbox"/> American Express		
Account Number _____		
Expiry Date _____		
Signature _____ (necessary to ship merchandise)		
NAME _____		
ADDRESS _____		
CITY _____		STATE _____
ZIP CODE _____		PHONE _____
PLCF _____		

DEALER ENQUIRIES NOW INVITED



STAINED GLASS

Send 50¢ for fascinating catalog of kits, tools, ideas, books, and supplies.

BIG STARTER KIT
Only \$17.95 ppd.

WHITTEMORE, Box 2065DE, HANOVER, MASS. 02339

Clock Components



Clock Movements: Battery, Quartz, Electric, Urgos Grandmother, Grandfather, Westminster & Triple Chime, 8 Day Key Winds & Westminster, Bim Bams, Barometers, Metal, Bezel, Paper dials, Hands, Brass & Plastic Numbers & Markers. Hundreds of Items. Quantity Prices. Send \$1.00 for 60 Page Catalog. Refunded on \$10.00 Order.

NEWPORT ENTERPRISES, INC. DEPT C
2313 W. Burbank Blvd., Burbank, Calif. 91506



TRAILER FOR THE 80's—Burro Travel Trailer kit sleeps four. Under 1,000 lbs. Fiberglass. Ready to tow. Finish interior only. Write Burro PS-3, 14143-21st Avenue North, Plymouth, MN 55441. For full color catalog send \$2.00 to cover postage and handling. Dealers Wanted.



LEARN MEAT CUTTING

Train quickly in 8 short weeks at Toledo for a bright future with security in the vital meat business. Big pay, full-time jobs—**HAVE A PROFITABLE MARKET OF YOUR OWN!** Time payment plan available. Diploma given. Job help. Thousands of successful graduates. **OUR 58th YEAR!** Send NOW for a big new illustrated FREE catalog. No obligation. C.I. approved. **NATIONAL SCHOOL OF MEAT CUTTING**, No. 71-02-0197T, Dept. 51-N 33 N. Superior, Toledo, Ohio 43604.

BRING ON YOUR TOUGH JOBS



Mow 3 acres in an hour. Plow 8" deep. Front load 1/3-ton bucket loads into a pick-up. Till, cultivate, bulldoze, blow snow...get your tough jobs done fast!

Power King's dependable cast iron engine provides high-torque workpower. Rugged, all-gear drive delivers nearly 100% of engine power to big, ground-gripping drive wheels...squeezes more work out of every drop of fuel. Ground clearance up to 19" lets you cultivate tall crops and work in rough ground.

Get American-made Power King in 12, 14, 16 and 18 hp models and over 20 man-sized attachments. See your Power King Dealer for a test drive or write for free catalog.

POWER KING

ONE TOUGH TRACTOR

ENGINEERING PRODUCTS CO., INC. 1005-A3 ANOKA AVE., WAUKESHA, WI 53186

Alternate-energy answers

[Continued]

between glass and absorber, temperatures can usually be kept under control. Mrs. McQueen's attic design (preceding page, lower right), with its large air plenum, would appear to be safe if it has controlled fan circulation in winter and venting (or reflecting shades) in summer.

Two other problems with wood are worth mentioning. As wood is exposed to elevated temperatures it loses strength. This should be considered in rafter design. Also, wood can "outgas," that is, the volatile organic compounds can evaporate from the wood at higher temperatures. If the collector housing is not well ventilated, these compounds will condense on the inner surface of the collector glazing and reduce the transmission of sunlight.

Homemade parabolic collector

I plan to make a parabolic solar reflector (trough type) for heating water, and I would like to know if Mylar mirror sheet would be a practical material for this.

Verne Pederson, Portland, Ore.

Aluminized Mylar, manufactured by several U.S. companies (Du Pont is one), is an excellent material for the reflector of a parabolic solar collector. A very accurate and smooth surface is required for the curved base, however, since Mylar is very thin and has no structural strength of its own. Depending on solar intensity, Mylar may last for several years if ultraviolet inhibitors are included in the compound.

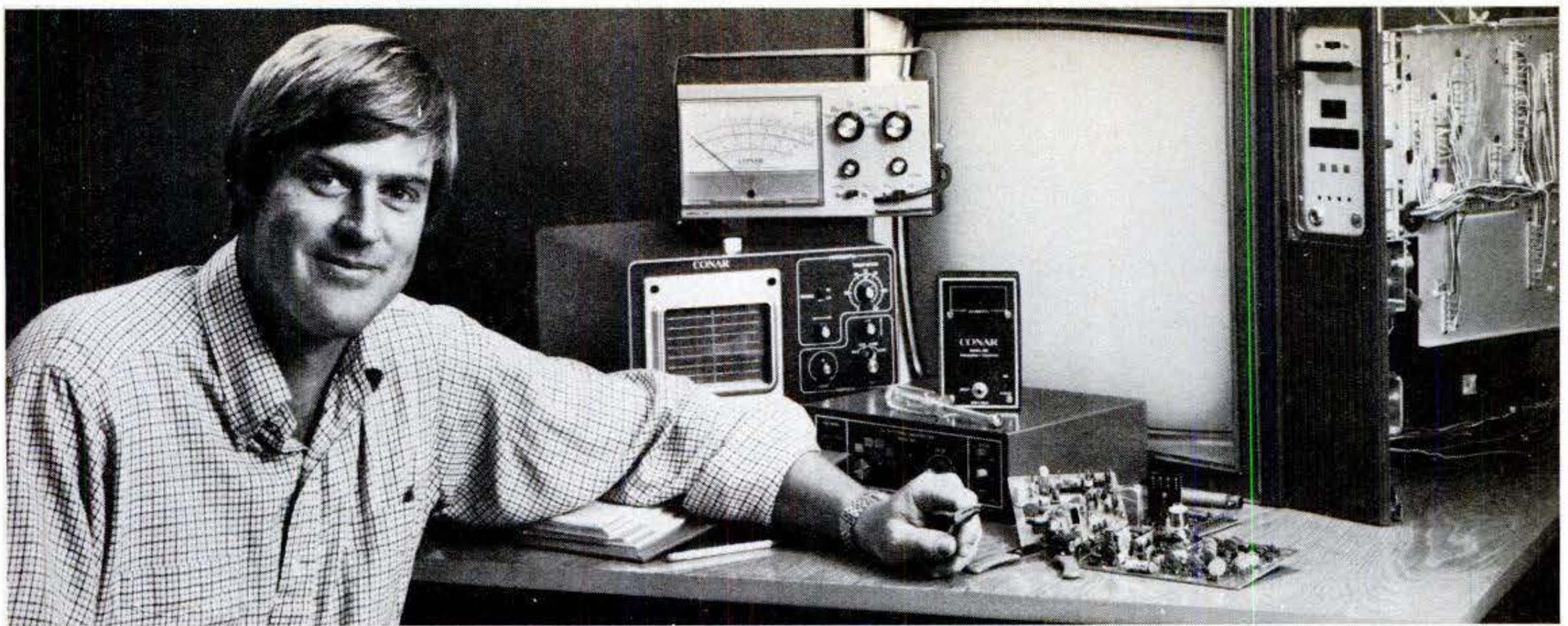
Information numbers

For inquiries about residential and small-scale commercial solar heating and cooling, call the National Solar Heating and Cooling Information Center toll free at (800) 523-2929. In Pennsylvania dial (800) 462-4983, and in Alaska and Hawaii dial (800) 523-4700.

For inquiries about photovoltaics, wind, solar thermal power, ocean energy, biomass, agricultural and industrial process heat, educational institutions, manufacturers, and government agencies, call the National Solar Energy Inquiry and Referral Service at (800) 525-5000. In Colorado dial (800) 332-8339.

Got a question on an alternate energy such as solar, wind, water, or wood? Wondering about energy-conservation techniques for home heating or cooling? Every other month, alternating with "Adventures in Alternate Energy," Jan Kreider answers selected questions from readers. Send yours to "Energy Questions," POPULAR SCIENCE, 380 Madison Ave., New York, N.Y. 10017. Individual queries can't be answered by mail.

In the "Alternate Energy Adventure" we present a project developed or reported on by PS readers, and pay \$200. Submit black-and-white glossies and a sketch to "Energy Adventure" at the address above.



Wouldn't you like to have a new skill you could call your own? Then learn TV and audio servicing with at-home training from NRI.

You can learn to service and repair TV, stereos, electronic musical instruments and amplifiers, car and portable radios, record and tape decks, the new video disc and tape players, almost any kind of electronic home entertainment equipment on the market. And as you take NRI's Master Course, you build your own 25" (diagonal) color TV with built-in computer programming that lets you preset a whole evening's viewing. You also build a solid-state stereo receiver with speakers and professional quality test instruments you keep and use.

Designed-for-learning Equipment

The computerized TV, stereo, and test equipment you build are not hobby kits or preassembled commercial units with retrofitted lessons. They are designed by NRI engineers and instructors to give you valuable experience as you build them, reinforce theory with practical demonstrations, and end up as fully operable, high-performance units you'll be proud to have. And only NRI gives you "power-on" training...you introduce and correct problems in live circuits as you learn.

Build Advanced Technology TV

The NRI TV you build features the latest advances in video science. Its com-



puterized tuner lets you change channels at the touch of a button, preset up to eight hours, programming and key lock it in to control children's viewing. It includes automatic tint and chroma controls, automatic degaussing, and automatic fine tuning...oversized speaker, built-in digital clock, 100% solid-state chassis, modular plug-in circuit boards, and the latest development in picture tubes with 100° tri-potential focus in-line gun. And console cabinet is included at no extra charge.

Other kits you build include the NRI stereo, 5" triggered-sweep oscilloscope, digital frequency counter, 10-display TV pattern generator, transistorized volt-ohm meter, and the NRI Discovery Lab® for performing additional experiments and proving theory.

Includes Business Training

Your NRI training includes what you need to build a business of your own. You learn how to set up and run a shop... billing systems... basic bookkeeping... business practices. You can start small, even part-time in your basement or garage, make the most of your opportunities to grow into independence.

Free Catalog...

No Salesman Will Call

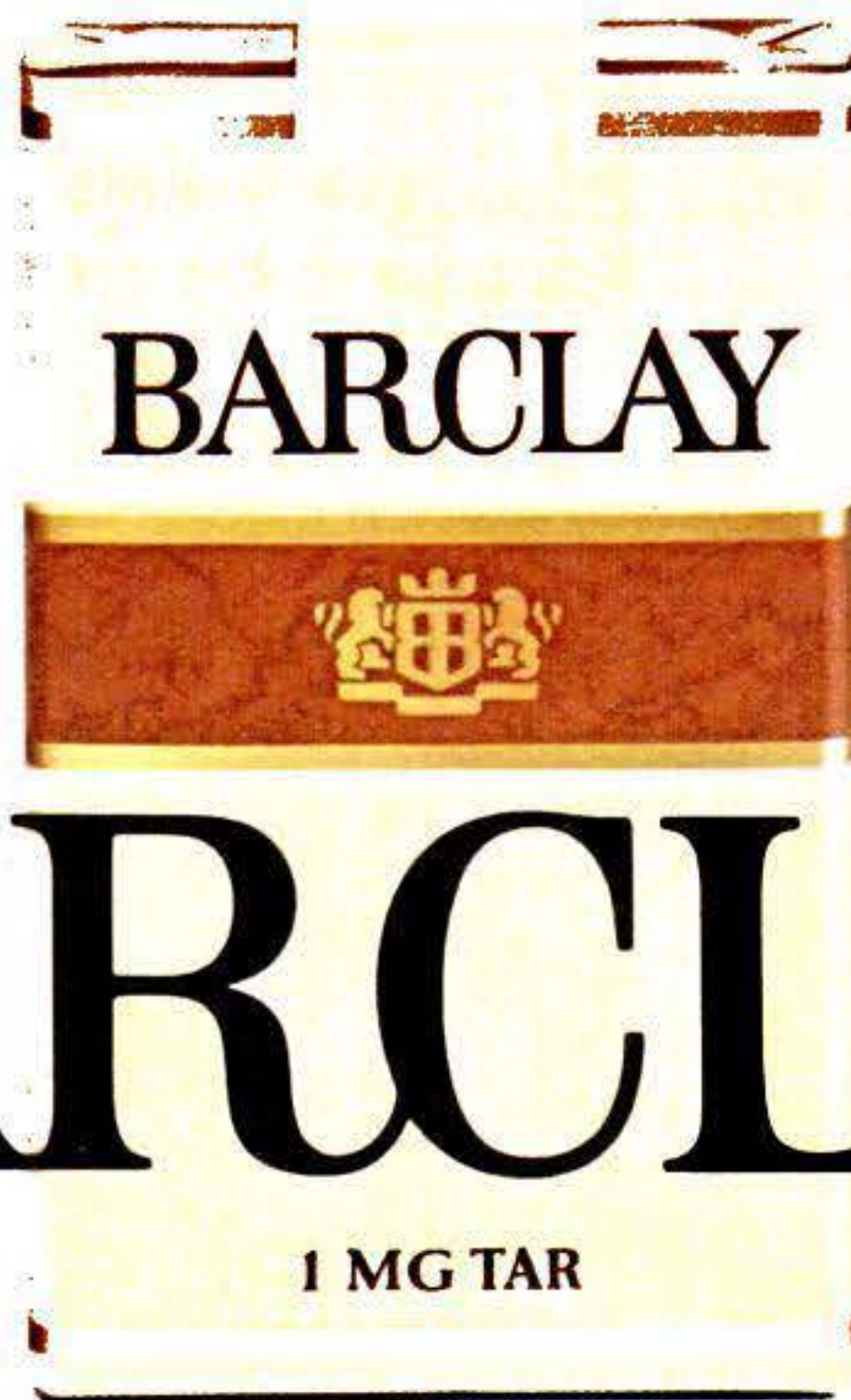
NRI does not employ salesmen. You make your own decision without pressure, with all the facts in front of you in our free, full-color catalog. It describes the course in full, showing all equipment, lesson outlines, and specifics of NRI training. It also shows other exciting courses like Microcomputers and Microprocessors, the big world of Complete Communications, and more. Mail the postage-paid card today for your copy. And see how you can make the most of your talent. If card has been removed, write to:



NRI SCHOOLS

McGraw-Hill Continuing
Education Center
3939 Wisconsin Ave.
Washington, D.C. 20016

*The pleasure
is back.*



BARCLAY

*99% tar free.*TM

*Also available
in 100's and Box*

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

Kings and Box, 1 mg. "tar", 0.2 mg. nicotine;
100's, 3 mg. "tar", 0.4 mg. nicotine
av. per cigarette by FTC method.



**FIRST TIME EVER!
BEST EPA RATING EVER!
AND CHEVY'S GOT IT!**

20 MPG. V8 POWER.



Chevy V8 Special Economy Truck

BEST EPA ESTIMATED GAS MILEAGE RATING OF ANY V8 TRUCK EVER! EVEN BETTER THAN ANY V8 CAR, IMPORTED OR DOMESTIC!

Here are some surprising facts:

FACT: In the past 5 model years, over 80% of all domestic light-duty trucks were equipped with V8 engines!

FACT: In V8 power and economy, Chevy V8 Special Economy Truck beats its closest sales competitor's highest-mileage V8 by 3 miles per gallon and 47 horsepower!

FACT: Chevy V8 Special Economy Truck combines the power of a V8 with the economy of a Six!

FACT: Chevy Special Economy Truck has the best EPA estimated MPG of any V8 truck...even better than any V8 car, import or domestic!

FACT: Chevy Special Economy Truck is not only surprising—it's amazing!

28 EST. HWY.

20 EPA EST. MPG (CITY)

Use estimated MPG for comparisons. Your mileage may differ depending on speed, distance, weather. Mileage will be less in heavy city traffic. Actual highway mileage lower. Not available in California where com-

parisons do not apply.

Fuel economy comparisons exclude trucks with same powertrains offered by GMC Truck Division.

Chevy pickups are equipped with GM-built engines produced by various divisions. See your dealer for details.

See a limited production Chevy V8 Special Economy Truck today.



**BUILT TOUGH.
BUILT FOR ECONOMY.**

Mercedes gas turbine

Is 16.5 mpg in a
3,500-lb. car
good enough?

Using new materials and techniques, Mercedes hopes to save the big car

By JAN P. NORBYE

Big, heavy cars are disappearing, for obvious reasons. The more weight an engine has to push around, the more work it has to do and the more fuel it uses. Small, lightweight cars get better mileage.

Mercedes would like to continue making big cars. Engineers there think that maybe they can—by using a gas-turbine engine to get acceptable mileage. They calculate that the prototype car in which it will go, and on which they are already working, will weigh 3,530 pounds when finished. By comparison, a 1981 Toyota Starlet weighs 1,730 pounds.

Recently I was admitted inside the Mercedes-Benz experimental design offices and research laboratories to look at work in process. I was accompanied by Dr. Michael Wessels, one of the engineers who works full time on the gas-turbine project.

Dr. Wessels spread a blueprint on a big table and explained the advan-

tages of the gas-turbine engine:

- Multi-fuel capability.
- Low emission levels—due to continuous combustion with a high proportion of excess air.
- Simplified maintenance—no tuneups or oil changes are needed.
- Minimal internal friction—low wear rates result in long engine-life expectancy.
- No vibration—because there is no reciprocating motion as there is in a conventional piston engine.
- Low noise level—which makes silencing easy.

Mercedes is looking at the year 2000 as a possible production date. However, before turbine-powered Mercedes start rolling off the production lines, many problems must be overcome.

A turbine's aerodynamic efficiency is dependent on the peripheral speed of the turbine rotors. To maintain the necessary peripheral speed, a small automotive-type turbine has to spin faster. This can cause mechanical failure. Components, therefore, must be made more durable, able to withstand higher temperatures and increased rpm.

Clearances are a problem. When

scaling down a turbine to automotive size, tolerances—which are already minimal—can't be scaled down proportionately. So the smaller unit tends to operate with disproportionately large clearances and loses aerodynamic efficiency.

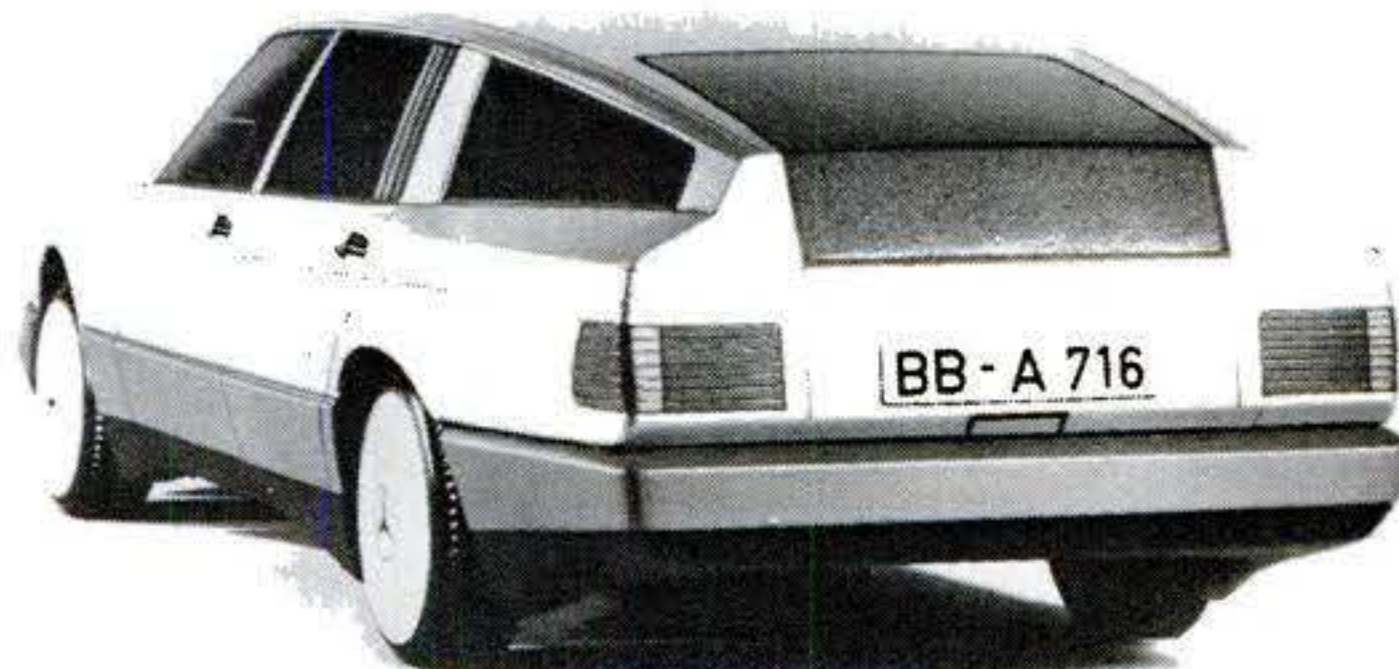
But the biggest problem of all is temperature, says Dr. Hans Joachim Forster, director of research for Mercedes-Benz. "At 2,400 deg. F the gas turbine reaches the same overall efficiency as a good diesel engine under full load, and exceeds the part-load efficiency of a modern Otto-cycle piston engine," he says.

Only ceramics can withstand these temperatures. Most promising are silicon nitride and silicon carbide.

"Both turbine wheels are made of silicon nitride," says Dr. Wessels. The secondary turbine is equipped with a variable-vane nozzle, which must also be made from ceramics. "We know the efficiency of our individual components, and we're on target," he says. "We have found good enough resistance in our ceramic parts to feel optimistic about reaching our goals."

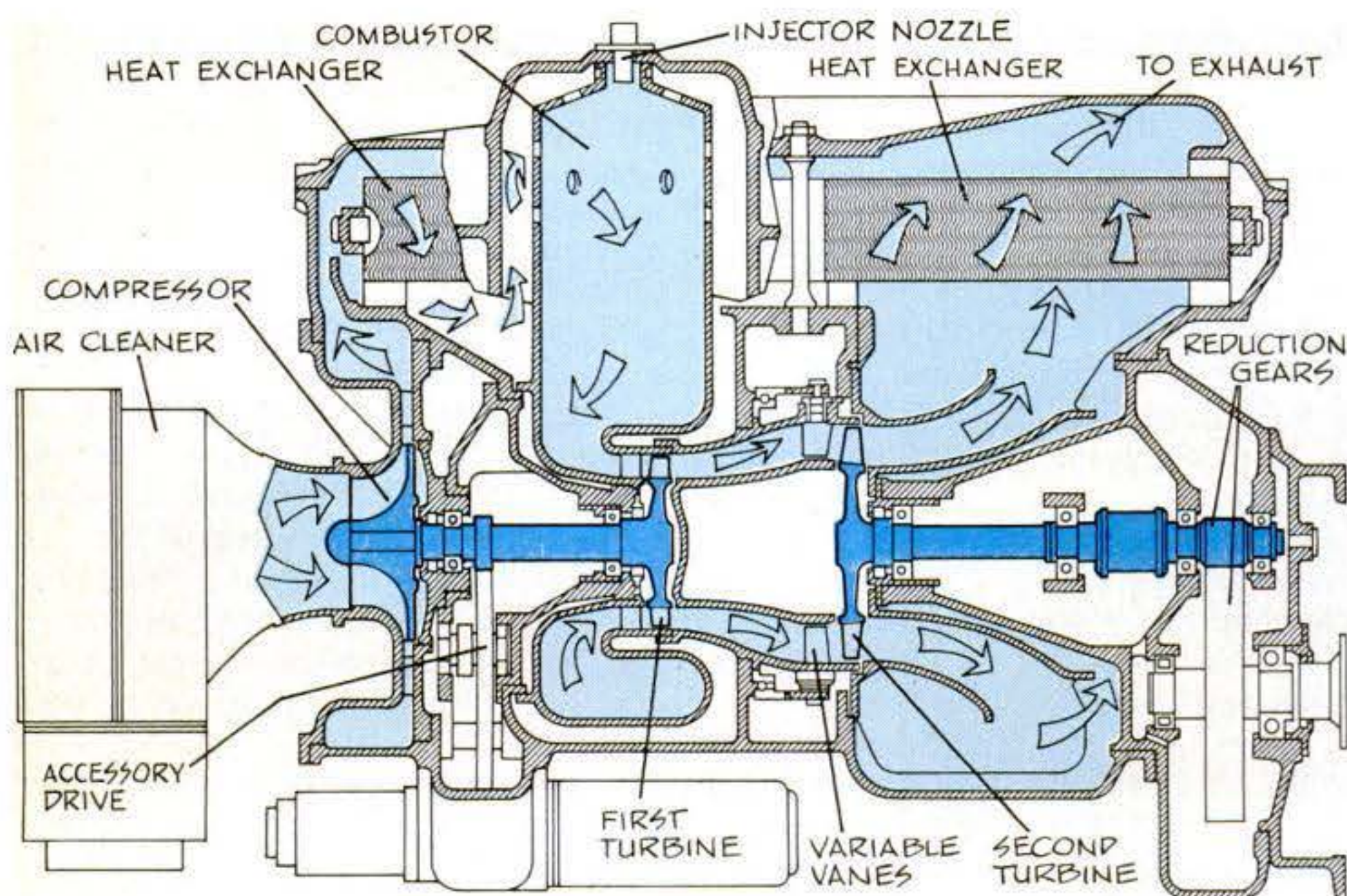
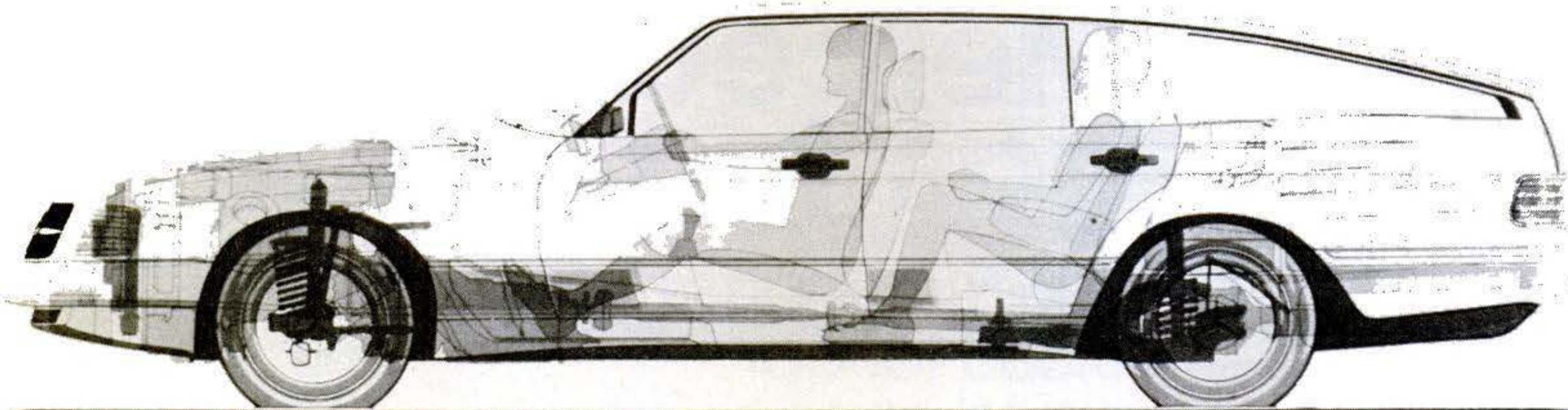
The Mercedes turbine basically resembles the GM, VW, Nissan, and

Continued



Turbine-powered car may look like this. Chassis and interior are based on current S-class Mercedes. Engineers are working on

improving vehicle aerodynamics as well as reducing weight. Other Mercedes models will benefit from these developments.



Location of engine, seats, and trunk (which provides ample storage space) is shown above. The transmission is automatic, with a hydraulic torque converter. Mercedes turbine engine works like this: The compressor impeller draws air in, forcing it through a rotating heat exchanger (heated by the hot exhaust gases). The hot compressed air is forced into the combustor, where fuel is continuously injected. The mixture is ignited and passes through the compressor turbine and the power turbine, causing both to turn. Power is transmitted from the power shaft to the rear wheels through reduction gearing.

Toyota gas turbines. It is an open-cycle, twin-shaft, regenerative type with a centrifugal compressor and two axial-flow turbines. Although it can run on various fuels, it is currently running on diesel fuel. It uses a can-type combustor and a single horizontal, revolving ceramic-disc heat exchanger (using exhaust heat to pre-heat the charge air after compression). The accessory drive is taken from the gasifier section, and the fuel system is electronically controlled.

At the end of the present initial development phase, the engine will run with a pressure ratio of about four to one and with turbine inlet temperatures of 2,280 deg. F. This is calculated to produce 128 hp at 60,000-65,000 rpm of the primary turbine, with a peak torque of 244 lbs. ft.

The complete engine should weigh no more than 530 pounds, with an installation package about 26 inches wide, 22 inches high, and 30 inches long (minus air filter, but including the reduction gear and its housing).

The final development phase will not start until the results of current testing have been evaluated and specifications agreed on for a second-generation design. This will involve decisions about the use of compressor-inlet guide vanes, water injection, and manufacturing considerations.

With the second-generation engine, Mercedes-Benz engineers will aim for a turbine inlet temperature of 2,460 deg. F, which would give 150-hp output and boost the maximum torque to 404 lbs. ft.

Fuel economy for the second-generation turbine for the European urban driving cycle is calculated to be 16.5 mpg. At steady speeds, the car would give 43.5 mpg at 53 mph, 42.7 mpg at 56 mph, 35 mpg at 74.5 mph, and 31.3 mpg at 80 mph. Whether this will be acceptable for a luxury car in the year 2000, though, is uncertain.

By springtime in 1982, a complete test car will be delivered to the BMFT (Bundes-Ministerium für Forschung und Technologie, or Federal Ministry

of Research and Technology), which is sponsoring the project as part of its car-of-the-future program.

Mercedes-Benz intends to pursue gas-turbine development at its own expense after the BMFT contract runs out. Even when a prototype that meets all objectives is ready, one final hurdle will remain: production.

Manufacturing problems for the automotive gas turbine remain unsolved. Neither the methodology nor the tooling equipment for mass-producing small turbine engines exists, even on paper. And as English gas-turbine expert Noel Penny has pointed out: "No mass production of gas turbines is possible until the cost comes down significantly. That can't happen unless turbines are used in cars made in very large numbers."

But right now, for Dr. Bernd Strackerjan, the project leader for the Mercedes-of-the-future, and Eberhard Tiefenbacher, chief engineer for the turbine-engine project, the gas turbine is a leading contender. E5

A comparison of projections from manufacturers' treadwear ratings under the new government Uniform Tire Quality Grading System indicates that on a government-specified course:

Uniroyal Steeler projected to last up to 24,000 miles longer than its major competition.

The U.S. Department of Transportation recently gave the public a standard yardstick to compare tires by.

Now, each tire company is required by law to grade its tires in three areas. Traction. Temperature resistance. And treadwear.

And then to emboss the resulting grades on the side of the tires.

When compared, most of the similarly priced steel-belted radials in the chart fared equally well in the traction test. Same for temperature resistance.

But one tire pulls ahead of the pack when it comes to the important grade that indicates the relative wear rate of your tire.

That tire: the Uniroyal Steeler.

In fact, when you translate its 220 rating into projected miles on the government-specified course, you see it was no photo finish.

On that course, the mileage projection for the Uniroyal Steeler is 66,000 miles.

That's 15,000 miles longer than the Goodyear, Goodrich, General and most Firestone ratings in the chart would project.

And 24,000 miles longer than Michelin's rating would project.

These mileage projections (including those in the chart) should be used for comparison only. You will probably not achieve these results. Actual treadlife will vary substantially due to your driving habits, condition of vehicle and, in many sections of the country, road conditions and climate.

Nevertheless, what do these ratings say about the Steeler?

They say when you compare the ratings, the Steeler should outlast its major competition under comparable conditions of consumer use.

UNIROYAL

Clip and take this to your Uniroyal dealer:

MANUFACTURERS' RATINGS FOR U.S. GOVERNMENT QUALITY GRADING SYSTEM			PROJECTION OF MILEAGE ON GOVERNMENT-SPECIFIED TEST COURSE
Manufacturer/Tire:	Traction and Temperature Resistance	Treadwear	
UNIROYAL Steeler	B/C	220	66,000
GOODYEAR Custom Polysteel	B/C	170	51,000
FIRESTONE 721 (13" & 14" sizes)	B/C	170*	51,000
GENERAL Dual Steel II	B/C	170	51,000
B.F. GOODRICH Life Saver XLM	B/C	170	51,000
MICHELIN XWW	A/B	140	42,000

*Most 15" Firestone 721 tires rated 200 which projects to 60,000 miles.

Source: U.S. D.O.T. 12/19/80.

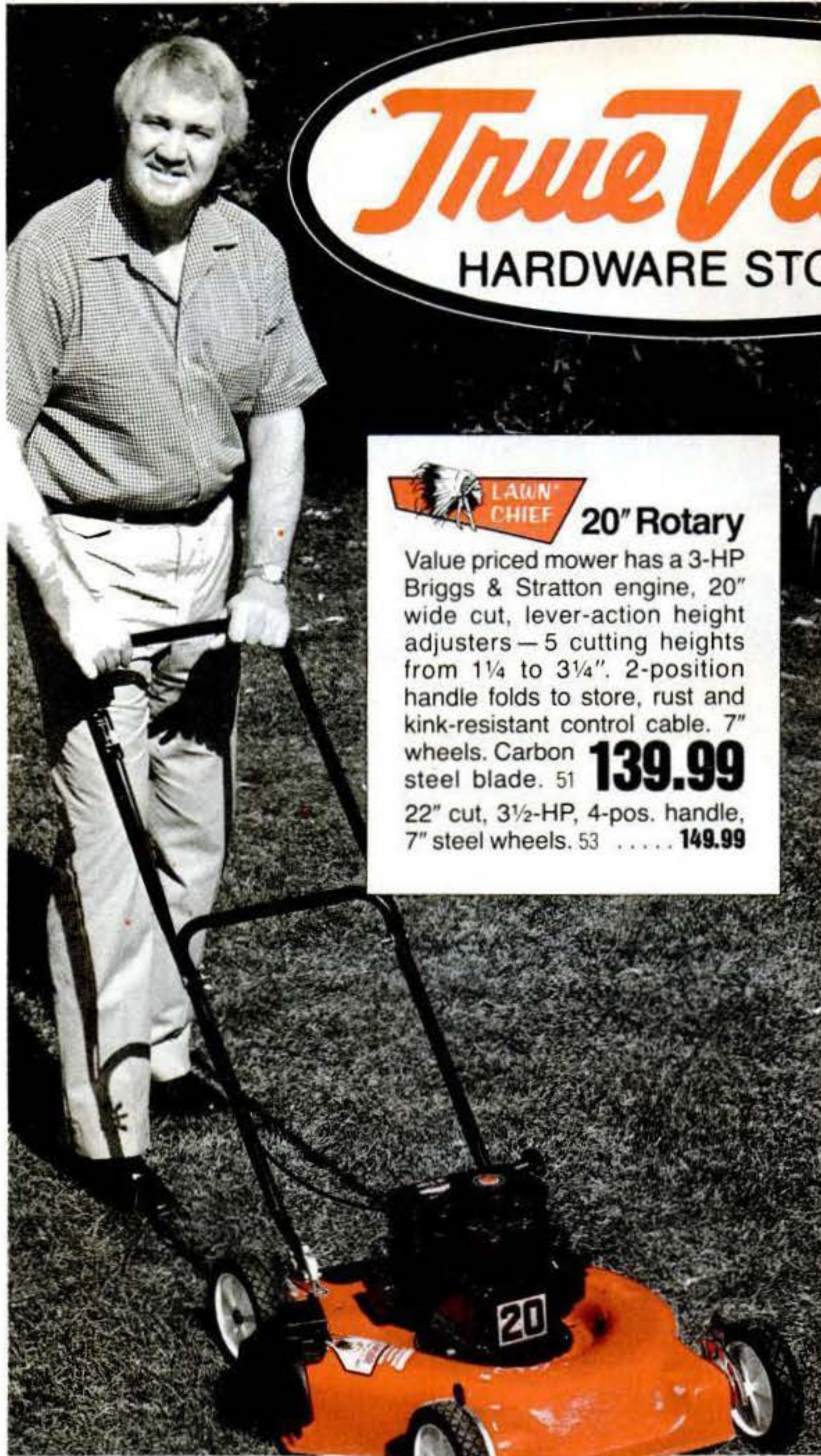
For a free booklet on grade-labeling, please send your name and address to: Uniroyal, Inc., Tire Advertising Department, Middlebury, Connecticut 06749. ©1981 Uniroyal, Inc.



True Value

HARDWARE STORES®

Keep a



20" Rotary

Value priced mower has a 3-HP Briggs & Stratton engine, 20" wide cut, lever-action height adjusters — 5 cutting heights from 1/4" to 3/4". 2-position handle folds to store, rust and kink-resistant control cable. 7" wheels. Carbon steel blade. 51

139.99

22" cut, 3 1/2-HP, 4-pos. handle, 7" steel wheels. 53

149.99



SERVES 18" Electric

Perfect for small lawns. 9-amp motor with built-in slip clutch runs quiet. Instant on/off, 3-sec. stop. 6" wheels. Steel blade. ES-18

109.99



Portatiller

Portatiller is ideal for small gardens. Handle folds to store. 8 slasher tines till 18 1/2" wide to 5 adjustable depths. 2-HP. 2C

199.88



melnor Time-A-Matic

Pulsating adjustable sprinkler covers full or partial circle to 88' dia. Automatic timer. 114

9.77



True Value Vinyl Hose

Nylon-reinforced for high burst strength, stays flexible. Brass couplings, 5/8" I.D. 60'. T666-6G

9.99



21" Rear Bagger

Extra maneuverability with a 2-bu. rear-bag that detaches easily. 3 1/2-HP Briggs & Stratton engine, roller-bearing wheels, lever-action height adjusters for 1/4" to 3/4" cut. Fully baffled with high-lift carbon steel blade. 81

179.99



ORTHO Pest Control

Malathion 50* kills a wide range of insects. 1-pt. 01641 Automatic Sprayette mixes and sprays up to 4-gals. 08320

5.44

6.98



Jobe's Spikes™

Fertilize plants one full year. Tomato formula. 6001 Evergreen formula. 1001 Tree/Shrub formula. 1000

.99

2.77

2.77


Grow With **Scotts** Turf Builder* gradual release lawn food promotes lush growth. Family* "all-purpose" grass seed. Check our low prices.



1005M

2050

Beautiful lawn for less

There are over 5,000 True Value Hardware Stores in 50 states. Look under "Hardware" in the Yellow Pages. 

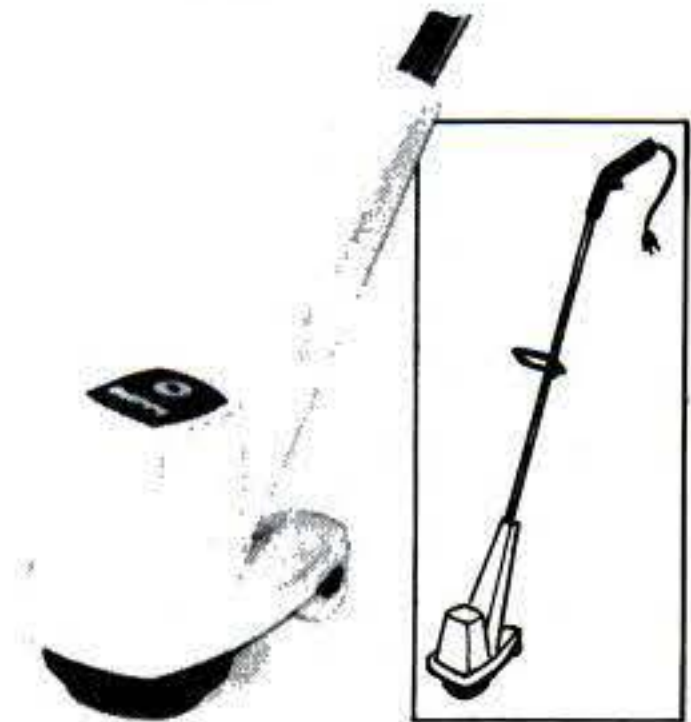


Big 30" Rear Engine Rider

Electric starting, 8-HP engine and 30" cut put your lawn work behind you fast. Variable-speed transmission reduces stalls, gives power to climb hills; rear engine stability adds safety. 2 to 1 steering ratio. Cutting height adjusts 1 3/8" to 3 3/8". Floating blade housing, safety blade interlock, single foot pedal combination clutch/brake. Headlight, on/off key, parking brake, comfort seat. 5-830E8 . . . **699.88**
4-bu. Rear Grass Bag lets you mow near edges and along fences. 024350 . . . **109.95**

- Big 30" Cut for Faster Finish
- Variable-Speed Transmission

- Easy Electric Start
- 8-HP Rear Engine
- 4-Bushel Rear-Bag Option

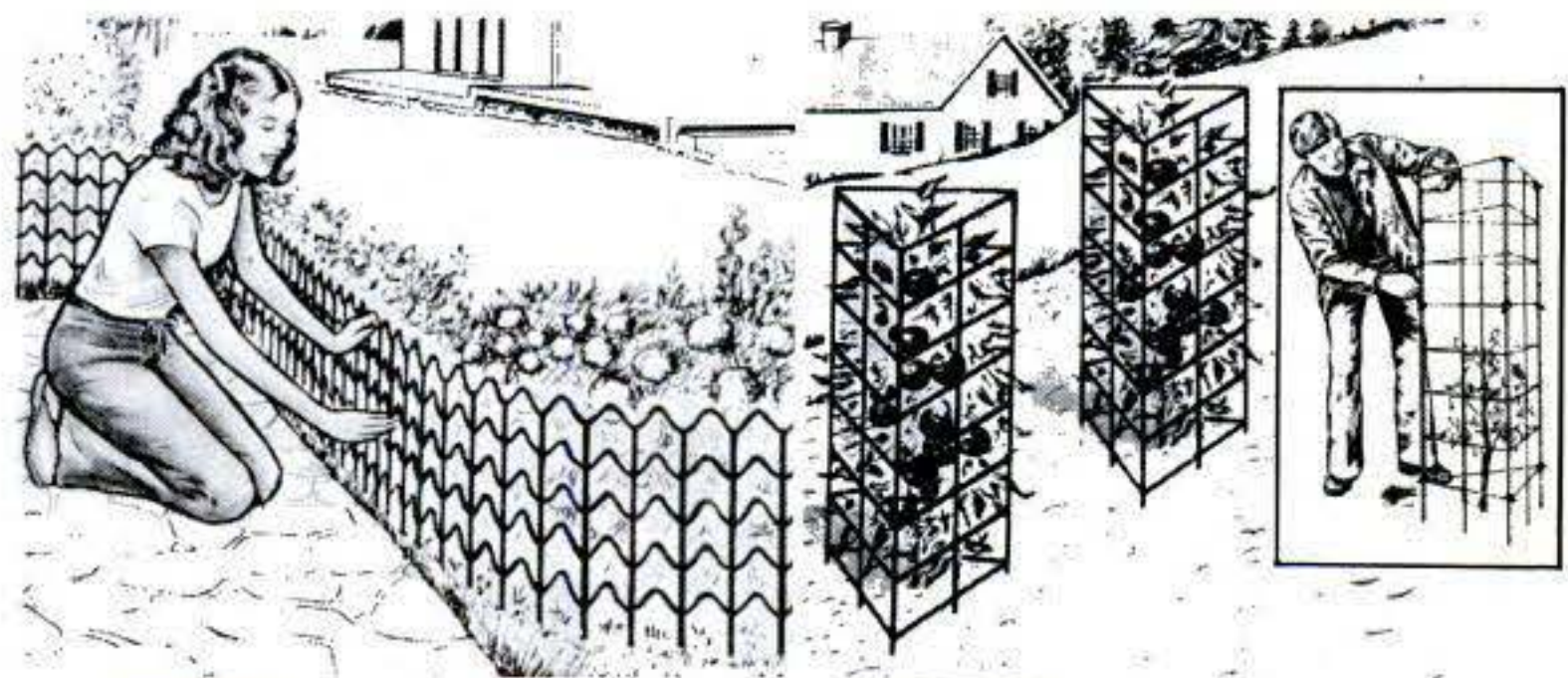
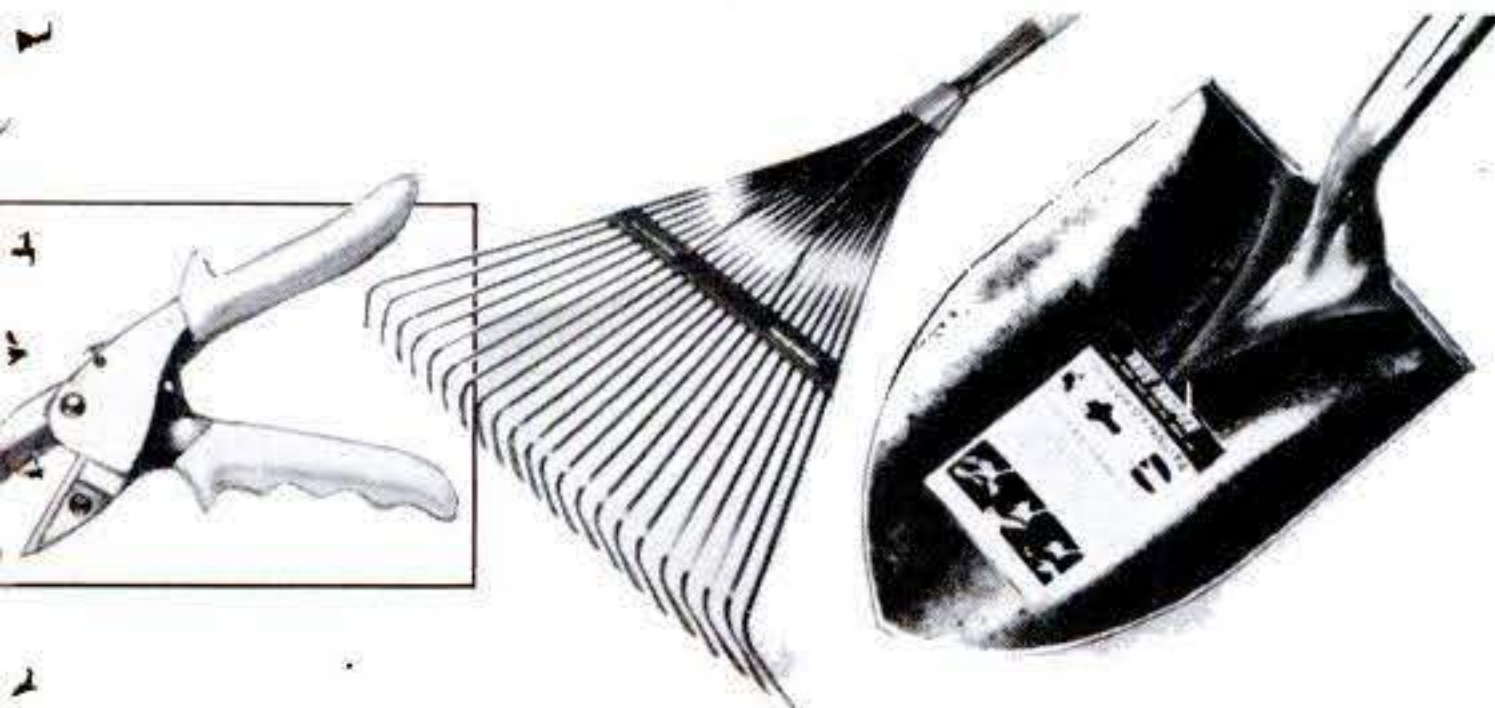


RAIN BIRD Sprinkler
Spray adjusts to cover full or partial circle up to 85' diam. Brass, stainless steel head. PS125 **12.88**

True Value Rubber Hose
Takes 400 lbs. pressure, coils easily at all temps. Has brass couplings. 5/8" I.D. 60' long. T996-6R **22.99**

HUDSON Bugwiser®
Sprayer adjusts for long range or mist. 3-gal. tank resists rust. Brass pump, spray extension. 6220 **24.99**

WEEDEATER Trimmer
Cuts a 10" path. Tap-N-Go™ cutting head has 35' of .065" diam. line. Weighs 3 1/2 lbs. 2 amps. 409 **24.88**



TRUE TEMPER. Big Values in Quality Lawn Tools
8" pruner has replaceable upper cutting blade, resists rust. A35 **6.44**
Rake with 22 spring-tempered teeth won't damage lawn. LR22 . **5.99**
Lightweight shovel has 1-pc. socket and blade, broad shoulders, round point, down-the-center balance. 47" handle. DLR . . . **11.99**

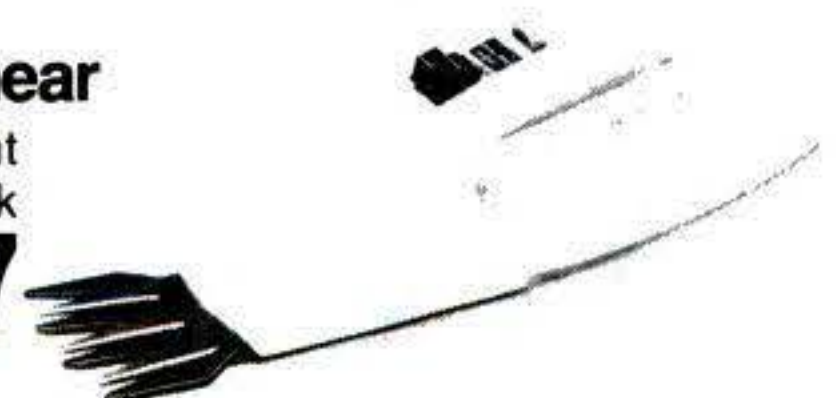
G-B Pick-it Gard
Protects flowers, lawns, edges. Yellow vinyl on steel. Bottom stakes in easily. 16" x 25'. 193600 **6.44**

G-B Tomato Tower
Promotes growth and eliminates staking. Helps stop plant rot. 48" high x 18". 262015 **2.44**

NELSON Dial 5™
sprinklers in 1. Cover a half or full circle, square, strip or rectangle. Snap connector. 2150SP **4.99**



DISSTON® Grass Shear
Streamlined to get into tight spots. Steel blades, non-stick coated. Cordless with charger. EGS-7 **18.77**



Walt Garrison
Football and Rodeo Star



Something for nothing.

If the best things in life are free, this is one of them. Just fill out the coupon below, send it in and we'll send you a free can of Happy Days moist smokeless tobacco.

Just a pinch between your cheek and gum will give you real tobacco pleasure without lighting up. Go Smokeless. It's the only way to go.

A pinch is all it takes![™]



SEND ME MY FREE CAN OF HAPPY DAYS.

Fill out and send to: "Smokeless Tobacco,"
P.O. Box 2900, Dept. PS 031, Greenwich, Conn. 06830
Name and complete address must
appear on outside of envelope.

Name _____
Address _____
City _____
State _____
Zip _____ Age* _____

Limited to one sampling per family. *OFFER NOT AVAILABLE TO MINORS.

©1981 U.S. Tobacco Company

Bait keeper



Six- to 12-volt pump mounts on perforated plastic partition that separates it from bait. Five water jets aerate water.

Get yourself some fresh, lively bait and you're on the surest course to successful fishing. But once you have that bait, how do you keep it in good shape for a full day's fishing?

One solution is Bayou Ed's Bait Rig, a device that turns an ice chest into an aerated live well. Heart of the rig is a small bilge pump that runs off any six- or 12-volt automotive-type battery. The pump is mounted on a perforated plastic partition that separates the cooler into two compartments.

One compartment, larger, holds your bait; the other compartment houses the pump. This keeps the pump from sucking up bait. It also lets you put some seaweed in with the bait without danger of jamming the pump.

To use, fill the cooler with about 30 quarts of water, slide the bait rig in place, and add your bait. Then connect the two alligator clips on the pump wires to your boat or portable battery. The pump immediately starts feeding five jets of aerated water into the bait compartment.

Bayou Ed's Bait Rig is made by Attwood Corp., Box A, Lowell, Mich. 49331, and sells for about \$40 at sporting-goods stores, marine dealers, and chain stores.—A. J. Hand

Copyrighted material

ENJOY AN ADVANCED RCA VIDEO CASSETTE RECORDER FOR A MONTH—FREE.

Thanks to Columbia House, you can enjoy SelectaVision, RCA's most versatile state-of-the-art video cassette recorder available—in your home. Free. For 30 days. Record up to six hours. Play any VHS-type cassette. Experience the special effects. They'll dazzle you: slow motion, freeze-frame, single frame advance and double speed search. And that's just for starters. There are also features like function remote control, and electronic memory that directs the recorder to switch on and off and change channels—without your supervision, for as long as 14 days.

Send the completed coupon for more information.

No salesman will intrude. No "hardsell." You get only the information you need. The rest is up to you. Try SelectaVision free with the option to return it in 30 days—or keep it and receive a free entertainment bonus worth up to \$200, including major movies. Payment by national credit card or Columbia House Budget Plan available.

Find out more about this incredible free trial offer. Mail the coupon today. You've got nothing to lose.



A Division of CBS Inc.

Final orders subject to review.

**COLUMBIA HOUSE, DEPT. 6295
P.O. BOX 1111, TERRE HAUTE, IN 47811**

Yes! Tell me more about your 30-day free trial offer of a brand-new RCA video cassette recorder. I understand no salesman will intrude.

Name _____

Address _____

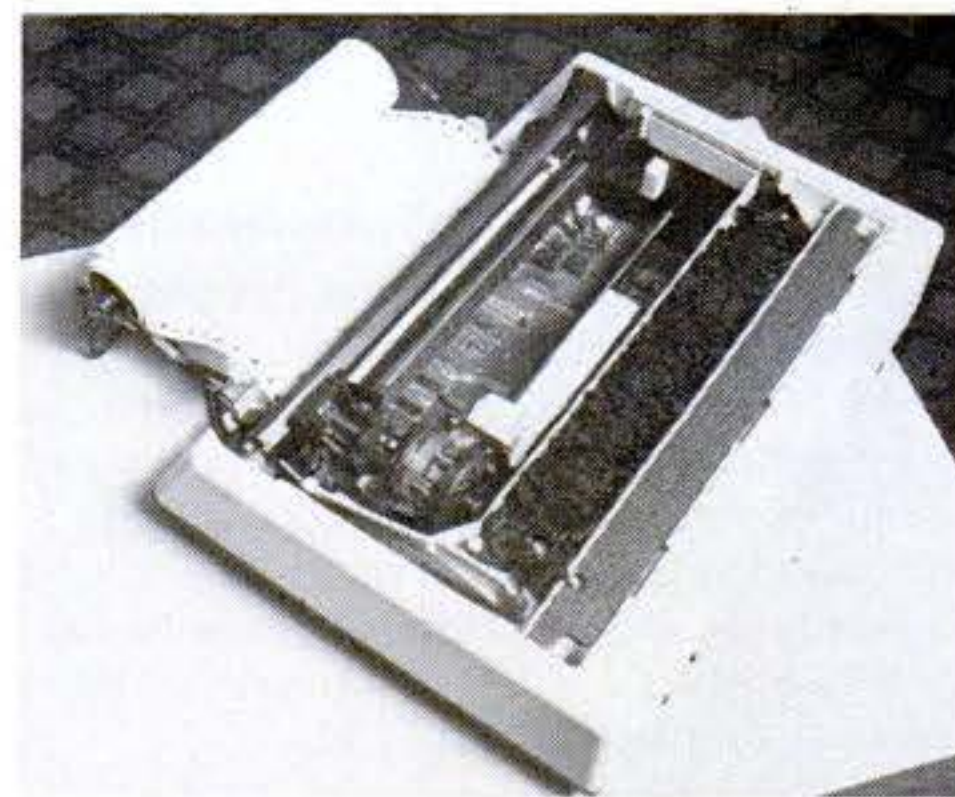
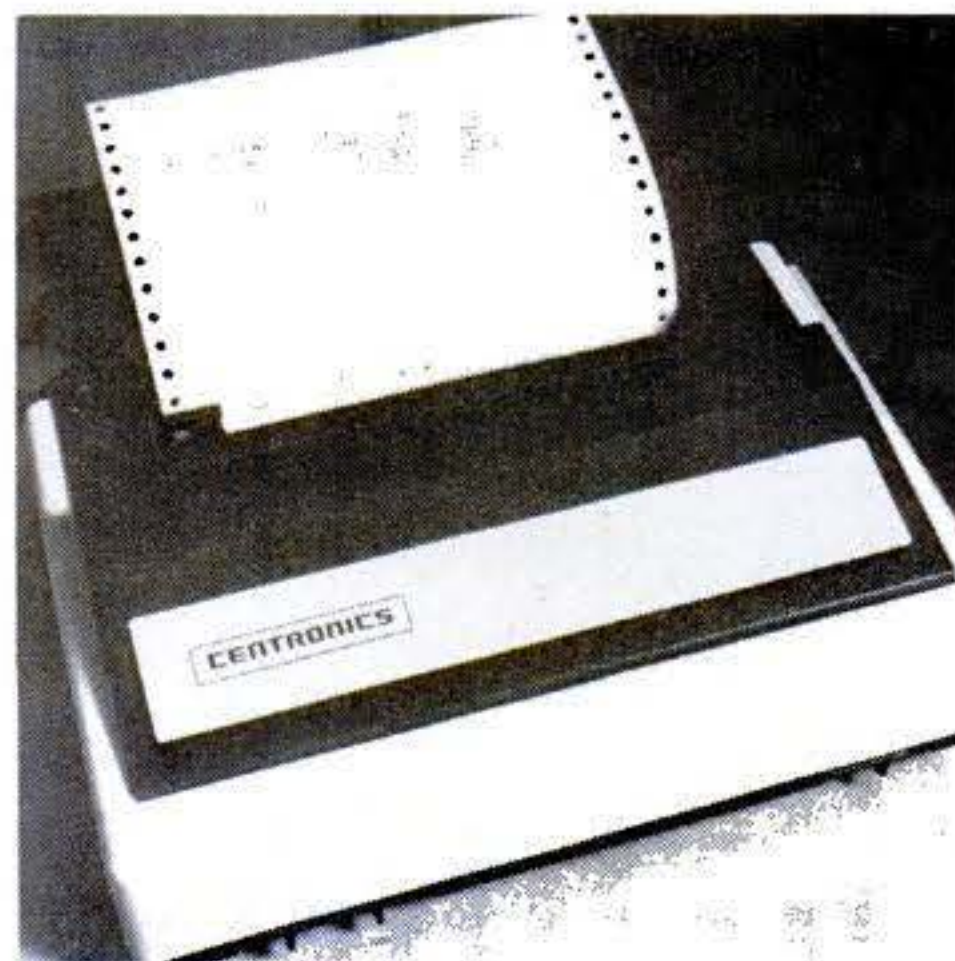
City _____

State _____

Zip _____

(please print)

Computer printer —big features in a small package



Just like other printers, the Centronics 737 puts data from your computer on paper for a permanent record. It's the way it's printed that makes this one different.

By using control codes (provided by your software), you can instruct the 737 to use one of three type sizes: 10-cpi (characters per inch), 16.5-cpi, and a clever proportional print in which character size and spacing are proportional for each letter (an i takes up less room across the paper than an o, for example). Type can be elongated or enlarged for headlines. And underlining is automatic: One command turns it on; another turns it off.

Other special codes control the mechanical movement of the printer. The print head can be instantly spaced to the right (for justification spacing) or to the left (for backspacing). And the paper can be moved up or down in normal or half-line feeds. With this feature, the machine can print formula notations (CO₂) as well as numerical powers (5¹²).

The unit measures just 14.5 by 11 by five inches and weighs 12 pounds. Price: \$995. From Centronics, Hudson, N.H. 03051.—W.J. Hawkins

"IN JUST 10 DAYS, I'LL SHOW YOU HOW TO DO

REAL MATH

ON YOUR SCIENTIFIC CALCULATOR!"



$$\int_a^b f$$

$$\frac{df}{dx}$$

$$\sum_{n=1}^{\infty} a_n$$

$$\lim_{n \rightarrow \infty} x$$

- Quick.
- Easy.
- Guaranteed.
- Fun, too!

STEP UP your math skills fast — thousands already have — by using my new method in guidebook form. It's called **CALCULATOR CALCULUS** and comes with this guarantee: If after 10 days you're not astounded at the problems you're solving on your own calculator, return the guidebook for an immediate refund.

But the point is — you won't want to send it back. For this is the easiest, fastest shortcut ever! The day you receive your copy in the mail you'll want to put it to work. It's that exciting and helpful.

My name is Dr. George McCarty. I teach math at the University of California. I wrote this guidebook to cut through the confusion. It does just that — with worked-out examples, simple exercises and practical problems — all designed to work on your calculator!

POWER METHODS. Need to evaluate functions, areas, volumes — solve equations — use curves, trig, polar coordinates — find limits for sequences and series? It's all here!

If you're in the biological, social or physical sciences, you'll be doing Bessel functions, carbon dating, Gompertz' growth curves, half-life, future value, marginal costs, motion, cooling, probability, pressure — and plenty more (even differential equations).

Important numerical techniques? Those algorithms are here, too — rational and Padé approximation, bracketing, continued fractions, Euler's method, Heun's method, iteration functions, Newton's method, predictor-corrector, successive substitutions, Simpson's method and synthetic division.

LOOK AT WHAT USERS SAY: Professor John A. Ball of Harvard College (author of the book 'Algorithms

for RPN Calculators') writes:

"I wish I had had as good a calculus course."

Professor H. I. Freedman of the U. of Alberta, writing in *Soc. Ind. Appl. Math Review*, states: "There can be no question as to the usefulness of this book... lots of exercises... very clearly written and makes for easy reading."

C. B. of Santa Barbara says:

"Your book has given me much instruction and pleasure. I do not hesitate to recommend it. 'CALCULATOR CALCULUS' is a book that inspires the reader to understand everything down to the last detail. You seem to have put your heart into the teaching part of good writing."

MONEY-SAVING OFFER. For a limited time, you can invest in 'CALCULATOR CALCULUS' for only \$14.95 plus \$1 for postage and handling (or \$3 by AIR), US or foreign. Calif. residents add 90c sales tax. If you need a suitable calculator, add \$25 (US only, UPS paid; in Calif. add \$1.50 tax) and I'll send you a TI-35 right along with your guidebook! As pennywise Ben Franklin said, "An investment in knowledge pays the best dividends." Get started now — Tax deductible for professionals.

NORISK WHATEVER! Send for it today. Be sure to give me your complete mailing address with your check or money order. If you want to charge it (Visa or MC), include your card no. and exp. date. *Prompt shipment guaranteed.* Thank you!

©1980

EduCALC Publications, Dept T2
Box 974, Laguna Beach, California 92652

In California, call 714-497-3600; elsewhere
TOLL FREE 24-hour Credit Card orders:
800-854-0561, Extension 845; Dept. T2

\$10,000 CASH

One week from now you can have \$10,000 deposited in your checking account.

And

The best part is you won't have to do any Selling of any kind, Buying of any products, or investing any of your own money to receive it.

Not a Mail Order or Real Estate Scheme!

No, it is Not a mail-order scheme. No, it has nothing to do with buying or selling of Real Estate. It is not gambling (remember I said NO Investment of your own money). No, it is Not going to make you a millionaire overnight. But it can put \$10,000 cash in your checking account next week (for you to use for ANY purpose you desire).

As incredible as this may sound, there is a way to have \$10,000 CASH next week without working twenty-four hours a day for the next seven days. But because of this bold statement, I would like you the reader to be the judge.

I promise you won't be disappointed.

I know you are skeptical and you have a right to be. I know you have been promised instant Money in the past and when you ordered the plan, it didn't work.

Let me start by telling a little about myself and how I discovered how you can put \$10,000 cash in your hands in one week.

My name is Bob Shindler and I have lived in Herndon, Virginia for the past four years. I own a \$100,000 home, three cars and have an income of over \$100,000 a year. (My CPA has a financial statement to prove it.) My children go to school locally and I have a professional business license issued to me by the Supervisor of the County of Fairfax, Virginia. (You can check it!)

I am telling you this so you will know that I am going to be right here in Herndon, Virginia tomorrow, next week and next year to back up these statements.

If you are still with me this far, and I hope you are, I would like to share with you how I discovered this plan for putting \$10,000 cash in your checking account in one week.

Now I know you expect me to tell you about a "secret formula" I found in the attic of some old mansion or I spoke to and studied the richest and most powerful men in the country.

I didn't do any of these things.

I wouldn't insult your intelligence.

Only a Select Group of People Know About It!

What I learned, by accident, was quite the opposite from any formulas or methods you may have heard or read about. It's Brand New and only a select group of people in this country know about it.

It was 9:00 AM Monday morning about two hours before I was to open my small business. I was desperate! I was just informed I was broke, because the bank reneged on my loan at the last minute and if I didn't raise five thousand dollars in Twenty-Four hours, I would be out on the street and my investment in the business would be down the drain. I couldn't believe it! All the years I had saved to have this small business and now, to have it taken away before I even opened the doors.

Believe me when I tell you it's a terrible feeling being broke. If you have ever been in this situation, you know exactly what I mean.

THEN IT HAPPENED! Like a miracle from heaven a man appeared at the front door, knocking as hard as he could, trying to get in. He looked like a salesman and at that very moment a salesman was about the last person in the world I wanted to talk to. But, I let him in anyway. I had to talk to someone about my dilemma. Besides, he seemed to have more interest in my business than my banker or anyone else did. He told me as soon as he entered he was not a salesman. He informed me he represented a company that was interested in helping entrepreneurs get their new ventures off the ground. He said he had noticed that I was opening a new business and if I needed any assistance or extra cash, his company was willing to write me a check for up to \$10,000 and deposit it in my checking account tomorrow.

I TOLD HIM TO GET OUT! I didn't know who put him up to this joke, but to me it wasn't very funny. I told him that I was in serious financial trouble and I had no time for him or his practical joke.

He assured me he wasn't joking and his company was indeed willing to write me a check for \$10,000. And if I was willing to listen, he would show me how I WOULDN'T have to pay back the \$10,000 out of any of the profits I made with it or out of any personal income I may earn with it in the future.

I still didn't believe him! I asked him to leave the premises immediately. He said he would leave, but he would like to leave his card so I could check out his company and his offer. I told him I would be more than happy to check out his company.

What did I have to lose?

He left me his card, phone number and detailed information on how his company program worked.

While investigating the company, I found several people in the Washington, D.C. area who were, until recently, working at meaningless jobs just trying to make ends meet. They all told me the company I was inquiring about was a very reputable corporation and that it had helped them start very profitable businesses, by using the corporation's financial assistance program. They also informed me that with this program they did not have to take any of the profits that their businesses earned to pay back the money nor did they have to invest any capital of their own to get started. It was theirs to keep and use in any way they deemed fit.

The Concept This Company Is Using Is New, Different and Unique!

I found that these cases were not isolated by any means. From one end of the country to the other I talked to men and women from all walks of life (all using the same program). They all started without any capital (except for the financial assistance from the corporation) and all became successful businessmen in a matter of a few years.

The man and the company with the \$10,000 check is "For Real" and so is the check.

The concept his company is using is New, Different and Unique. Who ever heard of a company giving you a check for \$10,000 and asking you NOT to pay it back out of any profits or money you may earn with it.

No gimmicks! No luck! No investment of your money! No hassle from bill collectors! (It is NOT a loan.) Just \$10,000 cash to do with as you wish, on whatever you wish.

What's The Catch? There Isn't Any.

Stop! Don't Rip Up this MAGAZINE. What I am telling you is the truth!

I know by now you are probably wondering what the catch is. LISTEN TO ME CAREFULLY. There isn't ANY. I checked. And I checked again. Everything I have told you is legal and above-board. This unique program is offered to anyone who is over twenty-one, in every state in the United States. There is NO special training or schools you must attend. There is NO age limit! It doesn't require "talent". It has nothing to do with any Federal Government or State Government loan program. Nor do you have to live in any particular part of the country or have experience to receive it.

What do I have to do to get the \$10,000? On page 52 of my report I will show you. Believe me there is no hard work involved. In fact, being employed is Not one of their requirements to receive it.

I know this is contrary to anything you have heard or read about in the past. But I will tell you this: anyone who does what the report tells him to do can make a substantial income every year by starting with this program and it would be foolish not to take advantage of it. Things are tough for people living on salaries. Tomorrow they'll be even tougher.

So there is no misunderstandings I would like to go over this important part again. This pro-

gram is NOT a Loan! There is NO gambling involved! It is NOT a pyramid game! There is NO buying or selling of any real estate OR products! No Investment of your money! It has absolutely NOTHING to do with mail-order! And there is no risk, because I won't cash your \$10 check or money-order for 30 days AFTER I've sent you my report.

I Guarantee it!

Warning: This Opportunity May Not Last Long!

I am not going to try and kid you and tell you this program will always be available. It won't be! Like everything else in life, circumstances change, people change and companies are bought-out by large corporations. This kind of company with a program that benefits them as much as it benefits you won't be around long before the word gets out and a big conglomerate buys it.

My advice to you is to order the report. You've got NOTHING TO LOSE and EVERYTHING TO GAIN. There is ABSOLUTELY NO RISK!

My report is 174 pages long and will take you about two hours to read. It will show you more than how to get the \$10,000. It will show you how to make a substantial income with it.

The program is available to EVERYONE no matter what financial situation you may be in.

I have already received many letters from housewives, businessmen, factory-workers and people from all walks of life who have thanked me and profited from the information in my report.

The only difference between them and you is their use of this program shown in "The Get Rich Report" and a solid lifetime income. In just one week from now you can know and have what they have.

The report is written in plain English to make it easy to read and easy to follow. You will find after reading it that you don't need any formal education with this program. Nor do you need any special experience. Both men and women, all ages, are acting on this information. And believe me when I say it does not require you to leave your present job, business or location.

What If I Don't Like It?

That's OK. Whatever your reasons. If you feel the Get Rich Report is not worth at least \$10,000, send the report back. I will send you a complete refund in the next day's mail. No Hassle! No Questions asked! I guarantee it!

For those who are still skeptical!

I will go one step further: POSTDATE YOUR CHECK FOR 30 DAYS FROM NOW. (That will give you plenty of time to receive the report and find out what I've been telling you is true.)

I won't cash your check or money-order for 30 days after I've sent you my report. Use the program and information for that period, and if you are not satisfied, just send the report back and I'll return your check UNCASHED.

This report is NOT available in libraries or book stores.

© Bob Shindler 1981

Bob Shindler
Kingston Chase Estates
Dept. AB-1, P.O. Box 607
Herndon, Virginia 22070

OK Bob. I still have serious doubts that your plan will work for me, but what do I have to lose. Send me a copy of The Get Rich Report, only with the understanding that you will not deposit my check or money order for 30 days after the report is mailed to me. If I am not satisfied for any reason, I simply return the report and you will return my check Uncashed. On that basis here is my ten dollars.

Name _____
Address _____
City _____
State _____ Zip _____

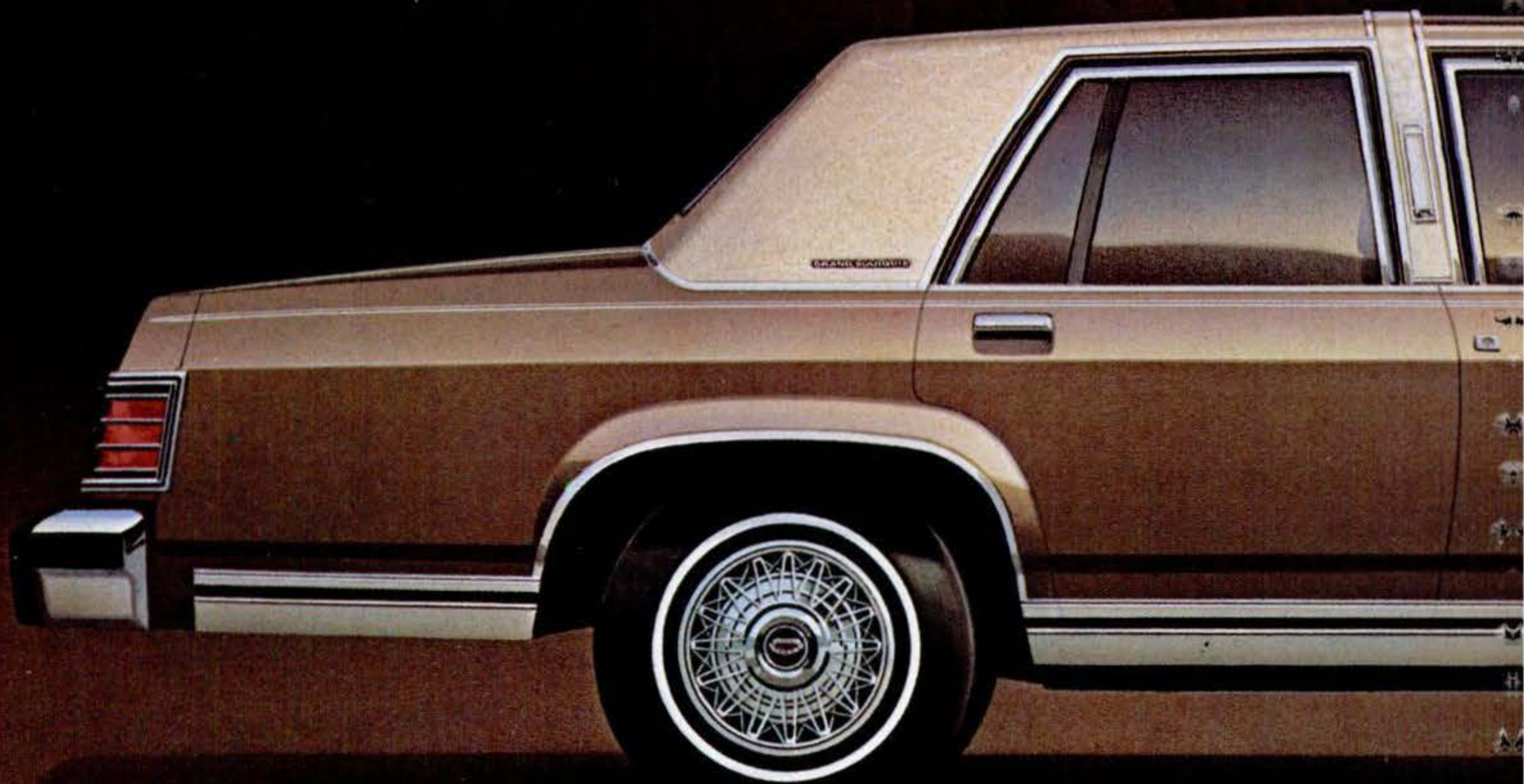
All reports are mailed the same day received.

PREFERRE

As irresistible as the 1981 Marquis is on the road, it's even more irresistible behind the wheel.

Surround yourself with such luxurious options as Twin Comfort Lounge seats of soft velour or genuine leather seating surfaces. The Valinograin formal "coach" roof. Automatic temperature-controlled air conditioning. Six-speaker Premium Sound System that makes every seat the best in the house.

For easy driving pleasure, choose the leather-wrapped "Tilt" steering wheel. Digital clock. Pivoting vent windows.



MARQUIS FROM L

***16** EPA EST. MPG, 25 EST. HWY. 5.0L engine. Compare to estimated MPG of other cars. Your mileage may differ depending on

D SEATING

And feel that Marquis ride, now with Automatic Overdrive Transmission for mileage ratings of **16*** EPA EST. MPG, 25 EST. HWY. The 1981 Marquis. By Lincoln-Mercury. It's the difference between just getting there and truly arriving.

MARQUIS
LINCOLN-MERCURY DIVISION

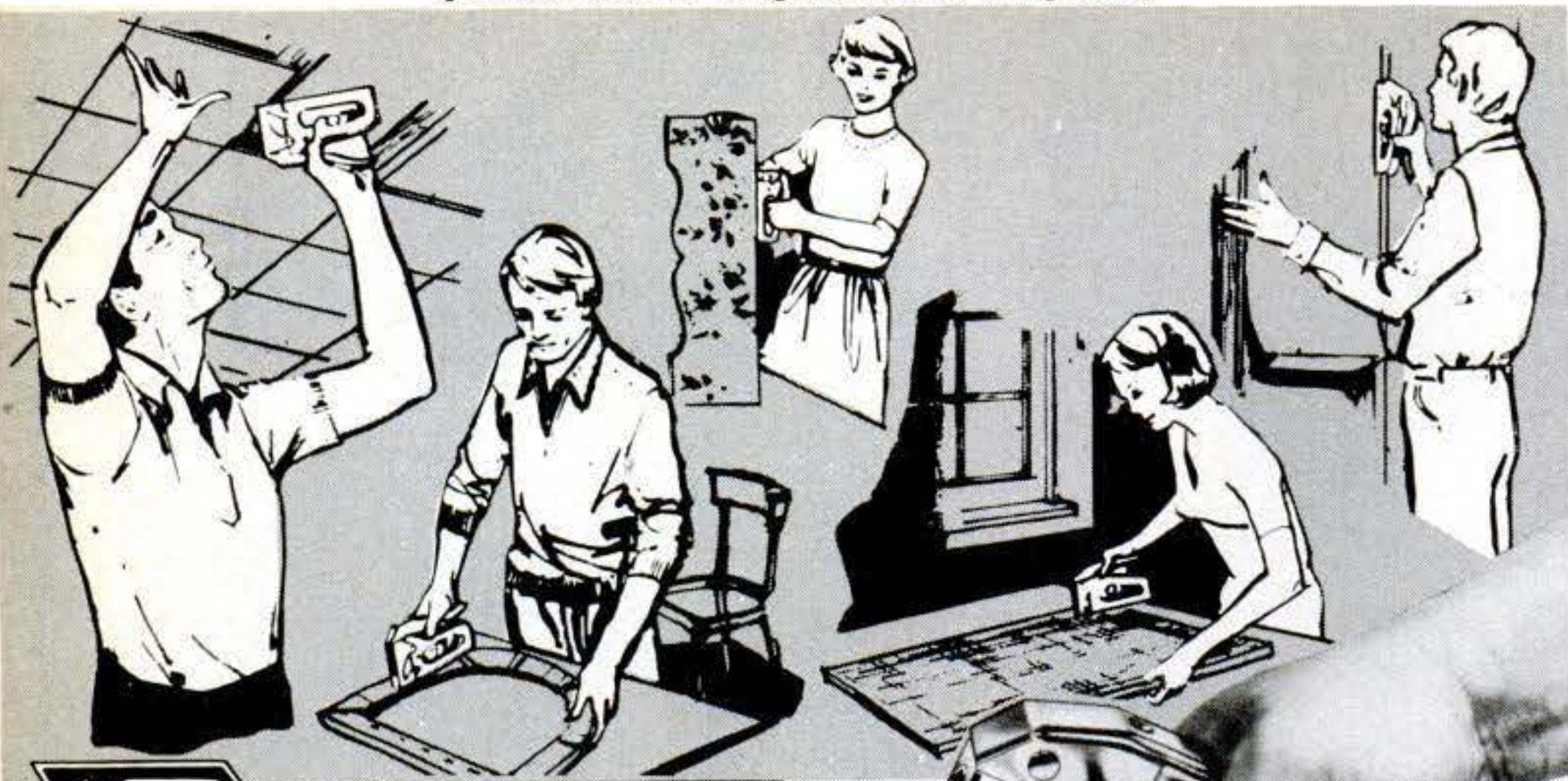


LINCOLN-MERCURY

speed, weather and trip length. Actual highway mileage and Cal. ratings less. Buy or Lease at your Lincoln-Mercury Dealer.

Copyrighted material

You don't have to be a professional..
 (to be a do-it-yourself expert)



ARROW T-50
 HEAVY DUTY

STAPLE GUN
 SHOOTS A STAPLE
 WHEREVER YOU'D DRIVE A NAIL!
faster .. better .. cheaper ...



Whether you're installing insulation . . . re-upholstering a chair . . . repairing a screen . . . covering a cornice . . . securing an antenna wire — there's no faster, easier or more efficient way to get the job done than with a one-hand operated Arrow automatic staple gun.

Arrow Staple Guns come in a variety of models,
 At all leading Hardware, Home Center & Discount Department Stores Everywhere.
ARROW FASTENER COMPANY, INC., 271 Mayhill Street, Saddle Brook, N. J. 07662

VISIT SOUTH CAROLINA. FREE.

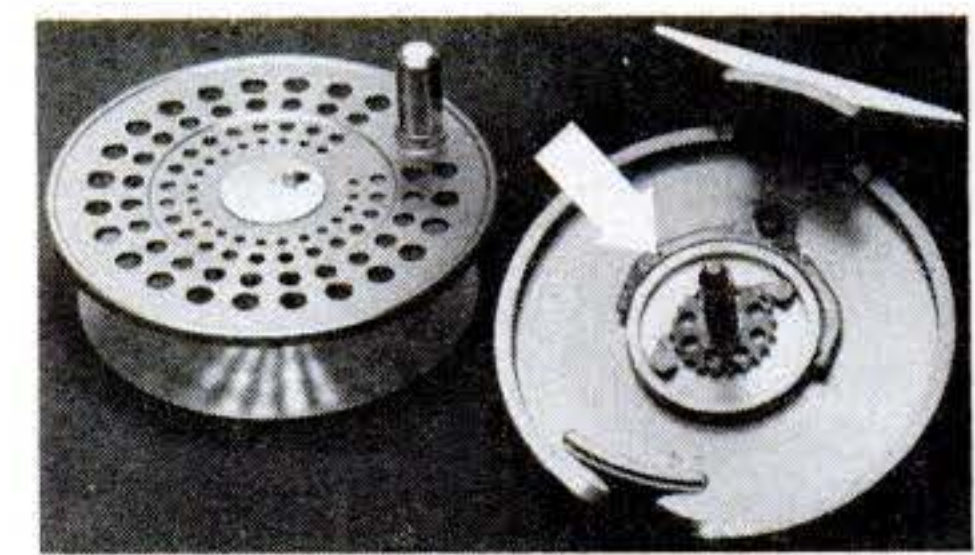


The golden beaches of the Grand Strand. Old Charleston. The Resort Islands. The whole beautiful State is right here in our free 64-page color book. And it's yours for the asking.

Please send me the free South Carolina vacation guide. MAIL TO:
 South Carolina Division of Tourism, Room 243, Box 78, Columbia, SC 29202.

Name _____
 Address _____
 City _____ State _____ Zip _____

Fly reel
 with brake-shoe drag



Marryat fly reel has a unique drag: Teflon "brake shoes" at the tips of a bronze caliper (arrow) rub against an aluminum drum, which dissipates built-up heat. The caliper is mounted on an eccentric to provide a wide range of drag adjustments.

It takes only one fish to make you appreciate that a reel does more than hold your line. In my case, it was a Mexican bonefish that sent me in search of something more than basic line storage. I finally settled on a new reel called the Gehrke Marryat.

Its one-piece frame is machined from solid marine-aluminum stock, then carefully polished and anodized. The two-piece spool and seat are made the same way. The absence of brittle castings makes the reel strong, yet very light. The model I've been using—meant for eight and nine weight lines—weighs just four ounces.

Interchangeable spools snap on and off in a second. And since the frame is single-sided, there's no cage to pinch your line (that's what cost me that bonefish). And best of all, the reel has a silky smooth drag.

I recently put the reel through a week of sand, salt spray, and hard-driving bluefish on the beaches of Chappaquiddick, and the drag performed flawlessly.

The Marryat is made in five sizes and sells for \$100; extra spools are \$50. The reel is sold at tackle stores or from George Gehrke's Fly and Gun Bench, Drawer 1204, Salidas, Colo. 81201.—A. J. Hand

The Guard is America at its best.



You can't train somebody to be a hero. And the Army Guard people on this page would be the last to label themselves that.

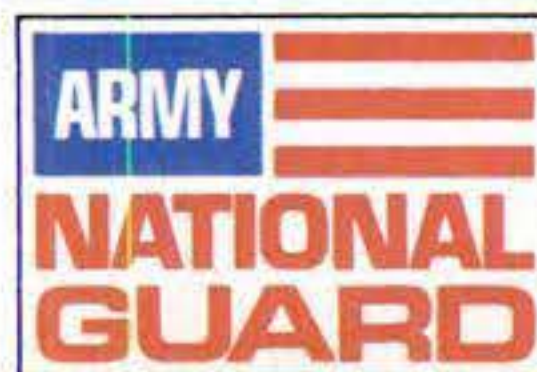
But it was Army Guard people like these who flew into the teeth of a devastating blizzard last winter to save a farm family trapped by a big, unexpected snow. And it's Army Guard people like these, working in their own communities, who help their neighbors and friends in all kinds of emergencies. Because from blizzards to floods to tornadoes, Army Guard people perform at their flat-out best.

And you could, too. You've already got the training. You know the ropes. You're ready. And in the Army Guard, you'll keep your vital skills sharp. Emergency-ready. Combat-ready. You'll train in your own community with friends and neighbors. You'll hold on to important benefits, too. Along with your pay and stripes.

But it won't just happen. You've got to do something first. Get in touch with the Army National Guard representative on your post. Or call us toll-free 800-638-7600*. It won't cost you a penny to find out what the Army

Guard offers. But, we can promise you one thing. A chance to be one of the best.

*In Hawaii: 737-5255; Puerto Rico: 723-4550; Virgin Islands (St. Croix): 773-6438; Maryland: 728-3388; in Alaska, consult local phone directory.



The Guard belongs. Copyrighted material

U.S. compacts

Is Chrysler's K-car the new champ?

By **JIM DUNNE** and **ED JACOBS**
PHOTOS BY JOHN KEATING

In 1979 General Motors' X-bodies—Citation, Omega, Phoenix, and Skylark—set the U.S. compact-car market on its ear, sweeping away benchmarks set only months earlier by

Ford's then-new Fairmont/Zephyr series. Now, however, those high standards are being challenged by Chrysler's all-new K-cars, Reliant and Aries, whose success or failure is likely to affect the firm's fate.

If the K-cars are to be the winners that Chrysler needs, they must stand

Continued

PS ratings— test report in a nutshell

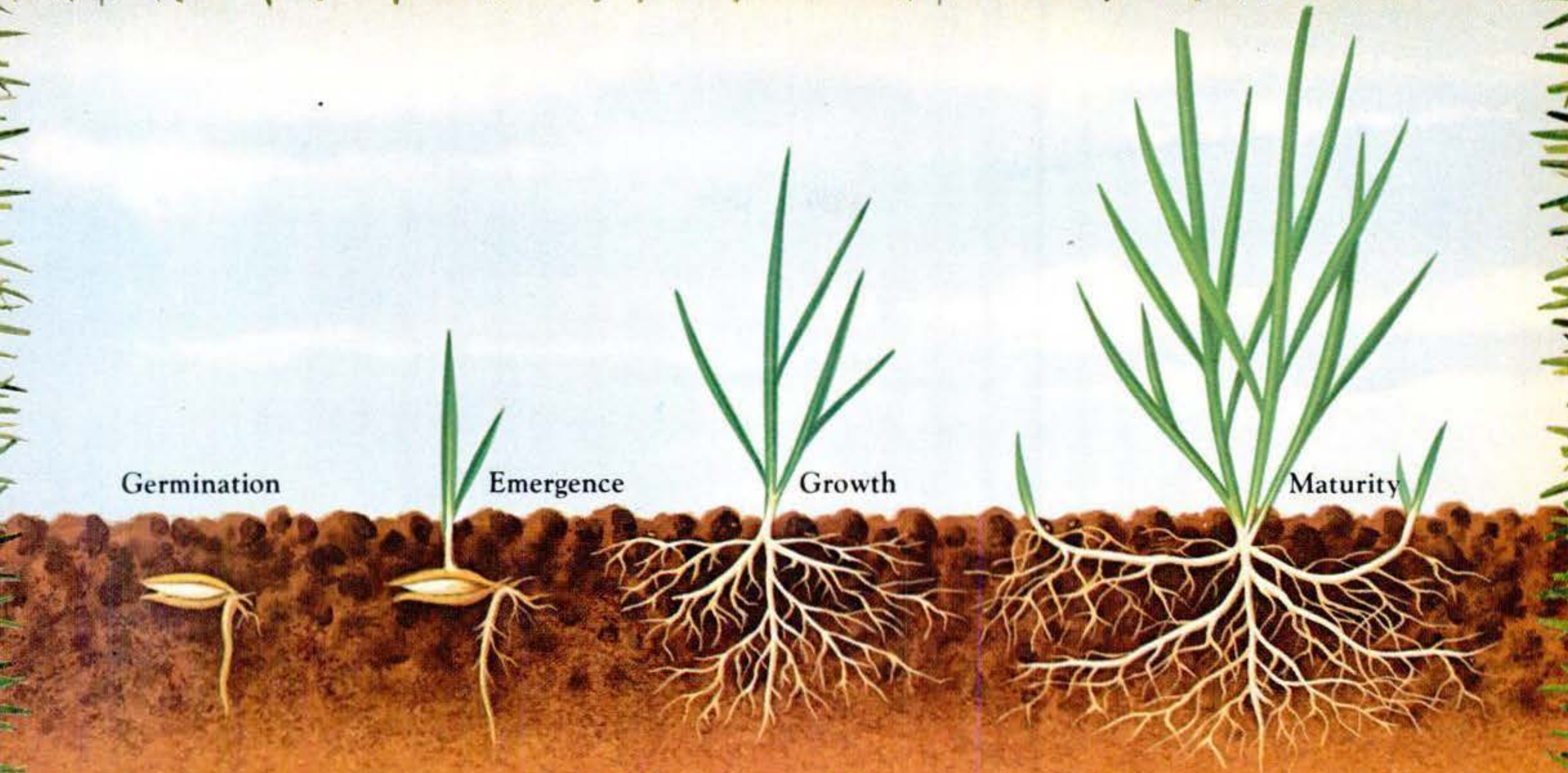
The ratings are based on test results and measurements. Results should be read with the understanding that they reflect tests only on our sample cars. An excellent rating is 5 points; very good, 4; good, 3; fair, 2; poor, 1; very poor, 0.

	Dodge Aries K	Chevrolet Citation	Mercury Zephyr	AMC Concord
Acceleration	2	4	3	5
Braking	2	3	3	2
Handling	4	3	3	3
Maneuverability	5	5	5	5
Quietness	0	1	0	0
Roominess	4	4	4	4
Vision	3	5	4	1
Entry/exit ease	3	3	3	1
EPA economy	4	4	3	3
Ride comfort*	3	3	3	3

*Authors' opinion

Four prime competitors in compact class (clockwise from left): AMC Concord, Chevrolet Citation, Mercury Zephyr, Dodge Aries K.





Germination

Emergence

Growth

Maturity

Our seed is guaranteed to have a future.

It takes a pretty robust seed to germinate and survive. That's why, at Scotts, we sort the seed that goes into our mixes.

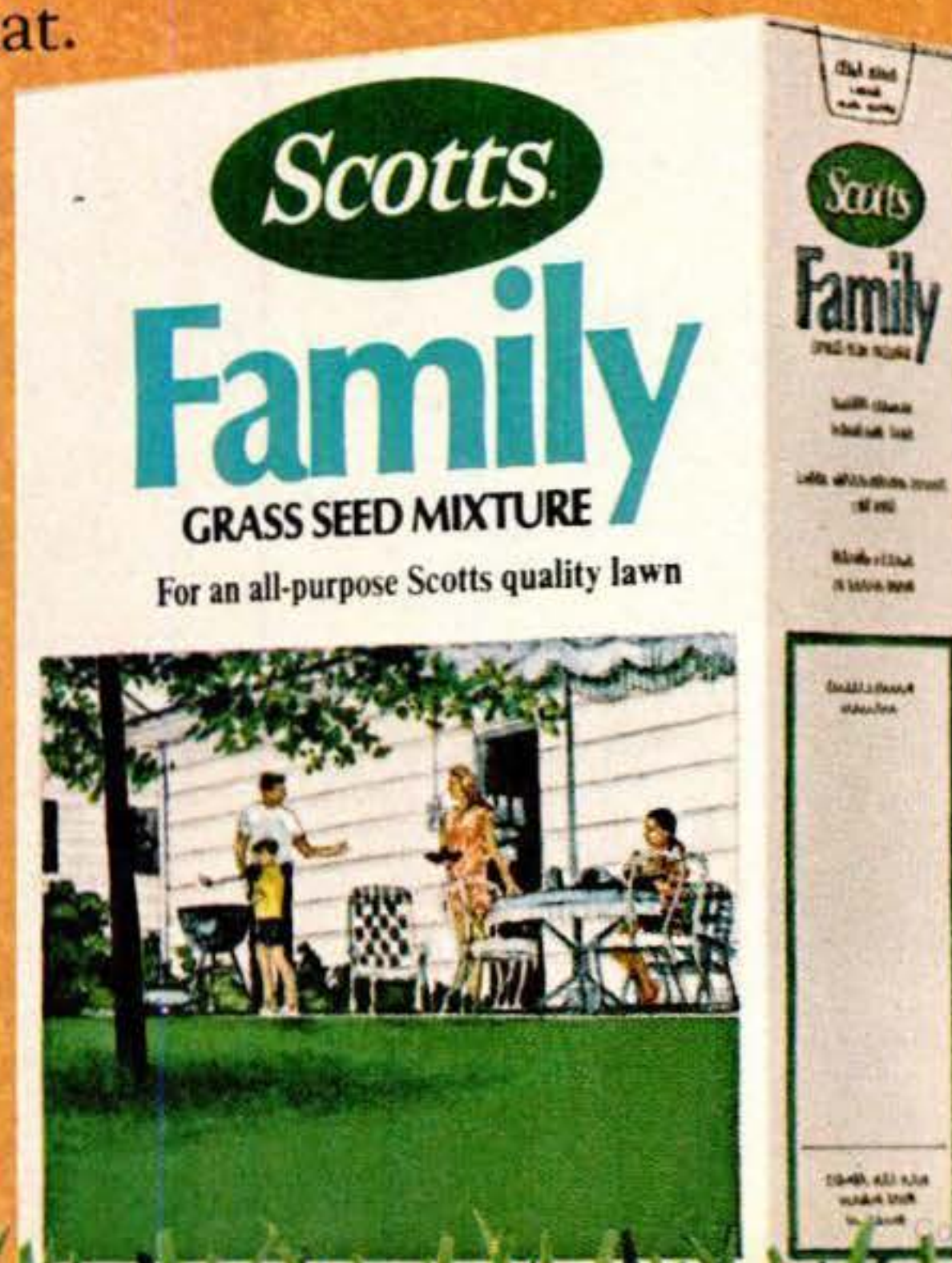
We get rid of most of the weak immature seeds that have little chance of making it and keep the plump mature seeds that are full of vigor. In fact, we're so particular, last year we rejected over five million pounds of seed that didn't measure up to all our standards.

The plump healthy seeds in our Family[®] mixture have food reserves to help them sprout and grow faster. They also grow roots that can dig down faster for food and water, so more seedlings survive.

Family seed will give you a green, fine-textured lawn that's a joy to behold. And it comes with this simple guarantee, "If for any reason you are

not satisfied with results after using this product, you are entitled to get your money back. Simply send us evidence of purchase and we will mail you a refund check promptly."

When you have seed like this, you can afford to have a guarantee like that.



9 mg. "tar", 0.8 mg. nicotine av. per cigarette, FTC Report Jan. '80.

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

Take the road to flavor
in a low tar cigarette.

© 1981 B & W T Co.

*The low 'tar' with
genuine tobacco flavor.*



RALEIGH LIGHTS

Copyrighted material



AMC Concord edged out Mercury Zephyr for the best cold-brake stopping distance, but turned in the longest stop with hot brakes.

PS car test & driving report

up to the competition from General Motors, Ford, and American Motors. So we pitted a Dodge Aries K against some of its domestic rivals: Chevrolet Citation, Mercury Zephyr, and AMC Concord. (But general comments about Aries K, Citation, and Zephyr also apply to their twin models: Plymouth Reliant K, Pontiac Phoenix hatchback, and Ford Fairmont, respectively.) We found that the K-car stands up well and is, in fact, one of today's best designs.

Each of the cars was equipped with the drive train most likely to be purchased for family use. That meant automatic transmissions in all four, but six-cylinder engines for Zephyr and Concord, whose fours tend to be overworked in their heavier chassis. The sixes, however, cut fuel economy, on which we place heavy emphasis for obvious reasons.

In economy, Aries, with the standard 2.2-liter engine, proved superior to the others in our tests. Our 29.3 mpg at a steady 55 mph is significantly lower than the EPA's 35-mpg highway rating, but our tests demonstrate that Aries' fuel-economy advantage is a real one—and worth noting.

Here's a detailed look at the cars:

Dodge Aries K

Dodge Aries K is the only completely new car in the group, so we looked

closely for any faults that might have shown up in chassis, power train, or body parts. We were impressed by the high quality of our test car, especially in the fitting of body panels and trim pieces. The interior is tidy and finished like that of a bigger car. In fact, it's easy to think you're in a full-size car when you're behind the wheel, except for the extra-short hood line, which greatly improves the driver's forward vision.

The new 2.2-liter four-cylinder engine—Chrysler's first new engine in 20 years—performed flawlessly, as did the automatic transmission. The engine appears to be just the right size in the 2,500-pound Aries chassis, combining better fuel economy than GM's X-cars with acceptable acceleration for today's traffic. (See our 3,000-mile test of Plymouth Reliant, elsewhere in this issue, for more on K-car fuel economy.)

In our tests of high-speed handling and low-speed maneuverability, the K-car again came out better than its competitors. At high speed, the car is stable both in a straight line and in turning maneuvers. In fact, the sense of control you get is pleasantly deceiving. The car has such good manners that severe handling tests don't seem as extreme. At no time during our high-speed testing did we note unusual or surprising handling reactions.

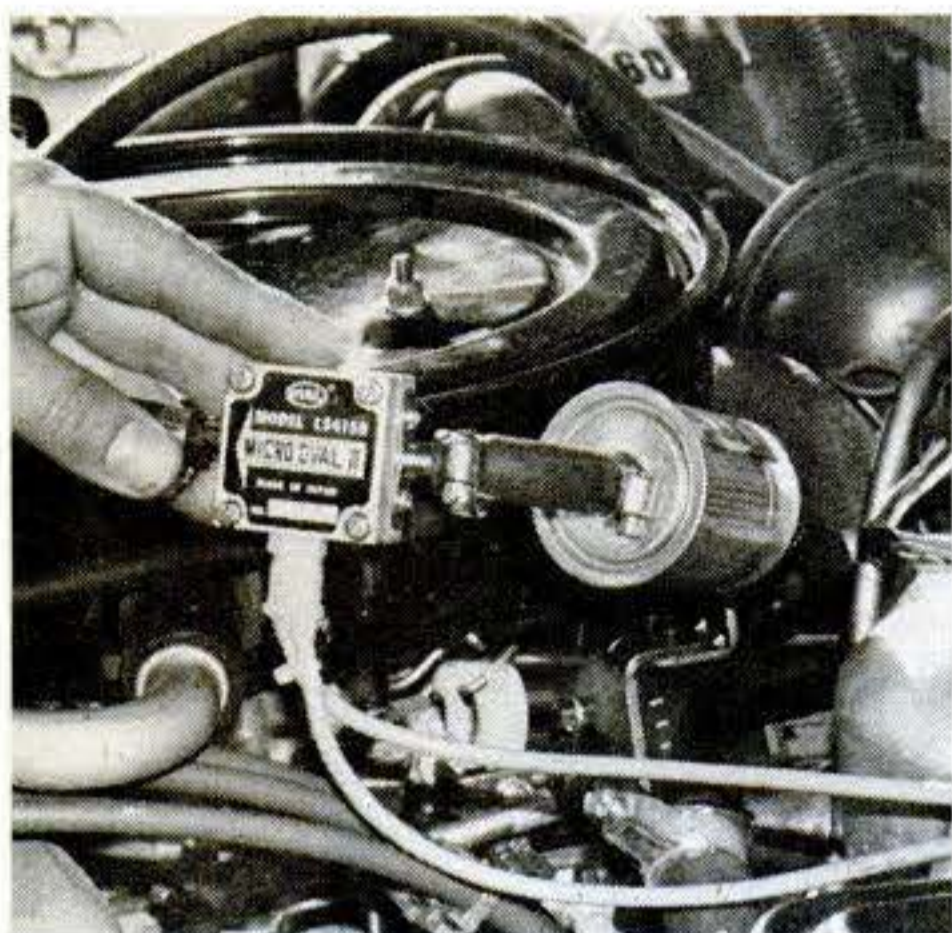
The K-car is more predictable and well mannered than the X-car, which we have considered to be the most agile and predictable of the compacts. And Aries is also better-driving in low-speed maneuvers, the type you might make in parking lots.

We are also impressed by the excellent layout of the passenger compartment—with one small reservation. While the seats are very comfortable, with thick padding and good support, the front seat is designed for three passengers, which results in a bit less comfort when two are carried. We'd prefer that the front seat have shaping to hold you in place, which would rule out comfortable seating for the middle passenger. In short, we believe that the K-car should have a rated seating capacity of five—as do GM's X-cars. (Note that the difference in front-seat hip room between the Citation and Aries is not that much—only one inch.)

Aries' instrument panel has the look of one in a full-size American car. Important gauges and controls are set in a band midway between the top and bottom, where they are easy to read and reach.

The absence of a transmission tunnel on the floor leaves plenty of room for both front- and rear-seat passengers to stretch out in and makes the

Continued



Fuel economy is checked by installing precision flow meters in each car's inlet and return fuel lines, then measuring steady-state consumption over measured miles.



Mercury Zephyr easily scored top rating in low-speed maneuverability test (slalom)—as did all four cars—and was second fastest in high-speed handling test.

PS car test & driving report

interior appear even larger than it is. Our impressions of what is big and what is small in today's models are changing, and it's easy to foresee the time when the Aries will be the big car of the Chrysler lineup, mainly because of its spacious interior and carrying capacity.

Two other features are worth noting: The engine compartment is laid out for easy service and is much better in this respect than Citation. The trunk is also well laid out, with balanced proportions. It's large enough, at 15.1 cu. ft., to swallow most normal loads.

Chevrolet Citation

It's amazing to find that GM is still the only builder of four-door hatchback compacts in America. The versatility of the hatchback is well known and should be exploited, but, so far, Chrysler, Ford, and AMC have no comparable models. The arrangement gives Citation the carrying capacity of a small station wagon yet allows the comfort of a four-door sedan.

A large security panel forms a shelf behind the rear seat and hides valuables in the trunk. It also effectively shuts out noise from the rear suspension.

Interior room is about the same as in Aries, and rear-seat head room is adequate despite the curvature of the fastback roof. The absence of a transmission hump and drive-shaft tunnel on the floor adds to the room inside and proves once again (in contrast to Fairmont and Concord) that the front-drive layout is the best solution to the

small-car roominess problem. In another couple of years, only a handful of cars built in North America will have rear-wheel drive.

Citation's 2.5-liter four-cylinder engine is a GM workhorse. That means service and repair parts are easy to find. Like Aries' 2.2, the 2.5 is a slow-running engine that is relatively quiet. It loafs along at highway speeds, in contrast to many noisy, high-revving imports. But despite having been redesigned to fit into GM's X-body series, it's still not easy to work on.

Chevrolet has carefully engineered out front-drive handling characteristics that you might notice in everyday driving. Steering is neutral, without the excessive and undesirable oversteer and understeer we noted in Ford Escort [PS, Jan.]. Instead, Citation obediently follows the driver's steering commands and is generally pleasant to drive.

Mercury Zephyr

Three years ago, Zephyr and its twin, Fairmont, were Ford's new compact cars. In a year or two, their dimensions will be those of the company's *full-size* cars. That's how quickly changes are being made between old and new in auto designs today. Unfortunately, Zephyr, like Fairmont, is already beginning to show its age. Ordinarily, a newly designed chassis might be expected to continue in production—unchanged under the skin—for a decade or more. But this is the car's last year in production, with a smaller, front-drive compact planned for 1982. Still, the 1981 version has a



lot to offer, and some improvements as well.

There is a more solid feel for the driver, due to extensive stiffening of the instrument panel. Instead of one support, there are now three, and a longer horizontal backup bar has been added. The shake and vibration that previously came through on rough roads or at high speeds is gone. The panel is steady, and that lends a solid feeling to the whole car.

Zephyr appears to have the most spacious interior of the American compacts. There is generous head room in the front and rear, and good leg room for four passengers. The only real complaint centers on the size of the transmission hump on the front floor. It is unusually large, even by rear-drive standards, and contrasts sharply with the fairly flat floors of Citation and Aries.

While instruments and controls are carefully mounted for convenience, we still object to the horn-button location on the end of the turn-signal stalk. You must make two motions to sound the horn, instead of the instinctive one you make to hit a horn button in the center of the steering wheel. It could be a problem in an emergency.

The 200-cu.-in., six-cylinder engine is our recommended power plant in Zephyr for all but heavy-duty service. It's husky enough to keep up with city traffic and about as smooth as a V8.

AMC Concord

There is no question that the DL version of the aging Concord is the

Continued

Educator, Entertainer, Accountant.

Your Challenger Personal Computer.

Through the miracle of modern technology, a complete computer as powerful as the multimillion dollar room-sized computers of a few years ago can be put in a package the size of a typewriter and sells for as little as a color television set!

Through its years of microcomputer experience, Ohio Scientific has effectively channeled this tremendous computer power into a "friendly" computer with hundreds of personal uses, via a huge software library of programs for a broad range of personal, home, educational and business use.

This available software allows you to use and enjoy your computer without becoming an expert. The Challenger, however, is a powerful, general purpose computer which can be programmed in several languages by those who choose to.

Here are just a few of the popular uses of an Ohio Scientific Challenger Computer:

Education

The personal computer is the ultimate

educational aid because it can entertain while it educates. Software available ranges from enhancing your children's basic math, reading and spelling ability, through tutoring high school and college subjects, to teaching the fundamentals of computers and computer programming.

Entertainment

Many of the Challenger's games educate while they entertain, from cartoons for preschoolers to games which sharpen mathematical and logical abilities. But, entertainment doesn't stop here. The Challenger's graphics capabilities and fast operation allow it to display action games with much more detail than the best video games, providing spectacular action in games such as Invaders, Space Wars, Tiger Tank and more! All popular sports such as golf, baseball and bowling are available as simulated computer games as well as many conventional games such as chess where the computer plays the role of a formidable opponent.

Accounting

Your Challenger computer can keep track of your checkbook, savings account, loans, expenses, monitor your calorie intake and your biorythms.

If you are involved in a business, you can use it to do word processing; accounting, inventory control, order processing, customer lists, client records, mailing labels and planning.

And more:

This may seem like a lot of uses, but it's only the tip of the iceberg for a general purpose computer. For example, your Challenger can be expanded to control lights and appliances, manage your energy usage and monitor for fire and break-ins. Furthermore, it can communicate with you, with other computers and the new personal computer information services over the telephone.

In fact, the uses of general purpose, personalized computers are expanding daily as more and more people discover the tremendous capabilities

of these new technological wonders.

Ohio Scientific offers you four personalized computer systems starting at just \$479.



For a free catalog and the name of the dealer nearest you, call 1-800-321-6850 toll free.

OHIO SCIENTIFIC

a **MACOM** Company

1333 SOUTH CHILLICOTHE ROAD
ALIBONIA OH 44202 • (216) 831-5600

EPA fuel mileage (mpg)

	Dodge Aries K	Chevrolet Citation	Mercury Zephyr	AMC Concord
Highway	35	32	28	26
City	24	22	20	19
Calif. city	23	22	20	19

PS fuel-mileage tests

(steady-state mpg)

35 mph	34.7	32.6	23.9	27.8
55 mph	29.3	27.5	19.5	23.9

most luxurious of the U.S. compacts. The large, well-padded individual front seats not only look expensive but feel quite comfortable and offer support comparable to anything in Concord's class.

Concord's interior is finished to a level of luxury equal in appearance to some of the most expensive U.S. cars. The instrument panel is a good example. It's at least a grade above the competition in appearance, with wood-grain trim and bright metal outlining. An extra shelf below the panel is handy for storing small items that need not be hidden from view in the moderate-size glove box.

Like Zephyr, Concord is a rear-drive car in a field that is quickly converting to front-wheel drive. A major problem from a comfort standpoint is the large transmission hump and



Chevrolet Citation's four-door-hatchback layout is the most versatile of the group,

drive-shaft tunnel on the floor. They cut front-seat foot room significantly and make it impossible to stretch out in either front or rear seats.

Room in the back is cozy at best, and we believe that most adults would find the space too confining for any but the shortest trips. Concord also has the narrowest entry space to the rear seat—less than five inches when the front seat is in the full rearward position.

The 258-cu.-in. six-cylinder engine is the biggest AMC builds for its passenger cars. It's been completely redesigned for 1981, and nearly 100 lbs. were shed to help boost fuel economy of the cars in which the engine will be installed. We highly recommend this well-proven power plant over the standard 2.5-liter four-cylinder engine for this car. We feel the six is

but the car is not available as a station wagon. Each of the other three is.

smoother-running, quieter, and has the muscle needed to run power-draining accessories without a noticeable loss of performance. Concord is slightly quicker in acceleration than the other cars tested, and fuel economy, understandably, is not on a par with any of the four-cylinder types we tested.

Our picks:

The K-car is a refined version of the GM X-body, and that makes it a top value in my book.—J. D.

Chrysler has beaten General Motors at its own game. As good as the X-bodies were in turning around the compact-car class, the K-cars are just a little bit better, although they would benefit from the refinement that usually comes with time.—E. J.

For specs and test results, turn page

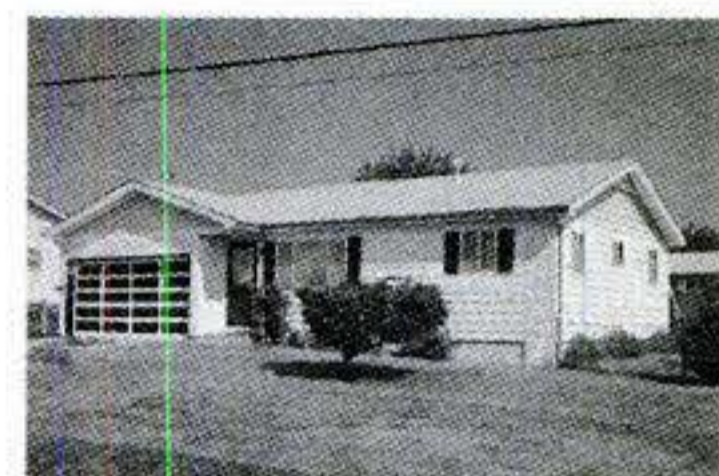


NBC television camera crew tapes this car test for inclusion in a segment of NBC Magazine with David Brinkley. Here they tape a 60-mph panic stop performed with Chevrolet Citation.



PS editors check ease of performing routine maintenance on each car. The ratings reflect how easy it is for the average person to do the work. All cars are compared without regard to size.

DO-IT-YOURSELF SIDING!



"Get more information by filling out coupon."

"Order and apply HOME-KIT to your home. It's easy... and beautiful."

"Sell your friends and neighbors. They'll never have to paint again."

"EARN SUPER PROFITS!! National average installed price is 3 times your dealer cost."

You can re-side your home yourself with one of our nationally advertised aluminum, vinyl or steel siding HOME-KITS... and then make as much as \$1000 per order by selling HOME-KITS to your friends and neighbors. Here's how it works. If you own a home which needs siding, you can become a part-time (or full-time) siding dealer for Aluminum Industries, America's largest mail-order siding distributor. To be eligible for a FREE dealership, you must apply one of our kits to your own home. Of course, you'll buy your kit at our wholesale dealer's cost, which is about 1/3 below the national average applied siding cost. Then, when your friends and neighbors see how beautiful your home is, you'll find it quite easy to sell them a HOME-KIT for their own homes. If you choose, you can make even more money by applying the kit for them. Our HOME-KITS are composed of the finest aluminum, vinyl, or steel siding available, and once you've installed a kit on your home, you'll have the confidence to sell them. You'll be able to talk first-hand about how great these kits really are. All materials necessary for a durable and professional looking job are included in our HOME-KITS. In addition to the siding panels themselves, you'll receive all of the accessories for the finishing touches... such as window trim, door trim and pre-shaped corner moldings... we even include the proper nails. HOME-KITS are available in 14 sizes and in 22 colors. And your first kit comes with professional siding applicator's tools at no additional charge. Fill in the coupon below, or call us toll free at 1-800-643-9904 for a dealer application.

QUESTIONS AND ANSWERS ABOUT HOME-KITS

WHAT IS A HOME-KIT?
A HOME-KIT is a complete kit of either aluminum, steel, or vinyl siding for covering a frame home. The dealer's first kit consists of all the siding, accessories, and tools for covering a certain size home. HOME-KITS come in 14 different sizes. Complete installation instructions are included.

IS IT HARD TO APPLY ALUMINUM, STEEL, OR VINYL SIDING?
No. If you can drive a nail and cut on a straight line with tin snips, you can apply siding. Our instructions are very easy to follow.

WHAT ARE THE PRICES OF HOME-KITS?
Our wholesale dealer prices are about 1/3 the national applied price. If you would like to become one of our part-time dealers (or a full-time dealer) just fill out the coupon and mail it to us or call us toll-free at 1-800-643-9904. We will send you a dealer application. We will not bother you with a personal visit. No salesman will call on you.

WHAT DO I HAVE TO DO TO BECOME A DEALER?
We require all our dealers to apply one HOME-KIT to their own home to qualify for a dealership. You can work as a part-time or full-time siding dealer. Most of our dealers are part-time workers... they use the HOME-KIT as a method of supplementing their regular income.

CAN I BUY MY FIRST HOME-KIT ON TIME PAYMENTS?
Yes indeed... in fact most of our dealers buy their first HOME-KIT on either an FHA Home Improvement Loan Plan or with our special \$7.00 per week plan with no interest and no carrying charges.

HOW MUCH WILL I SAVE BY BUYING HOME-KITS?
Our HOME-KITS are priced to our dealers at about \$2,000.00 less than the national average applied price. You will be amazed at how inexpensively

you will be able to buy a complete siding kit, including all accessories and all tools.

HOW DO I GET A DEALERSHIP?
If you own a home which is suitable for the application of siding, your first step is to mail in the coupon or call us toll-free at 1-800-643-9904. If we have an opening in your county for a part-time or a full-time dealer, we will let you know. There is no charge for a dealership except in the purchase of your first HOME-KIT.

EARN UP TO \$1000 PER SALE



ALUMINUM INDUSTRIES OF ARKANSAS

300 Phillips Rd. North Little Rock, AR 72117

PS31

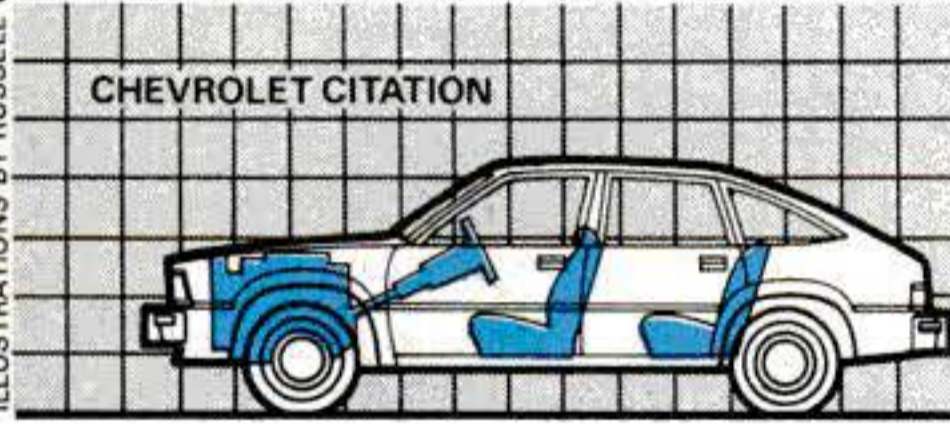
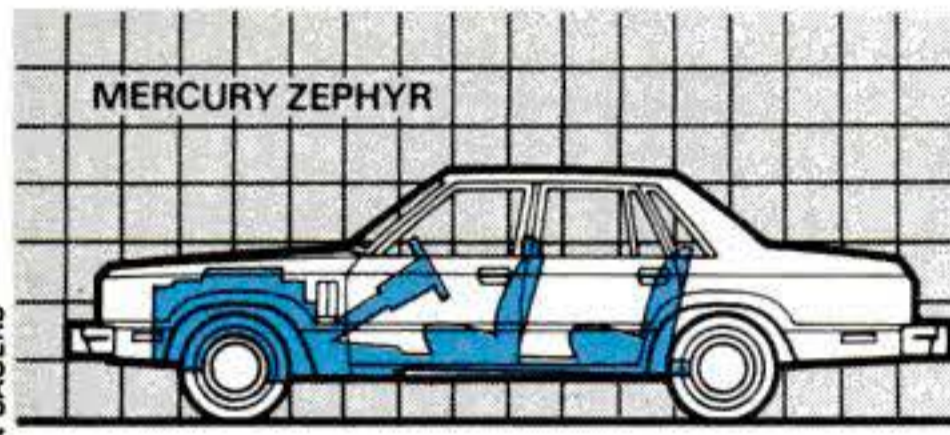
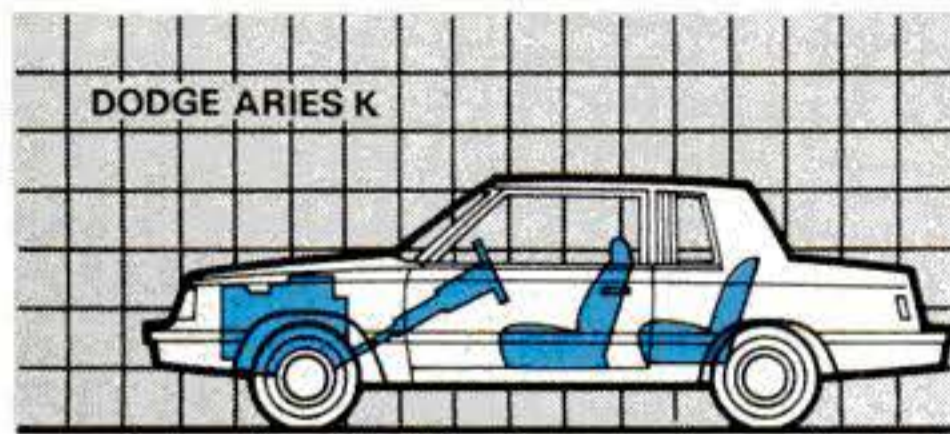
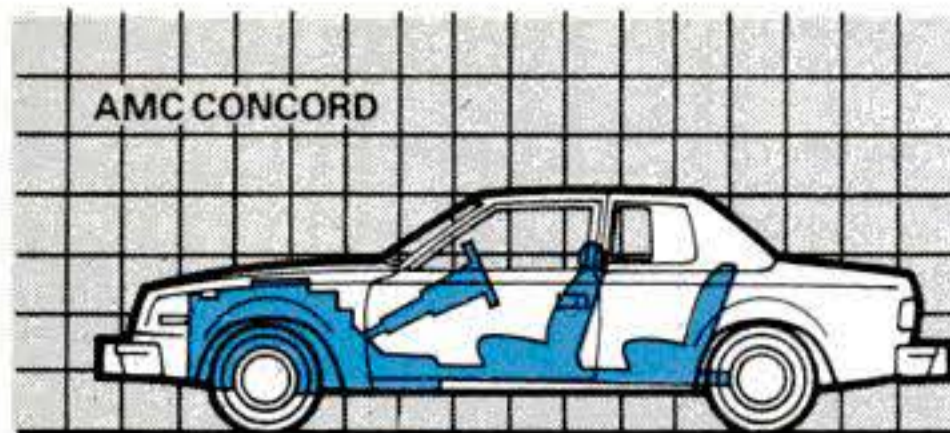
Sounds interesting, please send more information!

Name _____

Address _____

City _____

State _____ Zip _____



ILLUSTRATIONS BY RUSSELL VON SAUJERS

Identifying the most modern designs is easy from these scale drawings: Aries K and Citation both have front-wheel drive and are markedly shorter than their two competitors, Zephyr and Concord.

PS serviceability ratings

How easy is it to service these cars? To give you an approximation of how difficult it is for a typical person to perform various service operations, we examine each test vehicle. The numbers mean: 1, very difficult; 2, difficult; 3, average degree of difficulty; 4, easy; 5, very easy.

	Dodge Aries K	Chevrolet Citation	Mercury Zephyr	AMC Concord
Checking fluid levels				
Battery	5	5	5	5
Master cylinder	4	5	4	4
Windshield washer	5	5	5	5
Engine oil	3	4	4	2
Coolant	5	5	5	5
Checking the engine				
Spark plugs	5	4	4	2
Distributor	5	1	4	3
Carb adjustment	*	*	*	*
Oil filter	4	1	4	3
Oil fill	4	4	4	2
Replacing hoses				
Upper radiator hose	5	5	5	5
Lower radiator hose	4	3	3	3
Heater hoses	2	1	1	3
Changing bulbs				
Headlights	3	3	3	3
Taillights	4	3	5	2
Front running lights	3	3	2	3
Front parking lights	3	3	2	1
Front directionals	3	3	2	1
Rear directionals	4	3	5	2
Rear running lights	3	3	5	2
Checking fuses	4	3	2	4
Spare-tire accessibility	3	4	4	3
Changing belts	3	2	2	2
*Sealed				

Dodge Aries K, Chevrolet Citation, Mercury Zephyr, and AMC Concord—dimensions, specs, and test results

	Dodge Aries K	Chevrolet Citation	Mercury Zephyr	AMC Concord
DIMENSIONS (inches)				
Wheelbase	99.6	104.9	105.5	108.0
Overall length	176.0	176.7	195.5	185.0
Overall height	52.4	53.1	53.6	50.8
Overall width	68.6	68.3	71.0	67.8
Track, F/R	57.6/57.0	58.7/57.0	56.6/57.0	57.5/57.1
Ground clearance	4.5	5.3	6.2	6.9
Front head room	38.2	38.1	38.4	38.1
Front hip room	56.1	55.1	56.2	54.3
Front leg room	42.2	42.2	41.8	40.8
Rear head room	37.0	37.5	37.5	37.5
Rear hip room	54.6	54.1	53.7	52.5
Rear leg room (min.)	35.2	34.5	35.4	35.7
Rear knee room (min.)	0.3	0.9	1.6	2.7
Couple distance	31.1	30.9	33.0	31.6
SPECIFICATIONS				
Engine type	In-line 4	In-line 4	In-line 6	In-line 6
Displacement (cu. in./L)	135/2.2	151/2.5	200/3.3	258/4.3
Compression ratio	8.5:1	8.2:1	8.6:1	8.0:1
Carburetion	2-bbl.	2-bbl.	1-bbl.	2-bbl.
Net hp @ rpm	84 @ 4,800	84 @ 4,000	88 @ 3,800	120 @ 3,600
Net torque @ rpm	111 @ 2,800	125 @ 2,400	154 @ 1,400	210 @ 1,800
Transmission	Three-speed automatic	Three-speed automatic	Three-speed automatic	Three-speed automatic
Axle ratio	2.78:1	2.84:1	2.73:1	2.53:1
Tire make	Goodyear	General	Firestone	Goodyear
Tire type	Arriva radial	Steel III radial	Steel-belted radial	Viva radial
Tire size	P165/65R14	P185/80R13	P175/75R14	P195/75R14
Steering	Rack and pinion, power	Rack and pinion, power	Rack and pinion, power	Recirculating ball, power
Overall steering ratio	18.0:1	17.5:1	Variable 20.0-16.1:1	17.0:1
Turns, lock to lock	3.2	3.1	3.1	3.0
Turn diameter (ft.)	34.3	38.4	39.0	34.9
Front suspension	Independent, MacPherson struts	Independent, MacPherson struts	Independent, hybrid MacPherson struts	Independent, struts on lower control arms, coil springs
Rear suspension	Independent, trailing arms, flex beam, coil springs	Independent, trailing arms, flex beam, coil springs	Solid axle, four control links, coil springs	Solid axle, Hotchkiss, semi-elliptical leaf springs
Front stabilizer-bar diameter (in.)	1.0	0.86	n.a.	0.81
Rear stabilizer-bar diameter (in.)	1.0	0.79	none	none
Trailer towing (max. lbs.)	1,400	2,000	2,000	2,000
Trailer tongue weight (max. lbs.)	150	200	200	200
Brakes	Disc/drum, power	Disc/drum, power	Disc/drum, power	Disc/drum, power
Brake swept area (sq. in.)	205.2	261.6	275.5	310.6
Fuel tank (gal.)	13.0	14.0	16.0	22.0
Trunk space (cu. ft.)	15.1	41.2*	16.8	11.0
Liftover height (in.)	26.5	20.5	30.0	27.6
Curb weight (lbs.)	2,448	2,625	2,726	2,881
F/R weight distribution (%)	64/36	63/37	54/46	56/44
Basic price	\$6,315	\$6,282	\$6,222	\$5,820
Price as tested	\$9,715	\$8,747	\$7,244	\$7,894
Major options on test car	A04 package \$775, automatic transmission \$360, rear defroster \$107, cruise control \$132, AM/FM stereo \$100	A/C \$557, power locks \$122, power windows \$187, deluxe exterior \$142, automatic transmission \$332, power steering \$162, AM/FM stereo \$100	A/C \$585, automatic transmission \$349, AM/FM stereo \$88	A/C \$794, six-cylinder engine \$129, automatic transmission \$333
TEST RESULTS				
Acceleration (sec.)				
0-60 mph	18.1	15.9	16.8	14.7
25-70 mph	22.9	18.3	21.4	16.7
Brake test (cool) 60-0 mph				
Stopping distance (ft.)	189	187	174	173
Pedal pressure (lbs.)	92	160	120	96
Brake test (hot) 60-0 mph				
Stopping distance (ft.)	175	163	168	186
Pedal pressure (lbs.)	80	88	143	165
Interior noise @ 60 mph (dBA)	71	71	71	74
Handling test (mph)	63.5	60.2	60.3	59.9
Maneuverability test (mph)	27.6+	27.6+	27.6+	27.6+
TEST CONDITIONS: Ambient temperature, 52°F; relative humidity, 70 percent; barometric pressure, 30.10 inches Hg *With rear seat folded				

Performance comparison with selected 1981 and earlier models

	Mpg (city driving)	Acceleration 0-60 mph (sec.)	Brakes 60-0 mph (ft.)	Handling (mph)	Maneuverability (mph)	Noise @ 60 mph (dBA)
1980 Chevrolet Citation V6	20	11.8	141	62.4	29.6	69
1980 Oldsmobile Omega in-line 4	22	15.0	163	64.7	29.6	69
1979 Ford Fairmont in-line 6	18	15.9	149	62.4	26.8	68
1979 AMC Concord in-line 6	17	13.4	152	56.3	28.1	67
1981 Ford Escort in-line 4	28	18.5	187	64.0	27.6+	73
1981 Plymouth Horizon in-line 4	25	12.7	203	61.0	27.6+	72

No film camera can do it: Videotape instant replay in color and sound.



Instant replay. Instant enjoyment. Instant check to be sure you got that once-in-a-lifetime shot. You just can't do it with ordinary 8mm film.

With this new portable Quasar Color/Sound Camera and Videotape Recorder you can do all that, and more. Including remote control slow motion, freeze frame, frame advance and program editing.

Shoot your own videotape "family album" in color and sound, show it easily anytime through your TV set. No hassle with projector and screen.

Easy-to-use video camera, turn it on, focus and shoot. Complete with power zoom lens and boom-type microphone. Compact, lightweight, 13-lb. recorder goes where you go, records up to six hours on a single cassette. Built-in battery operates up to 80 minutes before recharge.

And remember: six hours of tape costs about \$20, six hours of film and processing more than \$1000. Enough said. The picture of the future is videotape. Get in the picture with Quasar.

That's fantastic! That's Quasar!

Quasar®

ONE GREAT IDEA AFTER ANOTHER...

AFTER ANOTHER...AFTER ANOTHER...AFTER ANOTHER...AFTER ANOTHER...AFTER ANOTHER...



Component style, component features, integrated into one high-performance stereo system.



Programmable 14-day Video Cassette Recorder with remote control, special effects, high speed picture search.



Beautiful furniture, giant 45" diag. color TV, too. Remote control, 105 channels, stereo capability.



World's most compact 7" diag. TV and AM/FM radio goes where you go. Runs on AC, DC or ordinary D-cell batteries.



Microwave/Convection Oven that bakes and browns. With 3 separate functions, it's like 3 ovens in one.

TV Pictures Simulated.

Quasar, Franklin Park, Illinois 60131.
Division of Matsushita Electric Corporation of America

Copyrighted material



PS 3,000-MILE TEST PLYMOUTH RELIANT K



Our Reliant K's manual transmission helped it deliver markedly higher fuel

Chrysler gets high marks on follow-up test of its production-line K-car

By ED JACOBS

Along with our coverage of the 1981-model introductions in last October's issue, we reported on the first open-road testing Chrysler permitted on its all-new K-cars. That test was an early-summer sweep through the Midwest in one of the firm's \$250,000 hand-built prototypes. Time constraints resulting from the scarcity of prototypes limited us to only 2,000 miles. So to complete our normal minimum of 5,000 miles—and to see how different from the exceptionally impressive prototype a production-line car would be—we ordered another Reliant, a two-door. We again specified the all-new 2.2-liter four, but this time with the more economical four-speed manual transmission.

What we got was another fine domestic compact. It delivered excellent economy, was roomy and comfortable, and rode and handled well. Even though we encountered a couple of minor glitches, which we left uncorrected due to time considerations, the car was still the near-equal of the

economy than the automatic-equipped prototype we tested last summer.

exceptional prototype. (The glitches included a broken self-adjuster in the clutch linkage and a front suspension that was slightly out of alignment.)

The economy advantage of the manual transmission proved to be considerably greater than we had expected. Where the prototype averaged 24.9 mpg for its 2,000 miles, the production car delivered 29.0 for 3,000 miles. On the highway, economy ranged from 31 to 33 mpg; in mixed driving, 26 to 29.

Along with its high economy, the engine produces reasonably good power. Response is good in first and second gears, but flattens out considerably in third and fourth due to gear ratios selected for maximum economy. You can accelerate uphill and pass other cars in fourth gear, but response is predictably sedate. A precise-shifting five-speed would be beneficial (and is in the works).

What could stand some attention, though, is the vague and clunky shift mechanism. Its long throws put the shift lever much too far from you, especially in third. In addition, the reverse detent is too weak, and you can sometimes get reverse instead of first. Early in our test, the car developed a transmission leak that spilled a considerable amount of fluid. A dealer in New York City told us there was no

leak, but a rural dealer quickly found and fixed a poorly sealed sump.

When it came to handling, our Reliant was good, although perhaps a bit bouncier than the prototype. It also seemed more susceptible to steering changes generated by pavement irregularities than either the prototype or the Aries in this month's test.

The Reliant's ride was smooth, pleasant, and comfortable, very much like that of a full-size car. But its short wheelbase did manifest itself in more abrupt pitching on bumps, although the magnitude wasn't objectionable. Even with four people and luggage aboard, ride quality was impressive.

Just like the prototype, our Reliant had little sensitivity to crosswinds or the bow waves of tractor-trailers. And the harder-riding P-metric tires did cause some slight additional harshness, but hardly enough to notice.

As small as Reliant is outside, it's really larger inside than you'd expect. Several people commented on how big-car-like its interior space is. The car is rated for six passengers, but that's a squeeze (see this month's Car Test for more comments). Four passengers, however, ride comfortably.

The driving position is very good, but the steering wheel sticks out a bit too far. You have to push the seat back more than you might want to get a comfortable, legs-out, arms-out position. The field of view to the sides and forward is excellent, but there are some restrictions toward the rear.

Wind noise may have been just a touch higher in this Reliant, but the car was still very quiet. Engine noise was discernible, but its low pitch made it almost no factor at all.

The instrument panel is well laid out and legible, with high-contrast markings. Unfortunately, at night it is very difficult to read the instruments because there isn't sufficient illumination. The rheostat limits intensity so much that it's impossible to read the odometer unless you have exceptional night vision.

Due to the slight position differences with bucket seats, the right-turn signal and engine-overheat warning lights are obscured by the rim of the steering wheel.

As is very common these days, the Reliant has a tiny glove box. In fact, I couldn't even fit a standard secretarial steno book into it. And one last complaint: The car needs positive stops to hold the doors open while you're getting out or unloading parcels.

The Reliant seems to be just about ideal for today's small families or anyone moving into a smaller car. Even with the little flaws noted above, Chrysler gets very high marks. **EB**

EARLY TIMES. THE WAY IT WAS, IS THE WAY IT IS.



**1871. A hastily arranged reception
for a pioneer balloonist.**

On July 4, 1871, an astonished crowd in Kalamazoo, Michigan beheld a lone balloonist descend from the sky. He was Professor Steiner, the first mortal to fly across Lake Michigan. And even then, what would have been more appropriate at a welcoming party than Early Times. The whisky that made Kentucky whisky famous.

Today, we're still slow-distilling it the same way we did then. And thoughtful people always have several bottles on hand for friends who drop in out of the blue.



NOW

The Low

Less than 0.01 mg tar

BOX: Less than 0.01 mg. "tar", 0.005 mg. nicotine,
100's FILTER, MENTHOL: 2 mg. "tar", .2 mg. nicotine,
av. per cigarette by FTC method; SOFT PACK FILTER, MENTHOL:
2 mg. "tar", .2 mg. nicotine, av. per cigarette,
FTC Report DEC. '79.

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

V

est



Box

Now—"closest to tar-free"TM

Also available:
Soft Pack 85's
and 100's



Regular or Menthol

DO-IT-YOURSELF

FINE GRANDFATHER CLOCK KITS

STARTING UNDER

\$235

(including movement and dial)

- Factory direct prices
- Heirloom quality
- Solid ¾" hardwoods: black walnut, cherry, oak
- Easy to assemble, parts pre-cut
- Solid brass West German chiming movements
- Money back guarantee
- Prompt shipment



MASTER CARD and VISA ACCEPTED

Write for FREE color catalog

EMPEROR® CLOCK COMPANY

WORLD'S LARGEST MANUFACTURER
OF GRANDFATHER CLOCKS
Dept. 743 Emperor Industrial Park
Fairhope, Alabama 36532

RECREATION ROUNDUP

By HERBERT SHULDINER

RV sales boost expected in '81

That's the optimistic picture I got at two industry shows in Los Angeles and Louisville, Ky., late last year. Despite the fact that 50 percent of all RV makers and 45 percent of all RV dealers have gone out of business in the last 18 to 24 months, the remaining companies—and, more importantly, the suppliers of motor-home chassis and engines—voice this optimism.

One of the more hopeful persons I interviewed was J. C. Perkins, Chevrolet truck-sales manager. Perkins told me that there were only 5,000 Chevrolet motor-home chassis sold last year (compared to 51,000 in 1979). "But the outlook is for solid gains in 1981," Perkins says. He forecasts 11,000–12,000 full-size motor-home-chassis sales and 6,000–7,000 mini-motor-home-chassis sales (cutaway vans) this year.

New chassis and engines

While making that forecast, Perkins revealed that Chevrolet will introduce a new, jumbo motor-home chassis with a 209-inch wheelbase. It can accommodate motor-home bodies up to 32 feet long. The new chassis will be powered by an 8.2-liter Detroit diesel, rated at 165 hp. Perkins says that 1,500 of the new chassis will be built this year.

Later in the year, the 6.2-liter Chevrolet diesel described in January's "Recreation Roundup" will be made available for smaller motor-home chassis, Perkins confirmed. You can look for Winnebago to be one of the earliest users of the 6.2-liter model. Some RV makers expect that small motor homes equipped with this engine will get 20–25 mpg. However, it would take the kind of lightweight construction and aerodynamic styling of the new Winnebago Warrior (see "'81 Camping Vehicles," this issue) to achieve the engine's greatest fuel efficiency.

I would also expect the 6.2-liter diesel to enhance the fuel economy of mini motor homes—and eventually of Trans Van-type vehicles. The latter are really a wider and longer version of van conversions.

Perkins also looks for a sales revival of vans and van conversions. He says Chevrolet expects to sell 12,000–13,000 vans in 1981. That's well below the level that prevailed before the Iranian crisis, but a boost over 1980.

Some reasons Perkins cites for his optimistic forecasts include the fact that there are relatively few carryover 1980 chassis and that potential RV customers have "pretty well accepted, or adjusted to, the higher cost of fuel." Perkins, however,

sees high interest rates as one of the major obstacles to an RV comeback.

Ford's new motor-home chassis

Ford stopped making motor-home chassis in 1974 when RV sales slumped following the first Arab oil boycott. But it's now developing a new series of chassis "on a crash basis," according to Robert C. Honke, Ford's RV sales manager. He says, "We hope to have them ready this spring." The new chassis will come in three wheelbase sizes: 158 inches for motor homes in the 21–23-foot class, 176 inches for 23–25-foot motor homes, and 206 inches for motor homes up to 32 feet long.

Ford's chassis will offer an option of a 460-cu.-in. V8 gasoline engine or the same 8.2-liter Detroit diesel used in the Chevrolet chassis.

International's new diesel

Another diesel power plant for motor homes was recently announced by International Harvester. International says it will be made available to RV manufacturers in time for 1983 model introductions. Although well suited for motor homes and vans, the 6.9-liter diesel is intended primarily for medium-duty trucks.

This fact seems to augur well for motor-home manufacturers. Truck makers are under increasing pressure to produce more-fuel-efficient vehicles as skyrocketing fuel prices cut into the profits of trucking companies. International predicts that 71 percent of medium-duty trucks will have diesels by 1985, 90 percent by 1990. The same chassis are usually modified to accommodate motor homes.

Can RV makers wait?

The only problem is that RV manufacturers need immediate help, and the economical chassis and engines aren't available in large enough quantities yet. This is bound to limit any sales comeback in 1981.

What's more, many RV manufacturers are convinced the public won't be satisfied with 20–25-mpg motor homes. Several manufacturers have as their goal a new class of motor homes that will get up to 30 mpg. How can they achieve this without Detroit's immediate help?

"We're talking to a number of European chassis manufacturers," says Frank Rotta, a Winnebago spokesman. Winnebago has pursued its sources for over a year now,

Continued

DOUBLE-WALL INSULATED SOLAR GREENHOUSES

ALL STYLES &
WINDOW UNITS
FROM JUST ...

\$399

SOLAR QUICK-MOUNT PANELS FOR SKYLIGHTS, WALLS, ROOFS

AS LOW
AS JUST ...

\$250

SQ. FT.

SOLAR STRUCTURES & ACCESSORIES THAT HELPS HEAT YOUR HOME AND QUALIFIES YOU FOR A

40% TAX CREDIT!

COLOR BROCHURE \$1, SENT FIRST CLASS



VEGETABLE FACTORY, INC.
P.O. Box 2235, Dept. A276
New York, NY 10163
Or Call: (212) 867-0113

Be your own boss with your own small-engine repair business.

NRI shows you how to service and repair mowers, tillers, snow blowers, chain saws, outboards, garden tractors, mopeds, motorcycles, and dozens more. Then shows you how to start and run your own business.

If you're looking for independence... for extra income in your spare time... for a productive retirement career... then look into the NRI home-study course in Small Engine Repair. It's a great way to get your own business, full-or part-time, with a minimum of investment and problems. And it's a business with plenty of room for qualified people.

Learn at Home in Your Spare Time

NRI gives you the training you need to enter this big field right at home. No need to quit your present job or travel to night school. You learn with "bite-size" lessons that show you how to service almost everything that uses small motors. You learn with "hands-on" training that even includes professional tools. And you learn at your convenience.

Build 3 1/2-HP Engine

As part of your training, you actually build a 3 1/2-HP four-cycle engine. You perform experiments and demonstrations that show you how each and every part works. You learn with professional tools like a complete set of wrenches, electrical system tools, inductive tachometer, engine overhaul tools, volt-ohm-milliammeter and more. Use them for learning, use them for earning.

Choice of Two Courses

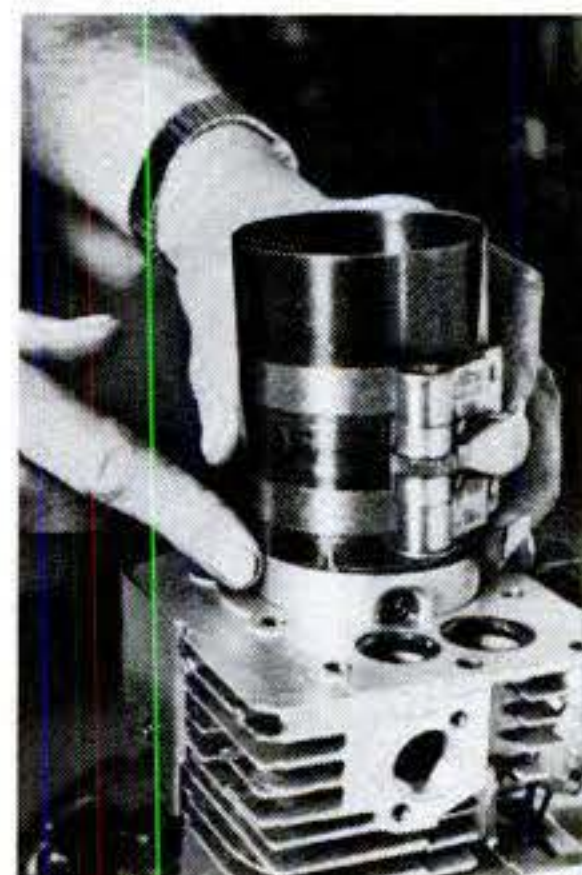
There's the 30-lesson Basic Course, which concentrates on the lucrative lawn and garden equipment business. The 45-lesson Master Course has it all, adding lessons on



A business you can start in your garage and watch grow.



Earn part-time income doing service work for hardware stores, lawn and garden shops.



"Hands-on" training gives you practical bench experience.

chain saws, mopeds, outboard motors, light industrial equipment, snowmobiles, and even motorcycles.

Send for Free Catalog, No Salesman Will Call

Our big catalog tells you all the facts, no salesman will ever bother you. Each lesson is

described in full, each piece of equipment is shown in colorful detail. It tells you about opportunities in the field and NRI's qualifications as the largest home-study technical school in the world. If postage-paid card has already been removed, write to address below.

Other income opportunities from NRI.

Air Conditioning/Refrigeration/Heating Including Solar Technology

Gets you into a wide-open, fast-growing area with practical training that includes lessons on solar heating, heat pumps, etc. Course is complete with professional tools, including top-grade professional vacuum pump, key tool in the proper servicing of refrigeration and air conditioning units. Two courses, with Master Course including optional postgraduate training at York Institute Resident School at no extra charge. Check card for catalog.

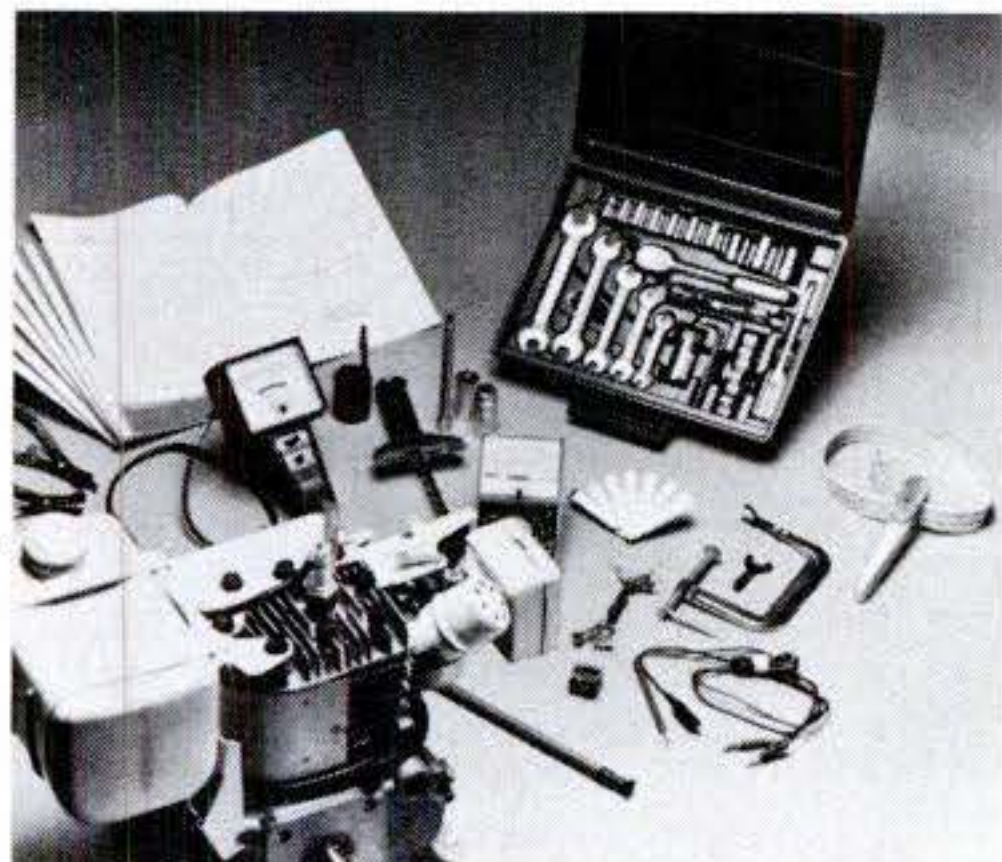
Electrical Appliance Servicing

Good appliance repairmen are hard to come by. NRI trains you for your own full- or part-time business in fixing everything from toasters to refrigerators and freezers. Step-by-step training includes professional tools and instruments like

clamp-on ammeter and appliance multimeter. Check card for catalog.

Auto Repair and Servicing

NRI "hands-on" home training covers what you need to know, even diesel engines. Includes professional tools like inductive timing light, tune-up instrument, vacuum test pump, compression gauge and ignition analyzer oscilloscope. Approved by Richard Petty, America's winningest stock car driver and NRI automotive consultant. Choice of two courses. Check card for catalog.



You build this 3 1/2-HP engine, get all these professional tools.



NRI Schools
McGraw-Hill Continuing
Education Center
3939 Wisconsin Avenue
Washington, D.C. 20016



GM
GMC
a division of
General
Motors

WITH A GMC, YOU DON'T TAKE YOUR LUMPS AT THE PUMPS.

NEW SUPER SAVER GMC PICKUP. Like all the new GMC pickups, its styling is more aerodynamically efficient than last year's. In addition, our new Super Saver is powered by a thrifty 4.1 liter six and equipped with a manual 4-speed overdrive transmission, low numerical axle ratio and specially selected tires. All of which result in the gratifying EPA-estimated mileage shown

here. It is, we submit, a clear indication that you can drive a 1/2-ton GMC pickup that's built to do a full-size job without taking your lumps at the pumps.



30 EST. HWY. **21** EPA EST. MPG

REMEMBER: Compare the "estimated mpg" to the "estimated mpg" of other vehicles. You may get different mileage depending on how fast you drive, weather conditions and trip length. Actual highway mileage will probably be less than the estimated highway fuel economy. Super Saver Pickup not available in California. GMC pickups are equipped with GM-built engines produced by various divisions. See your dealer for details.

TRUCKS ARE WHAT WE'RE ALL ABOUT.

Copyrighted material

Recreation roundup

[Continued]

however, and doesn't appear close to finding a satisfactory platform to import.

Share a motor home

A growing phenomenon is time-sharing ownership of resort facilities. It's already a well-established practice in Europe, but its introduction has been slow in the U.S. Now an even more novel idea is the time-shared motor home. Share a Motor Home (3326 E. Atlantic Blvd., Pompano Beach, Fla.) is a new company offering partial ownership and use of the big RV's.

At present, the motor homes are based only in Florida, California, and New York. Later, Nevada and Texas will be added to the list. Three classes of motor homes are available: moderate, superior, and deluxe. One-week-per-year ownership for 10 years (expected life of a motor home) costs \$2,500 for the moderate vehicle, \$3,500 for the superior, and \$4,500 for the deluxe RV. Payment is over a five-year period in equal amounts, plus interest. Of course, you can purchase any number of weeks you choose.

Late-winter snowmobiling

This is the time of year when winter begins to slip away and snow is just a memory in most areas. But in a large number of places, the snowmobile season is still going strong and offers enthusiasts some of the best conditions for enjoying the sport. Obviously, the best of these places are high in the Rockies or fairly far north—but they're generally not hard to reach because road conditions are less hazardous this time of year.

In the January '80 "Recreation Round-up" I wrote about one of the snowmobiling Mecca's—Old Forge, N.Y., whose trails are often open until April. Other areas include Jackson, Wyo., and West Yellowstone, Mont. These two places offer some of the most gorgeous mountain snowmobile trails in North America. Colorado has a host of good snowmobiling spots still open at this time of year. The Irwin Lodge at Crested Butte is only accessible by snowmobile, but the Black Mountain Ranch near Vail and several resorts near Grand Lake can be reached by car.

Penticton and Vernon in southern British Columbia are readily accessible in a day's drive for residents of Washington and Oregon. The Upper Peninsula of Michigan is another area that retains its snow until late spring. One of the best spots there is the Keweenaw Peninsula—a little finger that sticks out into Lake Superior. It gets an average of 250 inches of snow per winter.

For easterners, the Rangeley Lakes area in mid-Maine is generally a good bet. And the Eagle River, Wis., area frequently has snowmobiling into April.

Rental snowmobiles are often available in these areas. And many motels and resorts can offer guides to accompany you. It's a good idea to check with the local Chamber of Commerce to make sure adequate snow conditions exist. P 5

OFFER EXPIRES MAY 31

Hardened Steel. For filing, drilling, milling, carving, routing any metal or wood.

Cutting edges from 1/4" to 1", all shanks 1/4". Brand new in air-tight G.I. packs.



32-Tool Set, G.I. cost \$295⁰⁰ now \$24⁰⁰

14-Tool Set, G.I. cost \$126⁰⁰ now \$18⁰⁰

Save Even More. Both Sets now \$36⁰⁰

Two \$36. Sets (Limited Time) \$56⁰⁰

Money Back Guarantee. Add \$3⁰⁰ for shipping

Texas orders add 5% tax. Export orders add \$4.

U.S. SURPLUS CENTER, Dept. 501

715 Camden, San Antonio, Texas 78215

FREE! HARDWOOD VENEERS & LUMBER CATALOG

96 varieties world's rarest veneers and lumber at reasonable prices. Simplified veneering instructions plus full color wood selector included. Send for free catalog now and get special bonus starter offers. **SAVE 25% Hurry!**



BOB MORGAN WOOD, Dept. PO2K87

1123 Bardstown Rd., Louisville, Ky. 40204

NEED THREE PHASE POWER

The "THREEPHASER" allows you to operate three phase motors 1/4 thru 7 1/2 horsepower from 220 volt single phase power sources. Rugged — heavy duty — patented unit built to give many years of satisfactory service. Satisfied users worldwide since 1966. Free literature furnished on request. Telephone 305-862-3038. **ONLY \$59⁹⁵**

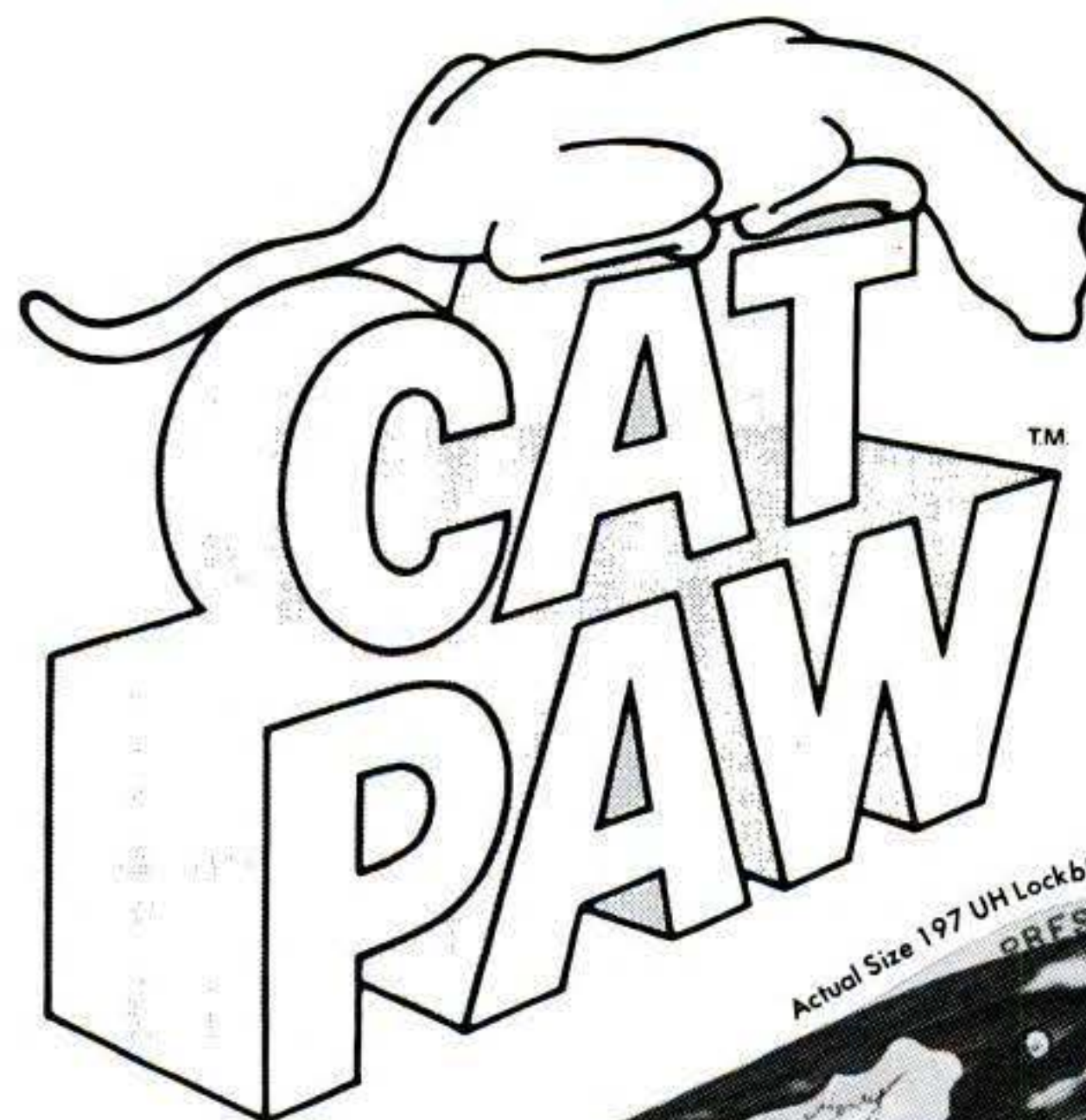
RELIANCE ELECTRIC MANUFACTURING COMPANY INC.
Rte. 2, 1024 W. Lake Brantley, Maitland, Fla. 32751

110 VOLT A.C. GENERATORS

60 cycles, 3000 watts. Wt. 27 pounds, 5"x10" Fan-belt driven from car or pickup. Operates T.V. All power tools. Over 17,000 in service. This is our 30th year. Guaranteed 6 months, \$189.00 Our X1200-watt generator needs no battery. Special Price \$179.00. Add \$7.50 for postage & handling, per unit.

VIRDEN-PERMA-BILT
Box 7160PS, 2821 Mays, Amarillo, TX 79109
Phone: 806/352-2761

Uncle Henry's Newest Lockblade.



"It's a little Beast. Guaranteed"

Slip a Cat Paw™ into your vest pocket and you'll discover a dozen reasons a day to use this little beauty.

It's trim and slim, but packs the heavyweight features that make Uncle Henry world famous.

The 3" stainless steel blade is totally rust resistant.

Like every Uncle Henry®, each Cat Paw is guaranteed against loss for one year from date of warranty registration.

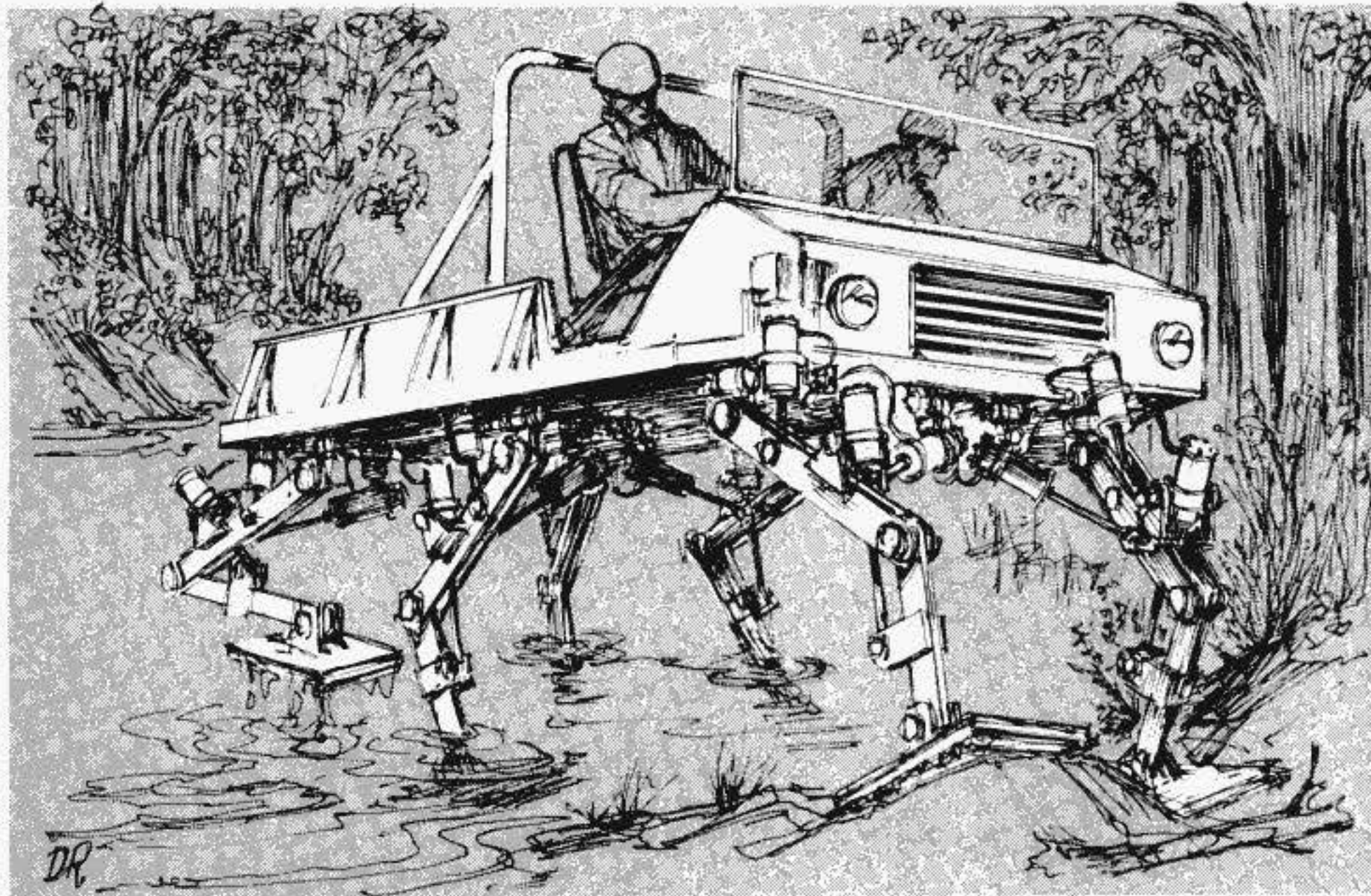
Find out more about the entire line, all made in the USA, send for the all new, free Old Timer® Almanac today.

**UNCLE
SCHRADE
HENRY**
Ellenville, N.Y. 12428



NEW IDEAS FROM THE INVENTORS

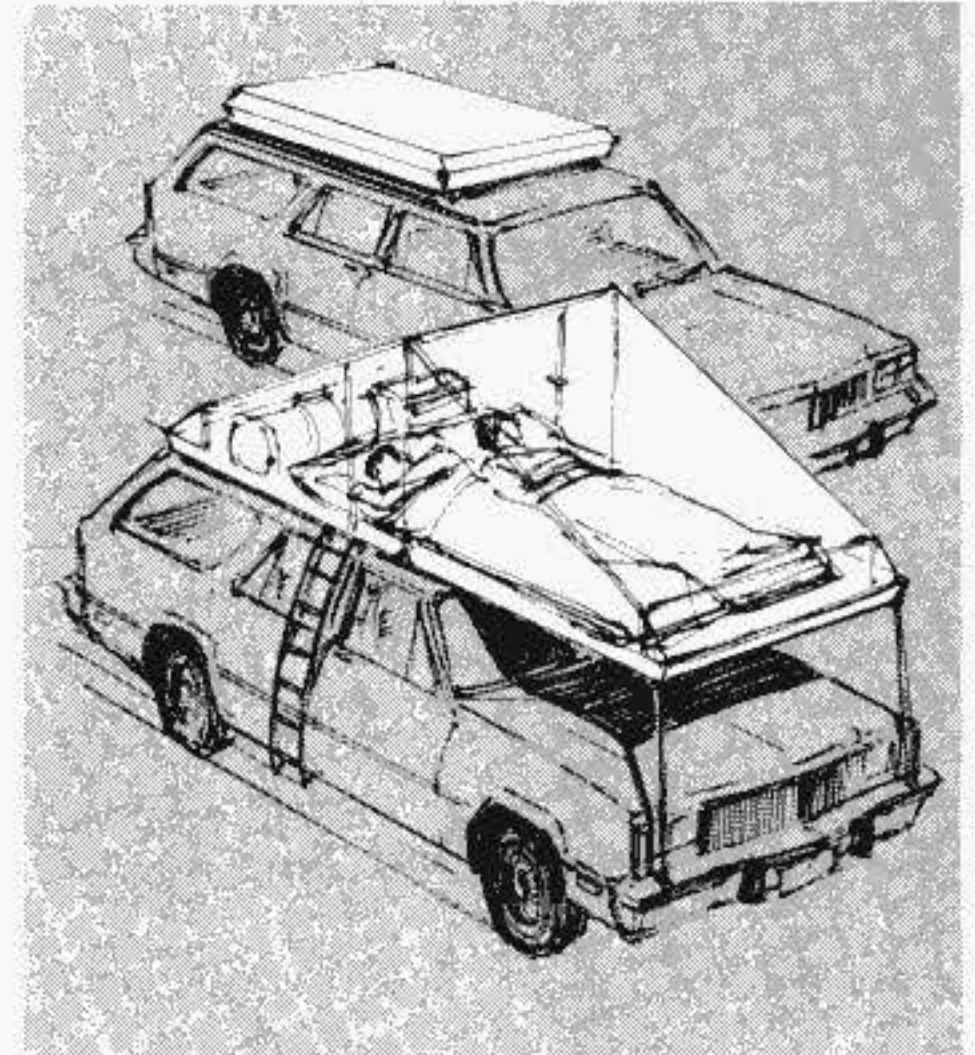
ILLUSTRATIONS BY DANA RASMUSSEN



Computer levels all-terrain walker's legs

Designed to move rapidly over water or the roughest of land surfaces, the articulated legs and feet of this ATV would adjust their own height to suit ground irregularities as they were guided forward, backward, or around banking turns.

Level-sensors would detect downward extension of each of the six legs and signal an on-board computer. The level signals would be integrated with an operator-set program, which would tell the legs how to move to maintain direction.



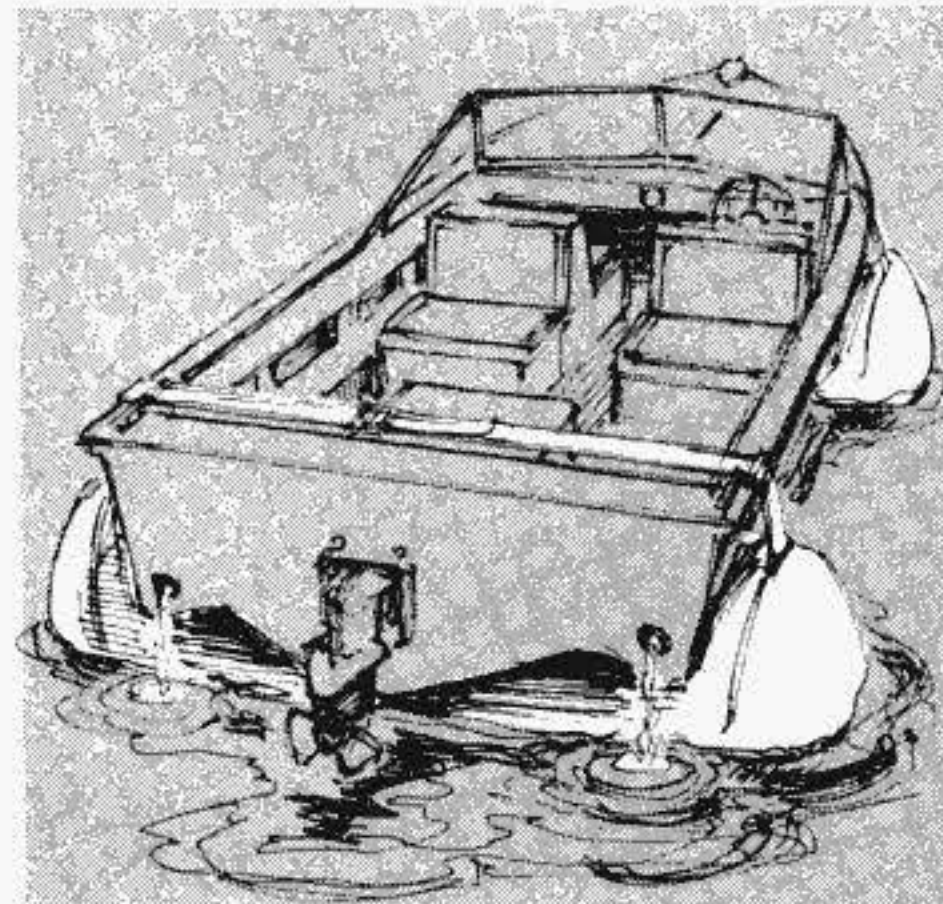
Bumper supports camper

This sleeper tent would fold back over the roof of a car to travel with you without overloading the vehicle or blocking your view. At the campsite you'd extend the hinged platform forward and prop it by hooking trusses to brackets you'd previously attached to your front bumper. The lightweight cover and side-access ladder would also unfold from the compact gear-hauler and sleeping platform.



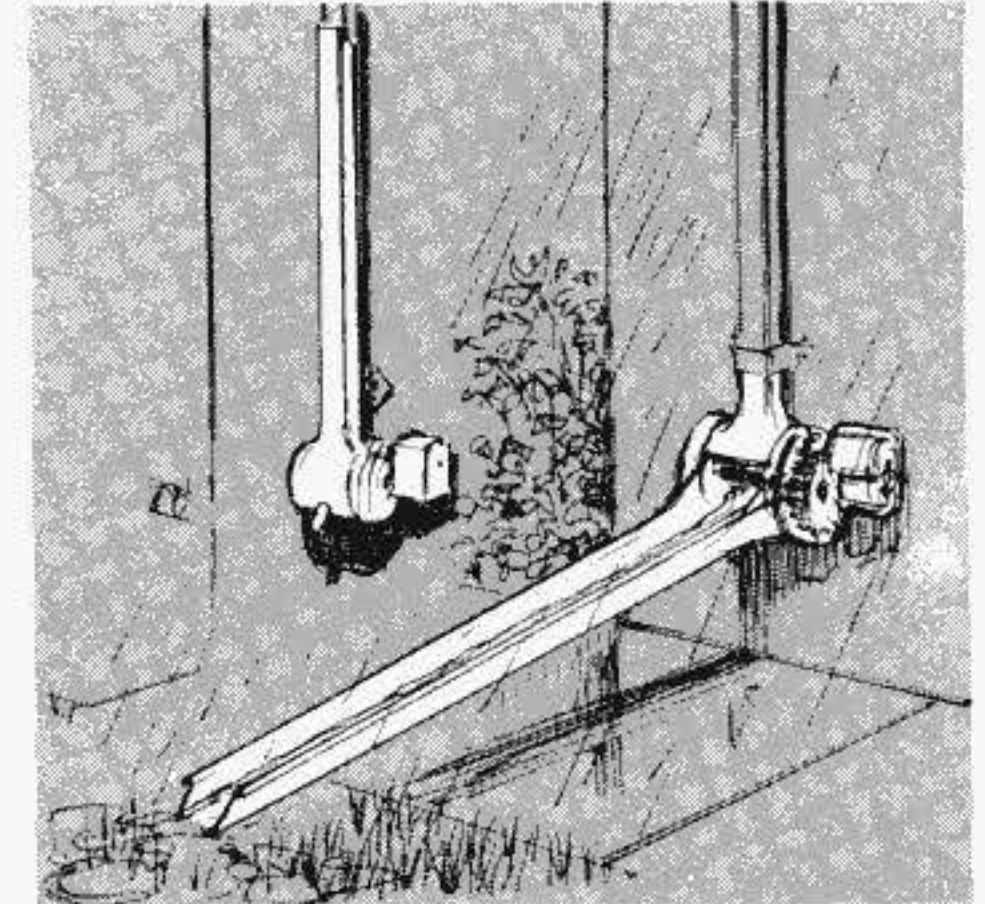
Broom carries its dustpan

This flexible dustpan, attached to a collar-like handle, would slide down behind the bristles of a broom to stiffen them for many different kinds of indoor or outdoor cleanup. The curve of the dustpan would form the bristles to a convex, dirt-scooping shape. But removed and pressed flat against the ground, the always-handly dustpan would pick up sweepings.



Moored boat drains itself

After you'd strapped the inner-tube-like floats around the bow and stern of a double-bottomed, transom-drained boat, you'd inflate them to raise the boat above normal floating position. The bilge vent would be left open so rain and spray could drain away automatically. Leaving your motor attached would normally ensure the proper drainage angle.



Downspout arm prevents floods

Does heavy rain sometimes cause damaging seepage through your home's basement or foundation? With this hinged trough connected—through an adapter—to the regular downspout, you could let it down manually (or by an inside switch) to carry excess runoff safely away from the house. Raised in good weather, it would lie clear of a path, drive, or flower bed.

The following patents have been issued on these inventions: **Leg-leveling computer**—No. 4,202,423 to Jose M. Soto, Lancaster, Mass.; **Double-duty dustpan**—No. 4,109,338 to Richard H. Mertes, Westlake, Ohio; **Boat drainer**—No. 4,075,065 to Frank J. Lasch, Albany, N.Y.; **Car-top camper**—No. 4,111,479 to John D. Rizzotto Sr., Abington, Mass.; **Downspout**

extension—No. 4,135,540 to Karl H. Felsen, Winnipeg, Canada. Copies of patents may be ordered, by number, from the Commissioner of Patents and Trademarks, Washington, D.C. 20231, at 50 cents each. To write to an inventor, if address above is insufficient, address him by name and patent number in care of the Commissioner.

STRONG LIKE THE BIG ONES... WITH SNAPPER QUALITY AND DEPENDABILITY.

SNAPPER garden tractors were designed by agricultural engineers with quality features. Like an in-line drive train for efficient power transfer and welded steel frames for ruggedness. Another great feature is your ability to "quick change" attachments so you spend less time getting ready and more time working.

You have a choice of standard gear transmissions; hydrostatic transmissions with "Memory"; manual or hydraulic ASAE standard lift systems; rear power-take-off; and 16 or 18 HP engines. In addition, you can get a 42", 48" or 54" trim line mower and a multitude of attachments for gardening and lawn maintenance.

Stop at your local SNAPPER Dealer for your FREE COPY of "How to get the most for your money when you buy a garden tractor."

McDonough Power Equipment
McDonough, GA • 30253



SNAPPER
Mowers • Tillers • Tractors



ANY WAY YOU CUT IT... IT'S A SNAP WITH SNAPPER!



Exit bland. Enter KOOL.

Here is low 'tar' smoking satisfaction that plays to rave reviews.

KOOL MILDS gives you a refreshing sensation that goes beyond the taste of ordinary low 'tars'.

There's only one word for the KOOL experience: **Bravo!**



Common up!
the coolest low tar

© 1981 B & W T Co.

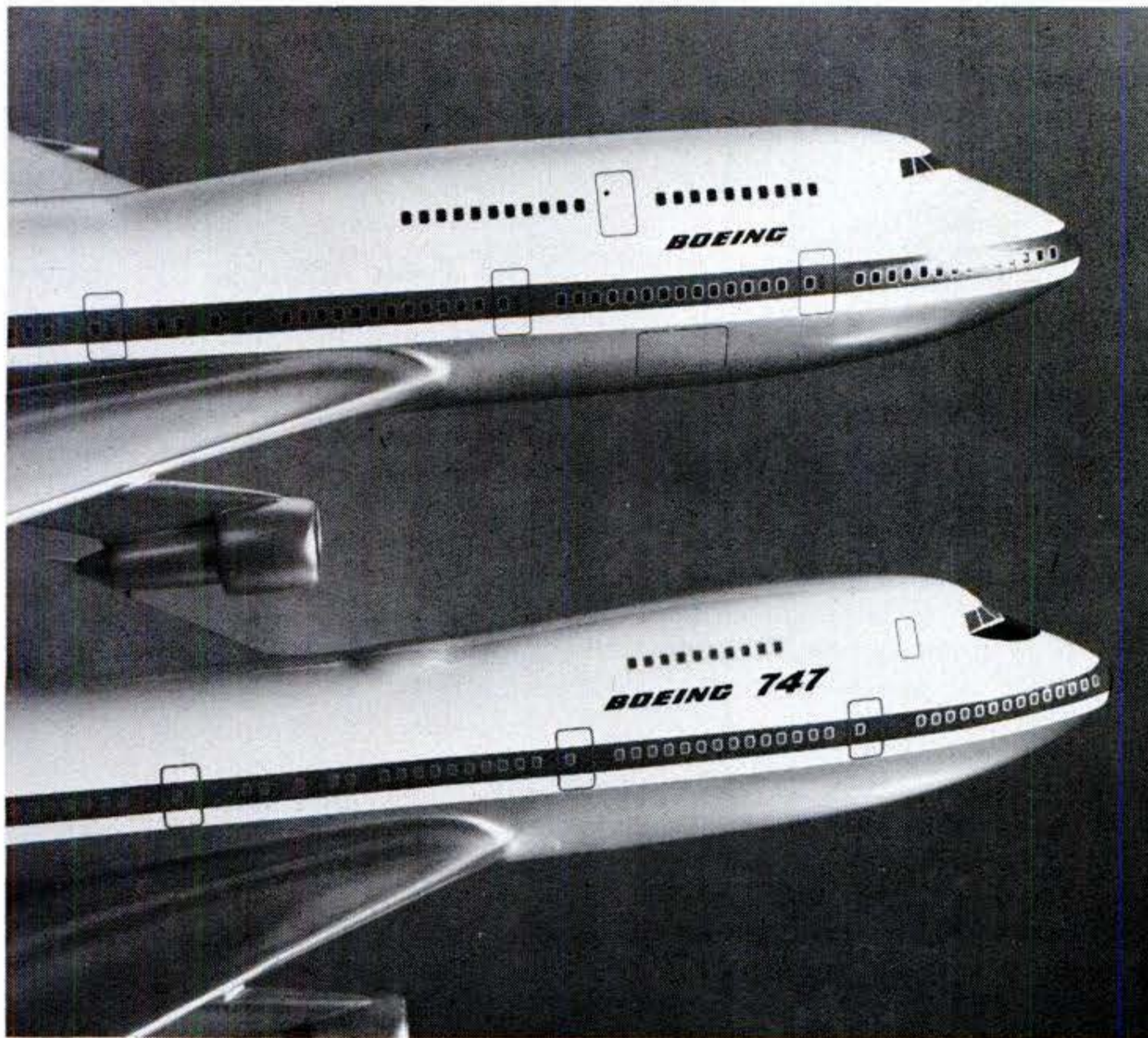
Kings, 11 mg. "tar", 1.1 mg. nicotine av. per cigarette by FTC method.

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

Copyrighted material

Bulging 747

has more room
at the top



Two versions of Boeing 747—new Swissair upper-deck model (top) and original

One of the 747's shown seats 44 more passengers than the other. Where? Look at the upper deck—the famous hump just behind the cockpit. It's been stretched—by a full 23 feet.

This hump, long a 747 trademark, originally housed a lounge, accommodating just eight first-class passengers who wandered between decks via an elegant spiral stairway.

Rising costs made such lavishness impractical, and through the years Boeing has expanded the upper deck's seating. Today, some 747's carry 32 passengers upstairs.

The new stretched upper deck can seat as many as 69 economy-class passengers. It has new windows and exit doors, and, sadly, a prosaic set of straight stairs has replaced the circular staircase.

The design change should help airlines lower costs. Though it boosts passenger capacity by 10 percent, the stretching increases empty weight by only two percent and doesn't require

design—shown above. Seven previous revisions did not change exterior.

changes either in engines or allowable gross weight. Even better, the enlarged hump means a five percent drop in fuel consumption per available-seat mile.

The first airline to reap these fuel savings will be Swissair, which has ordered four models for delivery in March, 1983. The Swissair version will have 392 passenger seats, including 56 seats on the upper deck in a five-abreast layout. The four planes will cost Swissair about \$350 million. And the airline has options for four more stretched 747's, to be delivered between 1986 and 1988.

Other airlines are also studying the new design. It has special promise for airlines that use the Combi version of the 747. This plane carries palletized cargo in the rear as well as passengers. The stretched upper deck means that 12-pallet Combi planes can carry 282 passengers instead of 238, an improvement of about 18 percent.

—Ben Kocivar

IONIZER BREAKTHROUGH!

NOW AT LAST YOU CAN USE THE REMARKABLE BIONAIRE IN YOUR HOME AND IN YOUR CAR. YOU NEED BUY ONLY THE ONE UNIT AND PLUG INTO EITHER CAR OR HOUSE CURRENT.

Wherever top calibre ionizers have been tried, they have changed things for the better. People have reported greater energy, better health and increased productivity. An ionizer replaces the negative ions killed by metals, man-made materials, air conditioning and central heating. It restores the natural balance of the air, making it fresh and easy to breathe. At the same time, an ionizer radically reduces airborne dust, pollution, bacteria and pollen. And almost completely eliminates odors like tobacco smoke. Naturally.

**THE BIONAIRE 300.
CONSIDER IT A SAFETY DEVICE FOR YOUR CAR.**

Ion deficient air slows reflexes by as much as 20%. This can mean all the difference between avoiding a dangerous situation and running right into it. Bionaire has perfected a unit that is the most efficient ionizer of its size on the market today. The compact Bionaire 300 (1" x 4" x 3-1/2") weighs only 4 ozs., sits on the dash without obstructing your view, and will keep you calm and alert through those endless rush-hour drives. It's easy to install, has a multi-point ion source and emits the highest ion output of any self-contained unit of its size.



**THE 300 PACKAGE
(with special stand and adaptor).**

Now it's packaged to use at home or in your office. Just unplug it from your car, place it in our attractive plexiglass stand by your desk or bedside, and with our adaptor, plug it into the nearest outlet. Each Bionaire unit keeps the air in an 8 ft. radius around it constantly charged with at least 10,000 negative ions per cubic centimeter. Full one-year warranty.

**THE DELUXE BIONAIRE 100A FOR
YOUR OFFICE OR HOME.**

This unobtrusive, decorator-designed unit (2-1/2" x 6" x 6") comes complete with unique output monitor indicators, omnidirectional emission, and a full one-year warranty. (Does not adapt to car use.)

**New! A powerful combination
ionizer and air cleaner (Bionaire 2000) that
does a whole house, even traps sub-
micron ash from Mt. St. Helen.**

Credit card holders:
Order your unit by calling collect

0-416-363-8704

BV DISTRIBUTORS	Dept. 123
P.O. Box 510, Grand Island, New York 14072	
I'm sold on healthy energized air in my car and home.	
Please send me for a complete money-back 21 day trial	
<input type="checkbox"/>	Bionaire 300 (for my car only) \$74.95
<input type="checkbox"/>	Bionaire 300 Package (with stand and adaptor for home, office or car) \$89.95
<input type="checkbox"/>	Bionaire 100A (for home/office) \$119.95
<input type="checkbox"/>	Bionaire 2000 (air cleaner and ionizer for entire house) \$399.00
Please add \$5.00 for handling and delivery for each unit ordered.	
Add \$10.00 for each Bionaire 2000 ordered.	
Ontario, New York residents, please add sales tax.	
I understand that I may return any item undamaged within 21 days and receive a full refund if I am not completely satisfied.	
My check or money order is enclosed for \$ _____	
or I prefer to charge this to my credit card	
<input type="checkbox"/>	VISA
<input type="checkbox"/>	M/C
<input type="checkbox"/>	AMEX
<input type="checkbox"/>	DC
Account Number _____	Expiry Date _____
Signature _____	
Name _____	
Address _____	
City _____ State _____ Zip Code _____	

People write to



Have a question about motor oil? Lubricants? Engines? Ask the Pennzoil experts...

Deceptive Darkness. I have used Pennzoil 10W-40 in my '73 since I purchased it new. I recently bought a case of 10W-40 and upon pouring the oil into my car's crankcase, I noticed that it was much darker in color than the Pennzoil I had used all these years. The only difference in can labelling was that the newer can says "For API Service SF and SE," whereas the older cans carried the initials SE-CC. What gives?

J.M.D., Walnut Creek, CA

The darker color of the 10W-40 oil which you just purchased is due to an additive change in the oil, to upgrade it to "SF". Service Classification SF was just recently adopted by the American Petroleum Institute (API). This is an upgrade from the old "SE" rating, and this SF oil is superior to oils meeting only the SE standards. The additive systems required to meet SF in Pennzoil's formulations are now darker in color which is evident in the finished oil. The SF oil should be used where SE oils were recommended in the past.



Too Hot It's Not. What is the ideal operating temperature for engine oil? I recently installed an oil temperature gauge in my 305 CID V-8 pickup, and find that the temperature of the oil stabilizes between 210°-215°F. When pulling a 3,400-pound travel trailer, the oil temperature rises to between 225°-230°F. Is this range acceptable? Would you suggest that an oil cooler be installed?

D.J.W., Morris Plains, NJ

Engine oil operating temperatures are a function of many factors including load, thermostat setting, oil viscosity and others. Your own experience shows the effect of load. Your temperature range (210°-215°F. to 225°-230°F.) represents a normal, satisfactory oil temperature range. If you plan to pull your trailer regularly in a very hot environ-

ment, an oil cooler might be advisable. Otherwise, it certainly doesn't appear necessary.



To Idle Or Not To Idle. I'm aware that it's not wise to let a gasoline engine warm up at idle or idle for a long time since the oil gets contaminated more quickly that way. However, is it all right for my VW diesel to be warmed up a bit at idle before driving off? I want to warm up the engine at idle so it's warm when I drive out of my garage, without harming the engine, of course. I know that large diesel trucks and buses are left to idle for long periods of time.

J.M.R., Missoula, Montana

Keep in mind that large diesel trucks that are left to idle for long periods of time carry as much as 16 gallons of oil in the crankcase to handle the fuel dilution that results from idling. These engines are left idling because they are often difficult to start in winter weather. Our advice to you for your VW is to start your engine and drive off at moderate speeds. Starting the engine and allowing it to idle so that the heater is producing warm air when you drive out of your garage could result in fuel dilution which could seriously shorten the life of your engine.

We've Got The Grease. The owner's manual for my new 4 wheel drive pickup calls for several different grades of chassis grease. For example, it recommends one grease for drag link and steering shaft and another for propeller shaft. Does Pennzoil make a multi-purpose product which would be suitable for all these applications?

H.R.R., Wallingford, CT

Pennzoil makes a multi-purpose lubricant called TTM 302 Lubricant, which will provide you with the essential requirements of the products you need. The

TTM 302 has a special base oil constituent which allows it to pump easily at low temperatures and still protect at high temperatures. The grease also contains moly sulfide which provides good frictional properties and extreme pressure protection.

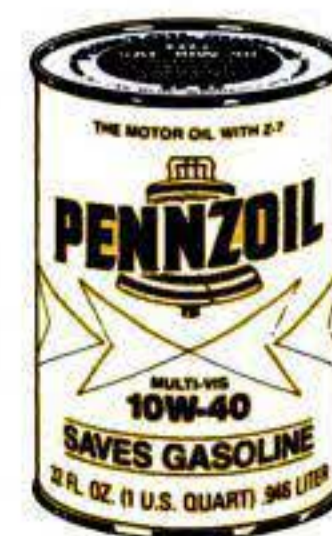
Air Filter Answers. I've noticed in many cars that when the top cover of the carburetor air filter is removed, not only is the air filter dirty with oil, but there are liquid oil deposits in the bottom of the air filter. What causes this condition? Could it be a bad PCV valve?

G.P., Rosedale, N.Y.

Most air filters are impregnated with a petroleum base material, usually a very light oil. When any portion of the crankcase ventilation system is plugged, excess gas fumes may accumulate. This may cause some of the oil to be washed out of the air filter. This build-up can also occur as a result of short trip driving which does not allow the engine to get hot and drive off the exhaust gases. To check the PCV valve, remove it from the manifold. The valve should rattle and not stick. The hoses attached to the PCV valve should also be checked to make sure they are not plugged.

WE'RE OPEN TO QUESTIONS about motor oils, lubricants, engines. But, you can tell us a few things, too. Maybe you have discovered something interesting about motor oils or lubricants. Or you have a special reason for being a Pennzoil fan. We would like to hear from you. Write to: Pennzoil Company, Research Department, P. O. Box 808, Oil City, Pennsylvania 16301. Note: sorry no pictures or material can be returned. Letters chosen for publication are subject to revision necessary for publication requirements.

Quality Products For Over 90 Years



**ask
for
it!**

DETROIT REPORT

By JIM DUNNE



Lean Lincoln: first photos

Last month in this space you read about Lincoln's plans to market a small Continental. Here are the pictures. Its side and rear styling borrows heavily from the Cadillac Seville, but from the front—with its centered rectangular grille flanked by dual rectangular headlights—the car is easily identifiable as a Lincoln. It's built on Ford's Fairmont chassis. Powered by a fuel-injection, 255-cu.-in. V8, it's expected to yield the best fuel economy ever in a Lincoln—about 20 mpg in city driving and close to 30 on the highway. The body style you see here, a four-door sedan, will be the only one offered. The new Continental will be available this fall, joining the Town Car and Mark VI as Lincoln's entries in the luxury-car market.

Not late this time

Ford and GM are actively developing mini-compacts that will compete with the smallest imports—Starlet, Colt, and Civic. GM's so-called world car, code-lettered S, is slated for public introduction in the U.S. in 1983, after a year of production in Spain. The mini will have a 92-in. wheel-

base, smaller than Chevette's. Ford's mini is called the Optim—for optimum—and will be built in two- and four-seat versions. It may get a plastic body as part of an overall emphasis on weight cutting. Its three- or four-cylinder engine will displace only about one liter. The addition of these two models to the American car lineup will put the U.S. makers only slightly behind the imports, who are already moving rapidly in the mini-car direction ["Economy Cars," PS, Feb.].

K-coupe coming

Government officials concerned with Chrysler's future have already seen a new specialty coupe the company will introduce for 1982. It's built on the K-car chassis and uses its drive line, which makes the design a natural. Investment in tooling will be minimal, and it fills a market niche not covered by Chrysler now. The Mustang look-alike (except for the front end, which has an Imperial-like grille) will carry Chrysler and Dodge nameplates. Primarily competing against Thunderbird and Monte Carlo, the car, with its front drive and small size, will be unique in the personal-sporty-car market, a fuel-economy

pacesetter. Chrysler will make the coupe a high-line model, selling for about \$10,000.

Lead time lengthened

Why did GM push the introduction date for its electric car back a year, to 1985 ["PS/What's News," Jan.]? Not because of design or technical problems, say company officials, but simply to allow more lead time for the difficult project, which involves several GM divisions. Key to the mini-compact commuter car is its high-density zinc-nickel oxide battery; GM expects it to deliver a 50-mph top speed and 100-mile range between charges. When the design is fully developed, GM will build a manufacturing plant from scratch to produce the new battery, which will also have a longer life than the conventional lead-acid types that have powered electric cars in the past. The delayed introduction gives GM more time to perfect the battery and other new systems before tooling up.

Goodbye, distributors

Spark distributors will be dropped from next year's Chrysler 2.2-liter four-cylinder engine. Instead, spark timing will be picked up directly from the crankshaft, with an on-board computer feeding spark to the plugs as needed. Insiders look for the distributor to disappear from other computer-equipped cars soon, which spells the end for an engine system that has been in universal use longer than the self-starter.

Engine displacements

● GM expects the V8 to all but disappear from its lineup in five years, and its gasoline V6 will see limited use, too. Here's how GM sees engine allocation for 1985: gasoline fours and threes, 60 percent; diesel fours and V6's, 20 percent; gasoline V6's, 18 percent; gasoline V8's, one to two percent.

● Here's a puzzle: Buick is building a new assembly line for its V6, yet it's also planning to phase out this best seller. The new line will meet the added demand for the V6, which currently outsells all other GM engines; down the road, the same line will produce three-cylinder engines. "The V6 is an interim engine," says Buick General Manager Don McPherson, "and it should be gone in a few years as we move to smaller sizes." How small? "Figure half of the current V6 sizes," says McPherson, "about two, 1.9, and 1.6 liters." The threes are actually half a V6; most of the V6 machinery can be used.

● Buick also reports that the threes under development are smoother running than four-cylinder engines, because they have more balanced firing positions. In some engines, Buick will go a step further to ensure smoothness by installing a high-speed balancing shaft—similar to the Silent Shaft design of the Mitsubishi engines (Dodge Colt and Challenger, Plymouth Champ and Sapporo). It will probably be used on threes installed in higher-priced automobiles. 5

LOOK AND LISTEN

By JOHN FREE

Video-disc race

Toshiba has joined Zenith, JCPenney, Sears, Sanyo, and Radio Shack to market RCA's capacitance electronic-disc (CED) system. CBS will make discs for the video players. RCA plans to offer its under-\$500 disc machine this spring. Radio Shack may sell a Hitachi-made player with more features than RCA's. An under-\$100 adapter will enable Radio Shack CED owners to play stereo disc releases. RCA has indicated its initial entry will be a monaural-only model, with a step-up stereo CED player to follow.

Later in the year, the video high-density (VHD) disc system is slated for sale by three jointly owned companies just formed by General Electric, Matsushita, JVC, and Thorn EMI. VHD players also use capacitance-type discs [PS, July '80] but are not compatible with CED. VHD firms, apparently making last-minute decisions about what player features to include, stress that the grooveless VHD-disc system can have stop-action, random-access, and slow-motion capabilities that CED doesn't have. To fill the VHD program library, movie companies and others are being offered bargain pressing rates (\$5.50 for a two-hour disc).

Not to be outdone in the three-way disc-system battle, Japanese, Dutch, and U.S. supporters of optical (laser) video discs have formed a promotional outfit called the Laservision Assn. Optical-disc players are now being sold in major cities by both Pioneer and Magnavox. Newest optical converts are Advent and Fisher, which

plan to market the noncontact disc machines along with giant-screen projection TV's. A Laservision Assn. member, 3M, is making video discs.

Quick looks

- Owners of the Texas Instruments TI-99/4 can now make their home computers better conversationalists. TI has formed a special data-bank information service [PS, Nov. '80] with Source Telecomputing called Texnet. Via phone lines, Texnet enables users to hear messages typed on the computer keyboard or transmitted over the network as spoken words. New information data bases will also take advantage of the 99/4's color graphics and music capabilities.

- CBS has enlisted its Los Angeles station, KNXT, and public station KCET to test the Antiope teletext system ["Data-Display TV," PS, Jan.]. This system broadcasts encoded news, classifieds, and traffic and other information over unused TV scan lines. Some 100 sets equipped with French-built decoders will be used. CBS hopes Antiope will become the U.S. standard and is investigating what programming the public wants.

- Among the new "magazines" marketed on videotape is *Instant Replay* (1980 McFarlane Rd., Coconut Grove, Fla. 33133). A few cassette back issues I sampled included fascinating segments on video art and music, home earth stations, video/audio hardware shows, and more. A sampler tape highlighting *Instant Replay's* growing catalog is \$14.95.



- An international committee that met in Switzerland is studying proposals for 3D home television. The goal is compatible receivers that could be viewed by a group. Several companies are now refining 3D-TV systems, and a technique requiring polarized glasses for viewers has been tested in Australia.

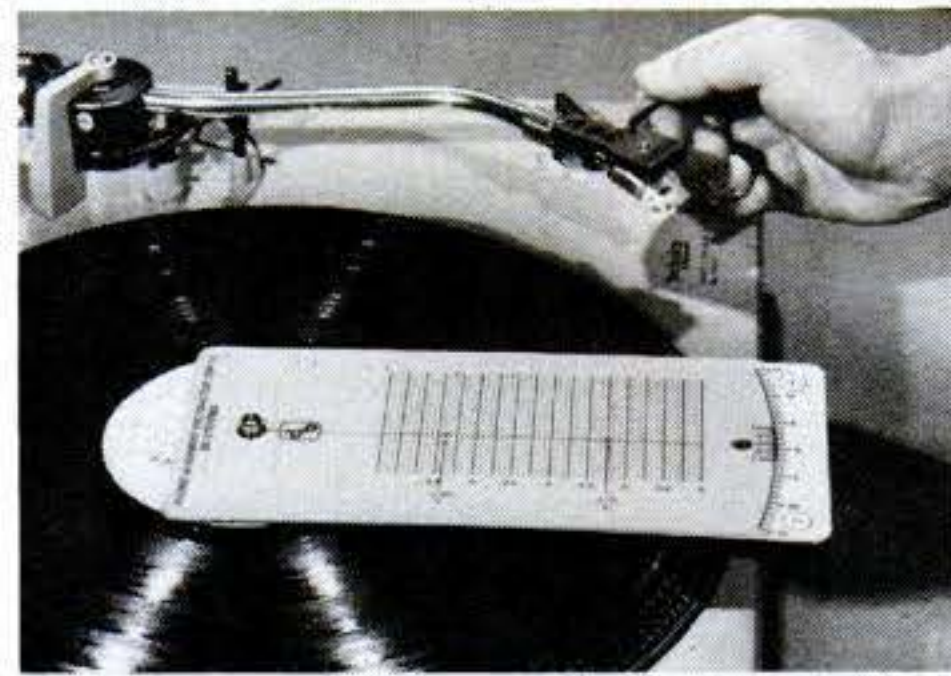
- A new large-scale-integration (LSI) microcircuit developed by Variable Speech Control Co. helps correct the "Donald Duck" distortion of sound from pitch changes during speed viewing with VCR's. The firm expects that speed listening, which permits comprehension at 250 to 300 words per minute, or twice the average speaking rate, will now be cost-effective for more decks with remote controls (photo). JVC's model 6700 was the first VCR to include a VSC speed-listening feature.

- Hitachi has demonstrated a flat-screen TV the size of a hand-held calculator. The monochrome prototype has a 1.9-by-1.5-inch screen with 160 horizontal and 140 vertical liquid-crystal elements. In bright light the LCD screen has enough resolution to reveal a ball struck in a baseball game. Toshiba and Matsushita have also shown flat-screen portables with similar small screens but higher resolution. Hitachi plans to market its set within a few years.



Cartridges vs. super discs

If the super-fidelity discs (see "High-Tech Hi-Fi," this issue) you've tried don't sound so super, your cartridge and tone arm may be out of alignment. A precise geometrical relationship between your tone arm and cartridge is needed so the stylus travels a radial path matching that of the



cutting stylus as closely as possible. Even small misalignments can produce severe tracking error and audible distortion.

A gadget I set up recently, the \$20 DBP-10 phono alignment protractor (above right) from DB Systems (Box 347, Jaffrey, N.H. 03452), simplifies cartridge-tone-arm alignment. Two plastic cards are placed on your turntable spindle, and the stylus

is alternately positioned at two points on the bottom card. The top transparent card is moved until lines on it are parallel to the cartridge. Tracking error can be read on a scale to within 0.25 degree. Instructions tell you how to adjust the cartridge and arm to zero the error at the two reference points.

The \$35 Geometric Soundtractor (far left) from Dennesen Electronics (Box 51, Beverly, Mass. 01915) has a pointer that's set up over the tone-arm pivot point to achieve cartridge alignment. The Soundtractor also has a small ruled guidepost, plus a bubble level, to optimize the vertical tracking angle (VTA) for discs. Tone-arm height is set for the "cleanest, most balanced, and most focused sound." Height reference numbers can be established and set for each disc, if desired. Nonperfectionists can set VTA once, for an average album. **ES**

The first personal computer for under \$200.

The Sinclair ZX80.
A complete computer—
only \$199.95 plus \$5.00 shipping.

Now, for just \$199.95, you can get a complete, powerful, full-function computer, matching or surpassing other personal computers costing several times more.

It's the Sinclair ZX80. The computer that "Personal Computer World" gave 5 stars for 'excellent value.'

The ZX80 cuts away computer jargon and mystique. It takes you straight into BASIC, the most common, easy-to-use computer language.

You simply take it out of the box, connect it to your TV, and turn it on. And if you want, you can use an ordinary cassette recorder to store programs. With the manual in your hand, you'll be running programs in an hour. Within a week, you'll be writing complex programs with confidence.

All for under \$200.

Sophisticated design makes the ZX80 easy to learn, easy to use.

We've packed the conventional computer onto fewer, more powerful LSI chips—including the Z80A microprocessor, the faster version of the famous Z80. This makes the ZX80 the world's first truly portable computer (6½" x 8½" x 1½" and a mere 12 oz.). The ZX80 also features a touch sensitive, wipe-clean keyboard and a 32-character by 24-line display.

Yet, with all this power, the ZX80 is easy to use, even for beginners.



Your course in computing.

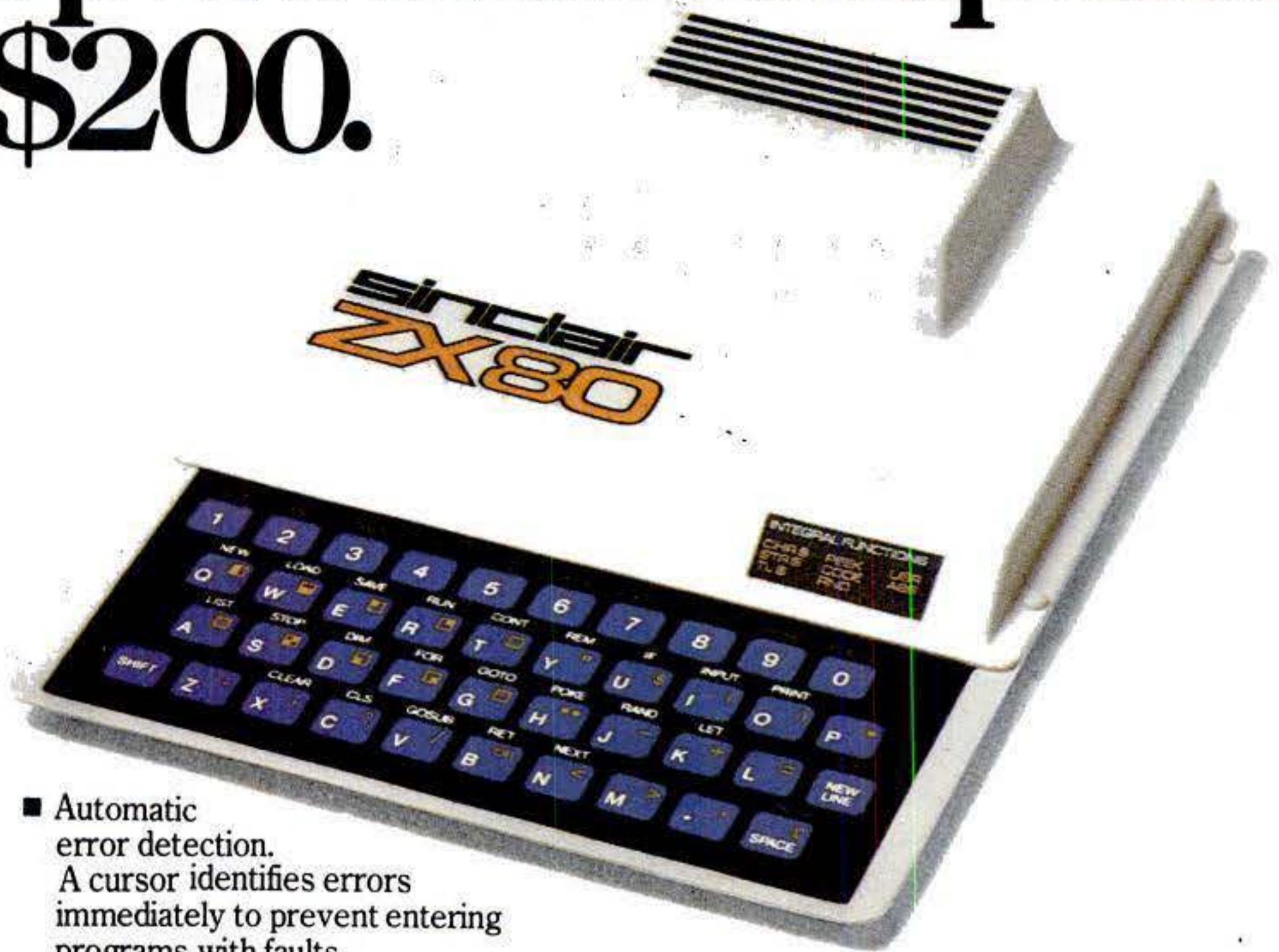
The ZX80 comes complete with its own 128-page guide to computing. The manual is perfect for both novice and expert. For every chapter of theory, there's a chapter of practice. So you learn by doing—not just by reading. It makes learning easy, exciting and enjoyable.

You'll also receive a catalog packed with items that can make your ZX80 even more useful. Including 27 program cassettes, from games and home budgeting for just \$6.95, to Sinclair's unique Computer Learning Lab (a workbook, six cassettes with 100 lessons, and two cassettes for storing programs).

ZX80's advanced design features.

Sinclair's 4K integer BASIC has performance features you'd expect only on much larger and more expensive computers.

- Unique 'one touch' entry. Key words (RUN, PRINT, LIST, etc.) have their own single-key entry to reduce typing and save memory space.



- Automatic error detection. A cursor identifies errors immediately to prevent entering programs with faults.
- Powerful text editing facilities.
- Also programmable in machine code.
- Excellent string handling capability—up to 26 string variables of any length.
- Graphics, with 22 standard symbols.
- Built-in random number generator for games and simulations.

Sinclair's BASIC places no arbitrary restrictions on you—with many other flexible features, such as variable names of any length.

And the computer that can do so much for you now will do even more in the future. Options will include expansion of 1K user memory to 16K, a plug-in 8K floating-point BASIC chip, applications software, and other peripherals.

Order your ZX80 now!

The ZX80 is available only by mail from Sinclair, a leading manufacturer of consumer electronics worldwide.

To order by mail, use the coupon below. But for fastest delivery, order by phone and charge to your Master Charge or VISA. The ZX80 is backed by a 10-day money-back guarantee, and a 90-day limited warranty which can be extended by 12 months under Sinclair's extended service program for \$25.00.

Price includes TV and cassette connectors, AC adaptor, and 128-page manual.

All you need to use your ZX80 is a standard TV (color or black and white). The ZX80 comes complete with connectors that easily hook up to the antenna terminals of your TV. Also included is a connector for a portable recorder, if you choose to store programs. (You use an ordinary blank cassette.)



The ZX80 is a family learning aid. Children 10 and above will quickly understand the principles of computing—and have fun learning.

To order call toll free: 800-543-3000.

In Ohio call: 800-582-1364.

Ask for operator #508.

Phones open 24 hours a day, 7 days a week.

sinclair

Sinclair Research Ltd., 475 Main St.,
 P.O. Box 3027, Wallingford, CT 06492.

To: Sinclair Research Ltd., 475 Main St., P.O. Box 3027, Wallingford, CT 06492.

Please send me _____ ZX80 personal computer(s) at \$199.95 each (US dollars), plus \$5 shipping. (Your ZX80 may be tax deductible.) For Conn. deliveries, add sales tax.

Send me _____ Computer Learning Lab(s) at \$49.95 each.

Register me for _____ extended service program(s) at \$25.00 each.

I enclose a check/money order payable to Sinclair Research Ltd. for \$_____.

Name _____

Address _____

City _____ State _____ Zip _____

Occupation _____ Age _____

Intended use of ZX80 _____

Have you ever used a computer? Yes No Do you own another personal computer? Yes No

PO-3-1

INTRODUCING DODGE MINI RAM. MORE MILEAGE, RANGE AND SEATS THAN VW VANAGON FOR THOUSANDS LESS.



Here's how Mini Ram beats Vanagon

Who moves more people than VW for less money? It's Ram Tough Dodge's new Mini Ram Wagon.

Compare Dodge Mini Ram 250 to VW Vanagon — passenger seating, mileage, fuel capacity and range, horsepower and rear loading area. Mini Ram gives you more.

Then compare factory-installed options like power steering, and your choice of 6 sound systems: all available in Mini Ram. Not in Vanagon.

Now compare price. Mini Ram costs \$2,553 less than Vanagon. For panel-side van buyers, there's a Dodge Van with the same performance, efficiency and interior dimensions as

	Dodge Mini Ram Wagon 250	VW Vanagon
Sticker Price (MSRP at base)	\$8,137.00*	\$10,690.00*
EPA EST. MPG	18 MPG**	17 MPG**
Horsepower	95	67
Passenger Seating	8	7
Overall Length	178.9"	179.9"
Wheelbase	109.6"	95.8"
Fuel Capacity	36 gal.	15.9 gal.
EPA Est. Range	648 miles**	270 miles**
Side Door Width	49"	42"
Removable Rear Seat	Yes	No
Factory-Installed Air Conditioning	Option	Not Available
Power Steering	Option	Not Available
Color-Keyed Carpeting	Standard	\$410 with int. pkg.

Mini Ram Wagon at a price VW hasn't seen in years—just \$6,418*.

Underneath it all, Mini Ram is a Ram Tough Dodge Wagon. With the best rust protection of all wagons. There's 100% electro-coating, plus 370 sq. ft. of galvanized steel in critical areas... compared to VW's 4 sq. ft.

New Dodge Mini Ram Wagon. It does more than VW Vanagon and it does it for less. As a pure people mover, it just might be the best buy on the road today.



DODGE TRUCKS ARE RAM TOUGH

*Sticker price comparison, excluding title, taxes and destination charges, unadjusted for different levels of standard equipment.

Two-tone paint and whitewall tires \$340 extra.

**Use these numbers for comparison. Your mileage and range may differ depending on speed, distance and weather. Calif. est. lower.

44-mpg two-seaters

Ford EXP/Mercury LN7

By HERBERT SHULDINER

PHOENIX, ARIZ.

Can a tiny car with an engine designed for fuel economy instead of performance offer the flair and excitement of a sports car? That's the question I set out to answer in an all-day test of the Ford EXP and Mercury LN7.

The cars are sporty versions of the Escort/Lynx, built on the same chassis and using the same power-train components. The big difference is that these new personal "sportcoupes," as Ford calls them, are unashamedly designed for two people (although there is an optional rear bench seat for kids and packages) and feature a sleek, sporty aerodynamic design.

I tested preproduction versions of both cars on smooth, flat interstates and curving mountain roads near here—and finally on the track of Phoenix International Raceway.

The two cars do not act like the conventional Escort/Lynx. Handling is precise, predictable, and has a definite sports-car feel. They behaved perfectly in hard cornering and braking.

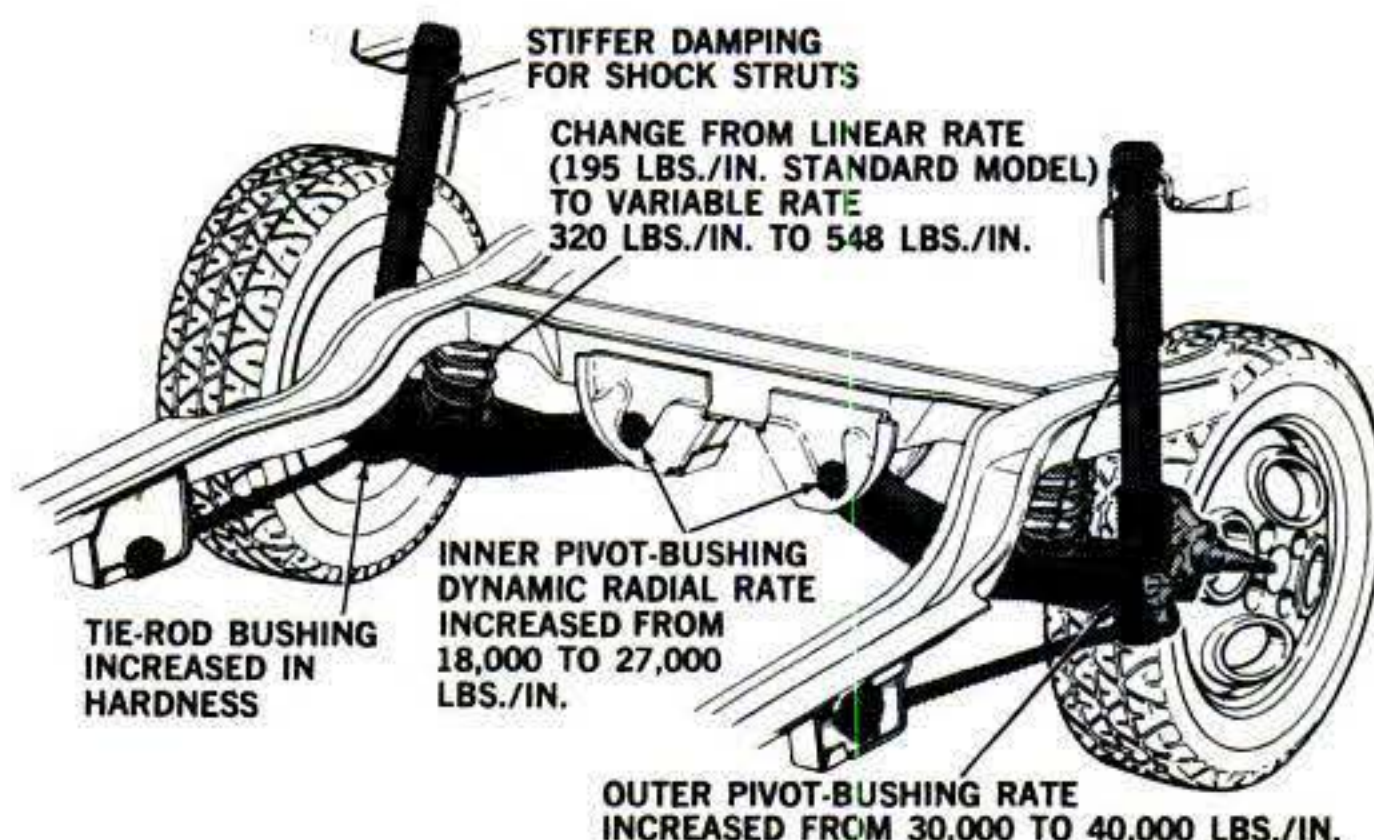
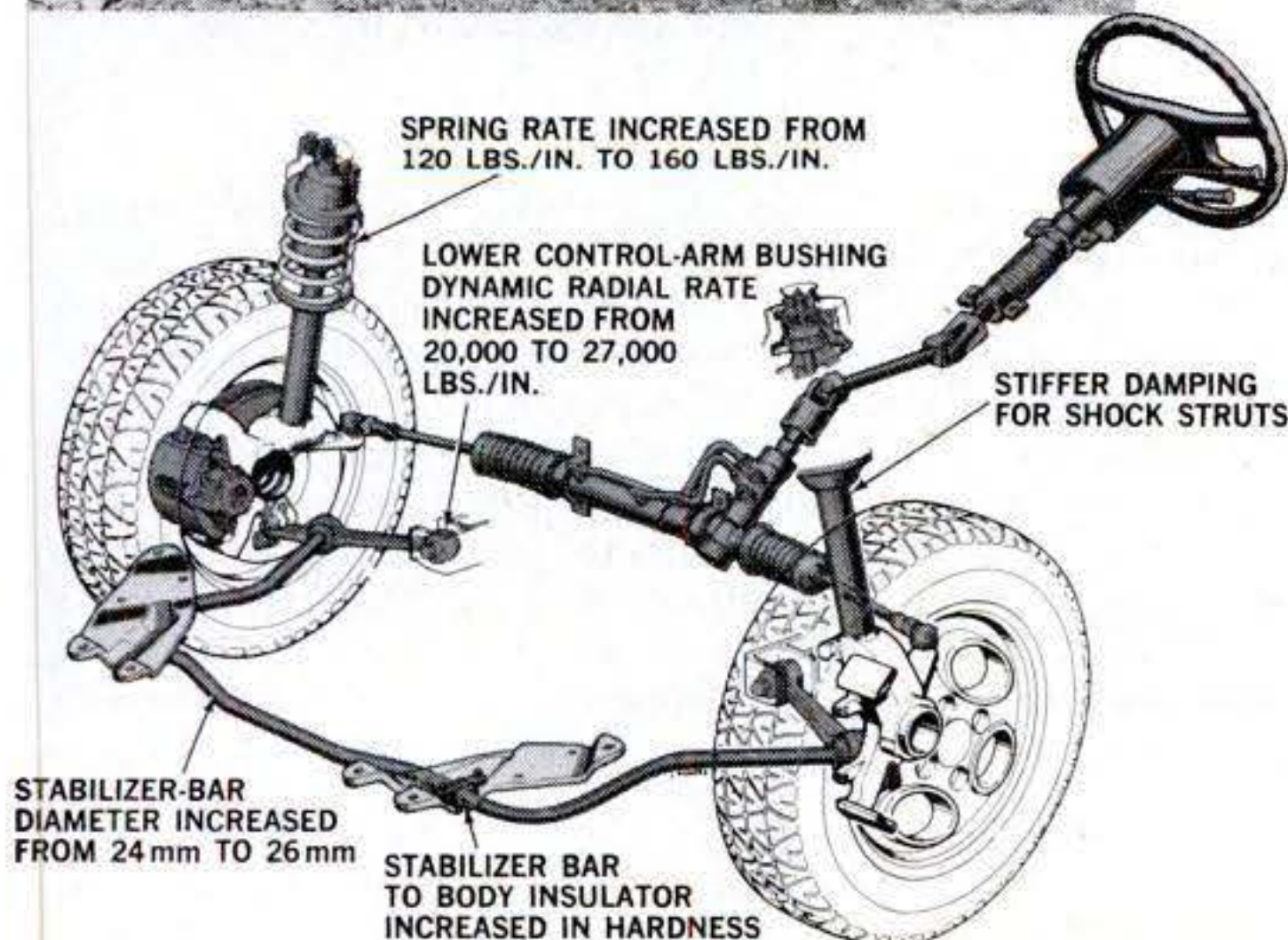
In addition, I found no hint of the handling problems the PS auto-test team described in its test of the base Escort [PS, Jan.]. The EXP/LN7 suspension is not sensitive to changes in power. When I deliberately took my foot off the accelerator in high-speed turns, there were no noticeable changes in steering when the wheel was not turned.

The EXP/LN7 standard suspension produces a flat, firm ride. There's almost no lean, even on hard turns. The optional TRX suspension, featuring Michelin TRX tires, improves the EXP/LN7's already good handling characteristics.

While handling is sporty, there's no sports-car performance in acceleration—even with a four-speed manual transmission. The 1.6-liter Escort/Lynx engine is inadequate for that. And when I drove a model with automatic transmission, performance was even less satisfactory. **ES**



Mercury LN7 is a flashy version of the subcompact Lynx introduced last fall. The stylish, sporty coupe features a hatchback that hinges at the roof line. Stiffer suspension gives it sports-car handling; spring and shock rates have been changed to provide a firmer ride and better cornering performance. The suspension changes are shown in drawings below.



CALCU-LETTER

By DARRELL HUFF News of pocket calculators—and how to have fun with them

Male-chauvinist calc?

The pocket calculator has produced some odd hybrid offspring lately, including several species that do stopwatch and time-keeping duty. But the ones that are most interesting to me—as a traveler and language buff—are the translators [PS, Feb. '80]. The photo at right shows recent additions to the lineup of capsules for the Quasar Information Processor ["What's New in Electronics," April '80] that let it translate between any two of 14 languages and play word games in any of them.

The clever little machine has a weakness, though: sex. Or gender, to be more precise.

Like many of us when we were tackling

French, Spanish, or German in high school or for travel, it is totally baffled when assigning articles to nouns. It fails not only with the tough ones (why should a French house be feminine?) but with the obvious ones, as well. Asked to translate



"the woman" into Spanish, German, and French, it gives you *el mujer*, *das Dame*, and *l'femme*. It's dead wrong on the first two, which of course should be *la mujer* and *die Dame*, and invents an ingenious straddle between *le* and *la* on the third.

One interesting and provocative thing about a device like this is the preview it gives of the problems to be faced by designers of more advanced translating calculators and computers. And although feminists may be offended by its predilection for the masculine, you can't help admiring its versatility.

It produces and translates phrases and learning lists as well as words and sentences you write yourself. A touch of its key marked EXT turns it into a four-function calculator (though a slow one lacking memory and constants). It has built-in metric conversions. And, for entertainment, it will play blackjack and other Las Vegas games with you.

Another processor, M100 from Craig, differs slightly in appearance but uses the same modules and does the same chores.

Although listing at a stiff \$200, these processors can often be found at greatly discounted prices. For more information: Craig Corp., Box 5664, Compton, Calif. 90220; Quasar Co., Franklin Park, Ill. 60131. P 5

CALCU-PUZZLES

Trapdoor angle

The law of cosines is one of the most useful of all tools in solving both mathematical puzzles and real-life mechanical problems, as the first of January's problems demonstrated. This law tells you that the square of one side of any triangle is equal to the sum of the squares of the other two sides minus twice the product of those two sides and the cosine of the angle between them.

The task that confronted Bob Quinlivan of St. Louis, Mo., was to figure out what angle a skylight or trapdoor 18 inches long moved through when opened eight inches. A sketch quickly shows that the door in its open and closed positions and the eight-in. opening distance form the sides of a non-right triangle. The wanted angle lies between the two 18-in. sides.

Apply the handy law and you find that the cosine of the angle equals 584 divided by 648, or 0.9012345679 (an interesting series of digits, don't you think?). A scientific calculator or trig table will tell you that the arc cosine of this decimal is 25.67917681 degrees. This is expressed more conveniently as 25 degrees, 40 minutes, and 45 seconds.

Packages and pi

Also in the January column, a reader noted that the postal service limits packages to a combined length and girth of 100 inches. He asked you to find the vol-

ume and length of the largest allowed package. He also asked for the dimensions of the largest *rectangular* package—and for the length of the longest stick that would fit into each.

Since a circle offers the most area for a given perimeter, it appears the shape of the largest package will be a cylinder. If the length is called L, the girth (circumference of the base) has to be 100 minus L. The area of the base would be the square of 100 minus L, divided by four times pi—and the volume of the cylinder is that value times L.

Without going beyond this simple algebra and geometry, you can now reach a solution easily by taking advantage of the enormous computing power of your calculator. Testing a few likely guesses will quickly demonstrate that the maximum volume is 11,789.255 cu. in., produced when the length is 33⅓ in. Speeding up searches like this is something a programmable is good for.

To meet the stipulation that the package be rectangular, as most packing boxes are, you could begin by observing that a square is the most efficient rectangle in its use of perimeter (which is why a square house beats an oblong one during the heating season). Volume then becomes one side of the base (100 minus L, divided by four) squared, times length. Again, the best length turns out to be one-third the sum of length and girth, though volume is now reduced to 9,259.259259 cu. in.

Now, about those sticks. The diagonal

of the cylindrical package is the hypotenuse of a triangle of which the sides are the length of the cylinder, 33⅓ in., and the diameter of its base, 66⅔ in. over pi. Using Pythagoras, you can figure the length of the stick: 39.5149 inches, just over a meter.

You had to use Pythagoras twice to figure the diagonal of the rectangular package: 40.8248 inches. Although the rectangular package is smaller in volume, it will accommodate a longer stick.

In doing and checking these problems a number of times, I found need for a quick way to enter 33⅓ and 66⅔ precisely. Using the reciprocal key, I found I could enter the first in four strokes (.03, 1/x) and the second in five (.015, 1/x).

One in a million?

Gene Ziegler, who lives in Wilmington, Del., read something recently in a newspaper that aroused his skepticism. His state and three neighbors, Pennsylvania, Maryland, and New Jersey, have daily lotteries in which one number from 000 to 999 is drawn. When the same number came up on the same day in two of the states, a newspaper called it a "one-in-a-million chance." But was the coincidence really as rare and remarkable as all that? How often, according to your calculator, could this be expected to happen? The answer—which I'll admit I found a bit surprising—will be in the May issue.

CANADA AT ITS BEST[®]

Light. Smooth. Imported Canadian Mist.[®]
The whisky that's becoming America's favorite Canadian.



Share some tonight.

IMPORTED BY B-F SPIRITS LTD., N.Y., N.Y., CANADIAN WHISKY—A BLEND, 80 PROOF. © 1980.
Photographed at Medicine Lake, Jasper, Canada.

9 mg. "tar", 0.8 mg. nicotine av. per cigarette by FTC method.

© 1981 R.J. REYNOLDS TOBACCO COMPANY

CAMEL

Where a man belongs.



Camel Lights.
Low tar. Camel taste.

9 mg tar.

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

PS | What's News

Airplanes are fast and can get you across the country in a few hours, but they need a lot of real estate for landing and taking off. Helicopters solve that problem but are relatively slow and expensive—not at all suited for long-distance travel. Obviously, a craft that combined the vertical-takeoff-and-landing capability of a helicopter with the range and speed of an airplane would be an extremely useful machine. That's why engineers have been working to design such a hybrid for decades.

They've produced a marvelous variety of flying machines, most of which have been featured in the pages of POPULAR SCIENCE over the years. But all have suffered from one or more problems. Now there's a new candidate that combines some old approaches in new ways. The team at Grumman responsible for designing it hopes that this time it will all be right.

One surprising thing about the new tilt-engine V/STOL on this month's cover is that while it may not appear so at first glance, it is a direct descendant of a strange-looking plane called the Nutcracker. You may remember that curious craft, which appeared on our September 1976 cover. In that version, the fuselage was hinged just behind the wings, and the entire rear half of the plane—with engines attached—tilted to direct thrust downward and allow hovering.

Eventually, various problems forced abandonment of that approach, but the work led to the current concept. The story of how the new design developed and why the engineers think they may be on the verge of solving an old problem this time begins on page 72. The cover painting is by Dean Ellis, who, by the way, also did the Nutcracker cover back in 1976.

Future engines

You've seen a lot of potentially important new engines discussed in these pages, among them stratified-charge, gas-turbine, and Stirling-cycle engines. They all appear to offer certain advantages in fuel economy, efficiency, and ability to use a wide range of fuels. Thus they have all been considered as candidates to replace the more conventional spark-ignited internal-combustion and diesel engines that power today's cars.

It isn't going to happen, at least not in the next decade. That's the opinion of John B. Heywood, professor of mechani-

cal engineering at MIT and director of the MIT Sloan Automotive Laboratory, and his colleague, John Wilkes. The two authorities, writing in the MIT publication, *Technology Review*, say that despite all the excitement stirred up by the novel engines, the fact is that no alternative engine ready for production is clearly better than conventional engines in efficiency, operating convenience, and cost. And doing the research and development needed to bring any one of them to that state would take at least five and probably ten years. The device closest to production is the stratified-charge engine, they say. But it seems unlikely that the development will be done in this decade.

The only real possibility for mass marketing of a new kind of propulsion system anytime soon, they say, lies in the electric vehicle. A specialized car, useful only for short-range urban use, can be brought to the stage of development necessary for large-scale production within the next few years. In fact, that work is now under way. Also, there would be enough demand for such a vehicle to make the project economically viable.

Satellite-to-you TV

The Communications Satellite Corporation has filed an application with the FCC to establish a direct satellite-to-home television service. Susan Renner-Smith, in her article in March 1978, pointed out that the technology to make such a system possible is already available. With the signal generated by a high-powered satellite, customers would pick up the programs with a two- or three-foot dish antenna and a decoder. Equipment would cost \$300-\$400.

Comsat says that the new service would offer three channels of programming, one of them on the air 24 hours a day. They would include:

- A general entertainment channel that would provide motion pictures, pop concerts, stage productions, etc.
- A cultural channel that would offer news, performing arts, discussion, film classics, and children's programs.
- A third channel for sports, adult education, and experimental theatre.

The service would cost about \$25 a month, or \$14 if the customer buys his own antenna and decoder. Comsat says it would concentrate on sparsely settled

areas where cable and other usual forms of television are not available. Despite this announced policy, the establishment of the service will be fought by commercial broadcasters who view it as competition. They may try to get Congress to outlaw direct satellite-to-home TV. And Comsat officials predict that even with FCC approval they couldn't launch the program for three, possibly four years.

Brief looks

● Want to invest in wind power? Southern California Edison has invited investors to join in developing wind parks to generate electricity. SCE says that if anybody is interested in financing wind parks, it will contract to buy the electricity generated. SCE has one such wind park of its own now under construction in San Geronimo Pass near Palm Springs, Calif., and says it hopes to have 120 megawatts of "firm generating capacity" installed in time to meet requirements for the 1990's.

● General Dynamics Convair Division has developed a space truss designed to function as a basic element in very large space structures, such as orbiting power stations. The 26-ft.-long demonstration beam would go into space folded into a neat package about the size of an average enclosed car-top carrier. Once in orbit, it would fold out to become an extremely light (3.25 pounds per running foot) but rigid beam. Jim Scheffer's article on space construction [PS, March '79] showed how such beams would be used to build giant permanent space stations.

● Want to get into a growing field? Consider solar energy. The Batelle Institute of Columbus, Ohio, has just released the results of a study of the employment prospects for the field. In 1978, the survey found, about 22,500 people were involved in research, development, manufacturing, and installation of solar-energy devices. That number has now jumped to 45,000, and should reach 67,500 by 1983.



Editor-in-Chief

Copyrighted material

Tilt-engine V/STOL

cruises at jet speeds,
hovers like a copter

Sophisticated new engines give this "Son of Nutcracker" amazing maneuverability

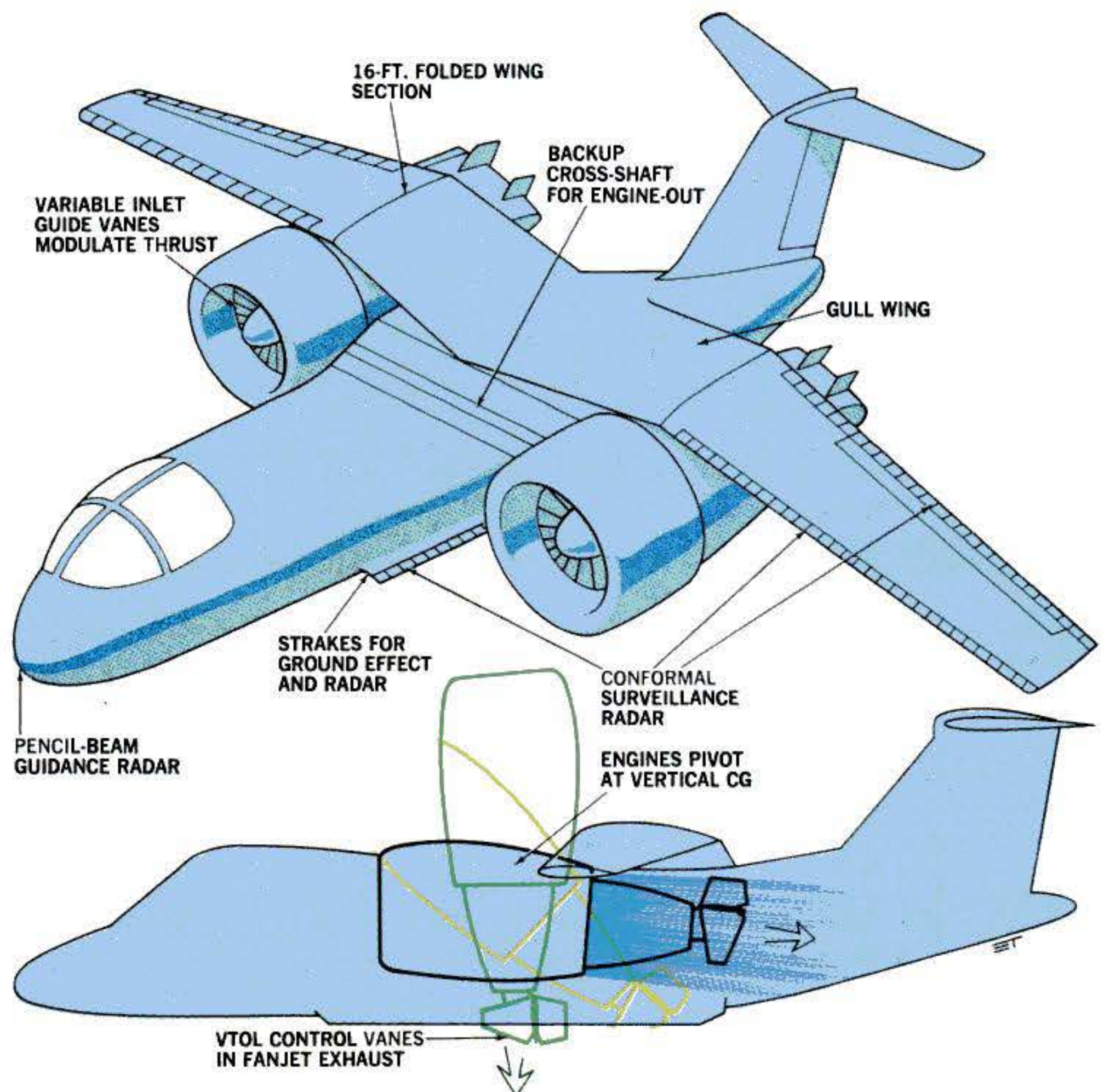
By BEN KOCIVAR

"This is the concept that could revolutionize our Navy." That's what experts are saying about Grumman's Design 698, the craft pictured on these pages and on the cover. To learn why, I visited Bob Kress, Grumman's director of advanced concepts.

At first glance, the shiny-white, seven-foot-long, radio-controlled model didn't look very different from a conventional Navy reconnaissance plane. True, the fanjet (also called turbofan) engines tucked under the gull wing did seem outlandishly large for the size of the plane. But what makes it revolutionary?

The answer, Kress told me, is that these engines can tilt from horizontal to vertical, for both fast forward flight and vertical takeoff and landing. Moreover, Design 698 tackles the problems that have plagued V/STOL planes of the past, including other tilt-engine designs. The result, according to Kress: It promises to combine capabilities that no other Navy or Air Force plane has. For example, it will be able to:

- Take off and land vertically from a heaving destroyer or cargo ship.
- Take off in less than 200 feet with overloads such as critical cargo and long-range missiles.
- Fly more than 1,000 miles and reach altitudes of 50,000 feet.
- Take over the functions of a half-dozen other specialized planes, includ-



Control vanes mounted behind each nacelle react to high-pressure air flowing behind each fanjet engine and pivot with the engine for vertical or forward flight.

ing "over the horizon" surveillance with a novel airborne radar (called "conformal" because it conforms to the shape of the plane) and other sensors that track enemy planes, missiles, ships, submarines, and even moving ground targets.

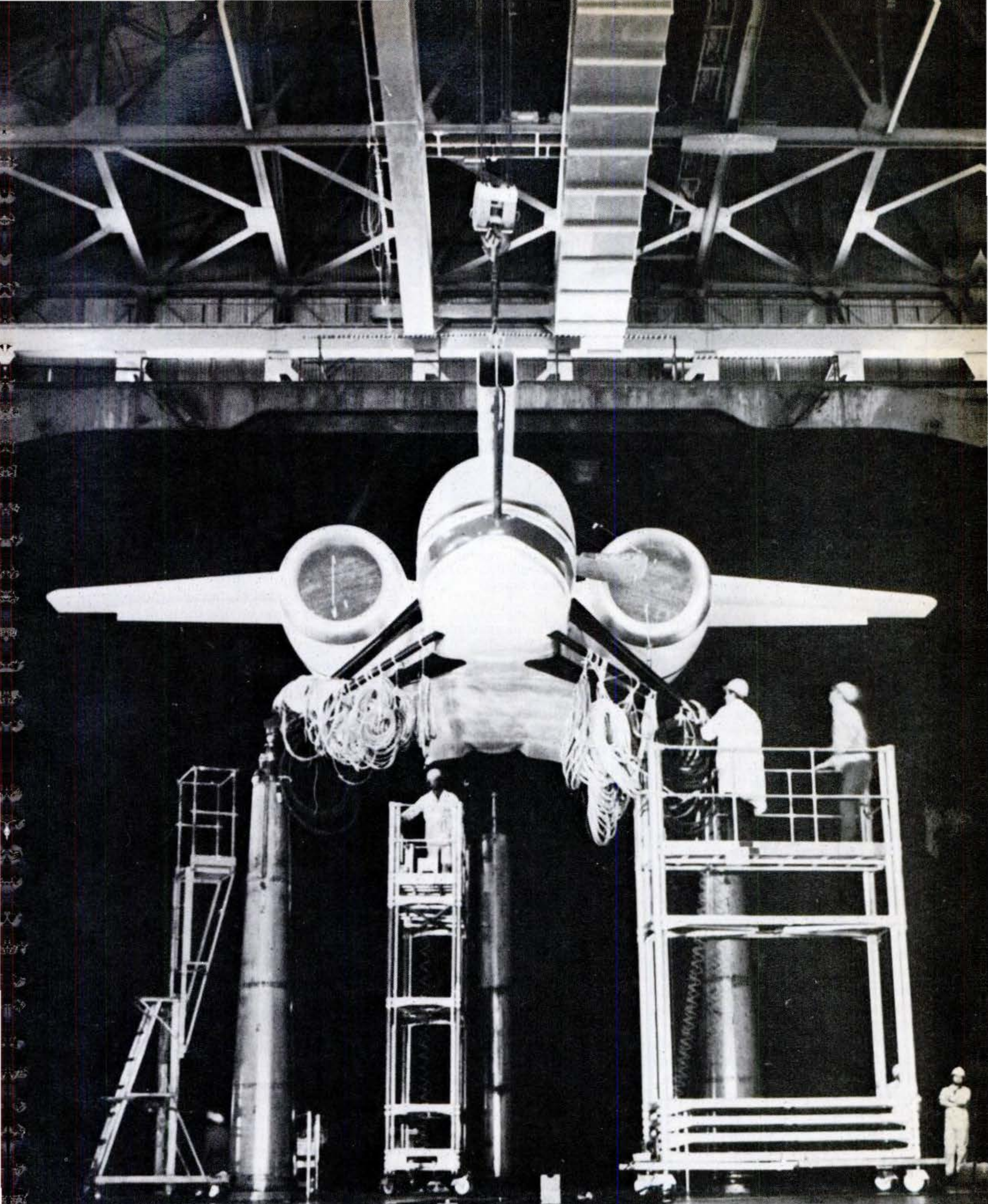
The history of past efforts in V/STOL aircraft, and an account of

Vanes provide yaw and pitch control. Roll control comes from varying angle of inlet guide vanes ahead of fan blades, controlling thrust differential for each engine.

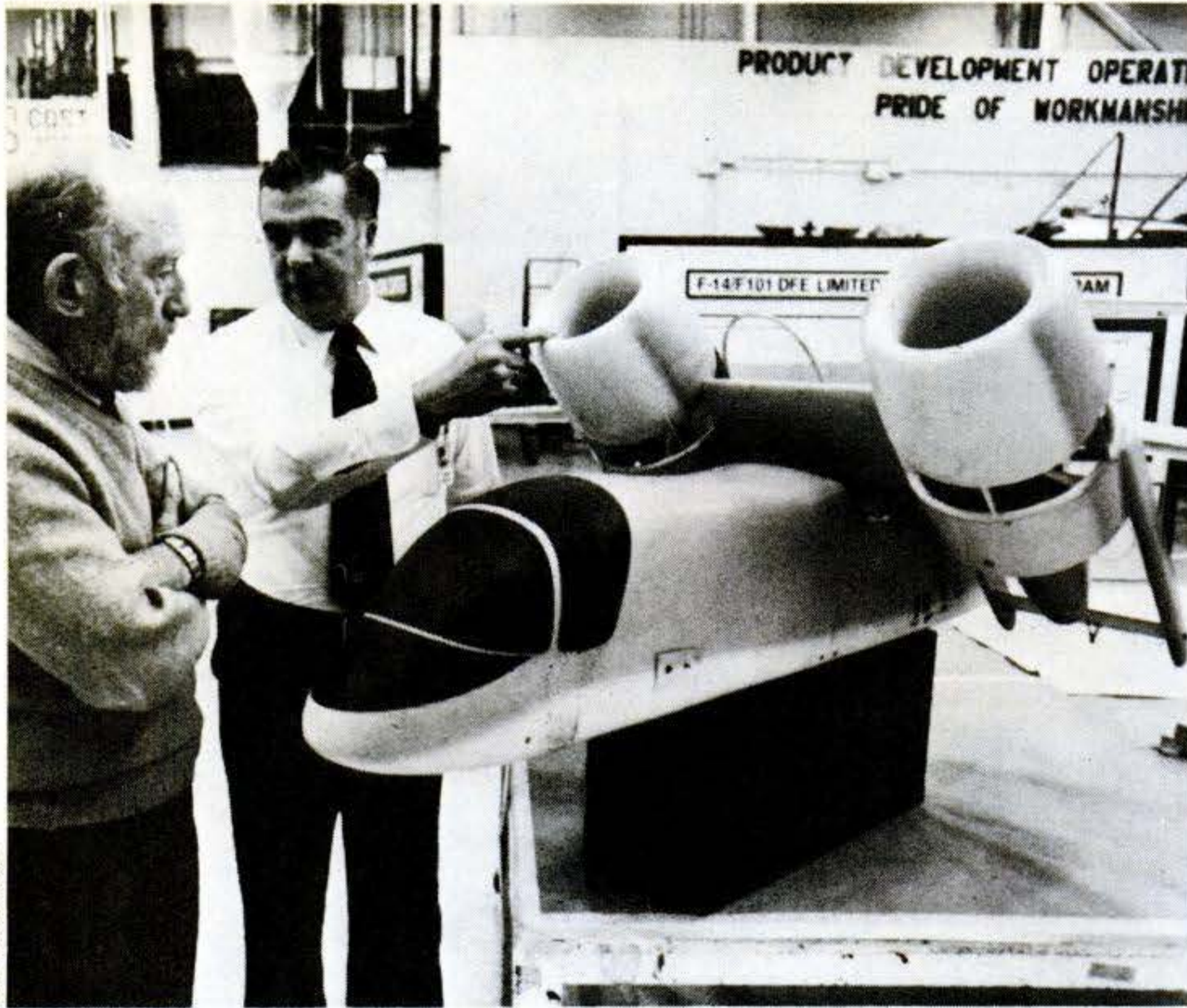
how engineers are attempting to overcome their handicaps in Design 698, is typical of the trial-and-error evolution of modern aviation.

All the V/STOL planes until now suffered from problems of power, precise control in the hovering engine, and/or high fuel consumption. For

Continued



Huge working turbofan engines and attitude of this full-size mock-up were pivoted in giant NASA Ames wind tunnel. Gull wing is 36.5 ft. long and fuselage 40.5 ft.



HAIG MANOOGIAN

How rigid "dumbbell" structure holds engines for pivoting is explained by designer Kress to author Kocivar. Model-

plane two-stroke engines with props inside ducts perform like turbofans in this radio-controlled model.

example, the British Harrier V/STOL fighter uses much of its fuel while hovering for only 10 minutes.

In the 1950's, I saw three tail-sitter research designs made by Lockheed, Convair, and Ryan being tested at Edwards Flight Test Center in California. The fuselages of the planes were in vertical position for vertical takeoff and landing, with the pilots on their backs in the cockpit. Visibility and orientation for the pilots as well as control in gusty conditions were problems in the delicate operation of backing down to the ground.

Research planes made in Germany included a transport design with eight jet engines, the DO-31. Four engines, positioned at the wingtips for lift, blasted such high-pressure streams of hot air downward that they dug holes in the ground. Other designs pursued in England, France, and Italy, as well as the U.S., tried separate engines for lift and forward thrust, vectored thrust, fans mounted in the wings for vertical lift using the same engines used for forward flight, tilting ducted fans, and tilting rotors, as in the Bell/NASA Army XV-15 [PS, Feb. '78], two models of which are now flying.

Fountain effect

One basic obstacle is the mission assigned to the lift engines. They must not only be powerful enough to lift the craft and payload vertically, but must have enough excess power

for control. This is made more difficult by the "fountain effect" close to the ground. Hot engine exhaust hits the surface, flows up and then down again in a fountain of air. This entraps air next to it, causing a larger downward flow at the same time the heated air reingested by the jet engine causes a drop in thrust—just at the instant when most thrust is needed.

These problems have been attacked in the Grumman design by using new-technology turbofans, which have important advantages.

- They develop more power and use less fuel.

- Their exhaust is much cooler than that of a straight jet because the air blown back by the fan not only provides most of the thrust, it also flows back outside the jet engine and mixes with hot engine-core air. The result is a relatively cool exhaust.

- New automatic controls operated by microcomputers provide the fine sensitivity for precise control needed while the plane is landing aboard a heaving ship.

Bob Kress calls Design 698 "Son of Nutcracker." It is, he says, a much improved version of an earlier concept he had proposed, one that had a folding fuselage. It was this device, rather than tilting engines, that changed the orientation of the engines for the transition from forward to vertical flight [PS, Sept. '76]. Nutcracker is on hold because it required a complex, auto-

matic, crane-like probe to hook its nose and bring it aboard ship for a landing. The new concept needs no such hardware.

"The concept is simple enough," says Kress, "but making it work has brought some surprises." One, early in the design stages, came after Kress had built his first model of the new plane on his kitchen table out of balsa wood and Styrofoam. Following the example of many advanced designs for the 1990's, Kress incorporated a canard—a small forward wing—to ensure aerodynamic balance. Most similar designs have center of gravity forward of the main wing and need the canard for lift up front.

But as research and testing progressed, Kress found that the canard wasn't needed. The round nacelles of the engines in front of the wing actually provided enough lift in forward flight, so out went the canard.

Design 698, the Navy plane of the future envisaged by Kress and other experts, has a conventional elevator and rudder, besides the gull wing and the pivoting turbofan engines. Behind each engine, directly in the exhaust path, is a set of movable guide vanes. These vanes enable the pilot to control the plane when it is hovering and there is not enough airflow over the regular aerodynamic tail surfaces.

In flight

With engines set straight up, the pilot would take off from a small helicopter-sized platform aboard a high-speed destroyer-like ship. At 50 feet off the deck, he slides forward a bit and builds speed. The automatically programmed engines tilt forward and nose the plane up, with lift developed from the gull wing. Within 20 seconds, the craft becomes wingborne, and the speed reaches about 500 mph within two minutes.

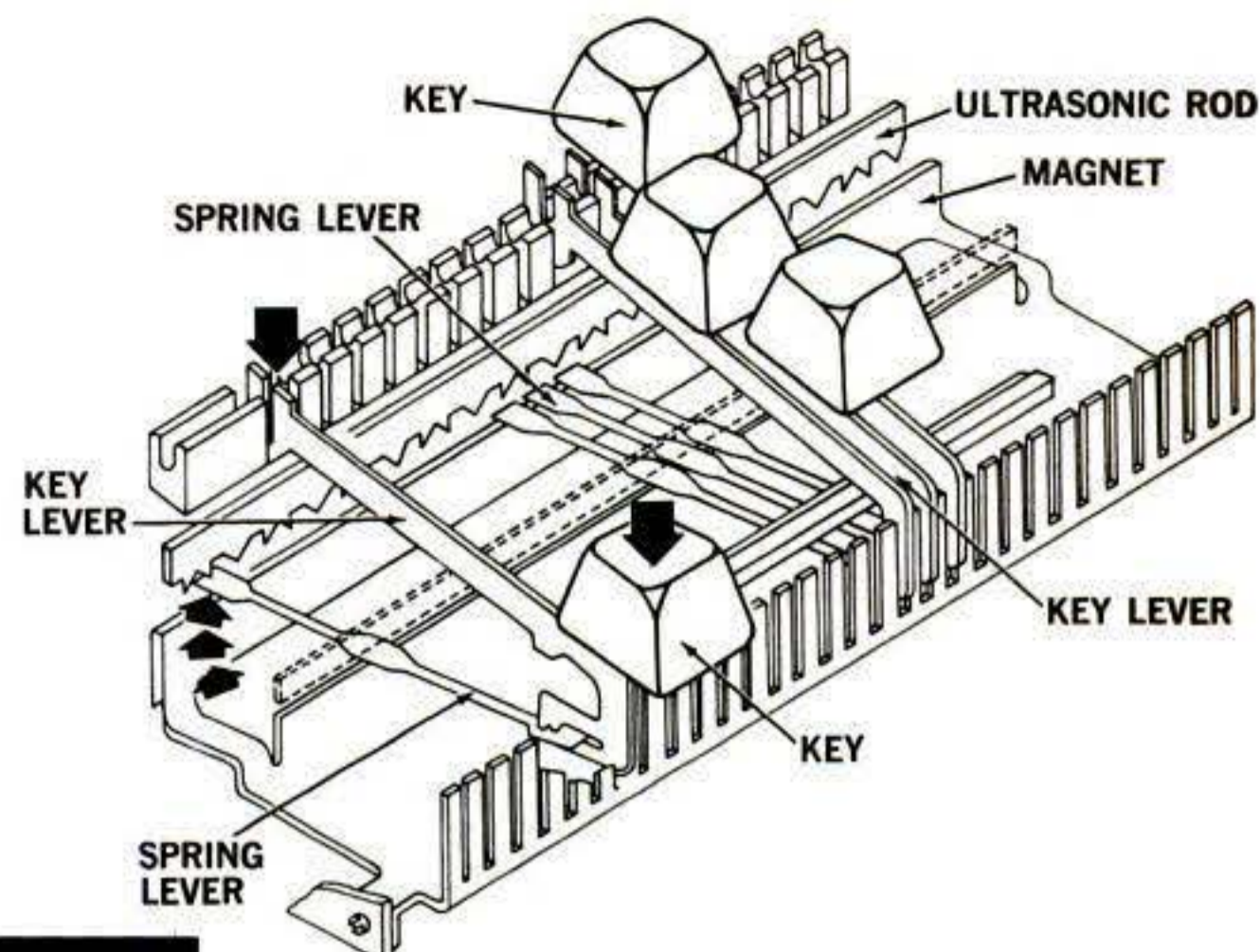
Returning from his mission, the pilot can land on a runway as in a conventional plane. He can also set down on a small ship equipped with a pad, even if it is heaving and bucking in waves up to 15 feet high.

For such a tricky landing the pilot reduces power almost to idle, and at 600 feet slows the plane to about 120 mph. Now the nose is tilted up, and the wing's angle of attack is about 12 degrees—enough to provide the required lift. The pilot presses a button on the throttle that starts the engines tilting up automatically and increases power. Even with the increase in power, the plane slows; within 20 seconds the engines are tilted full up. Now the pilot controls his flight path and descent rate with engine power. At

[Continued on page 138]

Electronic typewriter

has ultrasonic keyboard



Major components of the Smith-Corona Typetronic (clockwise from upper right in photo): print-wheel and cassette-ribbon mechanism, electronic-circuit board, ultrasonic rod, keyboard. Depressing a key (above) moves a key lever that, in turn, strikes the spring lever. This lever hits the ultrasonic rod and is pulled back to the magnet. Sound waves from the rod enable a microcircuit to determine what key has been struck.



Sound waves help identify the keys—and minimize the number of parts used

By JOHN FREE

Something was missing. I'd just flipped up the cover of a new Smith-Corona Typetronic typewriter. Inside was a puzzling amount of empty space. But eliminating the pulleys, gears, levers, and wires that jam standard electromechanical typewriters was precisely what SCM Corp. planned when it substituted a unique ultrasonic rod and microelectronic "brain" in its office typing machine.

Modern technology not only eliminates up to half the failure-prone mechanical parts of standard ma-

chines but makes it possible to price Typetronic under \$900. SCM's new machine prints with a so-called daisy-wheel mechanism, widely used with computer hardware. (It cannot, however, store sentences in memory, display text before it's printed, or expand its functions through software [programs], features included in costlier electronic office cousins.)

The ultrasonic rod is a steel bar with teeth corresponding to positions on the keyboard. This simple but ingenious device helps Typetronic transfer keystrokes to the print wheel. When you push a key, a simple mechanical sequence results in one tooth on the bar being struck (diagram). Ultrasonic waves then travel toward both ends of the rod, where crystal transducers are located. These crystals help convert the sound waves into signals that

can be recognized by the typewriter's "brain." This custom microcircuit is a very-large-scale integrated (VLSI) chip with the equivalent of 30,000 transistors.

By calculating the difference between pulse-arrival times at the crystals, the microcircuit determines what letter to print. Keystroke identification is also aided by tooth shapes, which vary the type of ultrasonic signal received.

The microcircuit then signals the print wheel on its movable carriage. SCM has introduced low-cost wheels made with glass-reinforced nylon that install in seconds to change type styles. Each wheel has narrow spokes, like petals on a flower, with characters on the ends. As the print wheel spins the right letter into place, a plunger whacks the "petal" against ribbon and paper.

New features on Typetronic help reduce typing errors. A memory-correction system lets you erase the last 10 letters typed using one key. I ran my finger across the keyboard to check its speed-cushion feature. After a split-second pause, the machine typed each randomly pressed letter. This memory capability compensates for typing bursts (up to 800 words per minute).

By eliminating from one-third to one-half the parts of conventional office electrics, SCM expects big gains in reliability. But when servicing is needed, a diagnostic tester has been designed to spot malfunctions. E

How Tennessee homeowners get a solar assist

With utility financing, a sun-powered water heater pays for itself—instantly

By TRAVIS PRICE

Travis Price, an architect and planner for Price & Partners, Tacoma Park, Md., was a principal in Sun Harvester Corp., which provided technical assistance for the TVA solar program.

Anyone considering going solar runs smack into an economic fact of life: The initial equipment and installation costs are considerable, and it may take many years of reduced fuel bills before the system pays for itself. The federal tax-credit program is a help, but for a residential solar hot-water system, for example, the homeowner still has to put up about \$1,000—an investment he may not recover for 10 or more years.

Not in Tennessee, though. The Tennessee Valley Authority, the government-owned utility in the Southeast, is offering customers long-term, low-interest loans for solar water heaters. The homeowner pays nothing up front, but pays back the loan in regular monthly electric bills that are equal to or less than what he'd been paying before. Going solar becomes an instant break-even proposition.

Solar showcase

So far, 950 Memphis residents are participating in the TVA program, which has now been extended to Nashville and will ultimately include 100,000 households in seven states throughout the Tennessee River Valley.

"TVA is going for the sun," says S. David Freeman, chairman of the util-

ity. "People in the valley will be able to regain control of their energy destiny in a way that will be inflation-proof."

How can TVA afford to be so altruistic? It can't—and it isn't. The utility profits by reducing peak loads and saving the cost of future power-plant and distribution-line construction. By passing these savings along to the customers in the form of low-cost financing, TVA hopes to offer a solar showcase for the nation. Additional benefits of the program are reliable solar components on a regular maintenance schedule, lower kilowatt-hour charges to all customers, and a shot in the arm for the local economy.

The solar hot-water system differs from one a homeowner might ordinarily install: It has two storage tanks and a timer that prohibits backup electrical heating during peak hours, usually eight a.m. to six p.m. Since peak demand is always the most costly for a utility to satisfy, the program will benefit TVA by shaving its peaks. The backup tank is sized so it can charge during off-peak hours and still hold enough hot water for a family.

Here's how the program works for the homeowner: After he applies and is accepted (if his site receives sufficient sunlight), a TVA-certified crew installs the system—two or three collectors, two storage tanks, timer, pumps, piping, controls, and insulation. The components and installation come to \$2,000–\$2,500, but he pays nothing.

On subsequent utility bills the homeowner begins to repay the capital cost and 3.37 percent interest, plus a \$1-a-month maintenance charge. Over a 20-year loan period the customer will pay about \$17 a month, including an average of \$4 for electri-

cal backup. This is roughly equal to what he'd been paying previously for 100 percent electrical heating.

Also, the customer may claim the federal tax credit right away and show a profit in his first year of solar. And the likely eight percent annual increase in utility rates will have less impact. In 10 years he will still be paying only about \$20 a month for hot water while his nonsolar neighbor will be paying close to \$40. After 20 years he will fully own his solar system and will pay only for the electricity he uses as backup.

Long showers

"We have more hot water than we ever had before," says Katherine Taylor, a Memphis resident who has been living with her solar system for about a year. The system is designed for a 70 percent solar contribution, but this figure depends a lot on family attitudes. Some people think that solar heating means they can shower twice as long. They are disappointed to find their electric bills are still high. In other homes the solar system spurs family members to conserve wherever possible; then the solar contribution approaches 100 percent.

TVA considers the solar program as additional installed capacity. The 100,000 residential solar hot-water systems will eliminate the need to build one nuclear reactor. The difference is that the solar program is decentralized and uses free renewable energy, while large power plants are centralized and use depletable resources with questionable future availability.

By applying the same economic standards to small solar installations as traditionally have been applied to large power plants, the utility not



only promotes solar energy, but lowers the cost of electricity to all customers (right now about three cents per kilowatt-hour, one of the lowest rates in the country).

In addition, the program gives a boost to the local economy by buying solar components from small, area companies and by training and employing local people to install the systems. If power plants were constructed instead, those dollars would go to huge industrial suppliers and outside contractors. Even management of the project is assigned to a local firm, New Memphis Development Corp.

By the same economic criteria, TVA will help homeowners with any energy-saving installation. TVA has financed heat pumps, home insulation, even new construction of passive solar homes. Any installation that helps the utility cut its load, especially its peak load, is eligible for TVA loans.

Starting a trend?

Could other electric utilities around the country establish similar programs? They could, but right now there is no incentive for them to do so. As a government agency, TVA is not in business like most electric companies, which must show a profit. Legislation is in the works in Congress and in many states, however, that would allow utilities to build a profit margin into loan programs like TVA's.

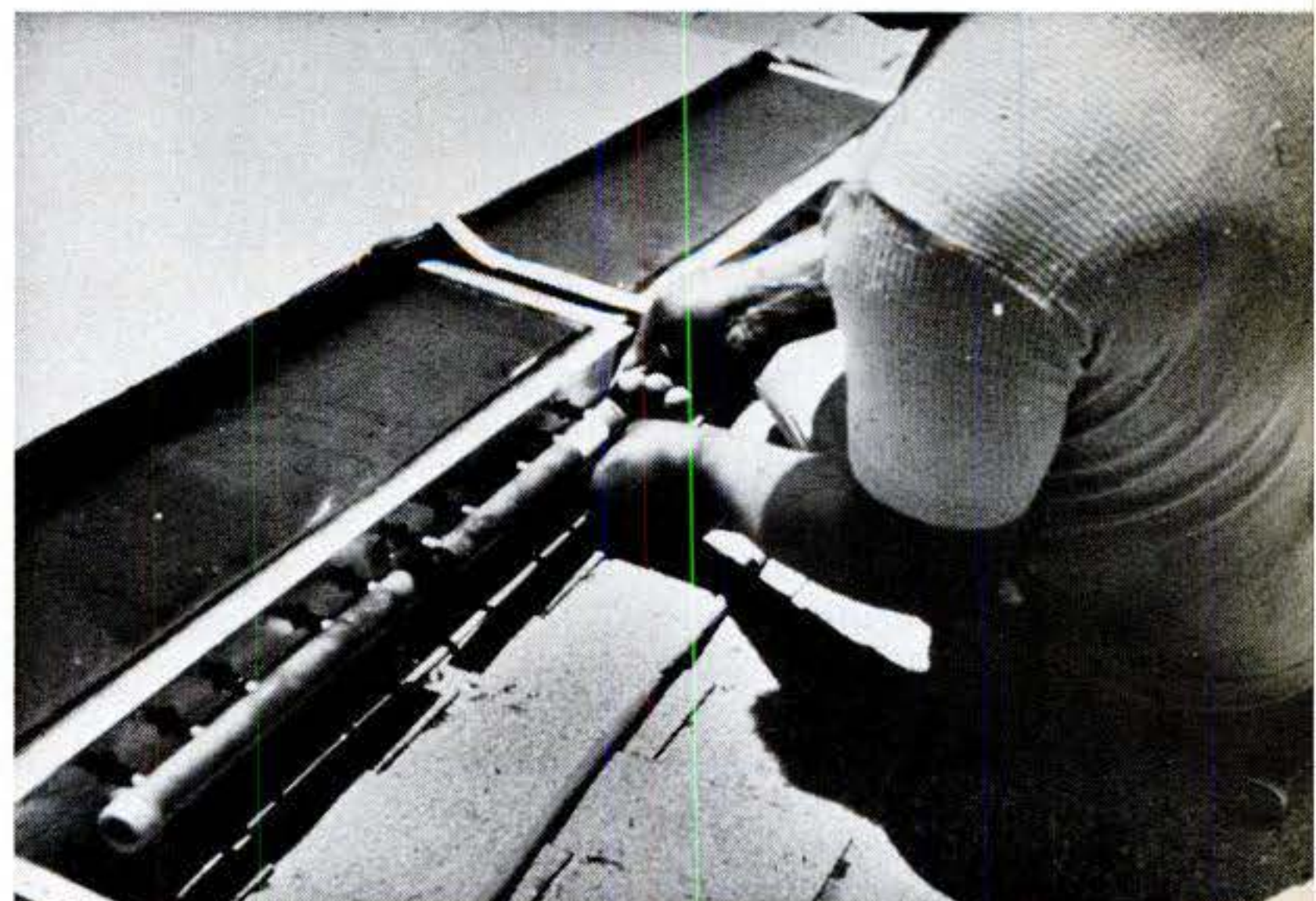
Utilities can get in the solar business now without waiting for large-scale projects, such as solar towers and photovoltaic power plants, to become economically feasible. By financing residential installations, they can become the bank account for each individual's solar purchase. ■



Going for the sun: Memphis homes get free hot water without initial investment.



TVA's secret: two storage tanks. To shave grid peaks, timer prevents daytime electrical charging of backup tank. Second tank



holds 120 gallons of hot water to last a family through one sunless day. Certified crews install and service the solar heaters.

Multihull speedsters

Cats of new stripes shatter old records



By **BEN KOCIVAR**

PHOTOGRAPHS BY C. CUNNINGHAM

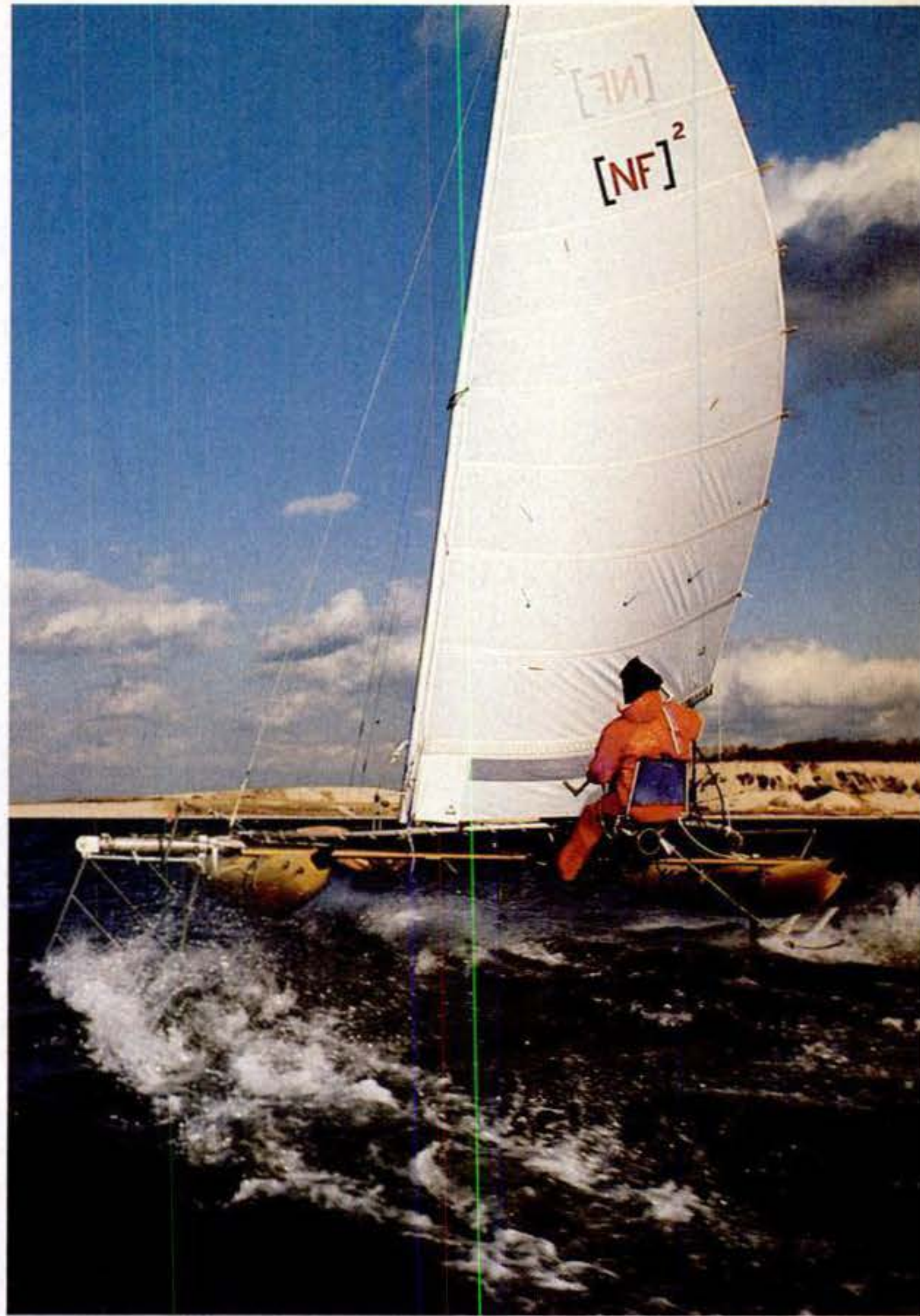
The meter nudged past the 20-knot mark as we skimmed across the sparkling Atlantic. I felt a rare, soaring sensation. I'd experienced it before—on a high-performance sailplane just before takeoff. But this time I was riding high on one hull of a big trimaran skippered by ocean racer Phil Weld.

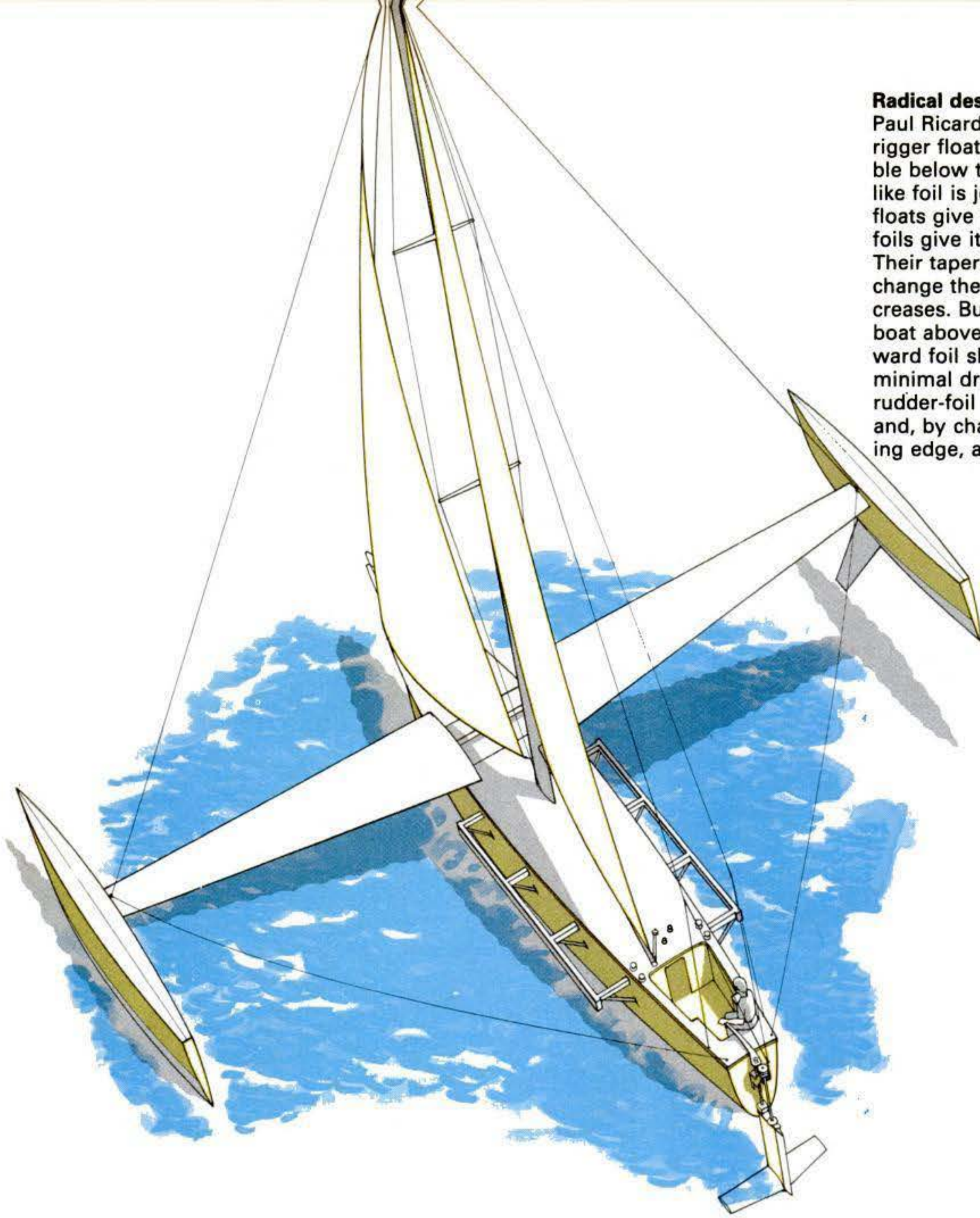
Such heady speeds are taken for granted by Weld and other racers. The quest for speed under sail has inspired innovative boat designs. The latest record-shattering racers, all multi-hulls, owe most of their sleek lines to aerodynamics research, and their lightweight construction to the use of modern materials technology.

The records set are impressive. The world sailing speed record, set in 1977, is 33.8 knots on a 500-meter course. The record holder is an unusual English sprinting catamaran with a pair of sails mounted on each hull. This speedy cat actually sprinted to

Continued

With record-breaking Moxie (lower right), Phil Weld triumphantly finishes his solo transatlantic voyage. Open webbing between main hull and outer floats was needed to reduce the area subject to ocean winds gusting under the lightweight craft—and maybe flipping it. At 10,000 lbs., the 51-ft. Moxie is about 56,000 lbs. lighter than a typical 65-ft. America's Cup racer. This light weight is vital for speed. Two other advanced, lightweight racers, Slingshot (above) and NF2 (above right), may also set startling new speed records, according to their designers. NF2 (short for "neither fish nor fowl") was designed by student engineers led by Professor Sam Bradfield of N.Y. State's Stony Brook University. The craft's 14-ft. rubber hulls come from a production boat—a Semperit inflatable catamaran. But hydrofoils added to the hulls make the craft fly as no production boat can. The foils slice through waves, creating lift so the boat actually rises out of water. NF2 has set a C-class record of 24.5 knots—its ultimate speed in a 20-knot wind may be 30 knots. Ultimate speed for the Slingshot could be as high as 45 knots in a 25-knot wind, says designer George Thomas. Slingshot weighs only 1,500 lbs. The crew must hang on as ballast to keep the flying outrigger from flipping the boat. The 40-ft. outriggers are linked to the 60-ft. main hull by 40-ft.-long aluminum sliding crossbars. For each run, the crossbars are slid out to windward so the leeward outrigger tucks up against the hull, keeping it from dragging through the water. Moxie and Slingshot are made of the same wood-epoxy material, the West System, developed by Gougeon Bros. of Bay City, Mich.





Radical design of the record-breaking Paul Ricard features relatively small outrigger floats with angled hydrofoils (visible below the airborne float). A tailfin-like foil is joined to the rudder. The floats give the craft stability at rest; the foils give it dynamic stability underway. Their tapered shape was designed to change the amount of lift as speed increases. But the foils don't fly the entire boat above the water. Instead, the leeward foil slices through the waves with minimal drag, lifting the small float. The rudder-foil unit controls boat direction, and, by changing the angle of the leading edge, adjusts fore-and-aft balance.

over 45 knots during one brief puff.

But speed records are not limited to dashes across calm waters. Last year trimarans set new standards for transatlantic crossings. Four of the first five finishers in the OSTAR (Observer Single-handed Transatlantic Race) were trimarans. This British-sponsored race pits solo sailors against the almost 3,400 miles of ocean between Plymouth, England, and Newport, R.I. The 1980 winner, America's Phil Weld, set a new speed record. The 65-year-old racer crossed in his 51-ft. trimaran, Moxie, in 17 days, 23 hours, 12 minutes.

Shortly after this race, Frenchman Eric Tabarly set a new record going the opposite way. The Paul Ricard, a 54-ft. trimaran, crossed the Atlantic west to east in 12 days, four hours, one minute, breaking a 72-year-old record.

Why the spurt of record breaking? Dick Newick, the naval architect who's designed many super-fast mul-

tihulls, including Weld's Moxie and Roy Nugent's proa, Godiva [PS, July '80], cites several reasons.

Multihulls like Moxie, says Newick, have long, slender hulls that go easily through a chop without tossing the rig about too much. This helps keep the sails at the most efficient angle to the wind. The skinny hulls don't have to push aside as much water as typical displacement keel boats. As a result, a lightweight multihull's speed is not determined by the traditional displacement formula (speed in knots equals 1.35 times the square root of the waterline length in feet). Because of this difference, the 54-ft. Paul Ricard was able to beat the time of the 186-ft. Atlantic, the 1908 record-setter, exceeding its average speed by a full knot.

Ultralight construction methods also boost speed, says Newick. Moxie, for example, has a core of thin plywood that's sheathed with polypropyl-

ene cloth, then coated with epoxy resin. The epoxy protects the wood from humidity that could increase weight.

The Paul Ricard is also lightweight. "It's made of welded aluminum using the same technology the French use to build the Concorde," says Newick.

Compared to monohulls, multihulls make better use of the wind. Their wide bases tend to heel over less at the start of a run, so more of the wind's force is converted to forward drive.

Hydrofoils, such as those on the Paul Ricard, also boost speed. These airfoil-shaped fins provide underwater lift just as a plane's wing does in the air. "Actually," notes Newick, "hydrofoils have been around for a while—in the form of rudders and centerboards. But using them to make sailboats 'fly' is new."

Such advances not only bring new excitement to sport sailing; they prove that today's technology can make more efficient use of the wind. **ES**

High-tech hi-fi

brings new realism
to performances

Digital and other circuits
bring heart-stopping
crescendos, velvety silence

By JOHN FREE

I pushed the START button on JVC's QL-Y5F turntable. The pickup arm—curiously bulky for an ultramodern disc player—began seeking out the record's lead-in grooves. Before it arrived, I pushed a switch labeled EXTERNAL PROCESSOR on a Carver preamp that bristled with push buttons. That put a small dbx decoder box into the playback circuit.

As the stylus settled on the super-disc (a Varese Sarabande digital dbx record), I cranked up the volume and listened intently. Nothing. Only black, velvety silence came from the lead-in grooves—not the usual ticks and background noise. Suddenly, a heart-stopping musical crescendo erupted from the loudspeakers. I listened to the wide contrast between soft and loud passages (dynamic range) and the extraordinary high fidelity. Then I pushed the SONIC HOLOGRAPHY button on the preamp.

An abrupt change was astonishing. The stereo field between the speakers gained far more depth; sound even seemed to be wrapped around the sides of the room. The clarity of the music improved dramatically, too, as though a curtain had been raised and I was at a live concert.

Continued

Music recorded on video cassettes (top) as coded digital signals PCM-ultimate in audio fidelity with Sony PCM-10 decoder. New hi-fi circuits, such as "3D-sound" generator in Carver preamp (right), aid in simulating the concert hall at home.





SONY
CMTA
100

SONY
CMTA
100

SONY
SONY
SONY

SONY

SONY

EMPIRE STRIKES BACK

DIGITAL HITS OF 1740

PACHELBEL
ALBINONI
MOURET
J.S. BACH
CANON
ADAGIO
Concerto for trumpet
in F major
RONDEAU
from Symphony
BRANDELSBURG

HOL
The Pleas

That super-disc and the hardware used to play it typify some significant new advances in the hi-fi industry:

- Special encoding of music before it's put on discs or tape can greatly enhance fidelity.

- Psychoacoustics—studies in how we hear sounds—have resulted in circuits that add new realism to high-fidelity sound.

- Microcomputers, other digital technology, and new circuits not only miniaturize and add operational flexibility to hi-fi components, but boost the accuracy of hi-fi reproduction.

Digital discs

Hardware firms and producers of conventional (analog) discs and tapes are acutely aware that some of the newest technology will become obsolete with the introduction of the digital audio disc (DAD). With total digital sound reproduction [PS, March '78], audio signals are converted into computer-like electronic codes and stored in that form on special discs and tapes. The first DAD's may appear on the market next year.

At the moment, this pure-digital technology is available to consumers only as a plug-in accessory for video-cassette recorders at a cost of several thousand dollars. These so-called PCM (pulse code modulation) encoders/decoders put audio signals in a format suitable for video cassettes. Professional PCM recorders are now used by most recording studios to make superior master tapes. These tapes are then used to make some new-breed super-discs, and account for the "digital" label on record jackets.

DAD's such as the laser-scanned Compact Disc [PS, Oct. '79] that Philips plans to market deliver superb hi-fi, although the best super-disc setup today comes very close in performance. DAD's have the special advantage of eliminating hassles with warped discs and scratched or dust-filled grooves. As you'll see, some of today's high-technology hi-fi can have a significant role in the pure-digital era developing in the 1980's.

Recently, the world's largest electronics firm, Matsushita in Japan, announced it would begin making tape recorders with a dbx compander circuit in them. This circuit, which electronically compresses audio sig-

nals before recording and expands them during playback, can also be used to play back the growing library of dbx-encoded discs [PS, Dec. '79]. Dbx-encoded discs overcome two significant problems with conventional records: limited dynamic range and surface noise. Compressing the signal before disc pressings permits some 90-dB difference between the loudest and softest music passages. (Most conventional discs are limited to under 60 dB of range.) The dbx circuit restores the loud passages to their original levels during playback. At the same time, as very soft sounds are electronically restored to their proper levels, surface noise is cut to inaudible levels.

Not long after Matsushita revealed its licensing arrangement with dbx, Inc., CBS Records announced that it, too, will soon begin releasing records encoded with a similar noise-reduction process developed by the CBS Technology Center. CBS indicated that low-cost adapters for decoding its records will be sold or built into phono systems. But CBS stresses that its compander technology will enable encoded discs to be played back without a decoder. They'll sound like conventional records, says CBS. Without a decoder, dbx discs have a distinctly muffled sound during playback.

Binaural speakers

Bob Carver, the president of Carver Corp., has observed a host of new products imitating the audio technology he's pioneered during the past 10 years. Not all the imitations of his latest sonic-holography circuit have been successful, although he's taking legal action against one firm.

How does this 3D-like sound circuit work? During a demonstration in the PS test lab, Carver outlined the problems with conventional stereo. "Suppose I make a recording of someone whispering in my left ear," he said. With stereo playback, that sound would appear to come from the left speaker, he explained, not at the left ear, because it would arrive first at the left ear and microseconds later at the right ear. Your "ear brain" correctly identifies the sound source, using time and phase differences between the sounds at both ears.

Here's what the holography circuit does to overcome this perception problem: "Very cleverly," Carver said, "the right speaker launches a sound wave timed and phased so that when it arrives in the space near your right ear an interference pattern is developed." This destructive interference eliminates the sound for your right ear, but reinforces the sound when it reaches your left ear. The result would

be an eerie whisper next to your ear. The hologram circuit usually functions in less extreme cases, extracting information from conventional discs that is blurred or inaudible in conventional stereo playback.

Carver also explained how his remarkably light M400 magnetic-field amplifier works. This compact cube weighs just under nine pounds, but it can deliver 200 watts to each stereo channel. The M400 uses a triac (like solid-state light dimmers) with a transformer so that its power supply only delivers the power required by the incoming audio.

One key element is the special transformer Carver designed. "It looks like a 25-watt transformer," Carver said, tapping a yellow, lemon-size device in his amplifier. "But that little thing is good for over one kilowatt." Computer-like logic circuits analyze the audio and signal the power supply through a beam of light in a solid-state device. Part of the output stage of the M400 is a conventional 15-watt amplifier; as demand for power is sensed, two additional output stages for each channel, plus progressively higher voltages, are switched in to meet the demand.

Computerized hi-fi

Microcomputers are used in turntables to store sequences of record selections and play them in any order; they're in audio cassette decks [PS, Nov. '79] to automatically set bias and other parameters. Also, a new computerized equalizer [PS, Nov. '80] can automatically adjust hi-fi frequency response for the listening room.

Now the tiny computer chips have a new function in turntables from Sony and JVC. The pickup arm in their new models is electronically controlled through a microcomputer. Tracking and anti-skating forces are maintained with linear motors—pairs of coils—that move the pickup arm with magnetic fields and free it from mechanical contact. Sensor coils help guide the arm across the disc by detecting its position and feeding signals to the computer. This technique, by monitoring the arm at split-second intervals, can also instantly compensate for jarring vibrations or undesirable arm resonances.

Microcomputers and a long list of other high-technology components—new plastics, solid-state devices, magnetic liquids [PS, June '79], carbon-fiber epoxies—will have a critical role in the coming era of digital audio. The extraordinary dynamic range and frequency response present in new recordings demand the very best that hi-fi components can deliver. ■

High-technology audio components include (clockwise from top right): Sony TA-F55 integrated amp, ST-J55 AM/FM tuner, PS-X75 turntable; Carver C4000 preamp; dbx model-21 decoder; Carver M400 magnetic-field amplifier. Dbx-encoded discs in foreground were made from digital master tapes.

Saturn's secrets

The week that stunned the scientists

You can throw away your astronomy books; everything they say about Saturn is wrong

By **BRYAN SOLTNER**

The surprises came early. Almost a month before Voyager 1 swept out of the depths of space and cruised into the near-realm of Saturn, the photos were already sending tremors of excitement through the mission's science teams.

The first pictures—from about 40 million kilometers away—revealed a glistening system of rings girdling Saturn's tilted equator, with tiny moons sparkling in the rings like diamond chips set into silver, and others seen against the planet's face resembling pearls on orange velvet.

But there were some disturbing anomalies: moons where none should be, gaps in the rings that weren't gaps at all, rings within rings, and—most peculiar—fingers of darkness moving across an inner ring.

And there were more revelations to come. Each day, image resolution improved until it doubled in a day, in a half-day, in hours, then minutes.

"I'm stunned by the spectacular display of pictures we've received," said Dr. Bradford Smith, the University of Arizona astronomer who heads the Voyager imaging team. "We've had extraordinary pictures in such quantities that it has been impossible to concentrate on one for more than a few seconds before being distracted by the next."

And the television pictures composed only a small part of the landslide of data. The spacecraft's incessant

radio chatter also included information revealed by instruments viewing the ringed planet across the electromagnetic spectrum: in the radio, infrared, and ultraviolet regions. Other instruments measured magnetic fields, cosmic rays, gas densities.

Voyager's trail through the rings had been blazed an Earth-year earlier by Pioneer 11 [PS, Jan. '80], but the results from that encounter were limited by the craft's lesser capabilities. The twin Voyagers 1 and 2 were expected to harvest the real surprises, as they had when flying by Jupiter [PS, July '79]. And the science teams that regathered now at the mission center at the Jet Propulsion Laboratory in Pasadena, Calif., would not be disappointed.

Through the exciting month of discovery they were sometimes baffled, often incredulous, but always awestruck at what they found. In the days of closest encounter with Saturn, photos and data flowed so rapidly into JPL and the three deep-space tracking stations around the world that scientists barely had time to jump from

“It's as if someone put a thread around a basketball and expected it to stay there forever”

discovery to discovery, casting off old theories and weaving new ones as they revealed in new knowledge.

First to go were a host of theories about Saturn's rings. "We felt very comfortable with the rings until we

got close," Smith said. Ring specialists were sure they were relatively smooth and uncomplicated bands comprising dirty ice particles of perhaps 30 centimeters in diameter. At closest approach, the cameras would not be expected to resolve individual particles or features.

Fingerprints

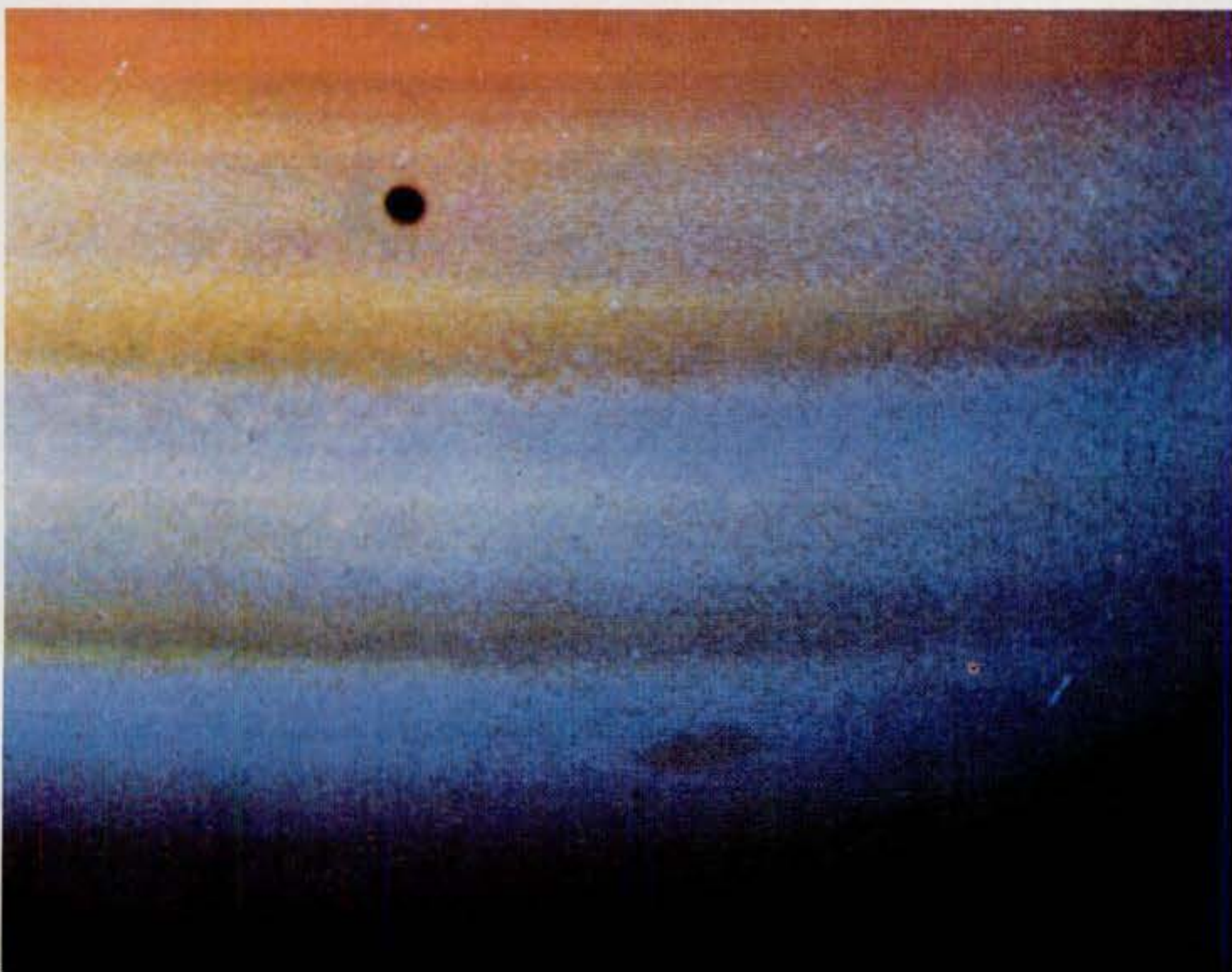
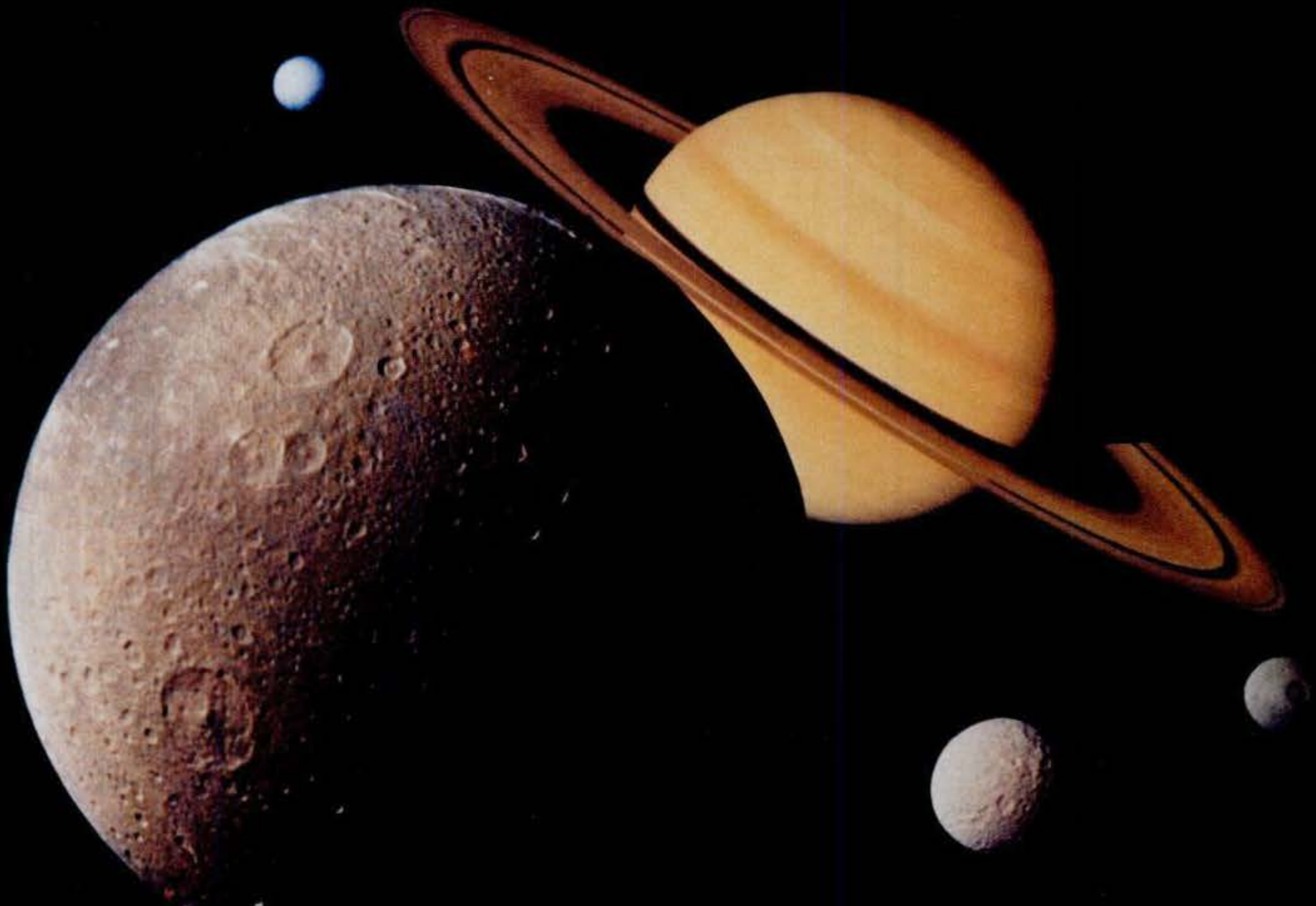
Then, on a Monday morning in mid-October, Dr. Richard Terrell noticed some dark lines resembling spread fingers in photos of the B ring, the broad middle ring. A subsequent photo sequence showed that these fingers moved with the ring instead of breaking up, as would be expected since inner particles should orbit faster than outer ones. "Nobody expected to see anything rotating in the rings," Terrell said later, "certainly not at 1,000-kilometer resolution. We were amazed."

It would be weeks before a clear theory emerged to explain the B-ring structures. Looking ahead toward Saturn, the fingers appeared dark; looking back after passing the planet, they appeared bright and shiny. That difference provided a clue.

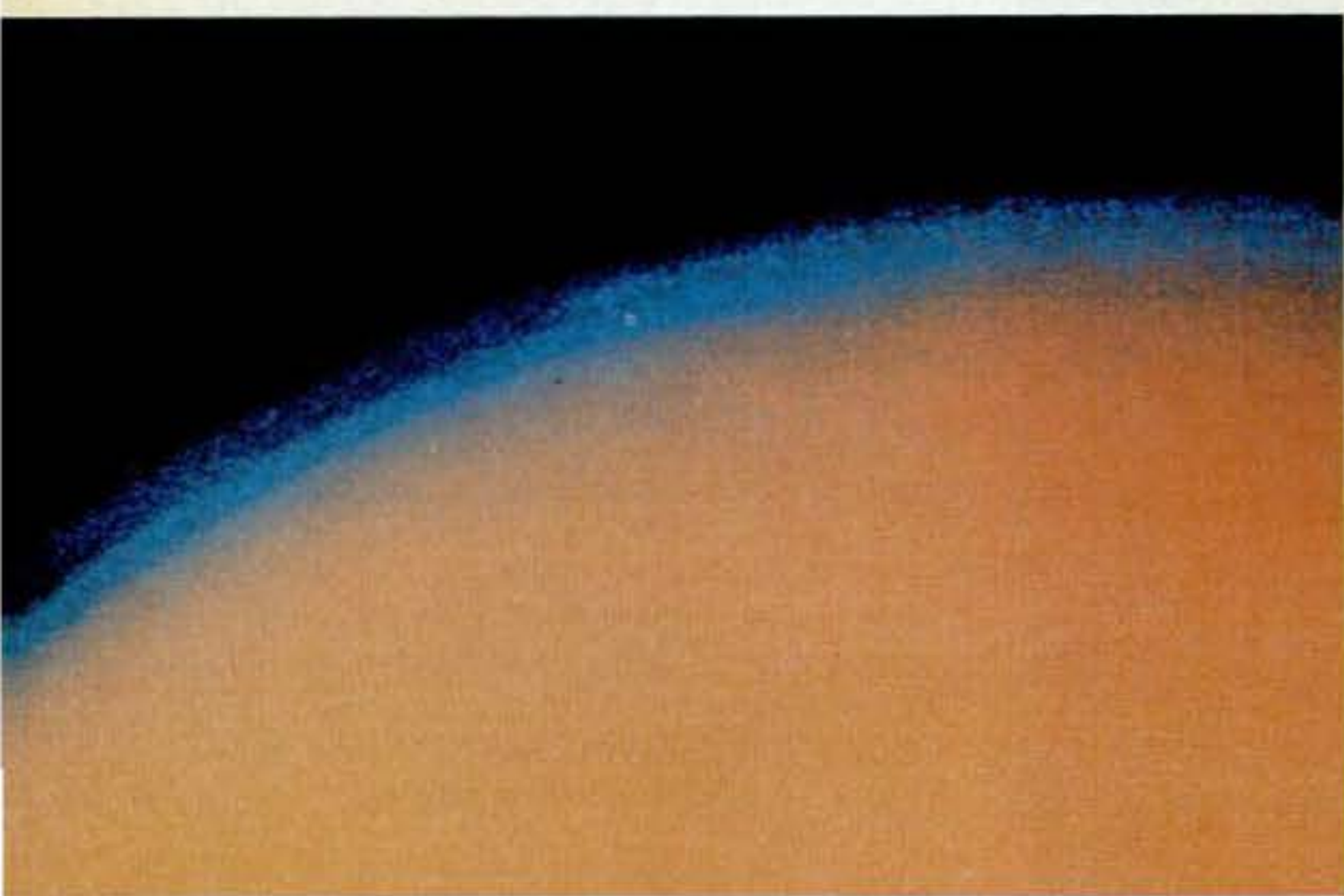
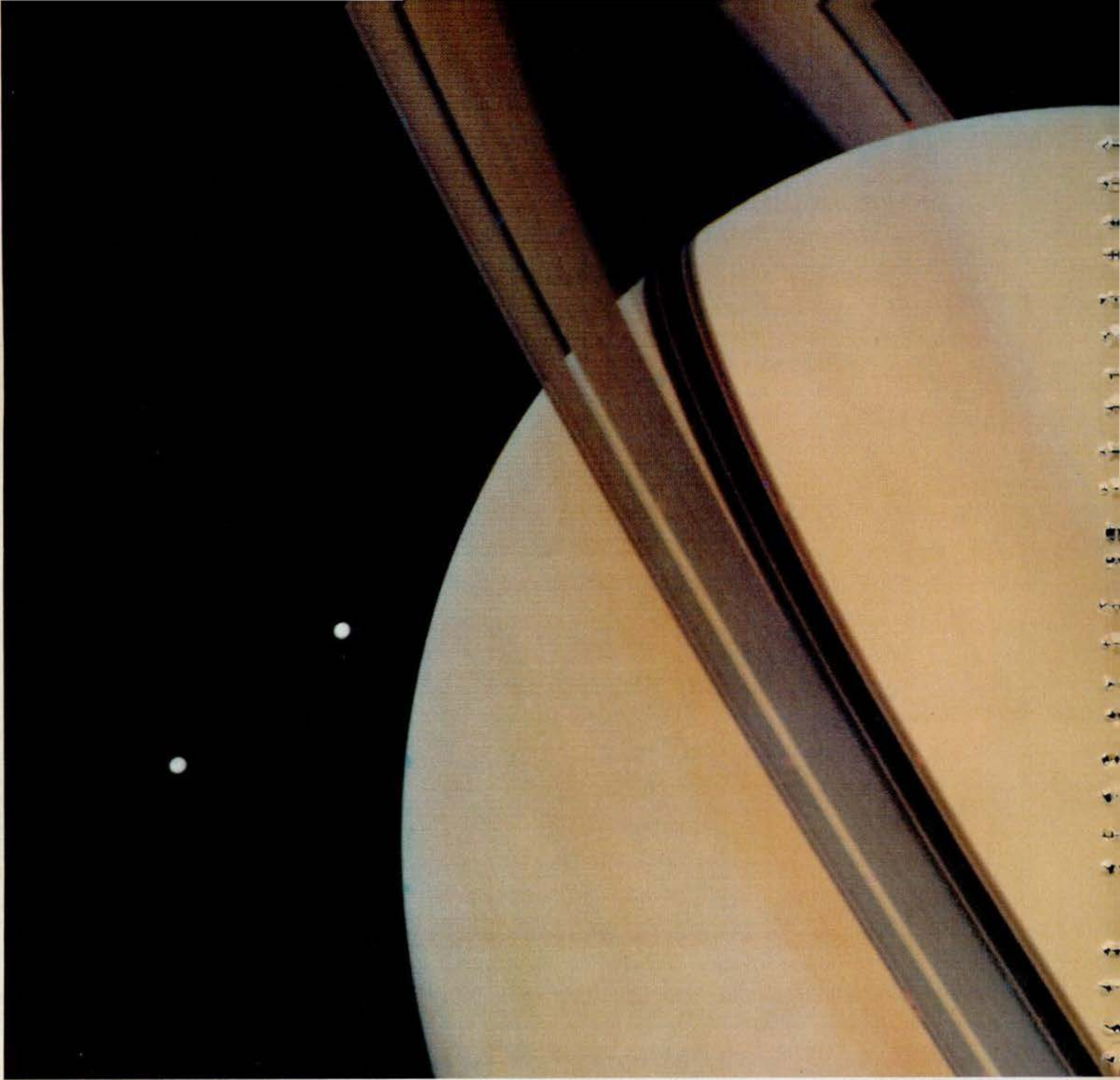
Smith explained: Sunlight is generally reflected off large objects, but it is scattered forward off tiny particles. Therefore, tiny particles would look dark to Voyager on approach but bright when it looked back.

If these particles were fine dust, the analysts theorized, they could be held together by static electricity, which would have no effect on larger bodies. Charged by Saturn's magnetic field, the dust would rise in a clump above the ring and orbit the planet. Says Terrell, "We're probably seeing a segregation of the ring's small particles

Continued



Saturn's neighborhood was full of surprises. The montage of moons and the planet (above) was assembled from individual images taken by Voyager 1 as it sailed through the alien system. Dione (foreground) looks much like Earth's moon, with craters up to 100 km in diameter, many with central peaks. Bright rays are icy moon-stuff ejected from impact craters. Other moons—Tethys and Mimas to the right, Enceladus and Rhea rising to the left—display various degrees of cratering and wispy features. Saturn's three major rings are visible here, along with the surprisingly populated Cassini Division. Left: Dione's shadow is cast against muted bands and zones of Saturn's southern hemisphere. The color-enhanced photo shows a 12,000-km-long red spot, evidence of a furious wind storm.



responding to electrostatic charging."

But the fingers in the ring were only one shocker about ring structure. Where previous observations had shown five or maybe six rings, suddenly there were rings within rings and within supposed gaps. There were wide rings, tenuous rings, braided rings, off-center rings, rings of every shape and description. Against all expectation, by the time Voyager left the Saturnian neighborhood, astronomers had counted more than 1,000 ringlets, including eight major ones.

As the ring count mounted, a cherished theory that explained how the rings were confined had to be unceremoniously discarded. This held that the gaps between the rings are caused by gravitational interactions—or resonances—with Saturn's moons. Any ring particle that orbited in exactly half the time that a moon does would be pulled out of that orbit and into a higher one. Therefore, the theory went, the Cassini Division, a 3,500-kilometer gap between the A and B rings, would be swept clear of material by the moon Mimas, which has an orbital period twice what Cassini Division particles would have.

The trouble is, the Cassini Division did not turn out to be empty, after all. Besides, there are far too many gaps to be explained by resonances with the known moons. There has to be another force that determines where a ring can exist and where one can't.

Ring makers

One early guess was that small moons embedded in the rings could be responsible for the proliferate gaps. Dr. Edward Stone of Caltech, head scientist on the mission, told team members to watch for icy chunks in the bright A, B, and C rings large enough to sweep out spaces. "There could be many, many embedded satellites," said Andrew Collins of the imaging team. "Something as small as one kilometer could sweep out a gap."

But even at closest approach to Saturn—on November 12, when Voyager skimmed by at 124,000 kilometers—the photo resolution was not high enough to detect embedded chunks.

Even as the theorists pondered that

problem, Terrell made two more discoveries: A pair of tiny moons, labeled S-13 and S-14, straddled the skimpy F ring, itself first discovered by Pioneer 11. It was clear evidence that satellites could be the "shepherding" forces that hold planetary rings together.

The F ring itself is so wispy—no more than 100 kilometers wide—that its existence is incredible. It's as if someone placed a thread in a half-meter circle around a basketball and expected it to stay there forever.

The shepherding satellites apparently provide the gravitational forces

“Titan may be a place where we can study prelife chemistry. It could be Earth in a deep freeze”

needed to keep the ring cohesive. The outer moon keeps particles from falling toward Saturn while the inner moon keeps them from floating away.

"The result is a pinching action," said Dr. Ellis Miner, assistant project scientist. "It seems to be very effective in keeping the F ring quite narrow."

Another moon, labeled S-15, was later found coasting along the outer edge of the A ring. It was one more piece of evidence that shepherding satellites help define ring limits.

The moons may also be partly responsible for another bizarre feature of the F ring: It isn't one band of material, but several strips of matter woven together in apparent defiance of the laws of orbiting bodies. "We have three strands interwoven, or braided, in some fashion that we don't understand," Smith reported.

Scientists speculate that the strands are the visible effect of electrostatic eddies, perhaps caused by a combination of the shepherding satellites and Saturn's own magnetic field. "It seems," said Collins, "that we'll have to augment the laws of Kepler with the laws governing electrostatic influences."

Revised photo plans for Voyager 2, due to reach Saturn in August, already include intense study of this braided ring.

Two more small moons, S-10 and S-11, cleared up a mystery. They had been sighted from Earth, but their existence hadn't been confirmed. Voyager's photographs of these elusive

satellites show that they behave in a manner never before seen.

The tooth-shaped moons appear to be on a collision course. "They are co-orbital," Smith reported. "They are now about 105 degrees apart—and closing."

Close encounter

Calculations predict they won't collide, however. Instead, they'll perform an intricate orbital maneuver. As the gap closes in January 1982, one moon will be in a slightly higher, and slower, orbit. The faster moon will catch up, but then the combined gravitational forces will cause them to swap positions. The higher moon will be pulled down, and thus speed up; the lower moon will climb slightly in orbit, and thus slow down. During the crossover, the two moons will pass within a few kilometers of each other. Every seven years, they will repeat this close encounter.

The "dodge-'em" moons also led to discovery of a new ring, probably to be called the H ring. Its shadow was seen moving across one moon, and the ring itself was found glowing faintly with forward-scattered light in post-encounter photos. Another new ring, tentatively labeled the G ring, was also found in these photos, circling Saturn inside the other known rings.

Moons S-10 and S-11 may once have been a single body that broke up eons ago. How does a moon break up? It could be pulled apart by gravitational forces (some have suggested that the rings originated this way), or it could be split in two by bombardment from a mighty meteorite. Indeed, Saturn's innermost major moon, Mimas, bears a magnificent crater from such a blow. Scientists speculate that a blow any more powerful might have split Mimas into pieces.

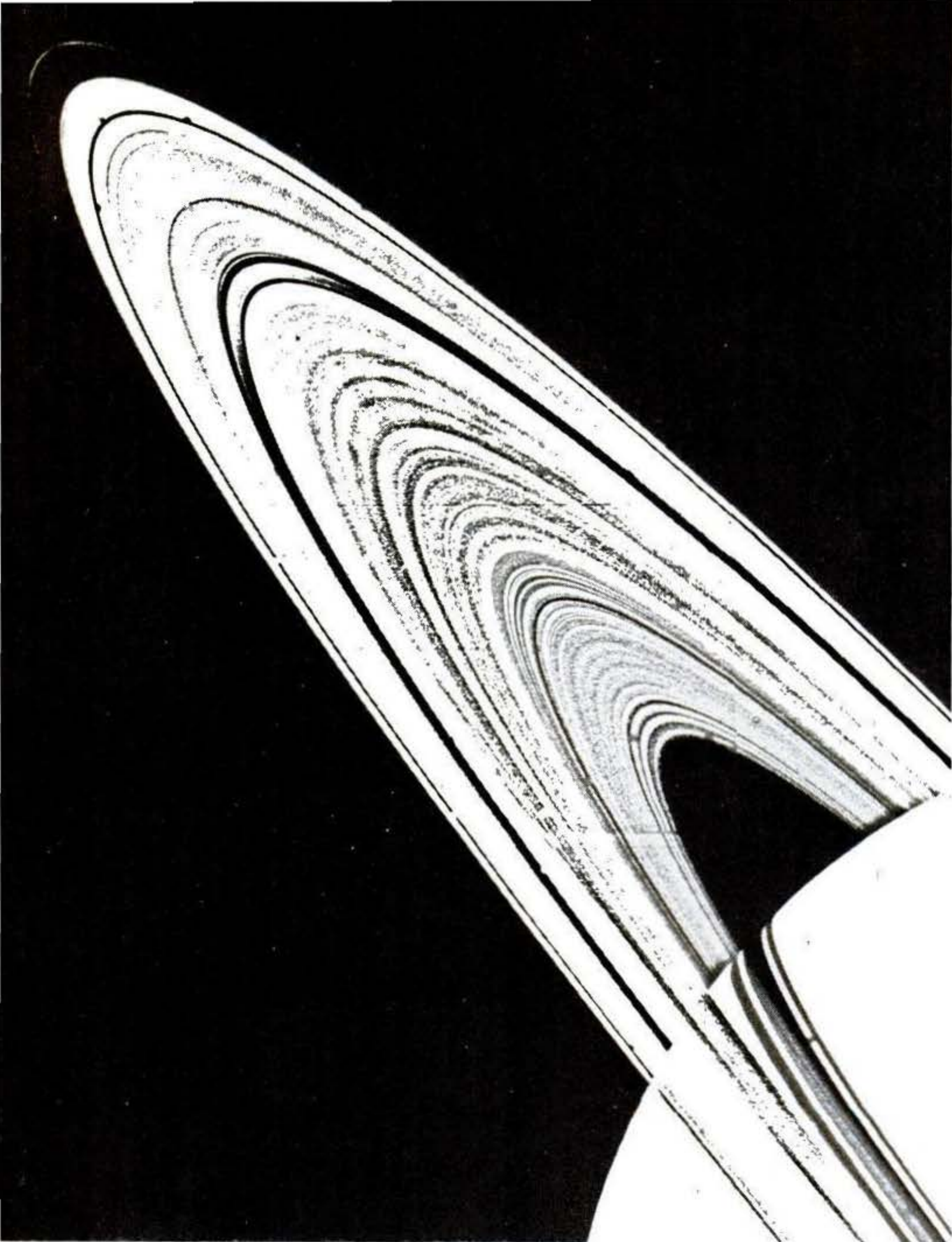
Most of the other moons are heavily cratered, too. Rhea is crater-saturated—any new impacts would obliterate as many craters as it would create. Tethys has a deep trench 750 kilometers long. Dione looks much like Earth's moon. Yet strangely, Enceladus—viewed from a distance—seems to be virtually smooth.

"The icy satellites of Saturn are growing from mere names out of mythology to become real places," said Laurence Soderblom of the U.S. Geological Survey. "And we're seeing things we never anticipated."

One problem is that all the moons seem to have undergone some degree of resurfacing. This indicates that the

Continued

Gas-bag Saturn and its marvelous rings dwarf Tethys and Dione in top left photo, taken from 13 million km. Much closer in (left), ribbon patterns and mottled convective zones in the clouds become evident. Titan's thick nitrogen atmosphere (far left) merges with a darker mantle over the north pole.



frigid moons were heated somehow, yet they are all too small to generate internal heat. Enceladus's smoothness might be explained by gravitational tides generated by Dione, which orbits in twice the time Enceladus does. Resurfacing on the other moons may indicate the presence of large amounts of radioactive elements.

A second problem is that the near moons violate the planetary tradition of decreasing density. With planets circling the sun and moons circling planets, near objects are most dense.

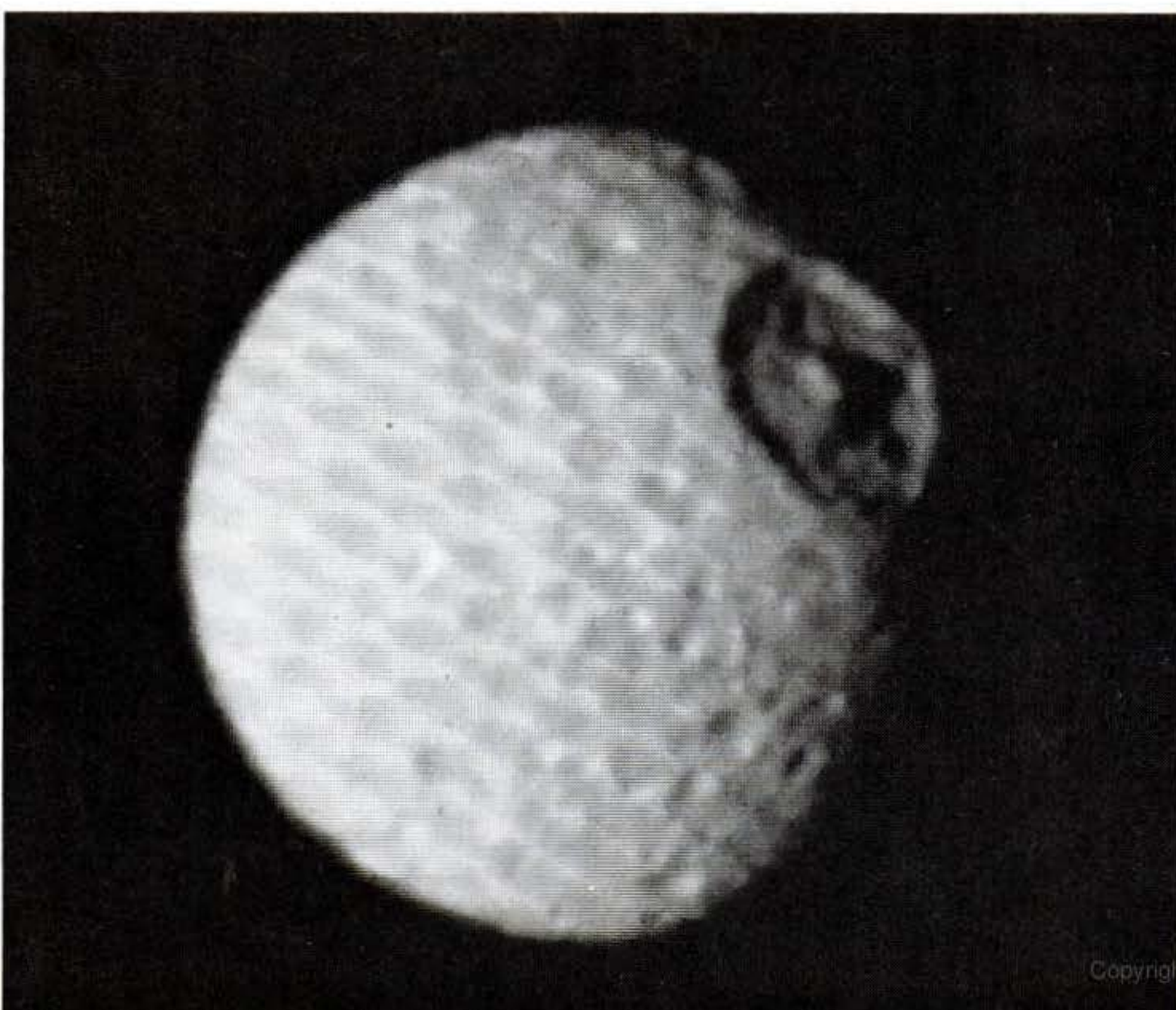
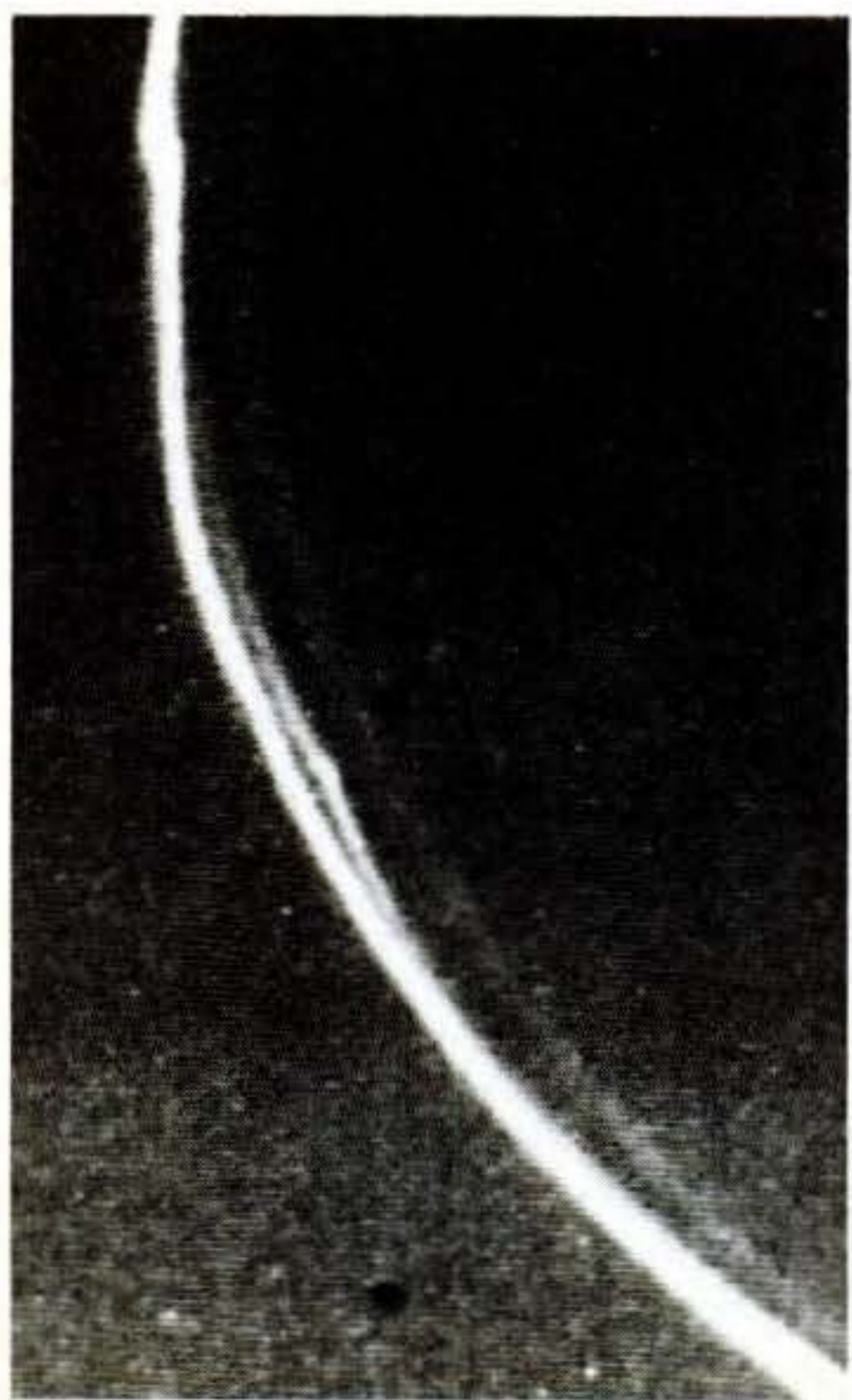
"They should become less dense as you move outward," said Soderblom, "but Saturn's satellites don't follow."

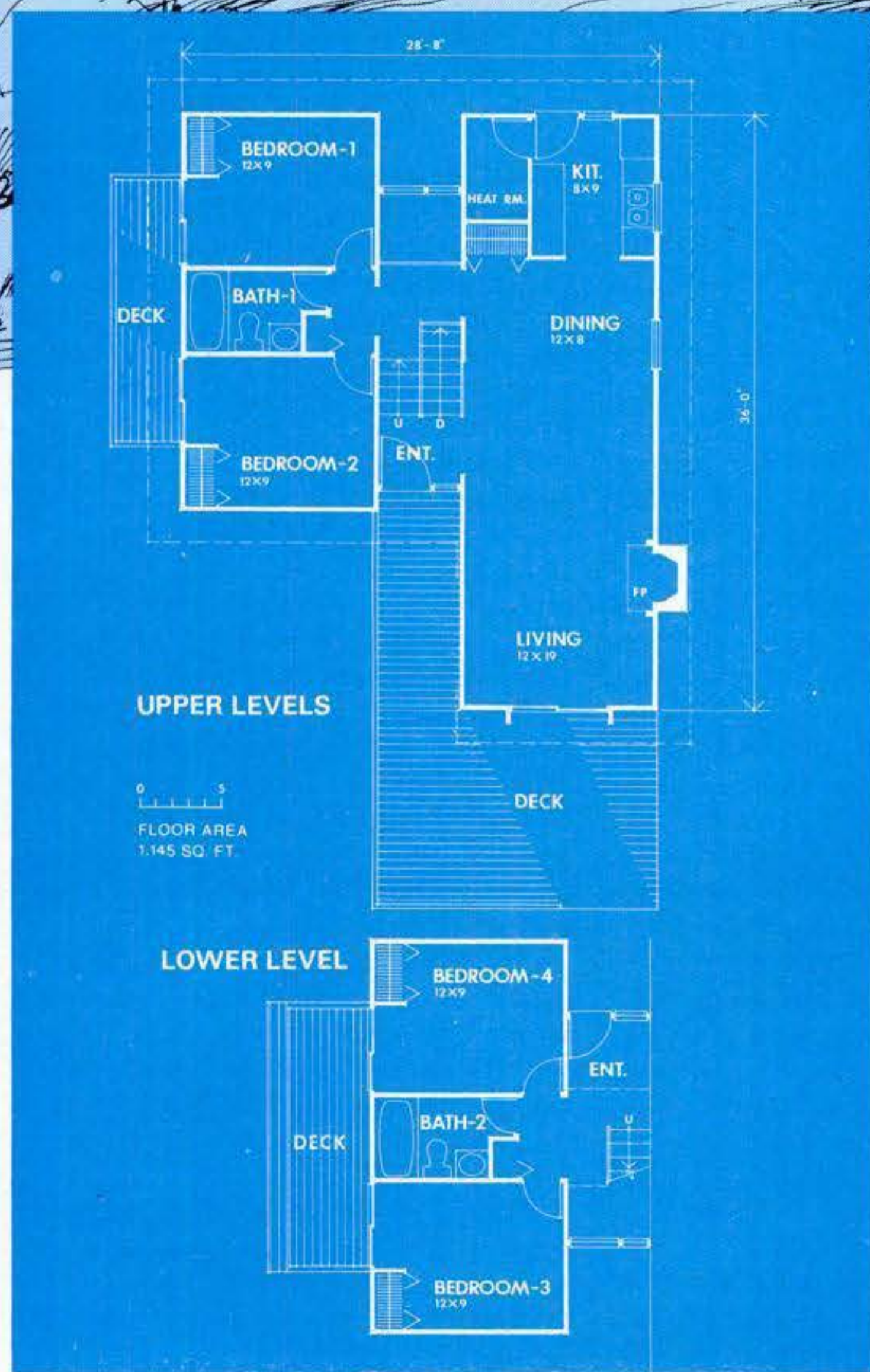
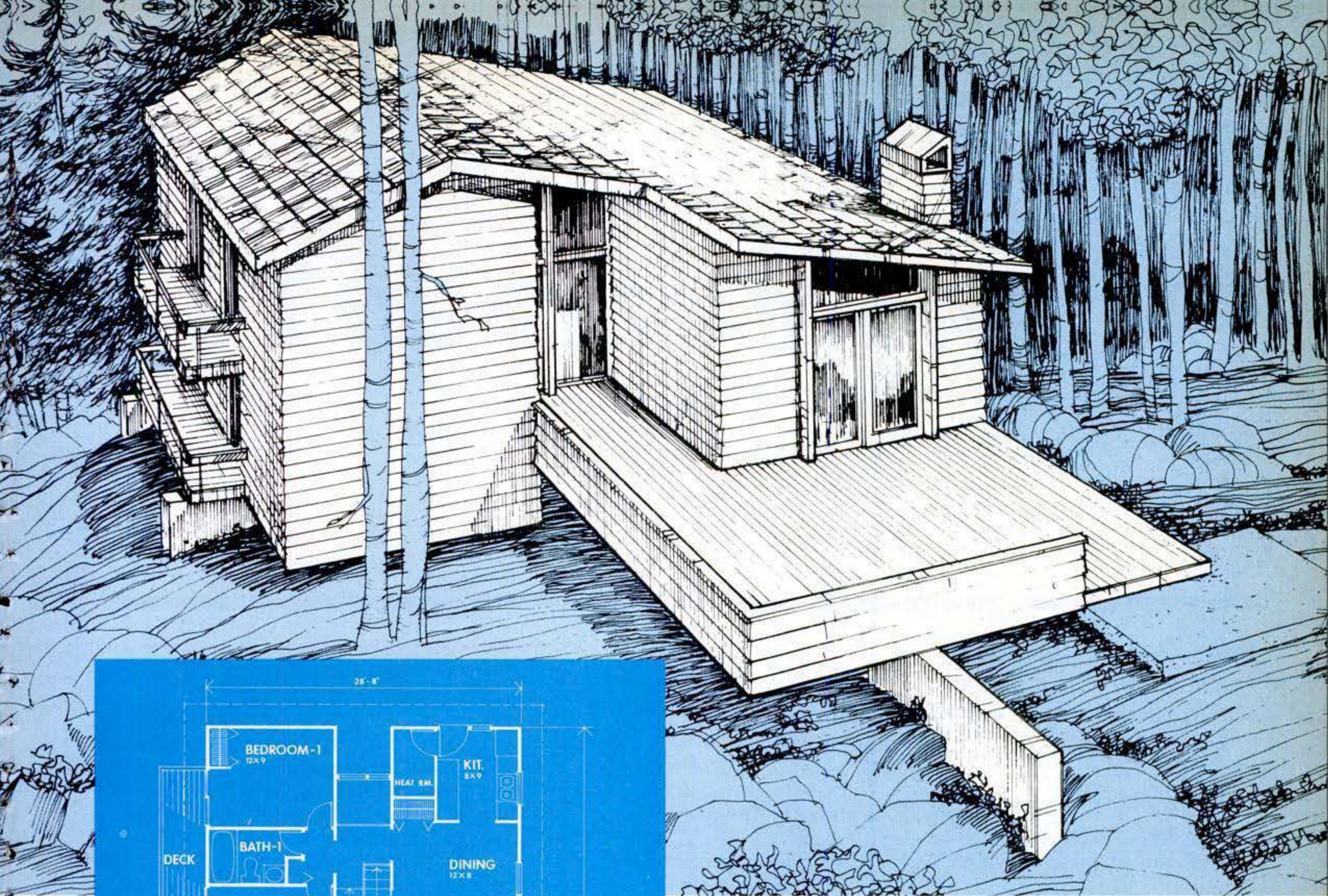
Voyager found the density of Mimas to be 1.2, a probable mixture of much water ice and some rock. Two moons outward, Tethys did decrease to 1.0 (almost pure water or snowy ice), but then came Dione at 1.4. That indicates more rock than either of its partners. Analysis of density data on Rhea and Enceladus is not yet definitive.

Saturn's moons are thought to have originated from the accretion of plan-

[Continued on page 140]

Too many rings: Cherished theories had to be discarded when this and similar photos revealed more than 1,000 ringlets, where only five or six featureless bands were expected. But close-up photos failed to detect any moonlets in the rings that might explain the drove of divisions. The F ring, just a thread in the upper left of the photo at left, resolved into three braided strands (below left), seeming to defy the laws of orbiting bodies. Mimas's monster crater (below), more than a quarter as wide as the satellite itself, has walls nine km high and a towering central peak.





PS leisure-home plan

Triple-decker

By AL LEES

This split-level lodge can float over a sloping, rocky site that would cause excavation problems for a conventional foundation. And each of the three levels sports its own deck. The major wing of the house is at mid-level and consists of a long living room (with fireplace tucked back of the wall line in a chase), dining area, and open kitchen. Access is from the big L-shaped deck, either through the formal entry or directly through a sliding glass door, or there's rear entry through the kitchen.

The sleep wing has two identical stories, with bedrooms flanking a bath and sharing a balcony deck. Where the site permits, another rear door can be provided for the lower level; on steep sites, this may even become the main entry. The stair corridor effectively zones activity areas from sleeping spaces. An offset ridge creates a cathedral ceiling over the main wing. Architect R. M. Engelbrecht designed the house for PS and the V-PAC Council. **45**

Here's how to order your V-PAC plans

Construction plans for the Triple Decker (VPS # 49) are \$50 a set, \$65 for three sets, \$75 for five sets. Add postage/handling charge of \$2.50 in continental U.S., \$3.50 elsewhere. Catalog of V-PAC plans is \$4. Send check to Vacation Plans Service, Box 622, Princeton, N.J. 08540 (U.S. funds only). To charge orders to Mas-

terCard or Visa call (609) 924-9655. V-PAC Council is a group of building-materials manufacturers, including American General (stairs), Andersen (windows), Olympic (stains), Du Pont (finishes), Frigidaire (appliances), GAF (roofing), Georgia-Pacific (paneling), Heatilator (fireplaces), Johns-Manville (insulation), Myers (pumps), Pass & Seymour (electrical), Simpson (lumber), Singer (heating), and Universal-Rundle (baths).

Giant-screen TV

Low-cost adapters convert small-screen sets

Improved lenses and screens let you join the video revolution for \$500

By JOHN FREE

Own a small-screen color TV? An adapter and screen for under \$500 will enlarge its 12- to 15-inch (diagonal) pictures into enormous four-foot images. Improvements in lenses and curved, light-intensifying screens provide much brighter pictures with adapters than hardware I tested a few years ago [PS, Nov. '77].

Projection TV has finally been accepted by major TV makers. They're all marketing models (or plan to) that have three projection tubes to deliver extra-bright pictures [PS cover, May '79]. With competition and mass production, prices for these sets should fall; now, three-tube models cost \$2,500 and up. In addition, a few small firms market \$1,000-to-\$3,000 pre-packaged projection TV's built around small-screen receivers.

So a little do-it-yourself effort can bring big dollar savings. I tried three adapter systems recently. Two require simple wiring changes in a home set so the projected picture won't be upside down. Rewiring may cost about \$25; only an experienced technician should do it.

Two-piece systems (photo) require a fair amount of floor space, but can be taken apart in seconds. Sets can then be used for direct viewing, though a rewiring switch may be needed.

The three systems tested provided good to excellent pictures and confirmed the importance of enlarging only clear, ghost-free pictures from small-screen sets.

All three adapters use plastic Fresnel lenses. These are big and optically "fast" (f/1.2 or f/1.3). As a result, many small-screen sets can deliver images bright enough to be viewed with room lights on. But the multiple concentric grooves in Fresnel lenses also give the projected image a fuzzy quality—as though it's being beamed through a lens coated with grease.

The cure for this, however, is simple: A cardboard ring provided with each system can reduce the aperture of the front lens in the two-lens projection cones. A test pattern I tried showed only a small gain in detail (horizontal resolution). But the overall improvement in screen sharpness was startling. The slight reduction in brightness is well worth the small sacrifice.

Top performer was the system from F & F Sales called UltraVision. It uses a pair of f/1.2 lenses in a hood that, for mounting, requires two small holes drilled in your set. A 12-inch Sony borrowed from F & F contributed *significantly* to the excellent pictures. That's because this small set has a very flat tube surface, which ensures a sharp focus over the entire projection screen. A special UltraVision feature, four spring-loaded fine-adjustment screws in the hood, greatly aids this critical focusing. F & F dealers can modify receivers for UltraVision.

F & F's five-foot screen was the best constructed, too, with a rigid plastic backing. Bright pictures could be viewed some 50 degrees off the center axis, which is a big improvement in coverage area for these adapter-type systems.

Schudel's Telekaster is the only model among the three that doesn't require rewiring your set. Instead, your receiver is tipped upside down

and strapped to an L-shaped stand. A housing with a front-surface mirror and pair of f/1.3 lenses is then placed over the TV screen. A 13-inch RCA set I used provided good images, although its CRT curvature made picture edges less distinct on Schudel's four-foot screen. But the screen has an unusual curvature that concentrates light toward its center. It was annoying to watch because small head movements caused abrupt localized changes in brightness.

VSR Sales' single-piece Creatavision is shipped in pieces and can be assembled in a few hours. For viewing, a hinged lid with a mirror mounted on it is flipped down. A 12- to 14-inch set, providing its base is less than eight inches from its screen center, can be used. The receiver is placed on a small stand with screw-type legs (for height adjustment) in the cabinet. Focusing takes longer, and you probably won't want to periodically remove your small-screen set.

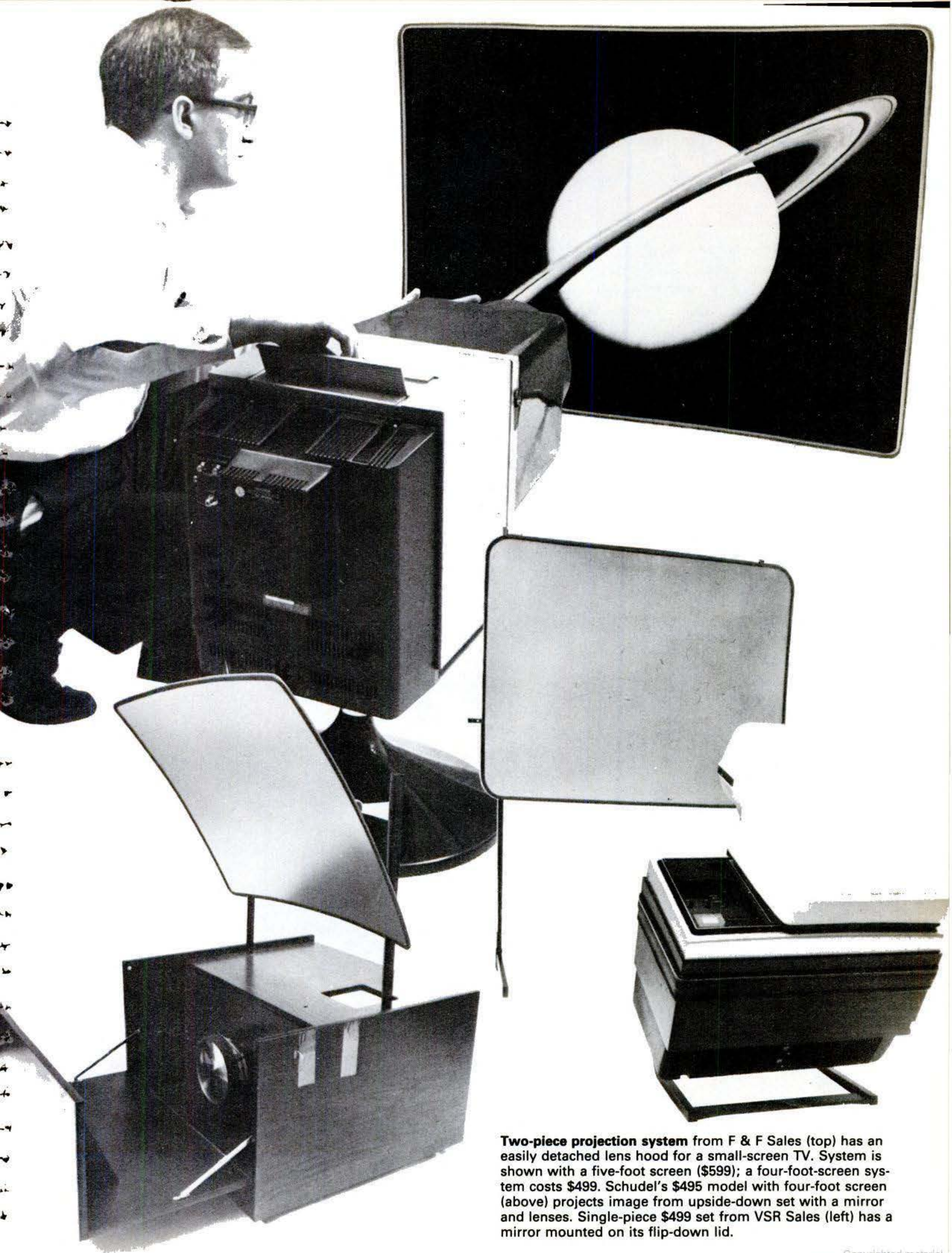
Creatavision images with the RCA set were good but more trapezoid shaped (optically distorted) than those with two-piece hardware. More of the image must be bled off the screen to minimize this so-called keystone effect.

Finally, if you can afford an extra \$100, a five-foot screen seems to provide more satisfying images than a four-foot screen. P 5

FOR MORE INFORMATION

Addresses: Sources for UltraVision are available from F & F Sales Co., Box 1047, Havertown PA 19083; Schudel Inc., 6973 Consolidated Way, San Diego CA 92121; VSR Sales, 433 Airport Blvd., Burlingame CA 94010 (also markets a two-piece system).

Other firms marketing components and plans are: Biener Systems, 47-20 37th St., Long Island City NY 11101 (maker of UltraVision); Edmund Scientific, 101 E. Gloucester Pike, Barrington NJ 08007; Projectapix, Ltd., 300-314 W. 53 St., New York NY 10019; Tele-kit, 15 Green Hill Lane, Spring Valley NY 10977.



Two-piece projection system from F & F Sales (top) has an easily detached lens hood for a small-screen TV. System is shown with a five-foot screen (\$599); a four-foot-screen system costs \$499. Schudel's \$495 model with four-foot screen (above) projects image from upside-down set with a mirror and lenses. Single-piece \$499 set from VSR Sales (left) has a mirror mounted on its flip-down lid.

What's New

A PICTURE ROUNDUP OF NEW PRODUCTS AND DEVELOPMENTS



Escape mask

Fire! But choking smoke won't disable the hotel guest who grabs the Parat mask from its wall mount. The heat-reflecting hood has a wide-angle faceplate and a chemical filter that gives 15 minutes of safe breathing. National Draeger, 401 Parkway View Dr., Pittsburgh, Pa.

Future cycle

Tomorrow's commuter car will be a motorcycle, says designer Ferdinand Porsche. His version, based on a Yamaha SR500, has fully enclosed wheels and engine to keep the rider clean. There's also automatic transmission and a single brake pedal to make the bike easier to drive.

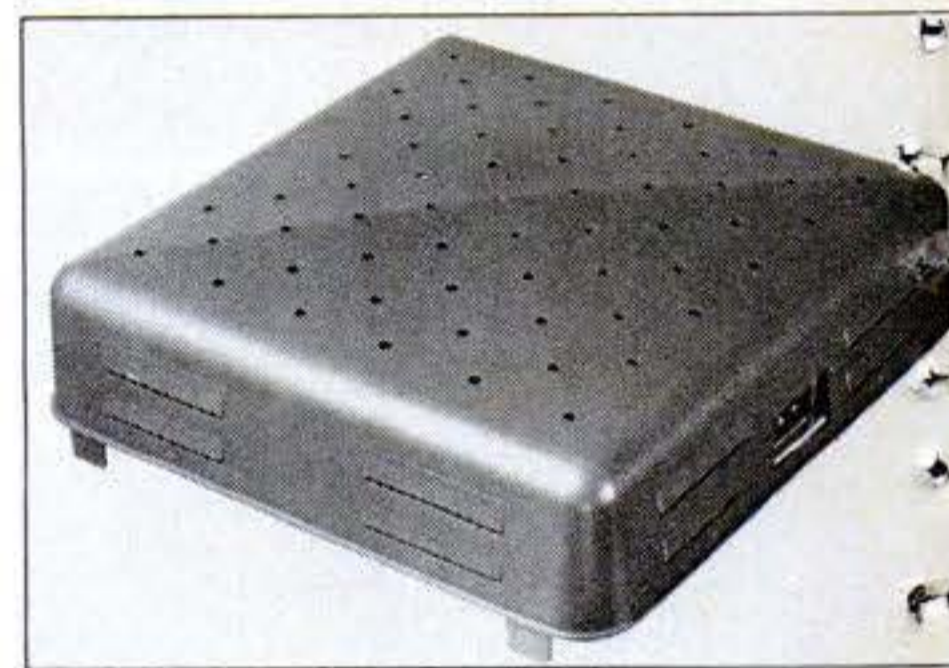


Laser phone

Short of change? Just insert the Phonocard, and lasers read the coded holographic pattern to see how much credit is left. This amount is displayed, then changes as the lasers melt off credit strips on the card during the call. The computerized system is made by Sodeco-Saia of Geneva, Switzerland.

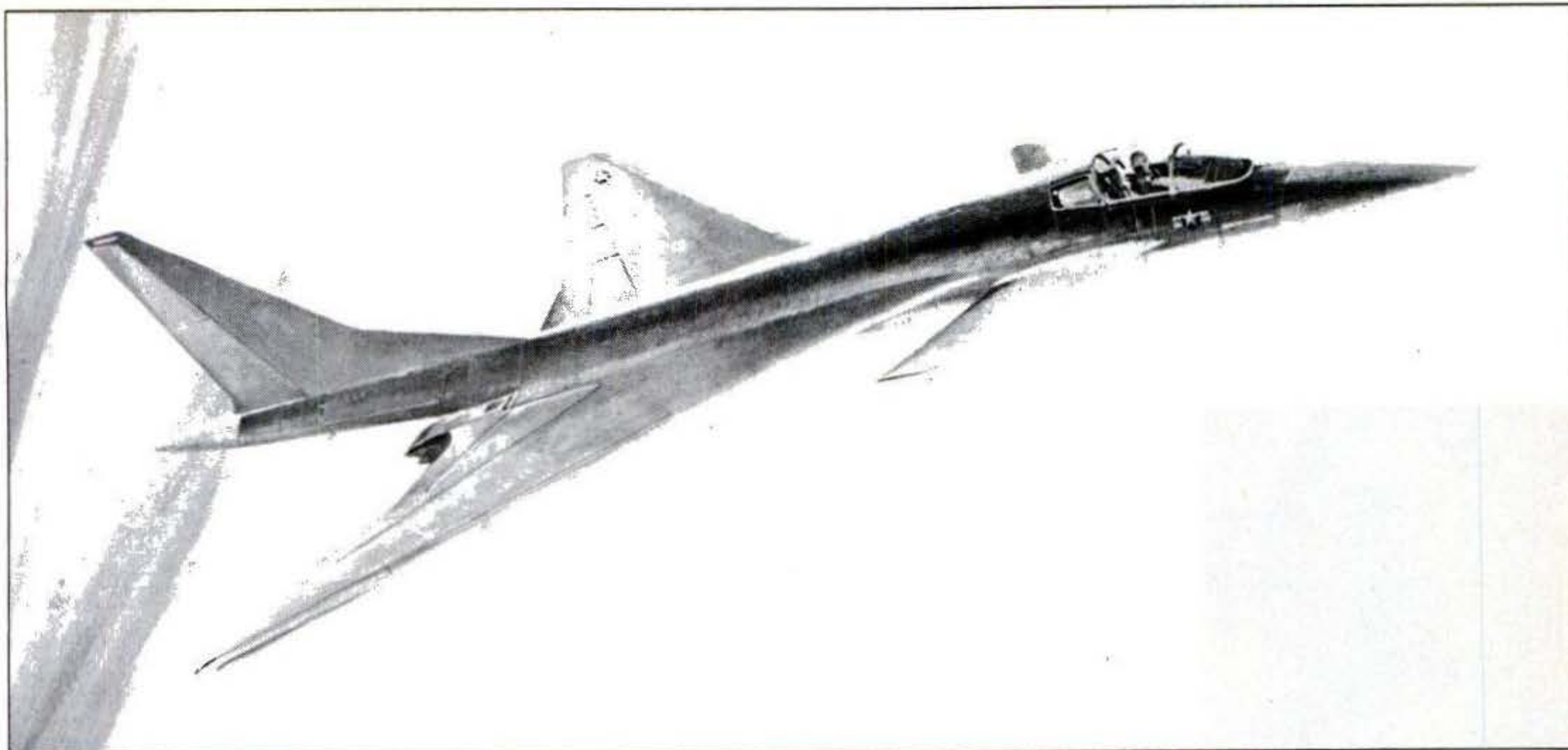
Mildew fighter

Damp air flows into Jack's Air-Dryr 1000, and warm, dry air flows out. Convection causes the airflow, so the unit uses little power. Its 165-watt heating unit is encased in a 14-sq.-in. plastic box. Price: \$35. From Stowline Enterprises, 811 S. 1st St., Kent, Wash. 98031.



Speed machine

Landbound but jet powered, the 7,500-lb. Thrust 2 is built to exceed 650 mph. Its Rolls-Royce Avon jet—once the power plant for the Lightning fighter—accelerates the car to 100 mph in 3.5 seconds. The British sponsors say the 25-ft. racer will break the official land speed record.



Four-wing jet

Civilian aircraft of the next century may borrow features from this advanced-technology fighter. Instead of a conventional horizontal tail elevator, it has two stubby canard wings just aft of the cockpit. The main wings have a variable camber: Their shape can be changed depending on the mission. A 6.7 percent scale model, designed by Grumman, is now being tested in the Air Force's supersonic wind tunnel. The full-size version should be able to circle 360 degrees at supersonic speeds.

Unique watch

Mounted on a matchstick-size bar of 18-karat gold, the moving parts of this \$5,000 Golden Bridge watch mesh with clockwork precision. Corum used miniaturization technology to fit a Swiss clock's straight-line movement into the tiny watch's sapphire crystal case.



Solar gas station

Why build a solar array in a Chicago filling station? So the sun can run the pumps, of course. In full sun, the 600-sq.-ft. array produces five kW of power for pumping gas—and charging backup batteries. Amoco is using the Solarex array for research and public education.



Semi sleeper

When this truck cab flips its lid, it deflects the wind. When fully raised, the hinged, hydraulically operated panel also makes room for an upper bunk with built-in curtain. The advanced cab was built by Motor Panels, Holbrook Lane, Coventry CV6 4 AW, England.



Versatile vehicle

Folding down the extra, rear-facing seats in the Matra Rancho creates a huge, 77-cu.-ft. cargo space. The front-wheel-drive car has a 1.4-liter, 80-hp engine and 8.5-in. ground clearance for limited off-road use. Peugeot's Talbot (formerly Chrysler's Simca) makes it.



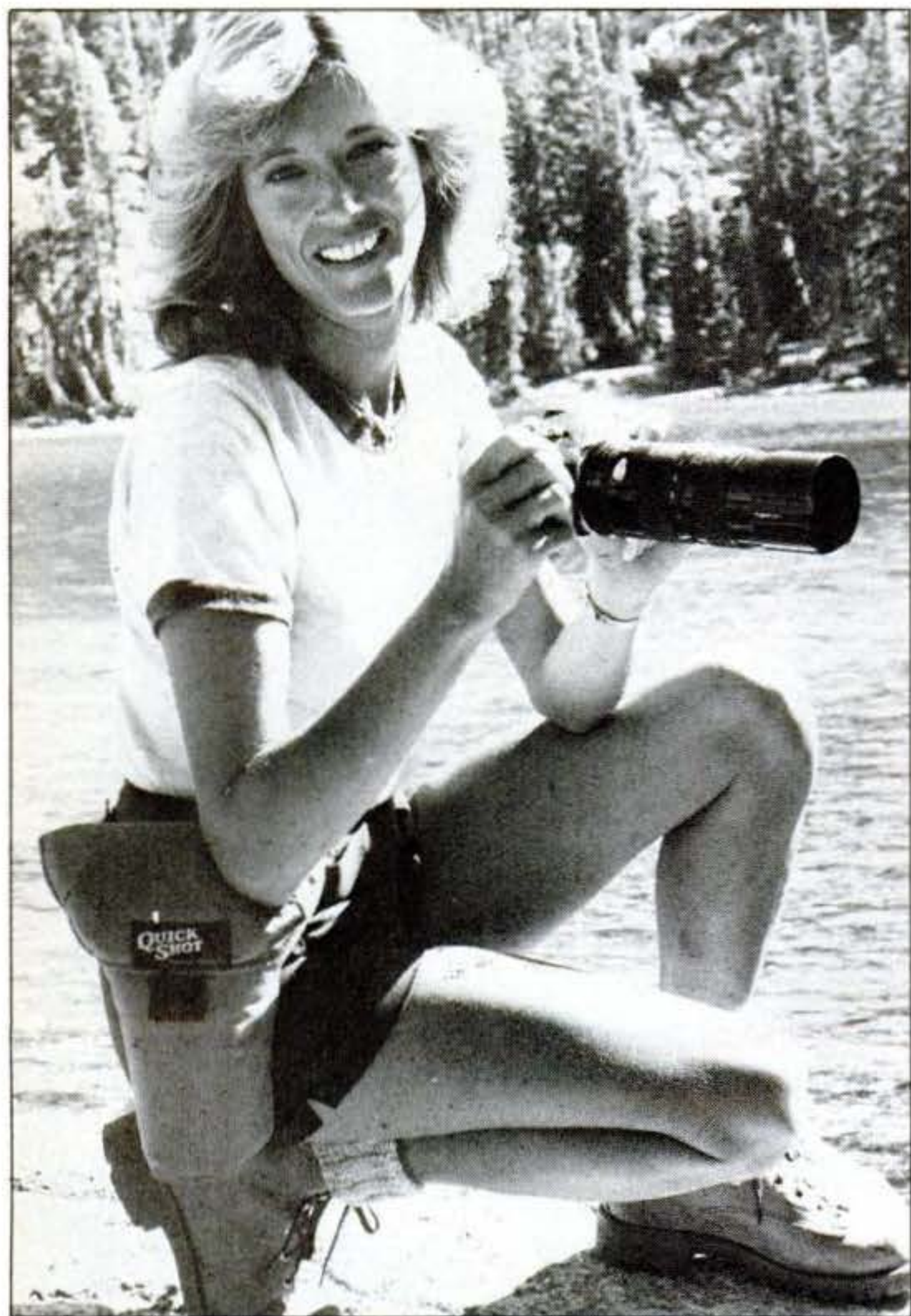
What's New IN PHOTOGRAPHY

BY E. H. ORTNER



Shock absorbers

Bumps and shocks are absorbed by the Lowepro lens cases' 3/4-inch foam walls; dust and moisture are sealed out by a drawstring. The cases hook to your belt or hang from a shoulder strap. Prices: \$14.50-\$29. Lowepro Alpine Systems, 802 S. Public Rd., Lafayette, Colo. 80026.

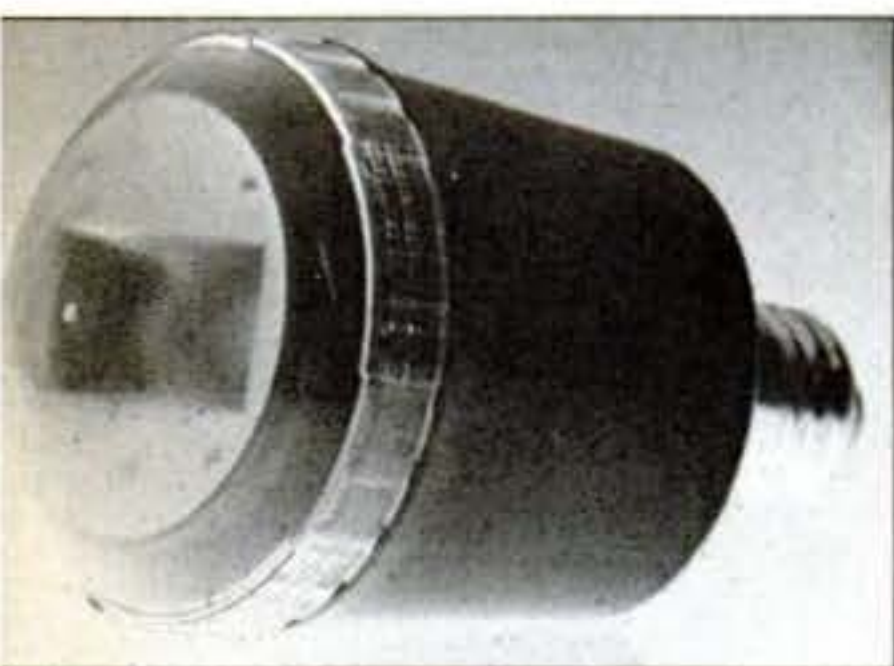


Padded pack

You're always ready for a quick shot with the Quick Shot Zoom Pack, designed for SLR's with 80-210 lenses attached. A belt holds the padded nylon pack to your waist or chest. Price: \$29.95. Maker: Richmond-Merritt, 1611 S. Pacific Coast Hwy., Redondo Beach, Calif. 90277.

Over/under strap

Do you carry two cameras at once? Or a camera and binoculars? The Comfortstrap II holds them securely, one under the other. The adjustable cowhide strap sells for \$18.95. Maker: Hervic Corp., 6910 Hayvenhurst, Van Nuys, Calif. 91406.

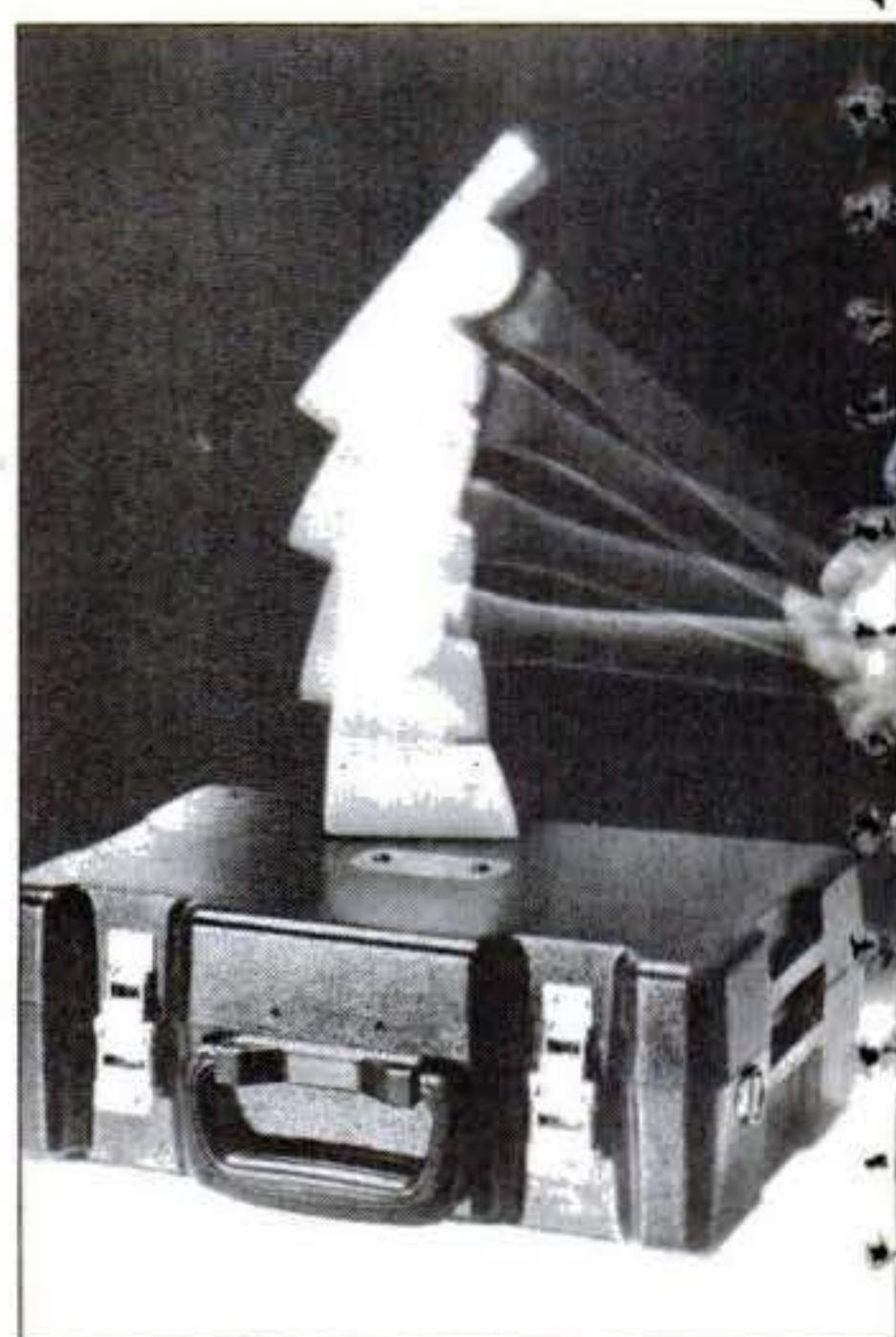


Slave flash

Screw it into a standard AC lamp socket—no batteries needed—and the Slavemate slave flash is ready to go, firing when your master flash goes off. It's the size of a 100-watt bulb, weighs seven oz., costs \$26.95 from Spiratone, 135-06 Northern Blvd., Flushing, N.Y. 11354.

Tough case

Molded Lexan makes it tough, padlockable latches make it secure, and a modular design makes it expandable—which is how the TSE case gets its name. Three sizes are \$75, \$80, \$85. A 3 1/2-in. expansion module is \$45. TSE, Inc., 340 Crooked Lane, King of Prussia, Pa. 19406.



Motorized 35

Smallest automatic-exposure 35-mm camera with built-in motor wind, the Agfa Optima 935 is a pocketable 4.4 by 2.5 by 1.3 inches in size. A motor drives its f/2.8 39-mm lens into position when you press a button to uncover it. Shutter speeds: 1/30 to 1/1000 sec. Price: not yet set.



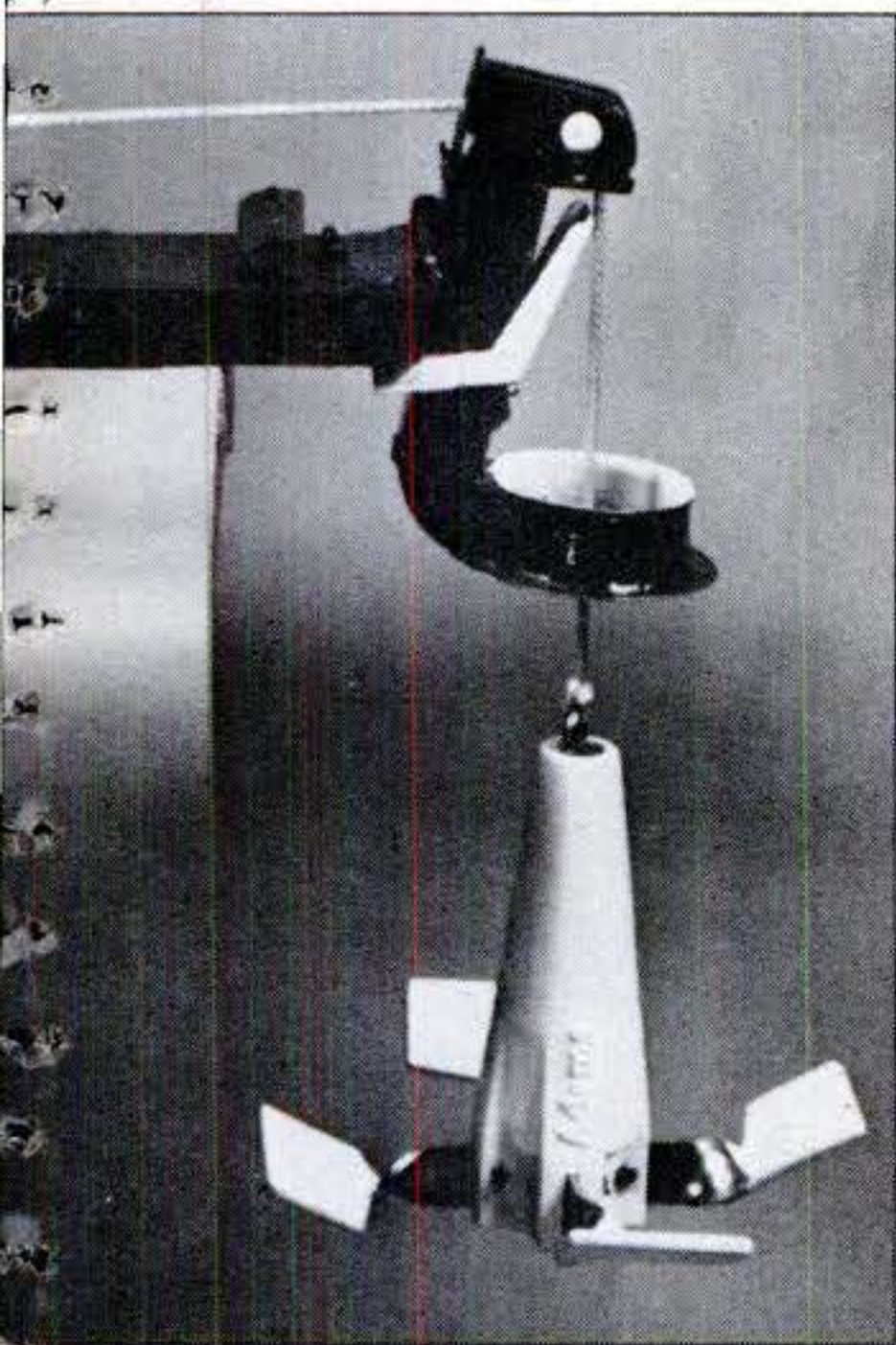
What's New IN BOATING

BY SUSAN RENNER-SMITH



Little tug

Nostalgia-inducing yet practical, the 26-ft. Red Apple gets about 13 mpg with its 36-hp Volvo engine. The tug's semidisplacement hull makes it stable even in rough waters, says Nordic Tugs (Box 314, Woodinville, Wash. 98072). The tug sleeps four. Price: \$28,000 to \$40,000.

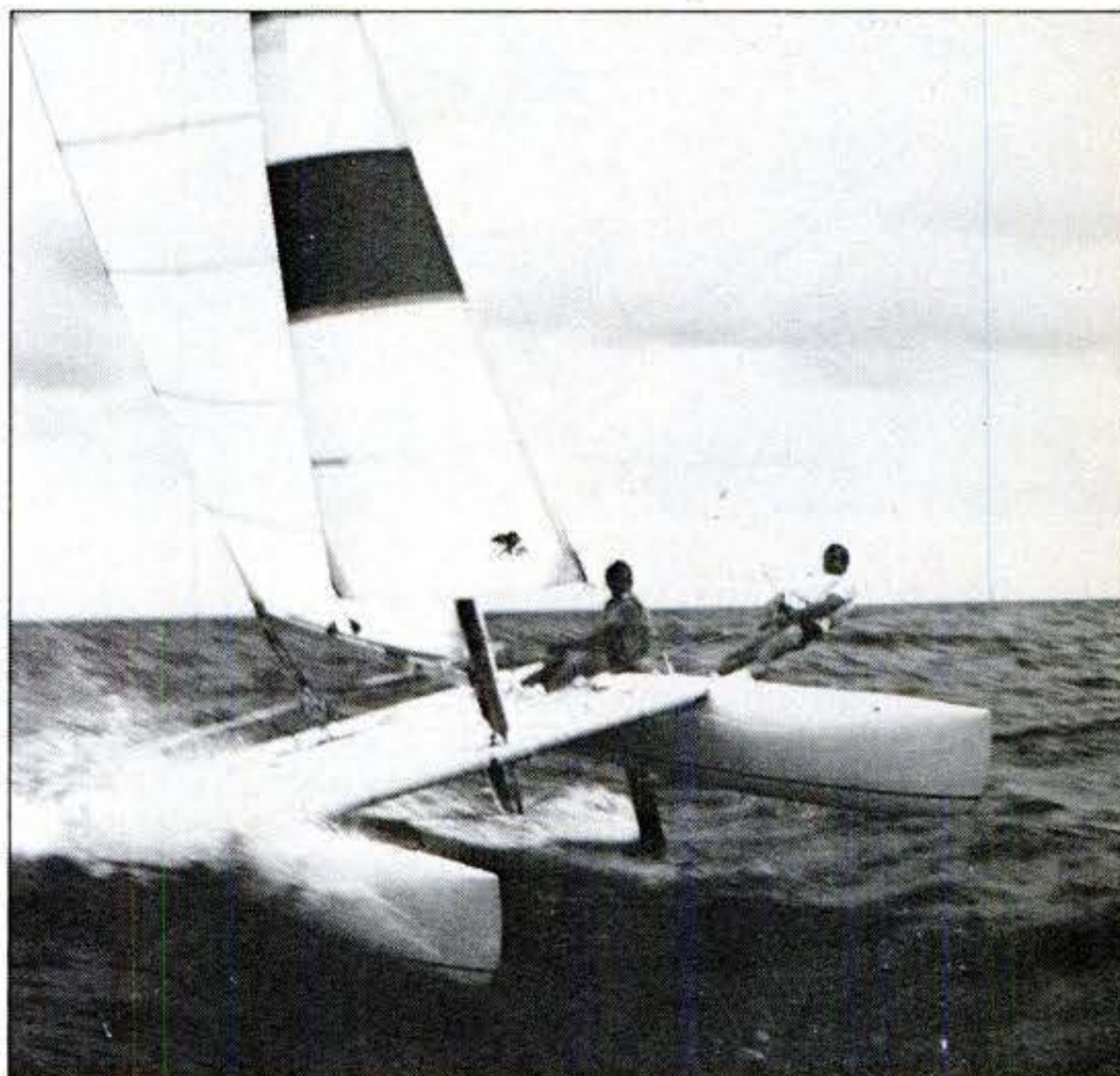


Agile anchor

Snagging's no problem with the Adams anchor. A sharp tug on the line, and an interior mechanism pushes the flukes down to free them. A retractor then pulls the anchor back into the bow mount. Adams Anchor Systems, 8555 Zionsville Rd., Indianapolis, Ind. 46268. \$105.

Fastest cat

Rocketing along at up to 22 mph, the Super Cat's slim, elliptically shaped 20-ft. hulls plow through the water with minimum drag. The 400-lb. craft has been officially rated the fastest of 54 production multihulls. \$9,280. Super Cat, Box 10184, Riviera Beach, Fla. 33404.

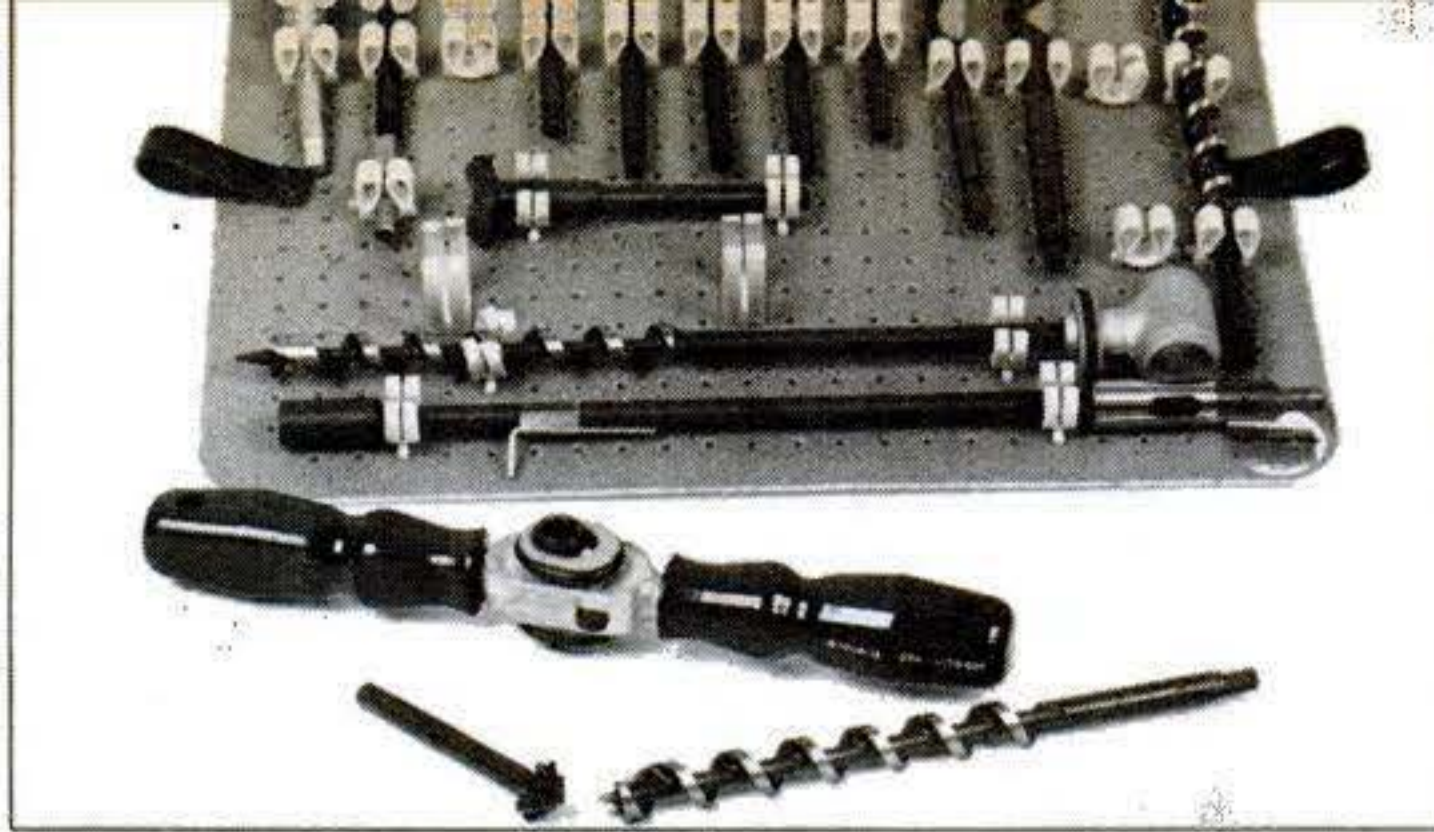


Little wheels

Aboard small boats, steering wheels are more than a convenience. They can improve safety, since a pilot amidships may help a small boat sit better in the water. Two new units from Teleflex Marine (155 S. Limerick Rd., Limerick, Pa. 19468) are designed especially for small boats. The steering system for inflatable boats with rigid floorboards (far left) stands 22 in. tall. Releasing four clamps removes the portable unit. Price: \$200. The welded-aluminum steering console (left) will fit most small open boats. The console kit comes with an XL 50-mph speedometer, and other gauges are available. Price: \$225.

What's New IN TOOLS

BY PAUL BOLON



Boring system

You can drill holes with the Compact System's double-handle ratchet and bits (or use a regular brace or electric drill). Bits include screw-point augers, expansion bits, and countersinks. The German-made tools are sold by Automatic Lubrication, 2736 Tanager Dr., Wilmington, Del.

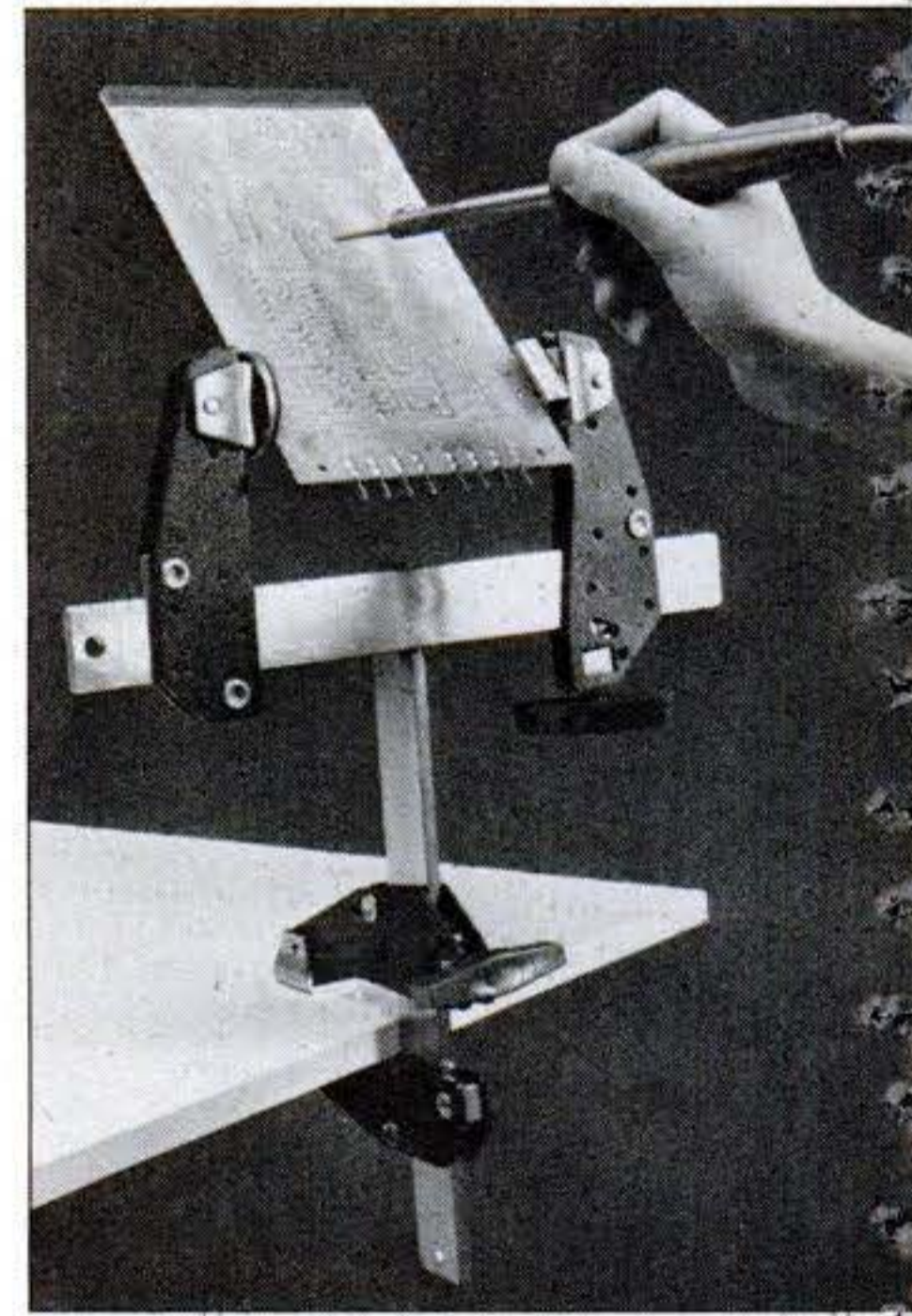


Square fence for table saws

The T-Square saw fence will convert your table saw into a precision cutting tool, claims Biesemeyer Tools (216 Alma School Rd., Suite 3, Mesa, Ariz. 85202). A single cam-action handle snaps the fence securely parallel with the blade. (Alignment is a weak point of many table saws.) In addition, a tape measure on the guide (see inset) gives accurate readings to speed setups. The maker says that T-Square's rails and guide can be fitted on any shop-size table saw in about two hours. A unit with 50-inch-long rails costs about \$240.

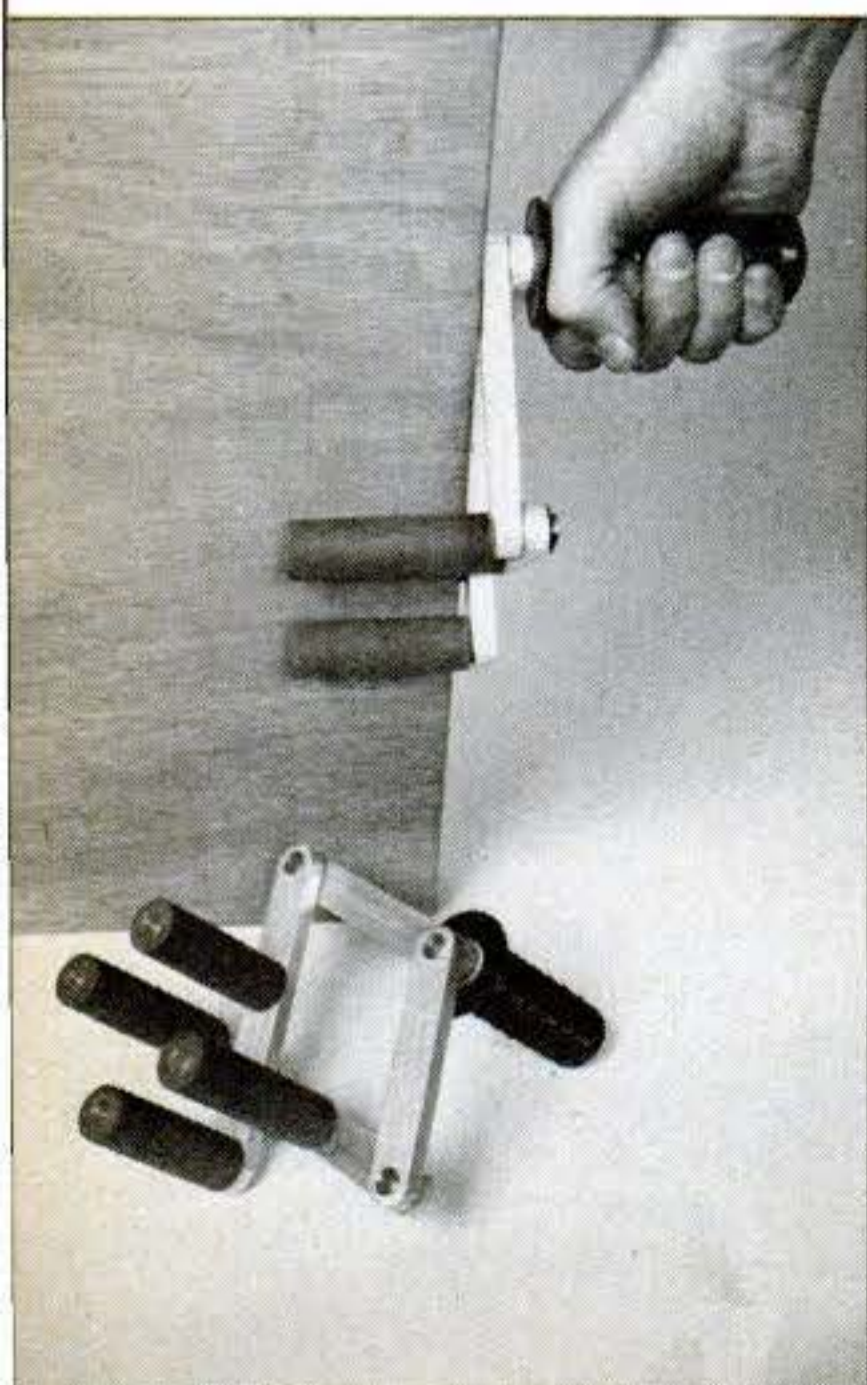
Table vise

Just light hand pressure on Jet Clamp's sliding jaws positions most objects for convenient table-top working, says Dollar Trading (20-28 Backus Ave., Danbury, Conn. 06810). Quick-adjusting jaws also can be reversed to stretch and hold flexible materials. Price: \$31.50.



Belt cleaner

Clean dust and gum from sanding belts with Nu-Life belt cleaner and they'll last up to four times longer, says Abrasive Service Co. (Box 126, Unionville, Conn. 06085). Three 1¼-by-1¼-by-five-inch sticks cost \$14.



Helping handle

It's no hat rack; it's Handy-Port, a Swiss-made tool for carrying plywood, gypsum board, or other sheet materials. Rubber-covered fingers accept panels up to two inches thick, says Colonial Saw (100 Pembroke, Kingston, Mass. 02364). It has a 220-lb. capacity. Price: \$75 a pair.

Wiring kit

You can tackle most home wiring jobs with these four tools from GE: wallboard saw, crimping pliers, tool pouch, and screwdriver with interchangeable bits. The crimping tool cuts bolts as well as cutting and stripping wire. Price for the four: about \$28.



What's New

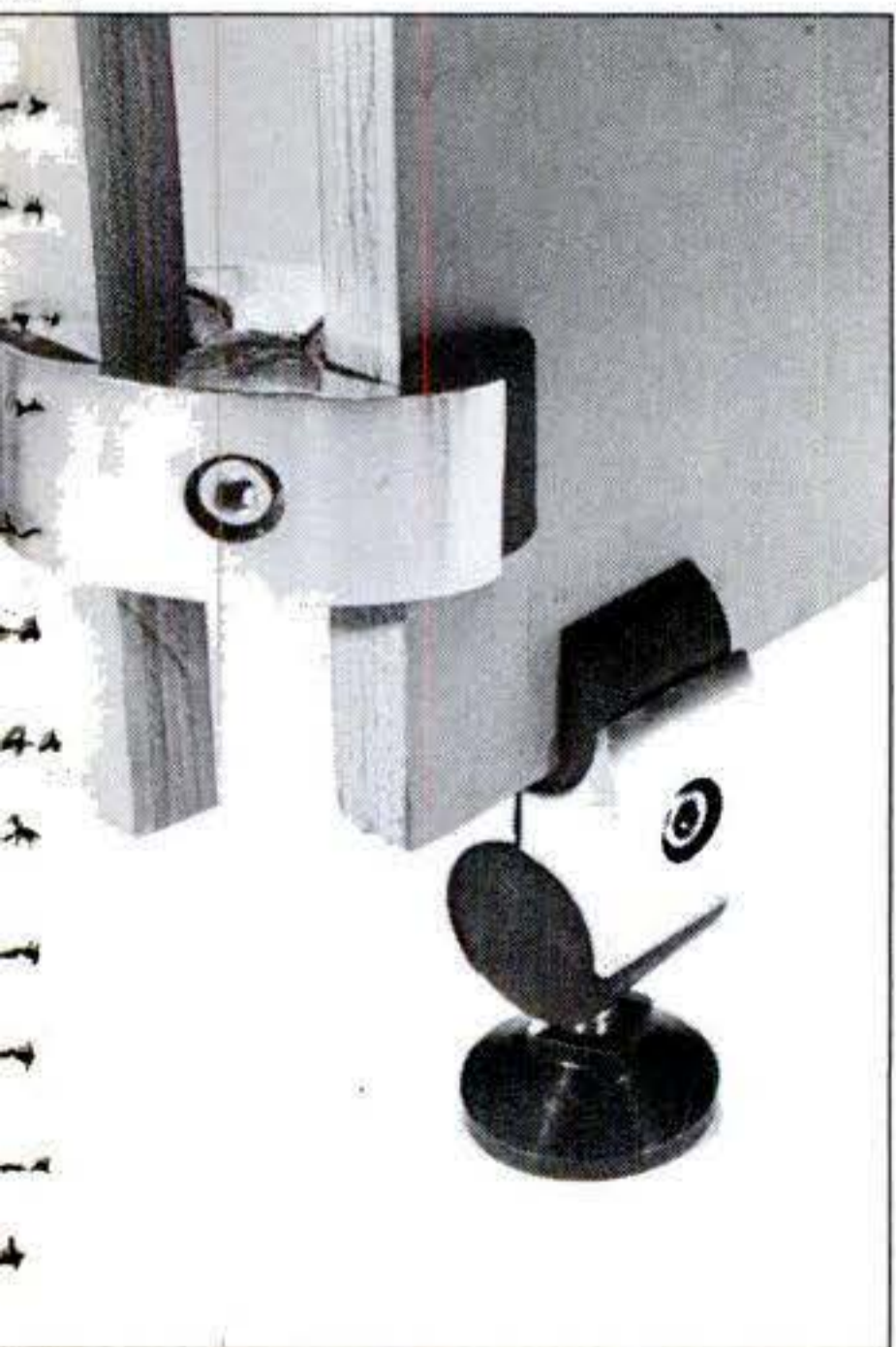
IN HOME IMPROVEMENT

BY PAUL BOLON



Springy sprinklers

Flexible nipples absorb kicks and stomps to protect the sprinkler heads and main lines of lawn-watering systems. The plastic units won't freeze or become brittle, says Multi-Flex Corp. (7561 S. Wynford Dr., Salt Lake City, Utah 84121). They fit all common pipe sizes.



Vinyl planks

Peel, position, and press—that's all you do to install Armstrong's wood-grain-pattern vinyl flooring. Bottoms of the self-adhering strips are preglued and covered with a paper backing. Two-plank and four-square-parquet designs are available in two colors. Price: \$3 a sq. ft.

New door

Not just a door, it's the Energy Entry System, an integrated design of door, frame, threshold, and weatherstripping. The urethane-filled door unit is made for maximum security and energy savings, according to the maker, Ceco Corp. (1400 Kensington, Oak Brook, Ill.).

Clever connectors

Create instant room dividers, picture frames, or do other decorative tricks? Rubber inserts fit into Klem Connectors' polished chrome jaws and hold round tubing or wood, acrylic, or glass from 1/8 to 3/4 inches thick. Maker: Youngstown Design Center, 435 Main, Youngstown, N.Y.

Fast bagger

RMX's through-the-deck discharge blows trimmings right into a standard trash can mounted on the back for easy disposal. The vacuum system can pick up leaves and pine needles, too, says Jacobsen. Eight-hp model with 30 1/2-in. cutting swath lists for \$1,025.



What's New IN ELECTRONICS

BY WILLIAM J. HAWKINS



Alphanumeric

Like many scanners, Bearcat 350 uses a digital display to show the frequency of the station you hear. But unlike others, it also tells *what* you've tuned to. Words such as POLICE, FIRE, WEATHER can be programmed in to show at each of its 50 channels. Made by Electra, it's \$600.



Touch entry

Just touch it—within one microsecond the 3,600 sensors in the 4-by-4-inch Touch Graphics surface determine the location and motion of your finger. The digital X-Y address can be used for electronic drawing or data entry. TASA, 2346 Walsh Ave., Santa Clara, Calif. \$980.



Color portable

Who says you can't take it with you? You can if it's the Sampo 9505 portable—AM/FM radio, cassette recorder/player with mike mixer, and five-inch-diagonal color-TV receiver are built in. The \$470 set runs on 10 D cells, AC current, or your car battery.



Light load

Along with the "big sound" from the new portable radios has come a problem—big weight. If your arms get tired before your ears do, try one of these Pioneer SK units. AM/FM stereo and cassette recorder are inside the 5.3-pound units. Price: \$199.95.

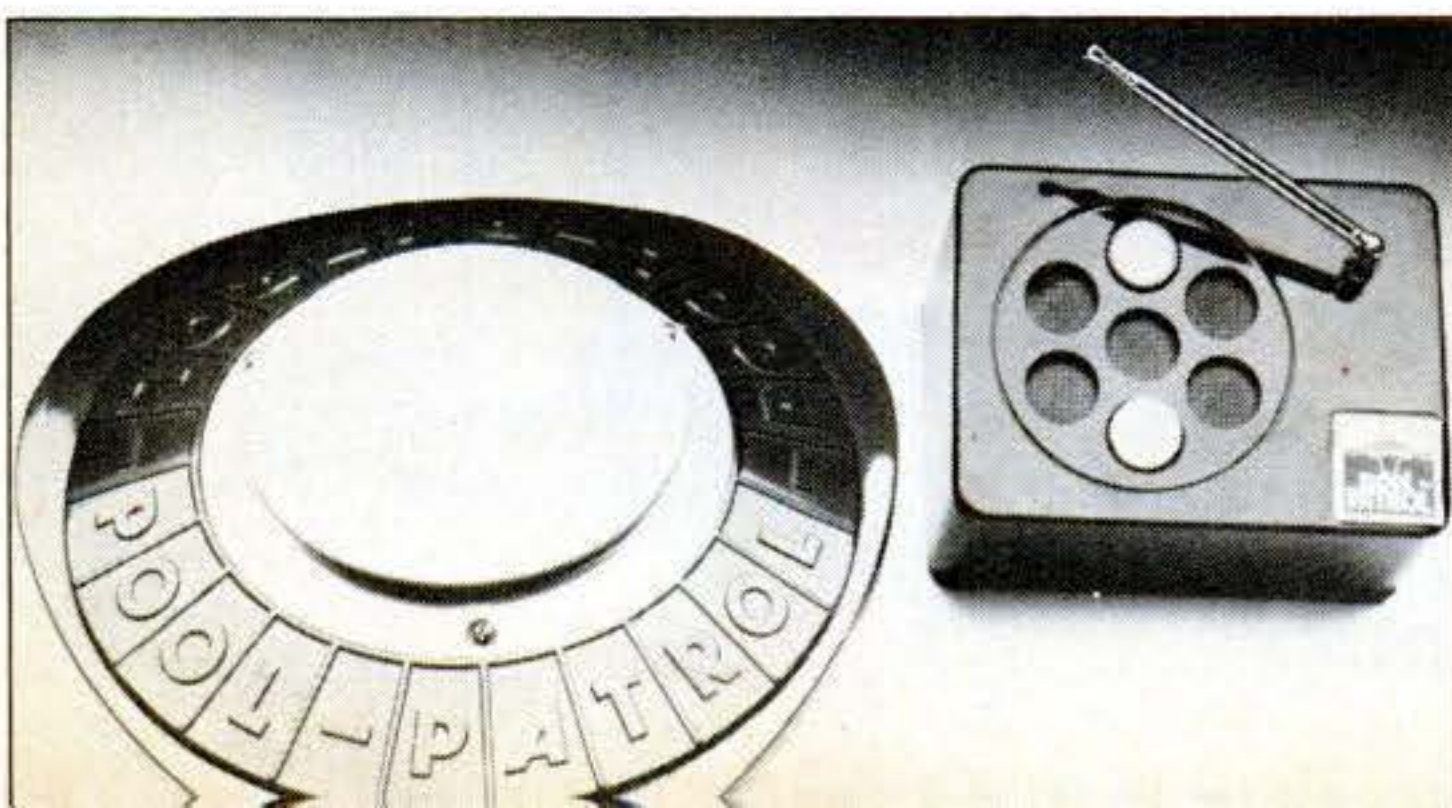
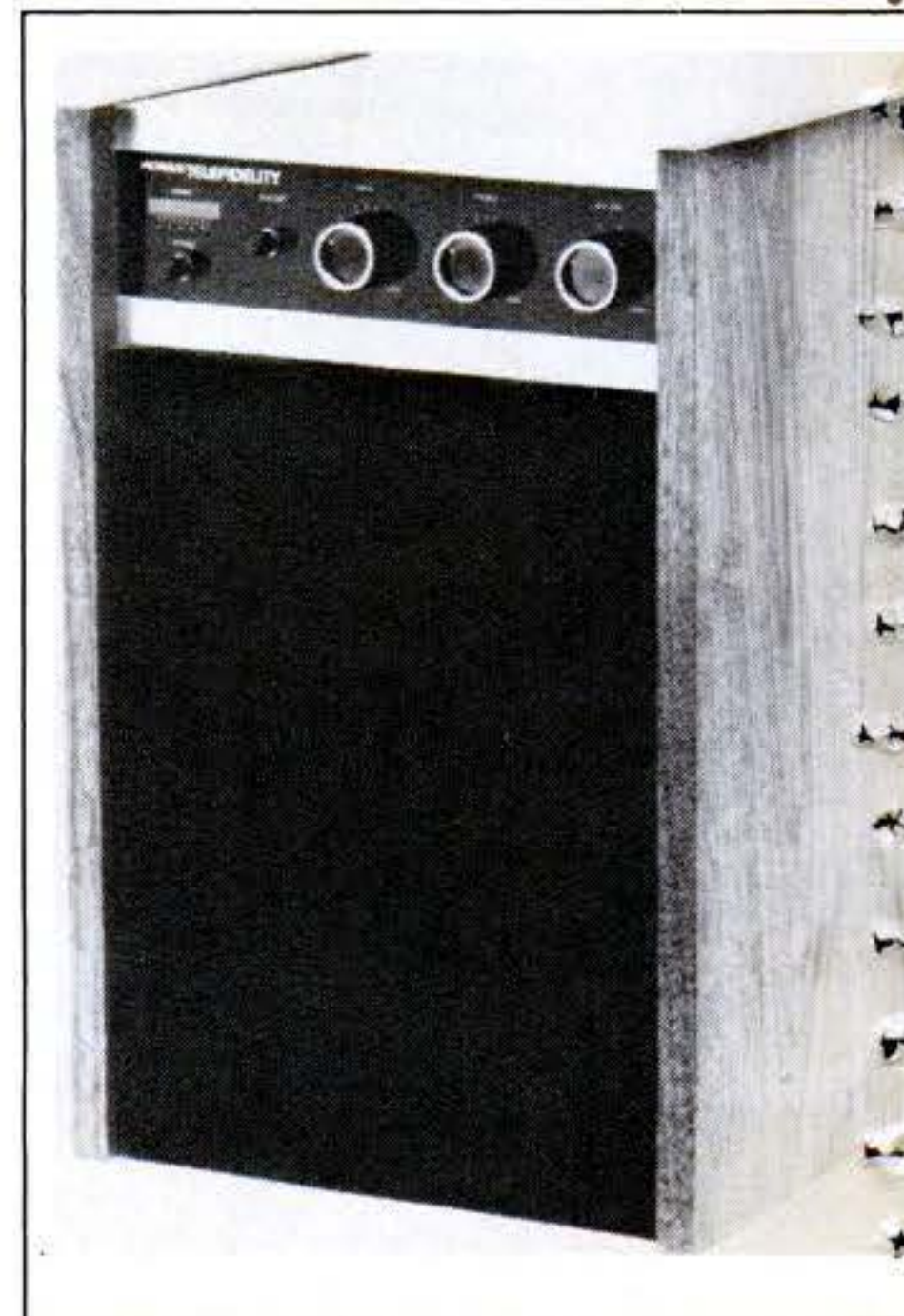
Sound maker

Rich Little can imitate any person's voice. But with the \$25 Sound Gizmo, you can match the sound of almost any *thing*. Two buttons and three dials let you control sound to produce anything from gun shots to jet noise. Fundimensions, 26750 23 Mile Rd., Mt. Clemens, Mich.



Hi-fi TV

Slip a thin copper sensor under your TV and turn on the Telefidelity adapter. The TV's audio will now come from an eight-inch woofer and three-inch tweeter inside the converter's cabinet as hi-fi-quality sound. It's \$129.95. Petrous Electronics, 415 W. Walnut St., Compton, Calif.



Pool alert

While maybe "the last one in is a rotten egg," the first one in your pool should be Pool Patrol. The wireless transmitter signals a receiver in your house if someone enters the water—on purpose or accidentally. It's \$275. ESC, 55 Ward Ave., Mt. Kisco, N.Y. 10549.

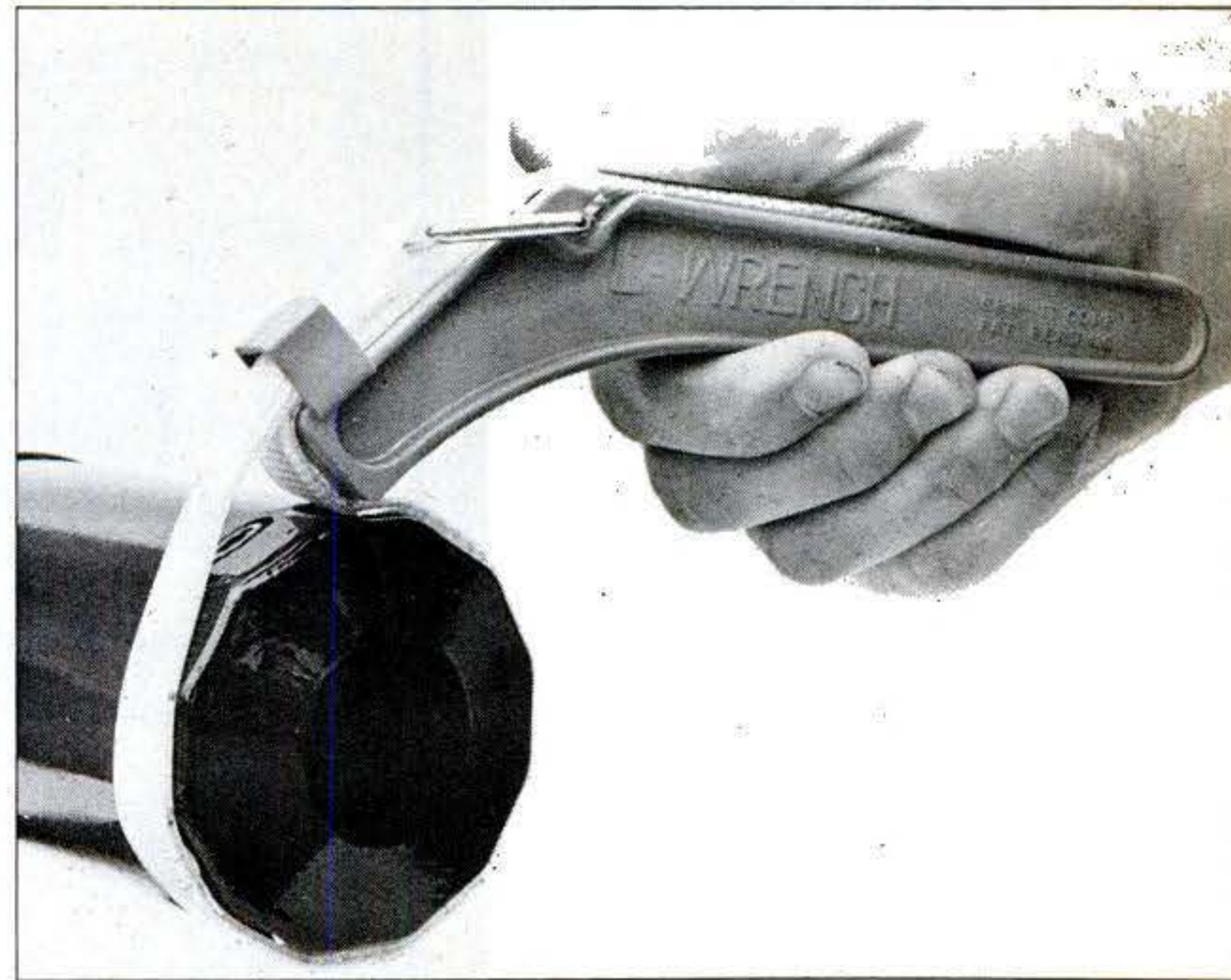
What's New FOR YOUR CAR

BY ED JACOBS



Crawler conversion

You get the go-anywhere capabilities of a tracked vehicle with the Globe Power Trax GPT-1 conversion kit. It fits Jeep, Bronco, Scout, Land Rover, and most other sports/utility vehicles. Globe Machine Mfg. Co., 701 E. "D" St., Tacoma, Wash. 98421. Price: \$7,600.

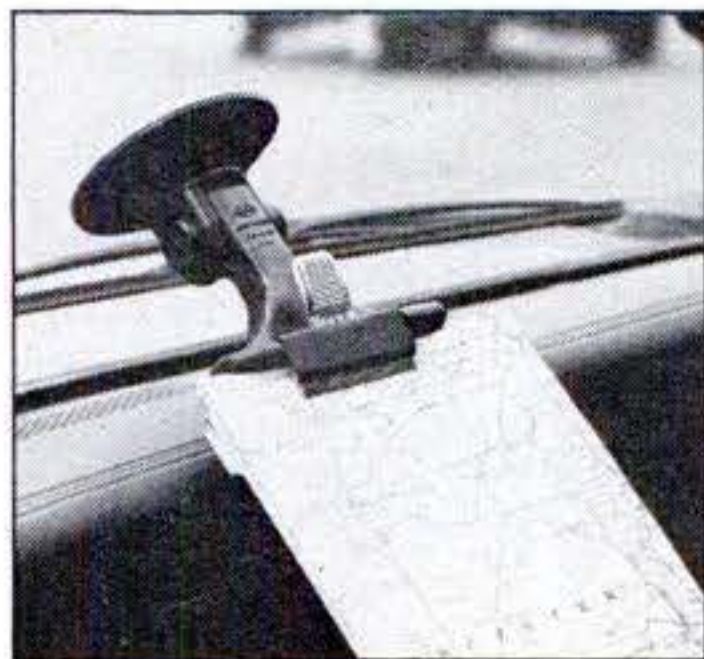


Sound safe

Audio Safe is a two-piece theft deterrent for dash-mounted sound systems. The base section replaces the stereo's trim plate, and the cover locks in place over the entire unit. It's \$39.95. Burbank Enterprises, Inc., 950-D N. Rengstorff Ave., Mt. View, Calif. 94043.

Filter wrench

By adjusting L'Wrench's urethane-coated nylon gripping strap, you can remove or install spin-on-type filter cartridges of all sizes. It costs \$3.59 at auto-parts stores or from Gripit Corp., Box 130, Intercourse, Pa. 17534.



Map holder

Just pop the suction cup of this molded-plastic clipboard onto your windshield or any smooth surface to hold maps or directions where they're visible. Atrali Accessories Ltd., Anglian Rd., Redhouse Industrial Estate, Aldridge, W. Midlands WS9 8EP, England.

X-car levelers

Monroe's Load-Leveler LL-419 shock absorbers—the first of their kind for GM's X-car series—are said to counter rear-end sag, bottoming-out, and instability when the car is fully loaded. (They're not designed to increase maximum load, however.) Price: \$51.95 each.



Pickup sleeper

Cubby Cab fits any full-size pickup, seats two adults, converts to a bed, and has a removable padded floor. It's lockable, has its own lighting, and is carpeted on all interior surfaces. Price: \$1,098. Universal Systems, Box 3467, Logan, Utah 84321.



Copyright



'81 camping vehicles

—sleeker and lighter

New materials, streamlined looks, and fewer conveniences give RV's more mpg

By HERBERT SHULDINER

LOUISVILLE, KY.

"It sure doesn't look like a Winnebago," an RV dealer said to me as we stood examining the new Warrior motor home during the annual Recreational Vehicle Industry Show at the Exposition Center here last December. And it's easy to see why when you look at the low, sleek motor home shown above and compare it to older Winnebago motor homes.

The Warrior is perhaps the most dramatic example of the new generation of lighter, streamlined, more fuel-efficient RV's introduced at the show. However, while more fuel efficient than older models, the higher-mpg camping vehicles merely belong to an intermediate generation—soon to be replaced by an even more economical class of motor home and trailer.

"Eventually, as new chassis become available," says Winnebago Chairman John K. Hanson, "future motor homes will deliver even greater fuel economy."

Meanwhile, Winnebago has introduced Warrior and its twin, Itasca Spectrum, both about twice as fuel efficient as most of today's motor homes.

How was it done? Principally by severe weight reduction: foam-core doors, smaller holding tanks, lighter appliances and furniture, and a new, lightweight, Chevrolet motor-home chassis. The result: a 4,600-lb. weight reduc-



Compact, utilitarian interior (above) of Winnebago's 22-ft.-long Warrior motor home is a hint of things to come in RV design. The design of the sportier, lighter Warrior (top) sacrifices interior space for better fuel economy. Prices start at under \$18,000.

tion over conventional motor homes of similar length, Winnebago claims. Yet inside, Warrior provides ample head room, storage space, and lots of other conveniences.

Just as Detroit is pinning its hopes on smaller, more fuel-efficient cars for a sales revival, RV makers are desperately hoping to entice customers back into their showrooms with this type of high-mpg camping vehicle. **PS**



OUTDOOR RECREATION
EQUIPMENT



Compact, 17-ft. Quantum 5 fifth-wheel trailer from Contempo (left) is designed for towing by small pickups. It sleeps four and has full galley and bath. Price is \$9,200. Tiny, 12-ft. Contempo Condo travel trailer (below) can be towed by compacts; it's only 1,375 pounds. Condo sleeps two kids and two grown-ups, has a galley and dinette. An optional chemical toilet is available. Its all-fiberglass body is easy to care for both inside and out. Condo costs \$4,900.



Trio of lightweight RV's: Diamond G.T. XL (left), Coleman Niagara II camping trailer (above left), and Prowler LT travel trailer (above). The 20-ft. Prowler from Fleetwood Enterprises has many weight-saving and aerodynamic features that improve fuel efficiency, including lighter-than-glass acrylic windows, horizontally mounted aluminum LP tanks, and an ultra-light chassis. Base price: \$6,295 f.o.b. Modular Niagara II lets you equip camper with as many convenience features as you want. Price range: \$2,395-\$2,595. Lightweight Diamond 23-ft. mini motor home features honeycomb construction and slippery styling that help deliver about 15 mpg, the company claims. Price is about \$21,800.

Weekender sloop

Build it for under \$800

Smart sailing craft has a cozy little sleeping cabin for two

By **SUSANNE and PETER STEVENSON**

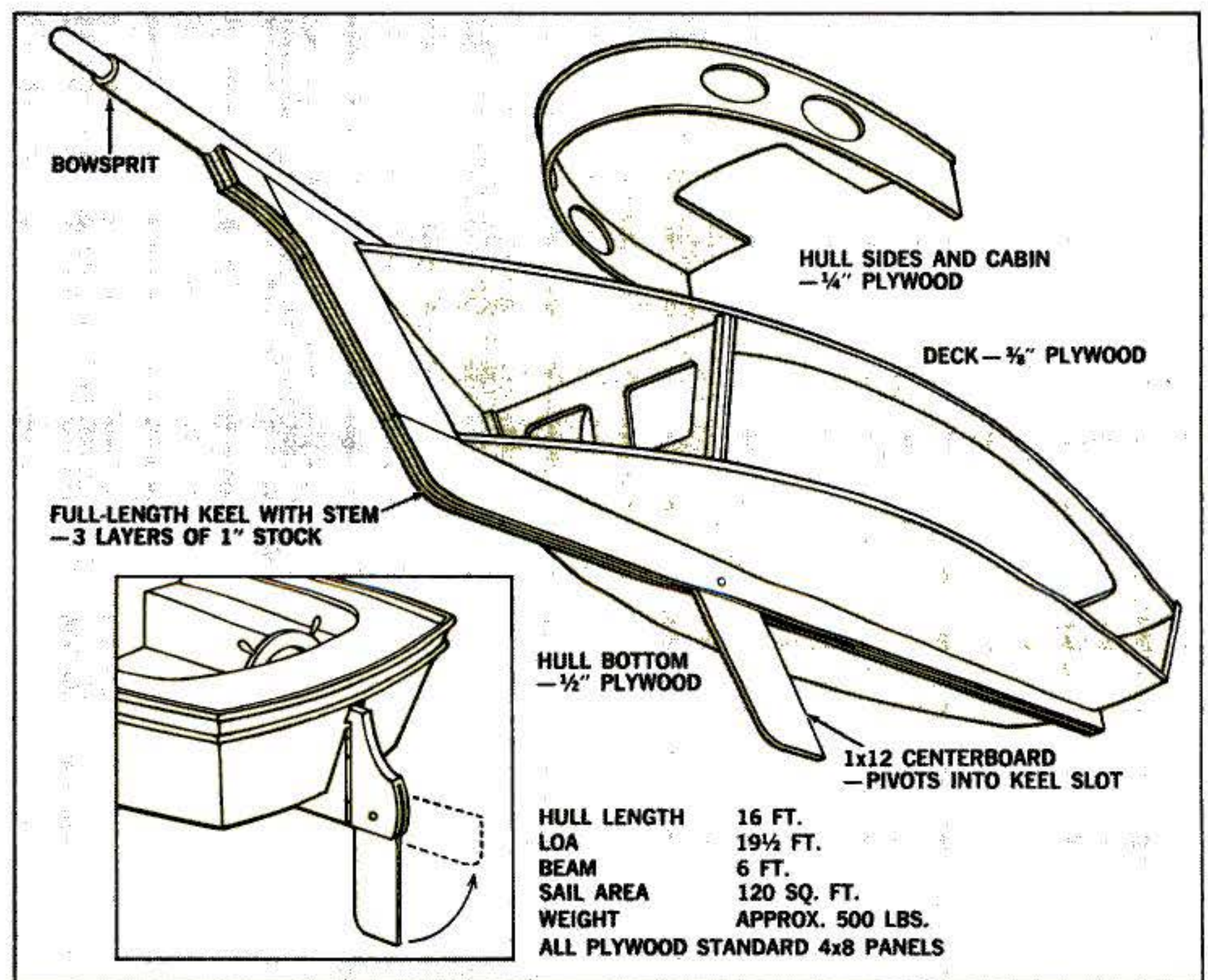
PHOTOS BY THE AUTHORS

DRAWING BY ADOLPH BROTMAN

To create a traditional craft at untraditional cost—that was the challenge we faced when designing this cuddy-cabin camper. The result is an easy-to-build, lightweight version of the classic fishing sloop that first sailed out of Friendship, Maine, a century ago.

Our Little Friendship is as handsome and nice-handling as its namesake. This swift-sailing little sloop paces conventional craft. Yet even beginners can manage its 120 sq. ft. of sail, thanks to self-tending lines on jib and mainsail. And its roomy cuddy lets two people camp overnight on the water—or even on the road. The craft is light enough to be trailered behind today's smaller cars.

You can build the weekender sloop with common tools, using standard lumberyard stocks. The mainsail boom and gaff, for example, are banister railings. The mast and removable bowsprit are stock full-round moldings. The mast hoops that fasten to the sails are slices of PVC pipe. Mast stays and shrouds are tensioned, not with costly turnbuckles but with traditional deadeyes—hand-shaped wood blocks. Even the salty-looking wheel is handcrafted from lumberyard spindles, plywood, and 2×4's. The whole boat, including paint, sails—even carpeting—should cost you well under \$800. **ES**



Don't be fooled by the snug size and easy construction—this is a versatile boat for active people, as the photos on the facing page demonstrate. Clockwise from top: For beaching, its keel-mounted centerboard kicks up and out of the way. When under sail, the club-foot jib makes tacking a simple matter of spinning the wheel, and the gaff-rigged main keeps heeling to a minimum. Yet the sloop can also be rowed more easily than a dinghy, thanks to its full-length keel. The craft needs no auxiliary motor, even when maneuvering in crowded anchorages. The carpeted cuddy has plenty of sprawling room, because of the sloop's flat bottom. The cabin has sleeping room for two. There's extra stowage and room for a portable head extending back under the cockpit seats. The cockpit also has storage space under aft sections of the seats and in the lazaret. The craft is not

only seaworthy and comfortable, it's simple to build. The sails, for example, need no sewing. They're cut from the heavy-duty, woven polyethylene that's sold for tarpaulins. These sun-resistant plastic sails proved rugged aboard the Mini-Cat [PS, Feb. '80]. The hull's flat bottom makes it easy to assemble (above). In cross section, the hull is a tapered plywood box that's self-aligning as you build. The laminated keel has a slot for the pivoting centerboard. When underway, both the keel and kick-up rudder can be locked in position from the cockpit. The steering system is also simple—it's a cable control that links the wheel directly to a hidden tiller. For detailed plans, including step-by-step drawings and a materials list, send a \$10 check to Stevenson Projects, Dept. W-10, Box 584, Del Mar, Calif. 92104. Make checks or money orders payable to Stevenson Projects.



Exotic new materials
in today's

outdoor gear



Hikers at rest: He's wearing a Klimate rain parka from Back to Basics and Danner hiking boots with the original waterproof and breathable material, Gore-Tex. The Gore-Tex is laminated to the gold-color fabric on the ankle, sides, and tongue of the boot. She has on a pair of San Marco polyurethane-shell boots from Vasque. Inside the boot's plastic shell is a lining of leather and insulating foam. These boots are too stiff for normal hiking; they're better suited for more rugged climbing. Her parka from Camp 7 has a Gore-Tex outer lining and is filled with Thinsulate insulation. Thinsulate is also available in sleeping bags from Great Iron Works and in kits for parkas from Frostline. Three of this year's new tents are pitched in the photo at right. Two of them are saddle-shape, family-size models by designer Bill Moss. The tent at rear left is from Moss Tent Works. It has a breathable inner nylon shell covered by a waterproof fly stretched over the poles. The other saddle-shape tent is Coleman's Genesis, which has a new fabric, Evolution 3. The maker says this stretchable fabric breathes better than nylon, yet is still water-resistant in heavy rain. The blue tent in the foreground is Camp 7's Royal Arch. It will shelter two or three people and weighs a transportable 5½ lbs. The tent is semi-free-standing with poles designed to absorb strong gusts. Early Winters' Silver Lining bag (foreground) has a reflective lining inside to save the body's radiant heat.



Improved parkas, boots, tents, and more—to take the chill out of winter

By PAUL BOLON

A synthetic fiber twice as warm as goose down? A tent fabric in a boot? Plastic underwear? Our survey of new camping gear has turned up all this—and more. New materials—and new applications for older ones—seem to be appearing with greater frequency each year. And makers are using them in imaginative ways and in unique combinations to solve special problems.

The new materials are plastics: woven polypropylene; Teflon; films with reflecting, metalized surfaces; and microfibers. Gear makers claim that although not always problem-free, the new materials are generally outperforming the older standbys.

Better than down

Thinsulate [PS, Jan. '79] is an aptly named insulating fill developed by 3M, which is just now appearing in camping gear. 3M says that the new product has about twice the thermal resistance of other fills—down, pile,

wool, or fiber. Thinsulate has a much finer fiber than others and can also be packed together more densely. Researchers believe that the insulating value of the new fill is due not only to the quantity of dead air space it creates, but that friction between air and fiber surfaces plays a major role in reducing losses by convection. Since Thinsulate's fibers have more surface area per unit volume than other fills, more air is slowed or held to the fibers. A Thinsulate jacket would produce the same warmth with much less bulk than older garments.

Outer skins

Gore-Tex was the first material that was both waterproof and breathable ["Camping Gear," PS, March '78]. Now there's another product, Klimate, that does the same job, apparently in about the same way—with pores too small for droplets of water to pass through but big enough for water vapor. Klimate is appearing in parkas and tents this year. Gore-Tex has two new applications—in boots and mittens.

The Great Iron Works offers a pair of working mittens with a Gore-Tex shell to cover them. Both Donner Mountain and Danner Shoe make

Continued



Survival kit from Eddie Bauer is the first the author has seen with a stove in such a small unit. Kit also includes a plastic tube tent, solid-fuel squares, three packs of broth, a foot-long wire saw, water-purification tablets, a water bag, bandages and surgical tubing, a cooking pan, a knife, six aspirin, duct tape, waterproof matches, a mosquito net, and other survival hardware—all squeezed into its 3¾-in.-high, 4¼-in.-diameter cylinder. The hiker is toting Early Winters' Trick Pack, a full-size day pack that can be turned inside out and folded into a hand-sized pouch. The pouch can then be slipped onto a belt for out-of-the-way carrying on the way home.





boots with large panels of Gore-Tex laminations in place of leather, mostly in the side and ankle areas. The substitution of these cloth areas makes the boots much lighter. As a bonus, these boots seem to have no painful breaking-in period.

Metalized films are also appearing in new applications this year. The metal-coated films first showed up years ago in survival blankets; recently they've been laminated onto tent fabrics. Now the films—which keep you warmer by reflecting your body's radiant heat back to you—are being used in sleeping bags and parkas.

Early Winters' Ultimo parka combines all the new materials: It has a Gore-Tex shell, Thinsulate fill, and a radiant reflecting-film barrier. You can expect to see lots of combinations of Gore-Tex or Klimate, Thinsulate, and reflecting films in the future.

Inner skins

Plastic underwear does not evoke images of cozy warmth, but long johns, socks, and fishnet underwear made of an extremely fine polypropylene yarn are now accepted by those who are active in very cold conditions. The plastic underwear doesn't sop up heavy sweat, as do woolen or cotton underwear, which may then stay wet and turn cold. The synthetic fabric wicks water away from the skin so it can evaporate. Lifa, a Norwegian company, made the first polypropylene underwear, but other companies are now also weaving the fabric. E3

MANUFACTURERS AND SUPPLIERS

Back to Basics, 1490 66th St., Emeryville CA 94608; **Camp 7**, 802 So. Sherman, Longmont CO 80501; **Class-5**, 1480 66th, Emeryville CA 94608; **The Coleman Co.**, 250 No. St. Francis, Wichita KS 67201; **Danner Shoe**, Box 22204, Portland OR 97222; **Donner Mountain**, 2110 5th St., Berkeley CA 94710; **Early Winters**, 110 Prefontaine Place So., Seattle WA 98104; **Eddie Bauer**, Fifth & Union, Box 3700, Seattle WA 98130; **Frostline Kits**, Frostline Circle, Dept 1090, Denver CO 80241; **Gott Corp.**, Box 652, Winfield KS 67156; **Great Pacific Iron Works**, Box 150, Ventura CA 93002; **Lifa-NorthSport USA**, Ways Lane, Manchester Center VT 05255; **Moss Tent Works**, Mt. Battie St., Camden ME 04843; **Vasque Mountain Boots**, Red Wing MN 55066.



Palm-sized stove from Early Winters (left) may be the smallest one yet—handy for a trailside cup of tea. The stand folds up and fits into a pocket-sized pouch along with the alcohol burner and flame snuffer. Gott is offering a new line of polyurethane-insulated coolers (top photo) that don't need loose ice to keep your goods chilled. Instead, the coolers maintain low temperatures via a Refreeze bottle that fits into the top. You simply fill the plastic bottle with water or a beverage, freeze it, and slip it into the top. She's wearing a windbreaker with a reflecting inner liner from Early Winters. His parka from Class-5 has a Klimate shell and a wool fill.

Windows tight? Now maybe it's time for energy-saving **insulating shades**

R-values? Edge seals? Here's how to evaluate the claims before you buy

By A. J. HAND

Today, window shades are expected to do a lot more than darken the bedroom when you want to sleep late. Properly installed, even an ordinary shade from the dime store can block a lot of heat loss [PS, Jan. '80]. A specially designed thermal shade can truly insulate your windows.

Just a few years ago, there were no such things as thermal shades. Today, there are a dozen or so, with more scheduled to appear on the market. POPULAR SCIENCE covered many of the shades as they were introduced, but several have since been modified; and a new do-it-yourself kit allows you to design your own insulating shade.

Thermal shades are not for everyone. To help you decide if they're for you, we offer a number of points to look for, as well as the comprehensive table on the next page.

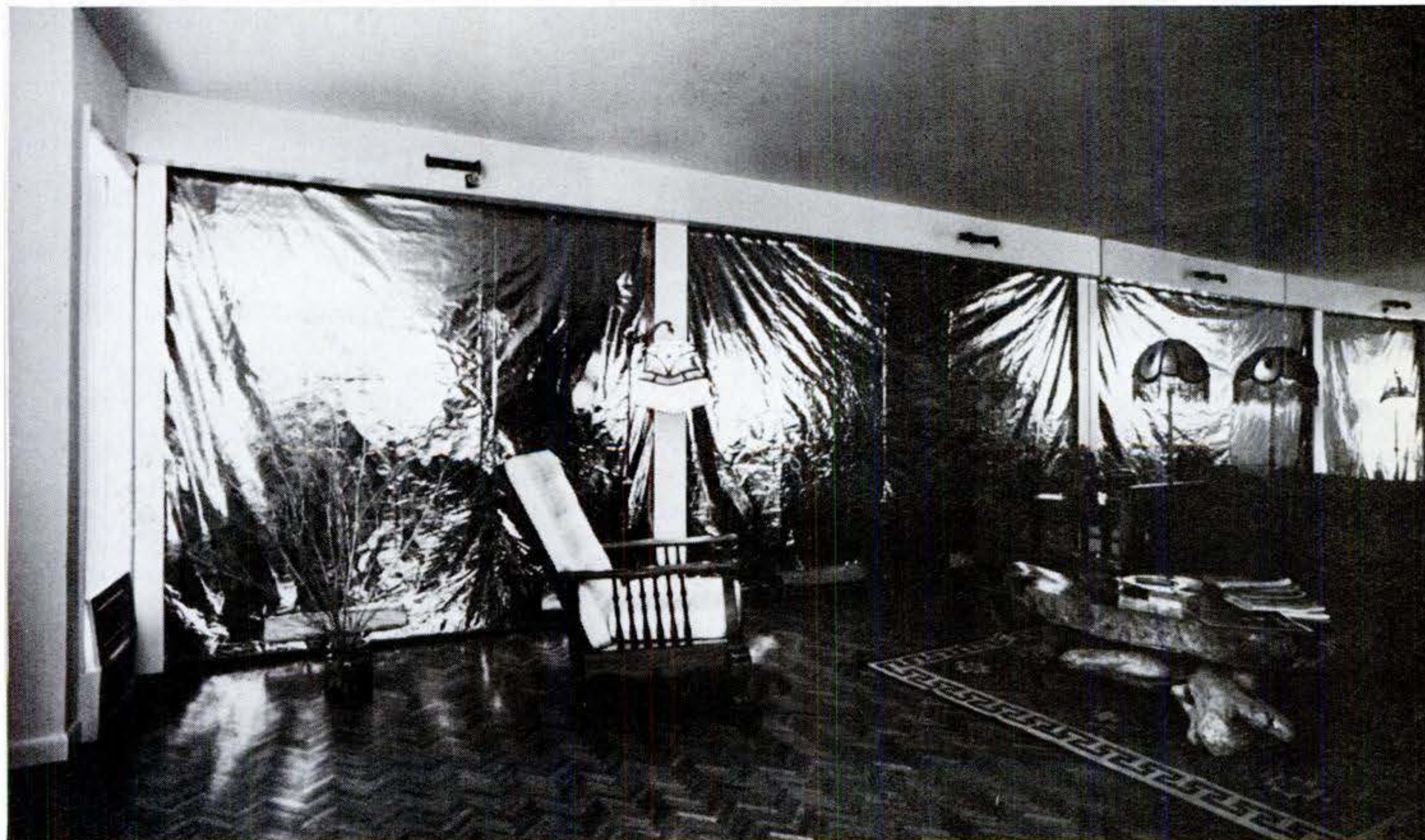
Thermal shades come in a variety of

versions, but all work on the principle that air is a good insulator. A tight-fitting shade creates an insulating air pocket that prevents warm room air from being drawn to and chilled by a cold window surface.

Most thermal shades also use some kind of heat-reflective material—usually metallized plastic film, the stuff used to reject summer heat.

Makers of translucent shades such as the N-R-G shade and the Inseal-shaid system ["Window Insulators," PS, June '78] say metallized shades

Continued



Glittering gold Curtin Wall has multiple layers that inflate when shade is pulled

down. Don't want the gold lamé look? Manufacturer will attach buyer-supplied

fabric to front of shade with Velcro so fabric can be removed for cleaning.

bounce infrared rays back into the room. (Other shade makers cover the metallized plastic with a decorative fabric or finish.) This infrared reflecting property may conserve some extra heat—though not much unless there's a radiant heater in the room. Here's one advantage of these translucent shades, however: On cloudy winter days you can pull the shades for insulation, yet still see out.

On the theory that more is better, most of the shades have multiple air-trapping layers. Shades such as Curtin Wall [PS, Oct. '79] and Independence I—formerly the IS High "R" shade [PS, Jan. '79]—have four layers

of metallized plastic that offer multiple air pockets.

An alternative approach to window insulation is to cover the window as you would a bed—with a thick, padded blanket such as Window Quilt [PS, Oct. '79].

Finally, some shades do double duty as solar collectors. Both Thermo-Shade [PS, June '78] and Curtin Wall have automatic controls that raise the shade when the sun is shining and lower it at sunset or when clouds cut off the heat. Insealshaid features a thermally controlled vent system that alternately closes and opens to trap, then release, warmed air to the room.

You can check the table for more details on the individual shades. But if you are dismayed at the prices, note the Sol-R-Shade listing. This do-it-yourself system should be a money saver when it becomes available. Components include a variety of shade materials such as reflective films, thin foams, and laminations combining fabric and film. The iron-on edge seals have self-adhesive window tracks. Clip-on bottom battens have foam strips to seal the shade against the sill. Spacers between battens hold the shade plies apart to create insulating air spaces. And the shade roller is a simple cord-operated system. All the hardware for the Sol-R-Shade is presently being imported from Japan, but there are plans to produce it in the U.S.

Who should install thermal shades? If you have not yet insulated your roof and walls, caulked and weather-stripped throughout your house, and installed storm windows, you're not ready for thermal shades. It makes little sense to spend \$4 to \$10 a square foot for thermal shades when R-19 insulation in your attic costs just 25¢ a foot and can save far more energy.

If you are ready for shades, here are purchasing guidelines.

First check R-value, the rate at which the shade blocks heat loss. Surprisingly, you're not looking for the highest possible rating. The R-value of a shade is based on the amount of heat loss it prevents. Obviously the shade does nothing to stop heat loss when it's raised during the day. So if you use a shade normally, it's impossible for any shade to cut daily heat loss through a window by more than about 58 percent.

Thus, the law of diminishing returns sets in quite quickly with window insulators. Shades with a rated R-value of 11 or 12 provide only marginally better insulation than do those with an R-value of five.

The moral? Don't spend extra money just to go beyond R-5. Exception: If you're shopping for a shade that you plan to leave closed constantly during the heating season, an R-value over five can make sense. On the other hand, if you plan to block the window off all winter, you don't need the convenience of a shade. A pop-in shutter [PS, "What's New in Home Improvement," Nov. '79] can do the job as well for far less money.

Air seals are another key checkpoint. Blocking the flow of air around the edges of a shade is a vital but tricky job. Without good seals, a shade can't prevent heat loss. Escaping warm air may also cause condensation that can damage window and sill.

Buyer's guide to insulating shades

Shade and manufacturer	R-value (winter)	Heat reduction (summer) (%)	Construction	Seals?	Cost (\$/sq. ft.)	Comments
Curtin Wall Thermal Technology Box 130 Snowmass CO 81645	9-12 plus R-value of glazing	90	Four layers of aluminized film that inflate and separate when shade is drawn	Make your own	\$4.00 and up	Motorized with thermal switch; looks like gold ripstop nylon but can be covered with decorative fabric if desired
Independence I Independent Systems Box 329 Durham CT 06442	10.7 with double glazing	90	Four layers aluminized Mylar; plastic or wood side and head frames	All four sides	\$4.75	New pull-cord mechanism is big improvement over old roller; motorized version in the works
Insealshaid Arc-Tic-Seal Systems Box 428 Butler WI 53007	5.38; see comments	80	Uses three separate shades: One absorbs heat, one reflects heat, the third has UV filter	All four sides	About \$9	Three separate shades allow the shade to function as solar collector, as a nighttime insulator in winter, and as a summer heat rejector; 5.38 R-value is nighttime mode
N-R-G Shade Sun Control Products 431 4th Ave. S.E. Rochester MN 55901	Approx. 3 with single glazing	85	One sheet of aluminized Mylar on standard wooden shade roller	Three sides	About \$2.70	Uses flexible vinyl track for side seals, heavy foam-bottomed batten for bottom seal
Sol-R-Shade Thermotech Corp. 808 Garfield Ave. Glenwood Springs CO 81601	n.a.	n.a.	Build it yourself, choosing from a variety of insulating and reflective materials; seals, roller, tracks available	All four sides	n.a.	Not yet available; performance depends upon materials you choose to use for shade; so does price
Sun Quilt Sun Quilt Corp. Box 374 Newport NH 03773	Approx. 6 with single glazing	n.a.	Thick batting with aluminized fabric outer face, decorative inner face; folds like a Roman shade	All four sides	\$5-\$9	Folds up into eight-inch pleats when opened; motorized and designed primarily for large areas
Star Shade Star Technology 417 Main St. Carbondale CO 81623	n.a.	n.a.	Multilayer shade on aluminum roller; number and type of layers not yet fixed	Top and bottom	n.a.	Still in development, may be available in March; fabric layers can be changed for various seasons; motorized
Thermo-Shade Solar Energy Co. 212 Welsh Pool Rd. Lionville PA 19353	5 with single glazing	n.a.	Tambour with hollow PVC slats, riding along edges in vinyl tracks	All four sides	\$6	Automatic operation available, but shade is also easily pulled by hand; very sturdy shade; available pre-assembled for greenhouses
Window Quilt Appropriate Technology Corp. Box 975 Brattleboro VT 05301	4.25 with single glazing	n.a.	Outer fabric with two layers of fiberfill and metallized vapor barrier in center, quilted via ultrasonic bonding	All four sides	\$4.25	Attractive shade with good sealing system; also available in panel form at \$3.25; variety of face fabrics available

Note: R-values given vary with airtightness of your windows, local wind conditions, quality of installation, and other variables. Use these values as a rough comparative guide.

But it's also possible to go overboard on expensive seals, just as it is with R-value. The seal's job should be to keep room air away from the window, not to prevent infiltration of outside air into your home. That's a job for caulking and weatherstripping. In practice, seals should be able to keep nighttime condensation down to a level that will quickly evaporate next morning when the shade is opened.

Good seals are especially important on shades that will be left closed during the day as well as at night, because any condensation that does form won't be able to escape.

How can you check for good seals? If you have an actual shade to examine, press against its face with both forearms. One with good seals will resist.

Unlike the insulation in your walls and attic, an insulating shade must be able to stand up to a certain amount of abuse. Before you buy, examine a shade for possible weak spots. Operate it and check the mechanism. Does it work smoothly, or does it require force that might damage the shade in time? Does the shade rub excessively against its seals? Is it made of durable materials? A rigid vinyl shade might be a better choice than one made of a delicate fabric if you have a home full of active children.

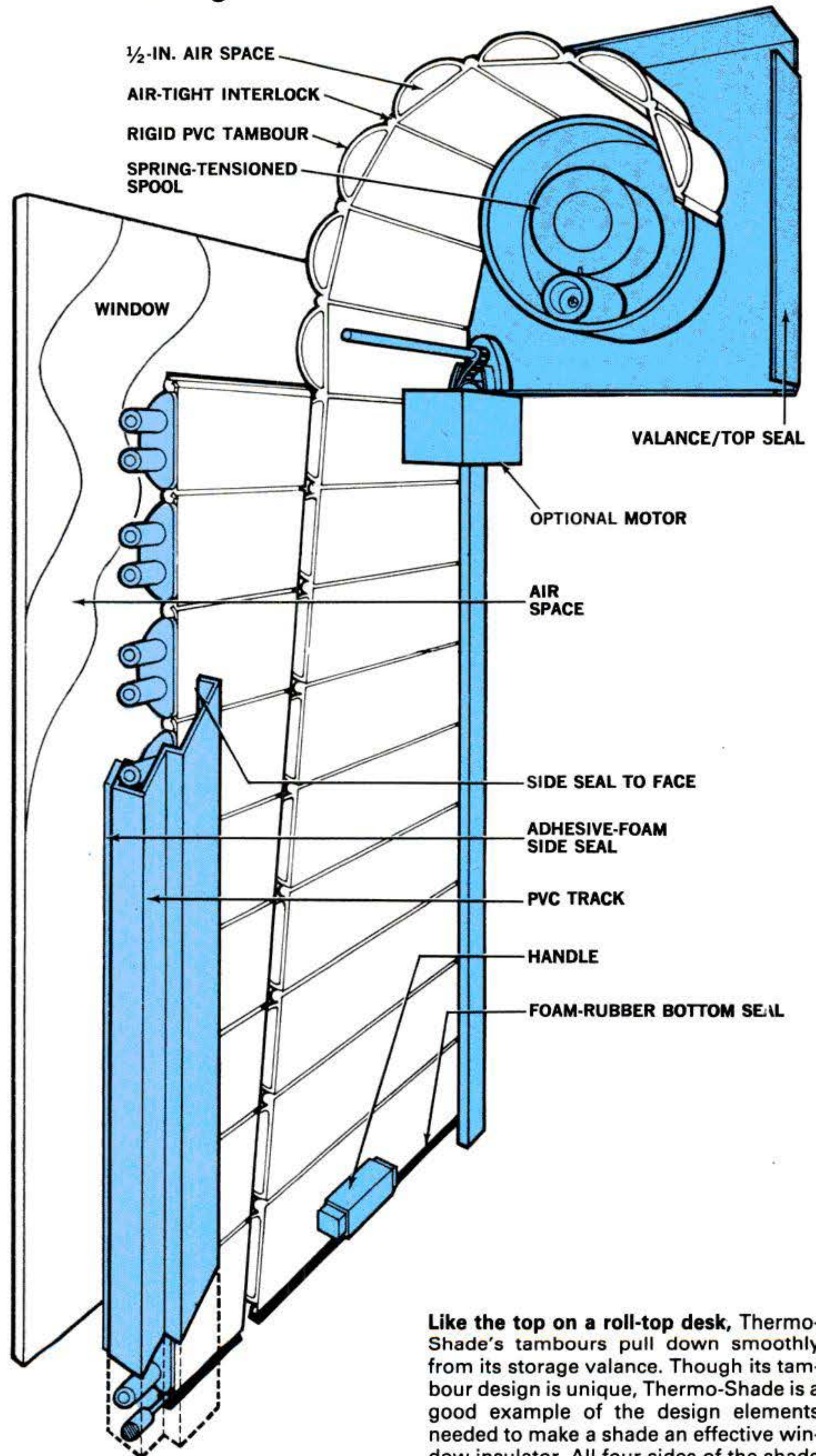
Be sure the shade is easy for you to operate. If a shade is clumsy to work, you may fall into the habit of "forgetting" to use it. A shade that isn't drawn at night is a waste of money. Before you buy a shade, try opening and closing it a few times.

Be aware of potential operating problems that might not show up till you get the shade home. For example, a heavy shade on a conventional, spring-loaded roller might work fine on a small store display, but might be difficult to raise and lower if you installed it on a door or an extra-large window at home.

Also, make sure you can live with the appearance of a shade before you buy it. A shade that's too ugly to pull down has an R-value of zero.

What about price? If a thermal shade were nothing more than a piece of insulation, your main goal would be to get the best performance at the lowest cost. But since a shade is also a decorative part of your home, only you can decide what is a reasonable price to pay. If shade prices seem high, consider this: Many people spend as much as \$5 a square foot for shades or drapes that are purely decorative and offer virtually no thermal benefits at all. If you deduct the money you would normally spend for decorative shades from the price of a thermal shade, it will seem a much better bargain. ■

How insulating shades seal in the air



Like the top on a roll-top desk, Thermo-Shade's tambours pull down smoothly from its storage valance. Though its tambour design is unique, Thermo-Shade is a good example of the design elements needed to make a shade an effective window insulator. All four sides of the shade are sealed. The shade rides in flexible side tracks; foam rubber seals any cracks between shade bottom and window sill; and the valance seals off the top. Thus, a cushion of insulating air is trapped between shade and window. A second air cushion is provided by the hollow tambours. As a bonus, the white PVC has heat-reflecting properties.

PRIZE-WINNING FRP DESIGNS

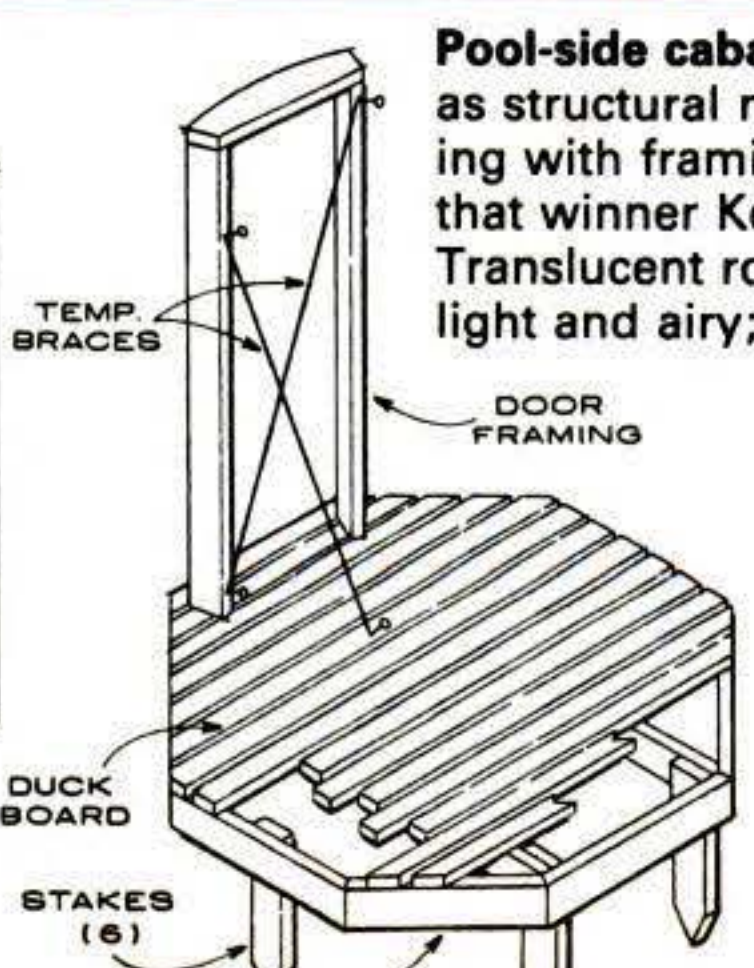
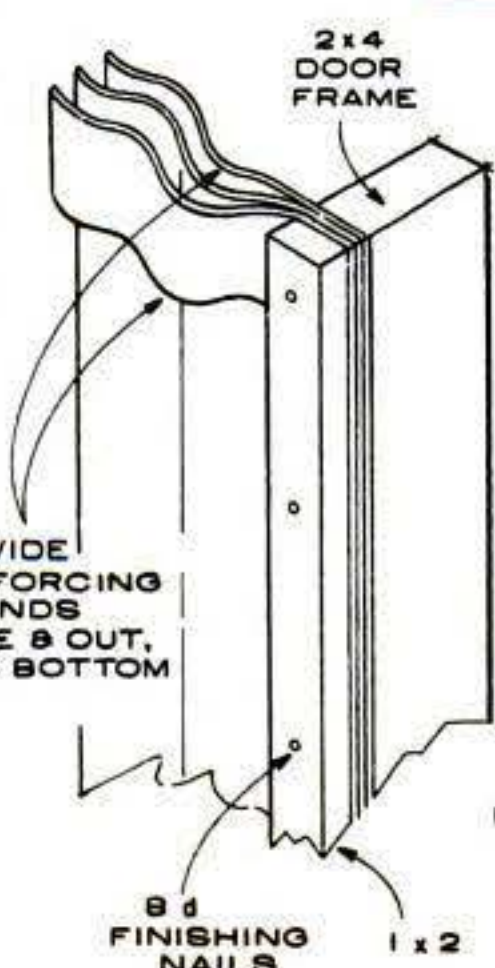
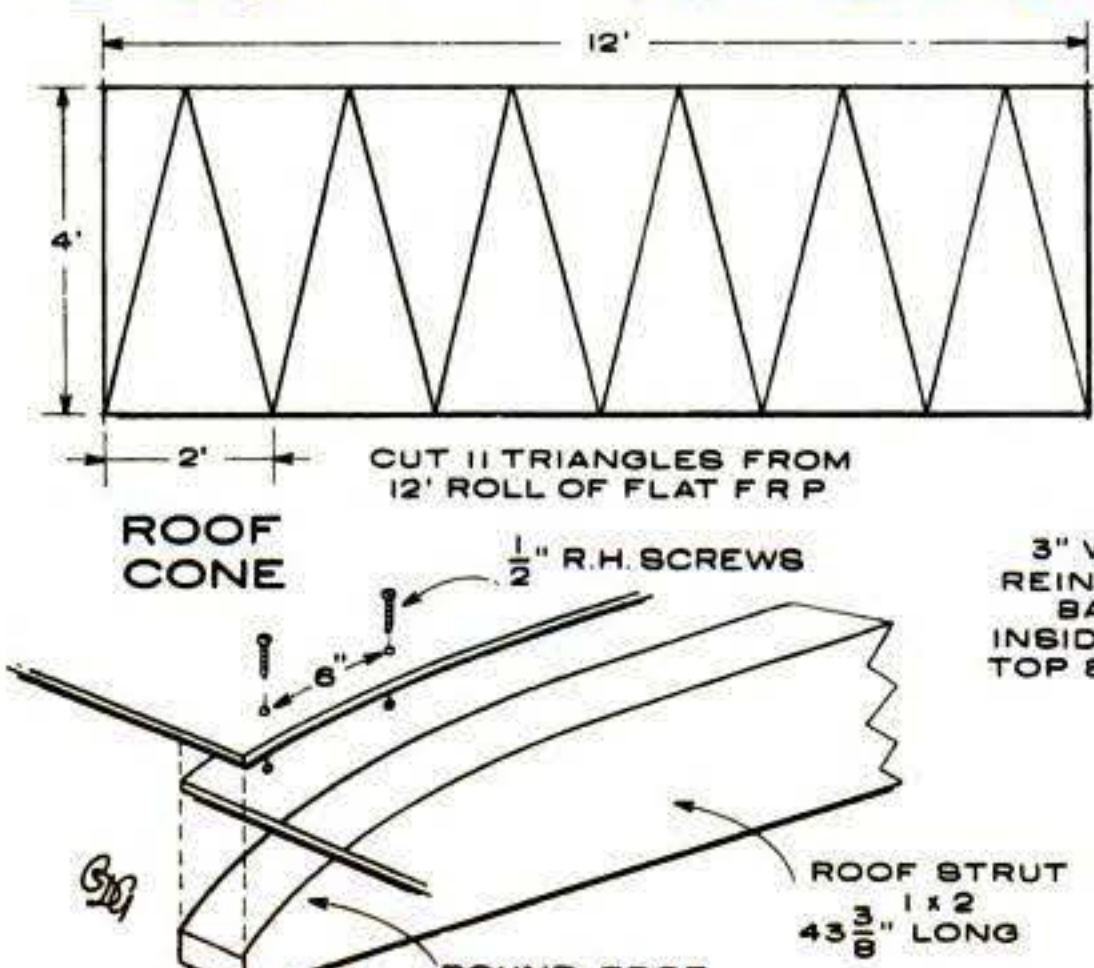
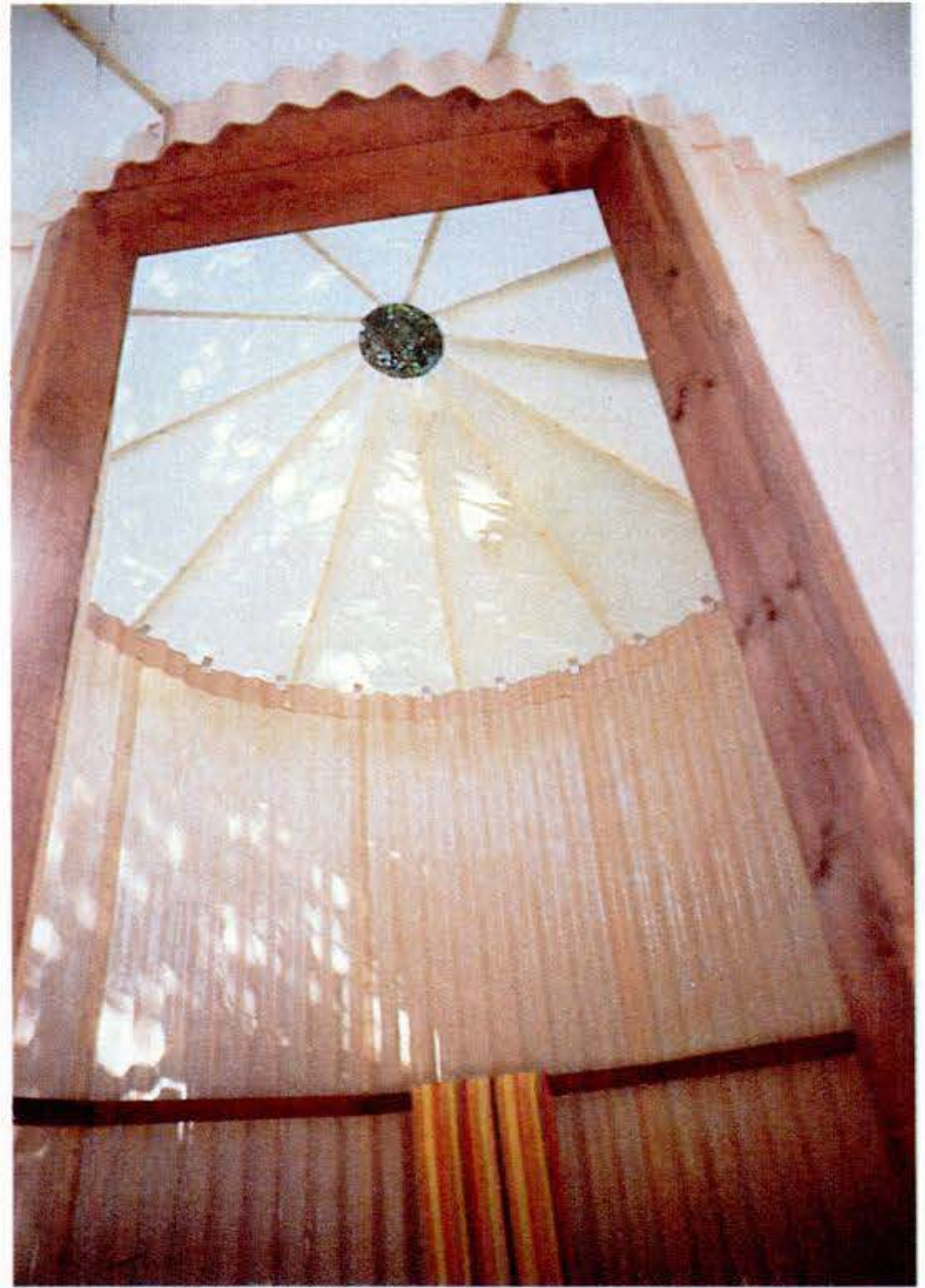
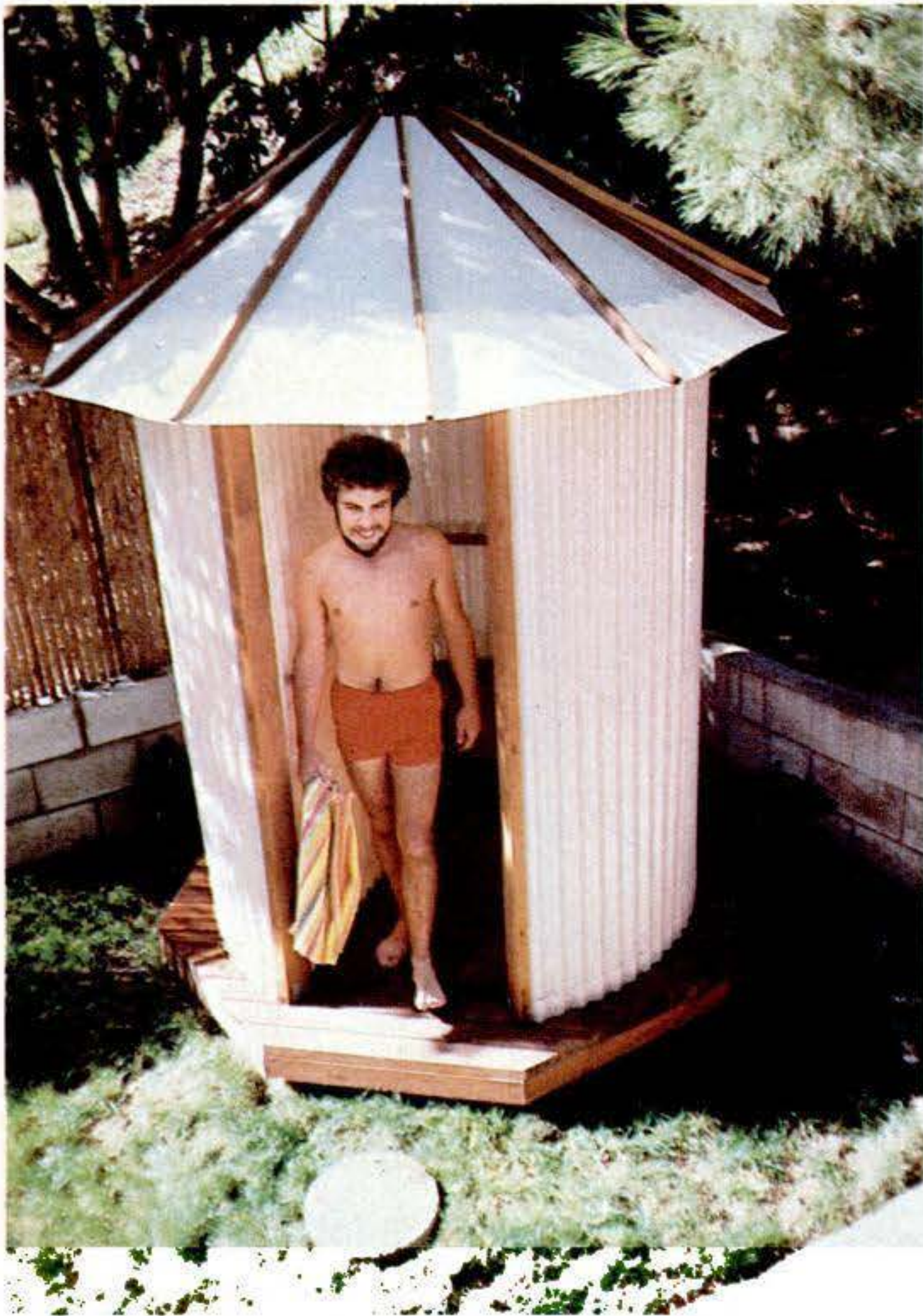
from 10 PS readers

Once again we went in search of innovative, good-looking projects where FRP (fiberglass-reinforced plastic) was the dominant construction material. This lightweight panel is clean and easy to cut, drill, and install over minimal framing (our Grand Prize project below *eliminates* most framing); and FRP now comes in a variety of types, styles, and colors, from flat translucent sheets to square-ribbed panels with awning-like stripes. It isn't just the "green banana" any more, though FRP manufacturers still make those vivid corrugated patio-cover sheets that once identified the product.

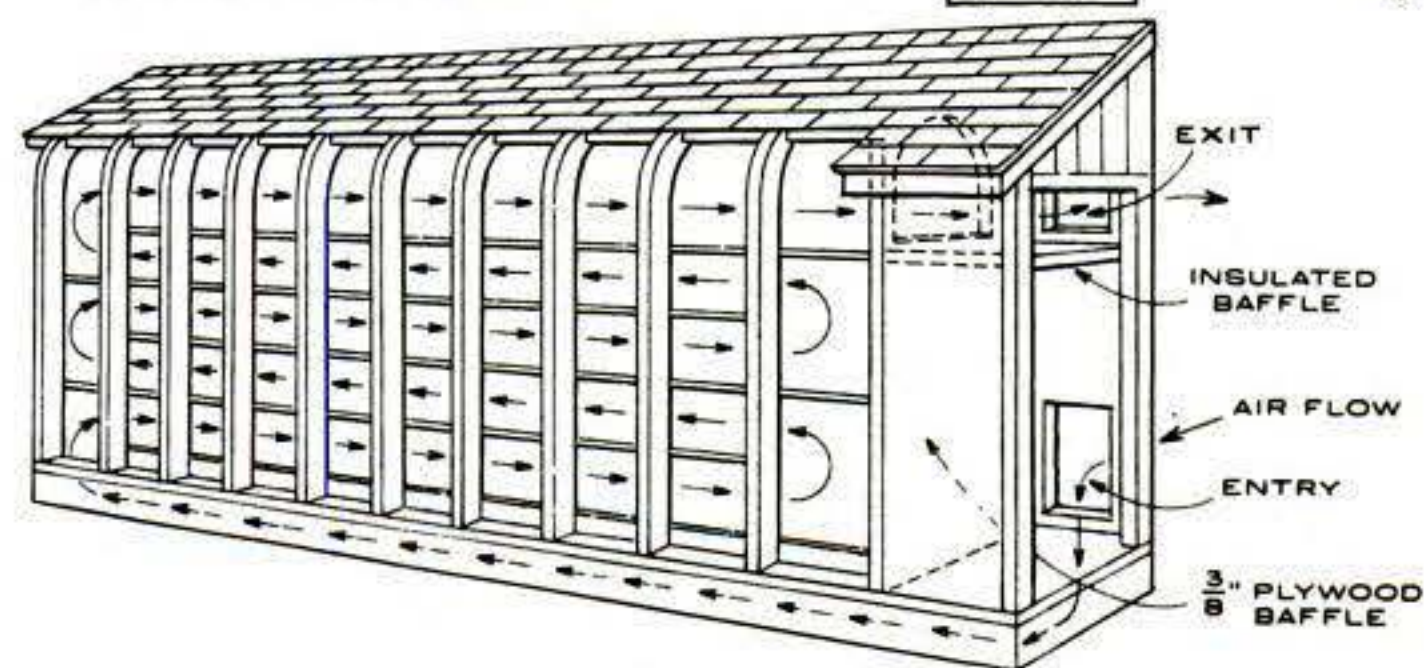
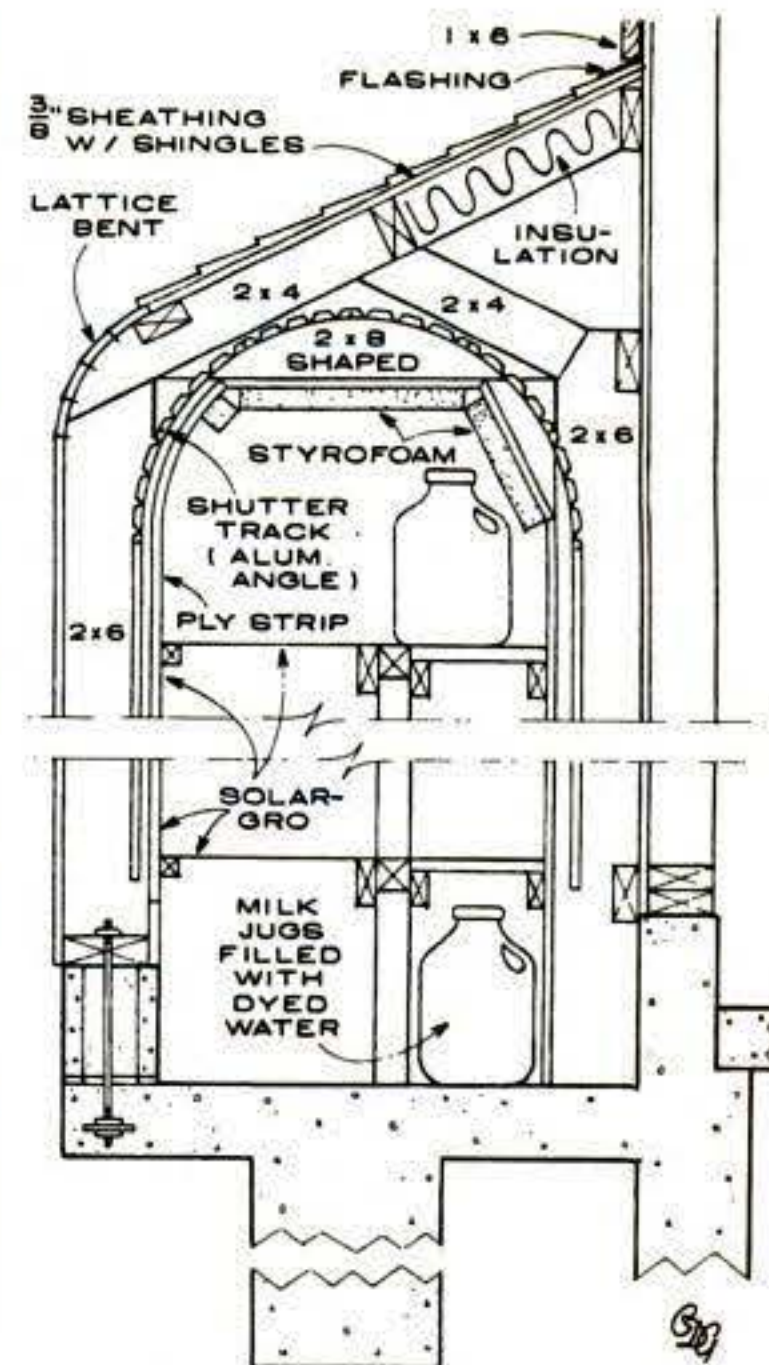
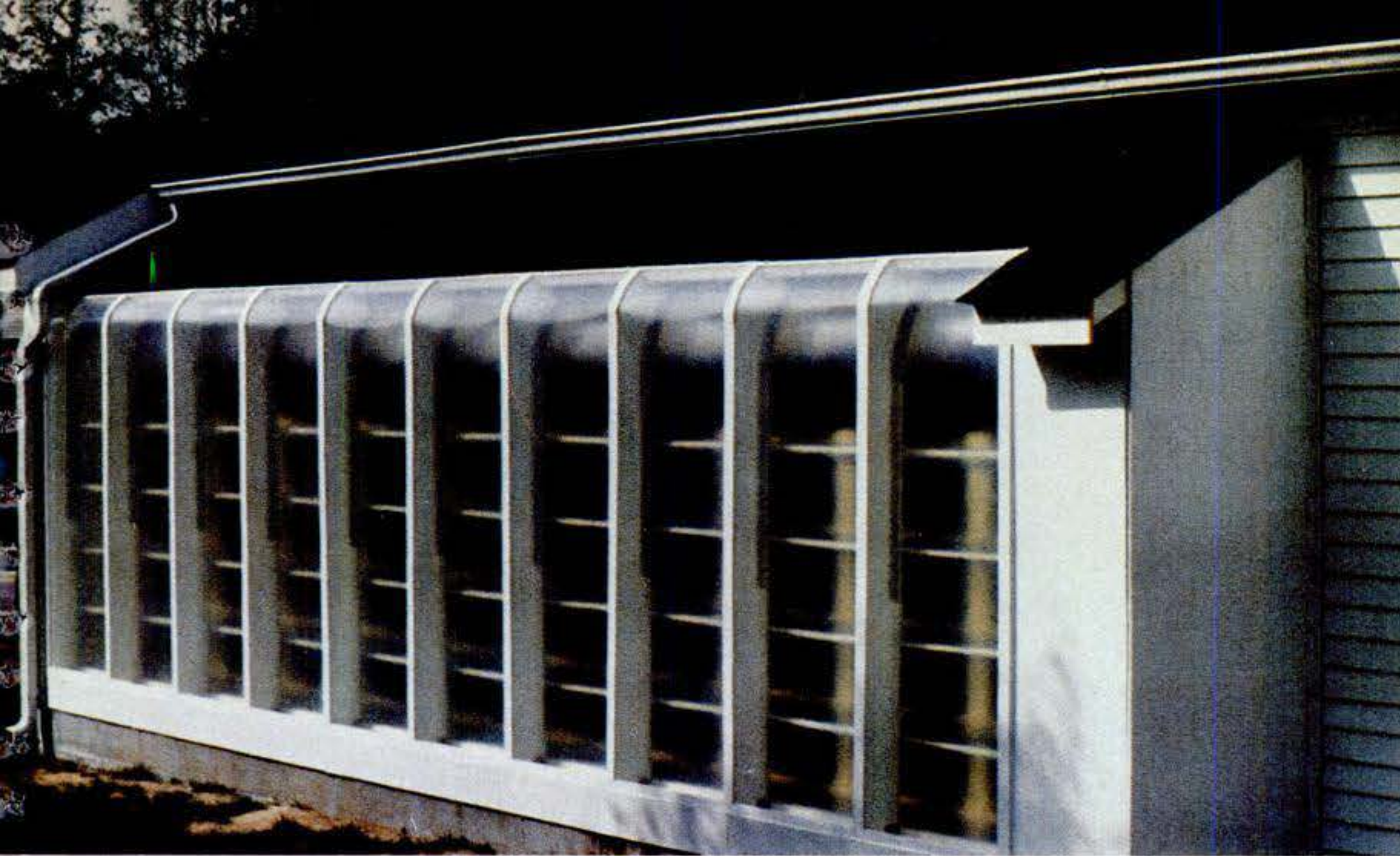
Continued

\$2,000 GRAND PRIZE

GARY KERR, San Diego, Calif.



Pool-side cabana uses corrugated FRP as structural material for walls, dispensing with framing, except for doorway that winner Kerr steps through at left. Translucent roof cone keeps interior light and airy; note flared eaves.



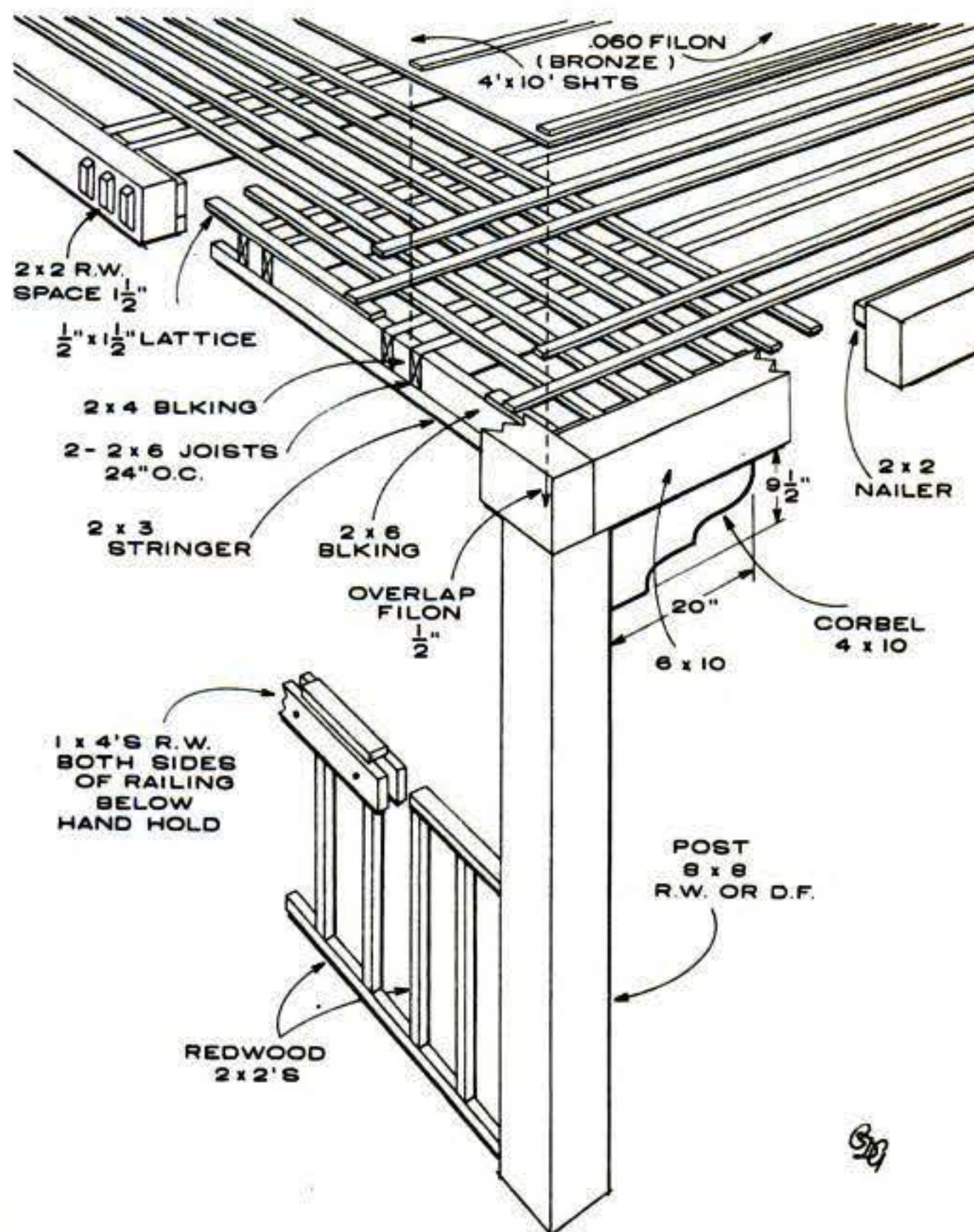
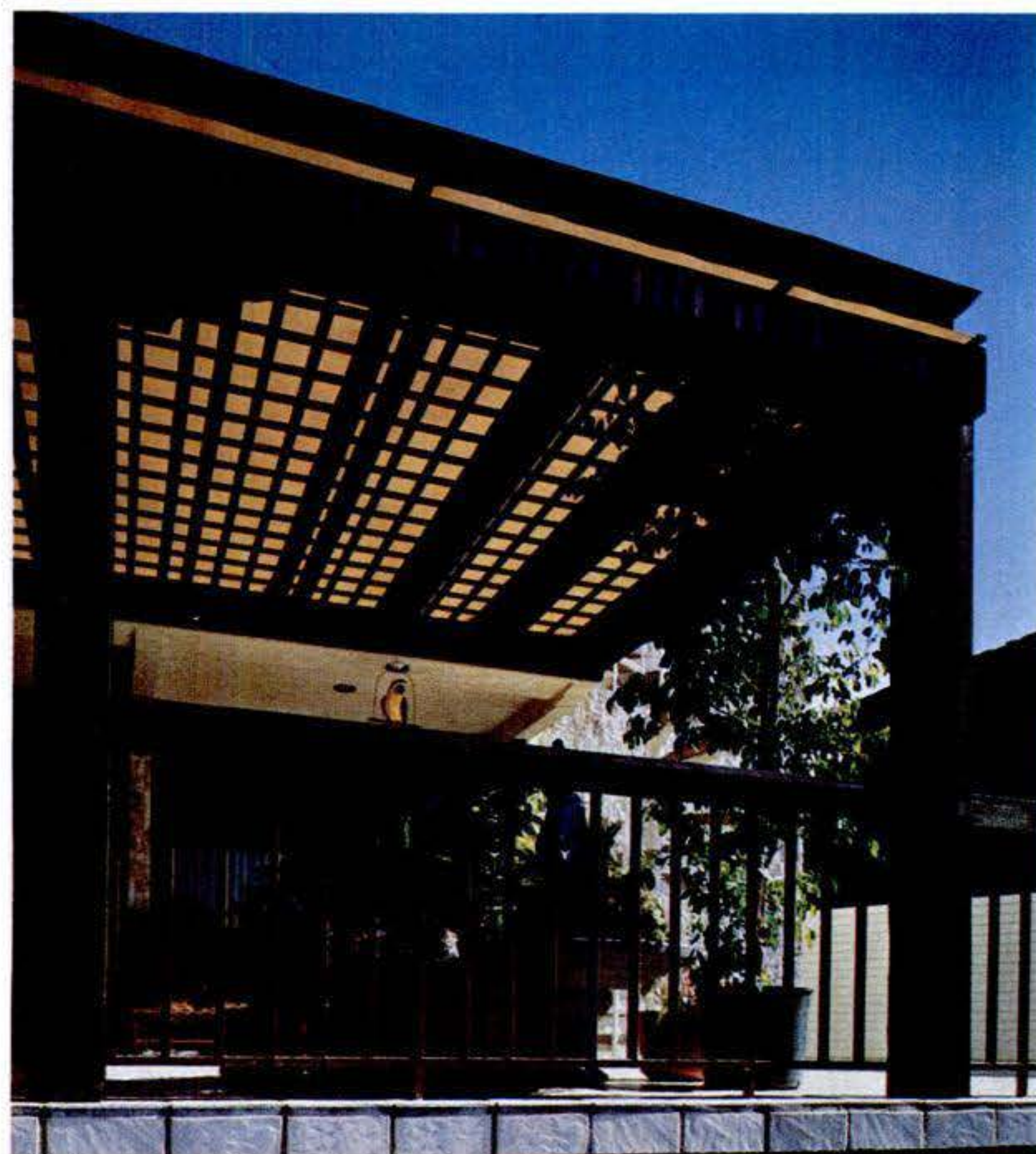
\$750 PRIZE/SOLAR GLAZING

GARLAND MILLER, Oxon Hill, Md.

Collector wall runs air past racks of water-filled plastic jugs and back into garage behind, keeping workshop at comfortable temperature without backup heater. Each stud space has separate tambour-type Styrofoam shutter operable from inside; these move on aluminum track to retain heat by masking FRP when sun's not shining on it.

\$750 PRIZE/COVERS

RICHARD SPENCER, Irvine, Calif.



Outdoor room is created with handsome lattice-work ceiling supported by massive posts, beams and paired joists, and railing of 2x2's—all redwood here. Bronze Filon sheets overhead give sunny glow to space, even on overcast days, and keep the parrot dry.

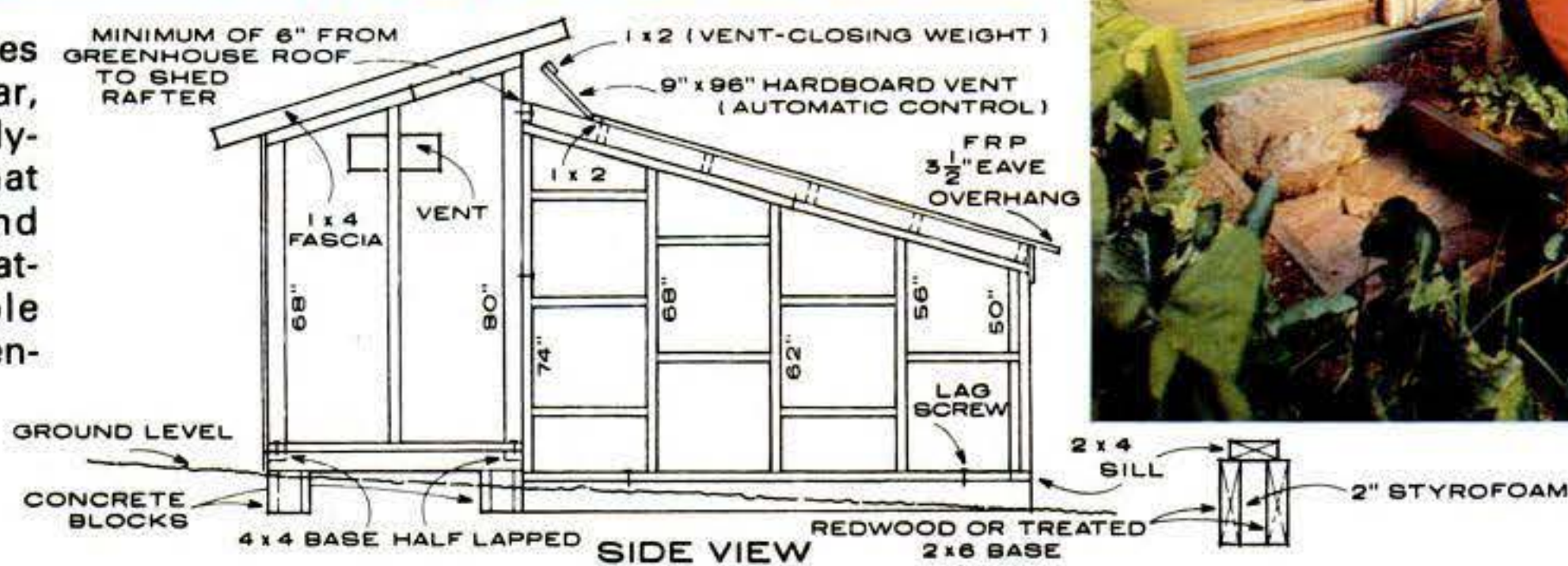


\$750 PRIZE / GREENHOUSES

HAROLD HONER, Conifer, Colo.

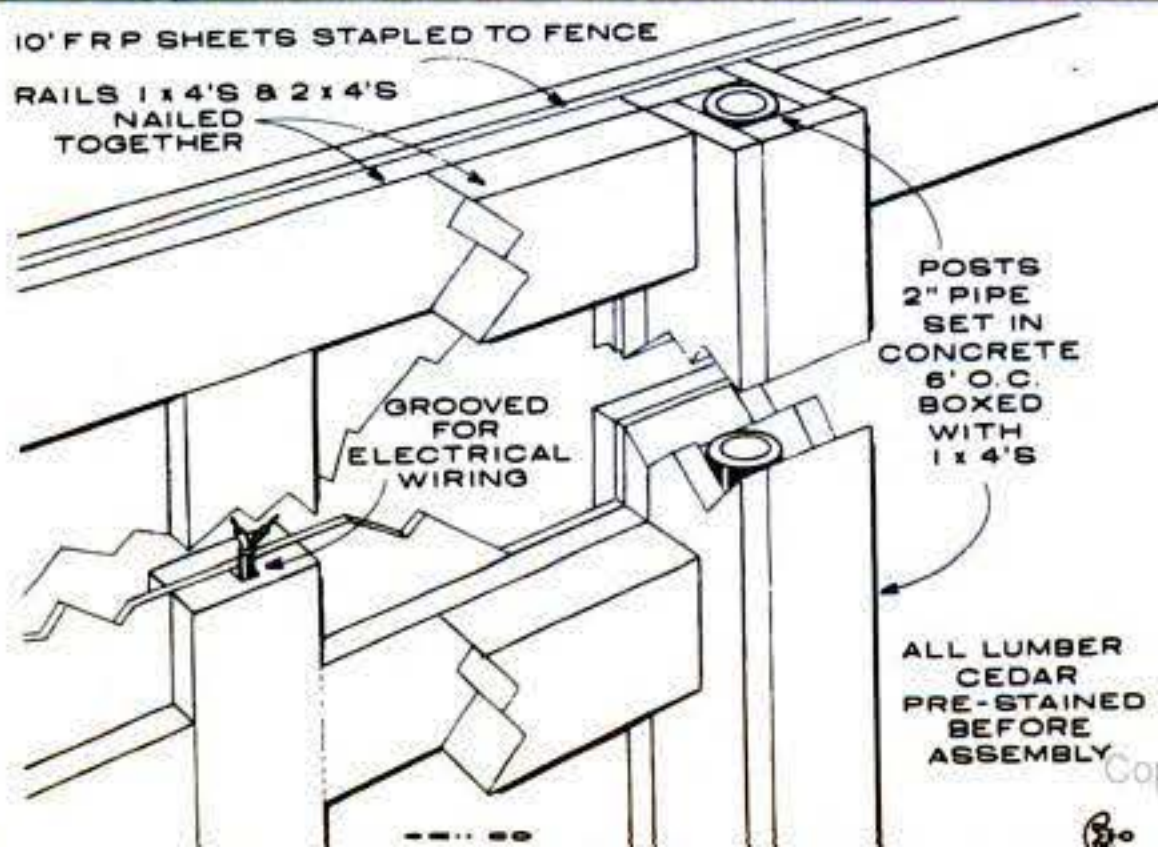


Double shed couples greenhouse of clear, corrugated FRP to plywood structure that stores potting and yard tools. Floor of latter bridges simple block footing; greenhouse is floorless.



\$750 PRIZE / FENCES & SCREENS

ANDY BERGLUND, Seattle, Wash.

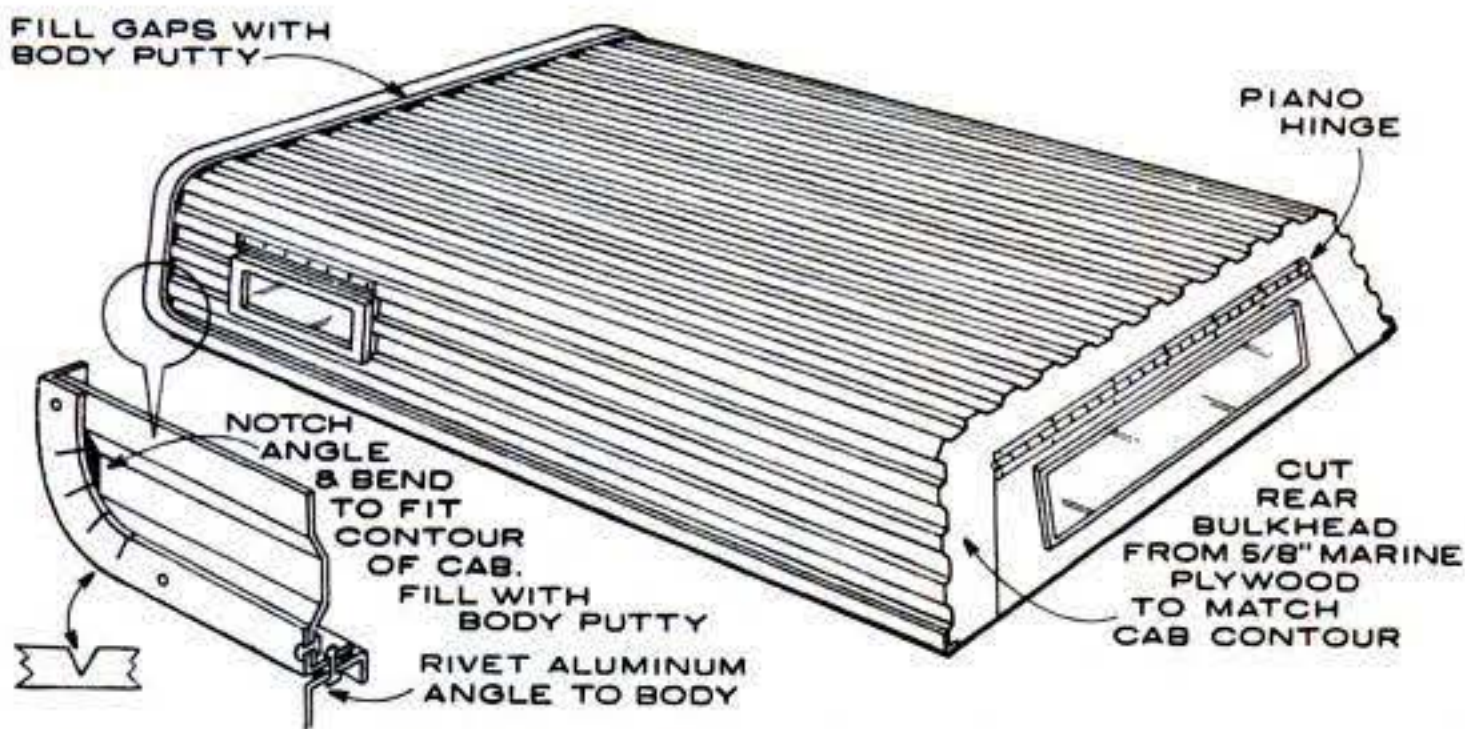


Privacy enclosure creates ideal space beside house for outdoor parties. Wiring for lanterns is concealed within frame that's applied to both faces of FRP. Concrete slab has grass carpeting.

HONORABLE MENTIONS

MISCELLANEOUS STRUCTURES

VIRGIL RAYMOND,
Eagan, Minn.

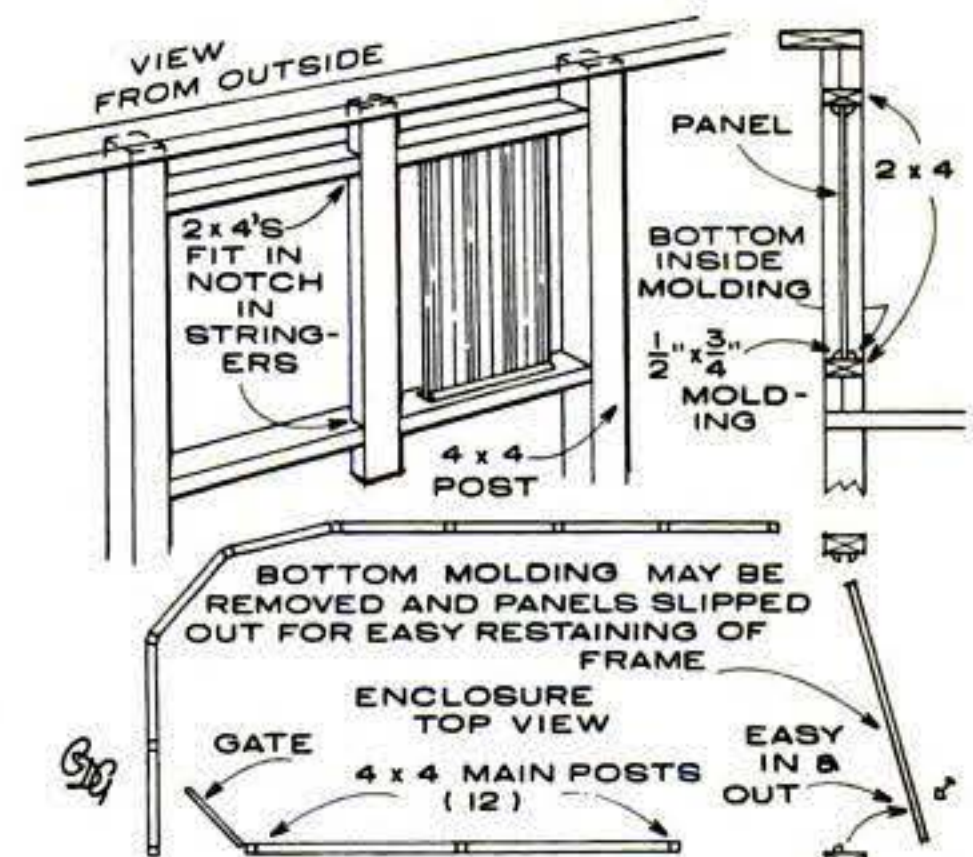


Truck-bed canopy, made from four Type 150 CoolRib panels, needs no inner frame, can be tailored to any compact pickup as a cargo cover or sleep shelter. Angle frame is easy to shape.



FENCES & SCREENS

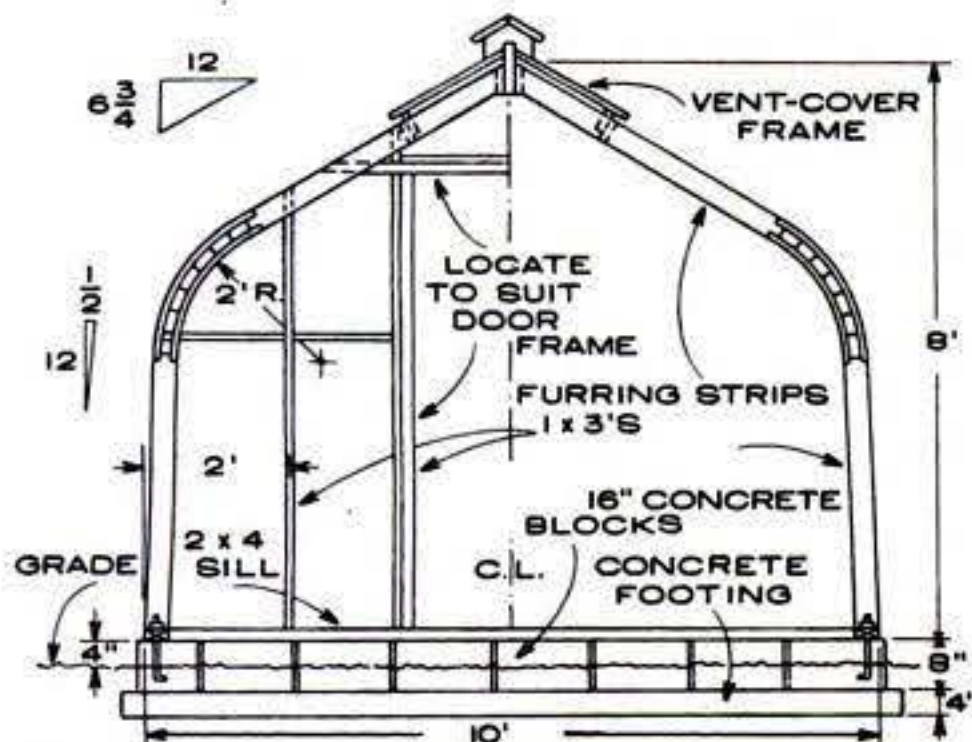
RICHARD L. CATT, Mogadore, Ohio



Pool enclosure satisfied designer's local safety code, gave privacy deck for sunbathing. Wood frame is easily restrained.

GREENHOUSES

W. E. BUNTING, California, Md.

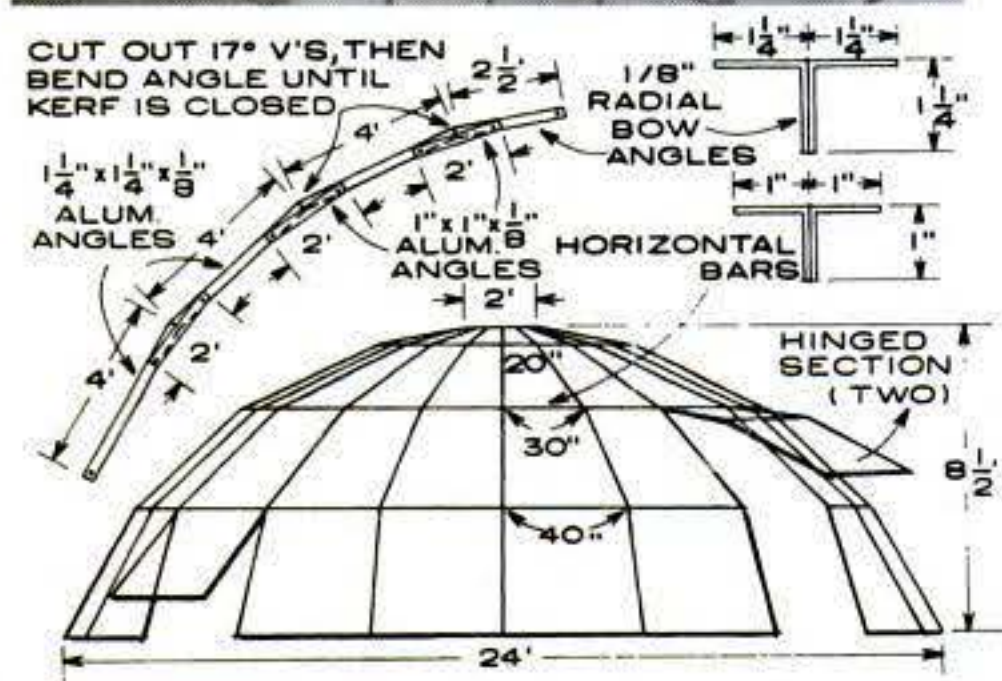


Greenhouse is erected in 4'-wide modules, so can be any length. Unit shown is three modules (12') long, took two FRP rolls.



COVERS

ROBERT J. KERINS, Niagara Falls, N.Y.



Pool dome, supported by shroud assembly of aluminum angles, has two hinged

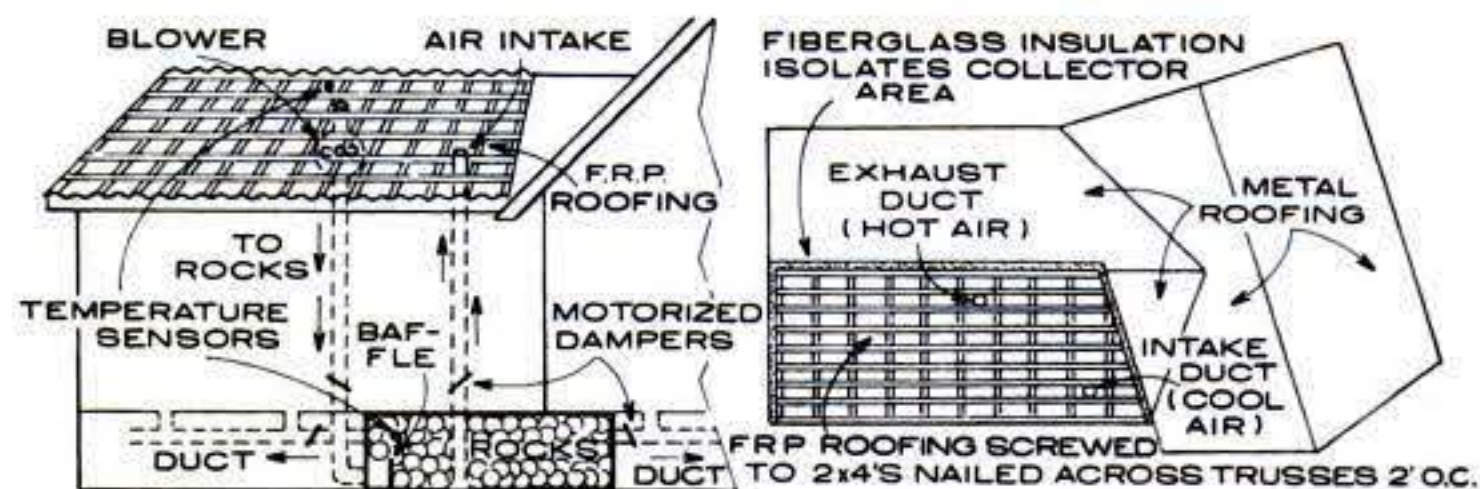
sections for access and ventilation. Solar gain extends swim season.

SOLAR GLAZING

TOM SALISBURY, Telluride, Colo.



Roof collector is south face of one wing of this mountain home, covered with corrugated FRP. Hot air in space beneath is pumped into rock storage bin and distributed to living areas.



We announced our contest in last May's issue, with a Sept. 30 deadline. I flew out to the Los Angeles headquarters of the major manufacturer of FRP—Filon—to judge the many entries. Filon had put up \$5,000 for the cash awards; five Honorable Mention winners received a large selection of how-to books from POPULAR SCIENCE Book Division.

On these pages are the 10 winners chosen with the help of Filon executives. There was a \$750 winner in each of five categories, and from these

top five projects we chose one for an extra-cash Grand Prize.

Our thumbnail sketches are only meant to suggest the construction, so you can judge whether the project is one you'd like to undertake. If you choose to go ahead, you can order construction plans directly from Filon Marketing Services, 12333 S. Van Ness Ave., Hawthorne, Calif. 90250. Send 50¢ for each plan you want, specifying by the name of the entrant (for example: Honer Greenhouse). All 10 of the winning projects this year are

within the skills of the average POPULAR SCIENCE reader, and all are practical, attractive uses of a material more homeowners should get to know.

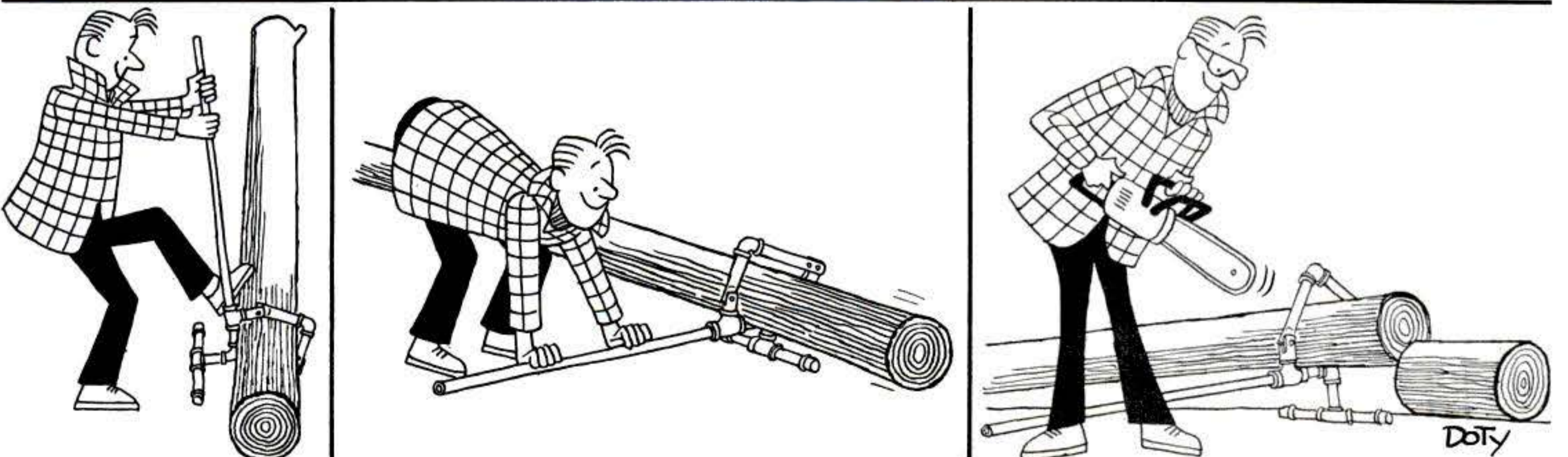
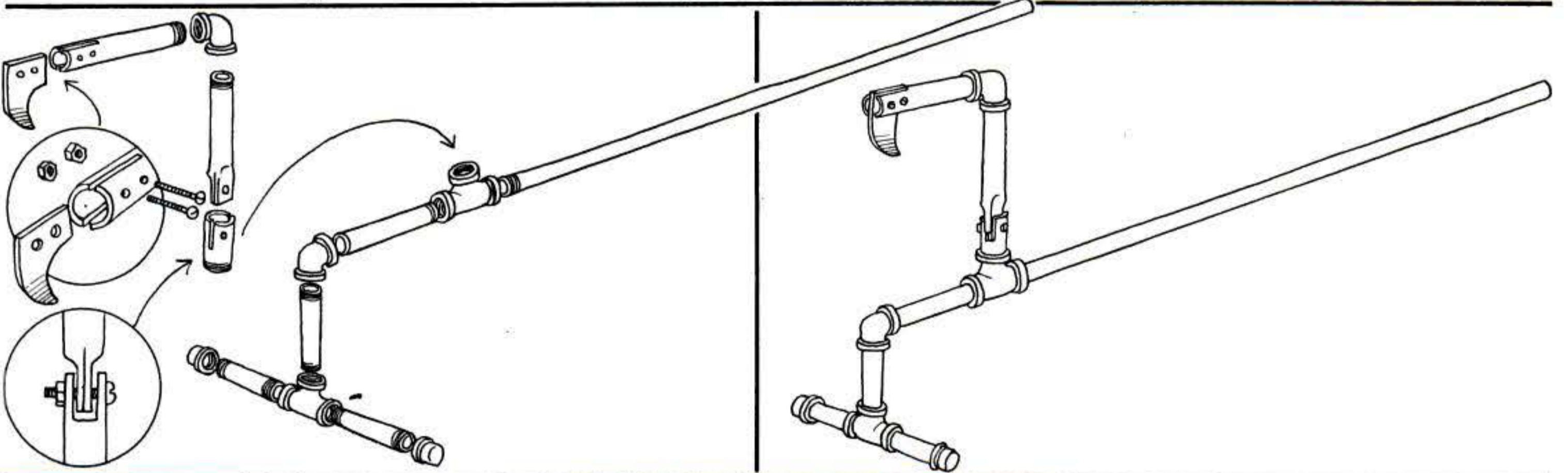
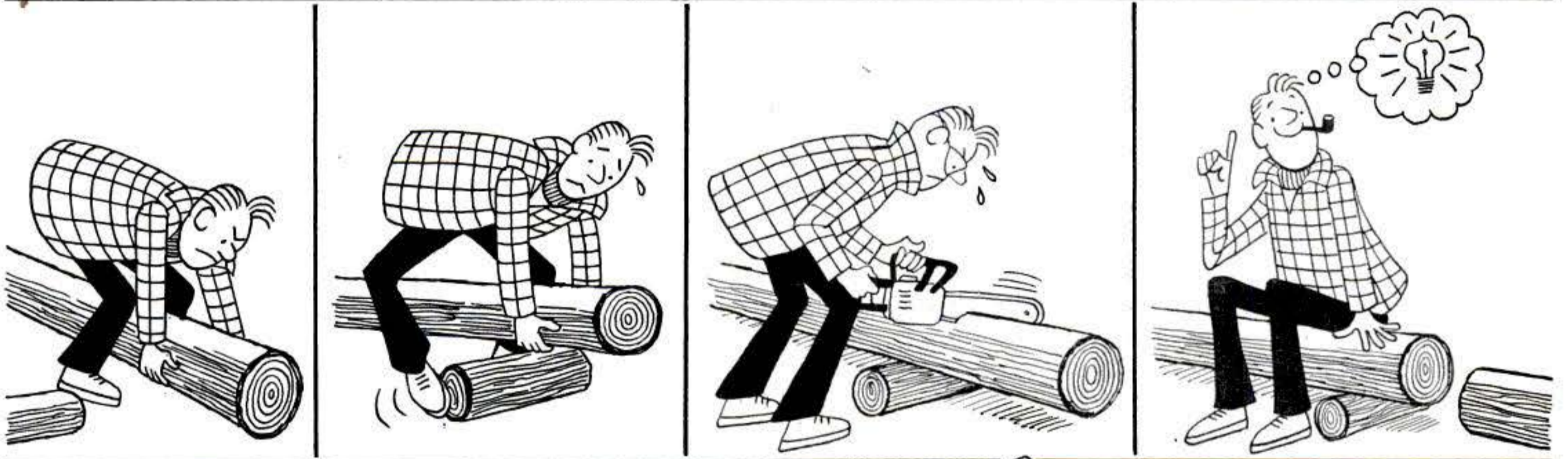
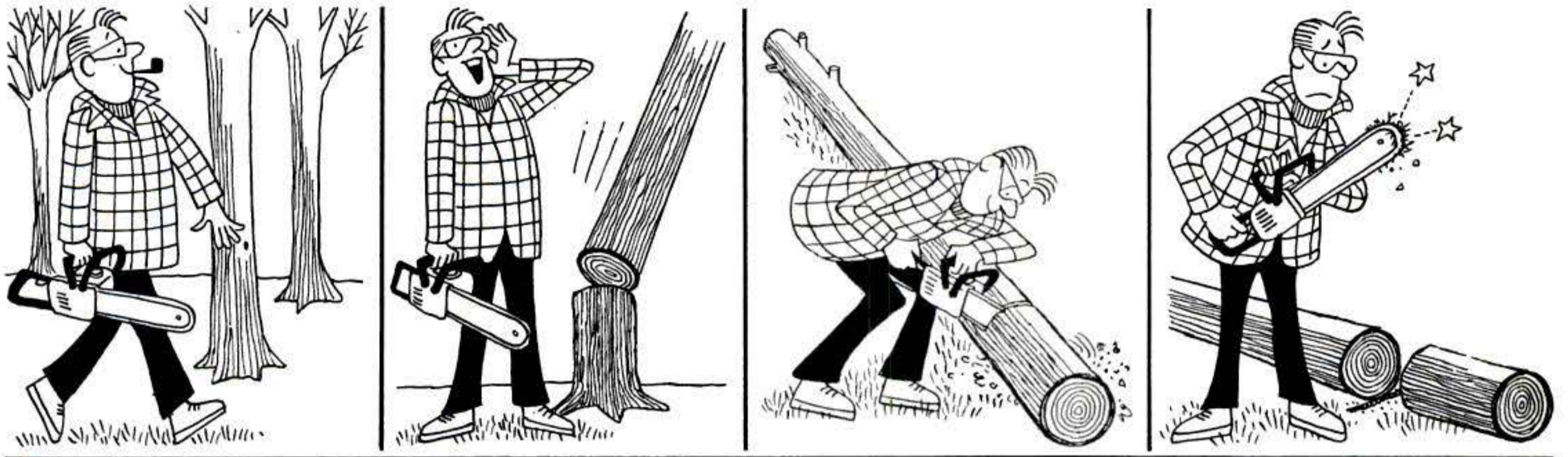
To all who entered our FRP contests these past two years—our thanks. To the 20 winners, our congratulations.—Al Lees

Photo Credits: In all but one case, we asked a studio in each winner's home town to photograph the prize project. Listed in the order the projects are shown: Kerr—Pete Stevenson; Spencer—Boulger & Kanuit; Honer—Writers Photographers & Artists (Denver); Berglund—Johansen Studios; Raymond—Heritage Photos; Catt—Carpenter's Studio; Bunting—Cosmopolitan Photo; Kerins—Longin Photo; Salisbury—Bill Ellzey.

WORDLESS WORKSHOP

By ROY DOTY

Thanks and a check to J. Howard Dunn of Oakmont, Pa. for this idea. Send yours (with Social Security No.) to Wordless, POPULAR SCIENCE, 380 Madison Ave., New York, N.Y. 10017. Only purchased ideas can be acknowledged.





OUTDOOR
POWER
EQUIPMENT

Garden tractor delivers big- machine performance



I engaged the front-wheel drive with the flick of a lever, the power takeoff with another, and eased a third lever forward to drop the big 48-inch tiller on its three-point hitch at the edge of my garden. When I let out the clutch, the little two-cylinder diesel grunted and then settled into a smooth, even pull.

The tiller chewed its way down to

its maximum eight-inch depth without a murmur. Fifteen minutes later, the packed and semifrozen soil of my 30-by-100-foot garden had been tilled to a soft, fine-grained, smooth-surfaced seedbed.

This was my first chance to test the new John Deere 650 diesel. The performance of this machine departs from the usual feel of the consumer-

type garden tractor—and for good reason. The machine is designed as a traditional John Deere farm tractor—water-cooled, cast-iron, 52.1-c.i.d. Yanmar diesel with a cast-iron-housed, sliding-gear, eight-speed transmission. The transmission is bolted to the cast-iron differential housing, forming the frame of the tractor. A short steel subframe at the front supports radiator, weights (for balance), and implement mounts.

Fuel and oil filters are accessible without lifting the hood, and all controls are easy to reach. The instrument and lighting package includes such niceties as a speedometer, hours-in-use meter, automotive-type indicator lights for engine functions and charging, rear work light, safety flashers, and dual-beam headlights.

The 650 holds its line easily, with or without the optional front-wheel drive engaged. Even with one set of wheels riding on firm, rough ground and the other set in deep-tilled soil, the machine went where I pointed it—without requiring the use of the individually operated rear-wheel brakes or the foot-operated differential lock.

With the tiller raised, the 650 proved to be stable and positively nimble on the lawn. The turning radius is well within the 6.2 feet John Deere claims. Steering is so light and responsive that I can see no need for the optional power steering unless you're using a front-end loader or fork-lift attachment.

The John Deere 650 combines ruggedness, handling, and a polished appearance into one of the most impressive machines I've ever tested. The exact price hasn't been announced, but according to a Deere representative, it will be about \$5,000.—
Mark Lindsley



Weed trimmer uses flexible disc

String trimmers have come a long way since their 1972 conception as a rotating can spinning a length of monofilament fishing line. In fact, John Deere's new model 90G doesn't even need string. Instead, it can use an 8.5-inch, blade-like polypropylene disc. The disc is flexible, just $\frac{1}{8}$ inch thick, and has eight large molded teeth for cutting.

This heavy-duty trimmer is powered by a 30-cc, 7,500-rpm two-cycle engine, similar to those used on chain saws. A 15.2-oz. tank holds the gas-oil mix. A straight shaft drives a gear-reduction unit at the cutting end.

The 90G is easy to use. Although it weighs 15 pounds, the weight is supported by a shoulder harness with a positive quick-release clip. The mounting-ring collar that attaches the harness to the drive-shaft housing is adjustable. This allows you to balance the trimmer so that the disc floats naturally just above ground level. The control of the machine, through its large, adjustable hand grips, is nearly effortless.

I found that it cuts tall grass and thick weeds quite effectively and even zinged through a row of tough, dried cornstalks without a whimper. But when it came up against one of my pine one-by-one-inch row-marker stakes, the effect was surprising. Nothing happened!

Instead of cutting off the soft pine



No-strain chain saw

"So it cuts oak just fine," said my neighbor, "but mine does, too. If you really want to test that saw, try it on this."

"This" was a 10-inch log of wet, stringy red elm that had bogged down my neighbor's chain saw. One minute later the Echo CS-302S had zipped through the log without any apparent strain.

Externally, the 302S isn't noticeably different from the CS-302, Echo's original machine. Performance is another story. The 302 carried a maximum 14-inch blade bar, while the 302S I tested handles a 16-inch bar with no difficulty at all. And it's been successfully used to cut green oak logs using bars in excess of 20 inches.

The controls on the CS-302S, though not new, do bear

mentioning. Choke, on/off switch, start lock, and throttle are all grouped around the handle, making them convenient to operate. Chain oiling is automatic, but the amount of oil can be varied by turning an adjustment knob on the top of the machine.

Weight and handling characteristics remain close to those of the original machine. The saw weighs 12 pounds with chain oil and fuel aboard. That's more than the nine-pound original I'm used to, but, because it's well balanced, you don't notice it.

The specification sheets on the CS-302S aren't available at this writing. But, presumably, it will have the same safety options available for the CS-302: chain brake, chain catcher, and front hand guard.

The CS-302S is an efficient small chain saw. Like its predecessor, it is well designed and built with quality castings. It will be a welcome addition to a wood lot.—M. L.

stake or damaging the blade, the only visible effect was a slight nick on the very corner of the stake. This, combined with a blade guard at the rear of the disc, seems to indicate it's a relatively safe tool if you're using it in the proper way.

A variety of attachment cutters are available, including a string-trimmer head for shorter grass, an eight-inch brush blade for heavy weeds and undergrowth, and a 10-inch circular saw blade that will handle brush and seedling trees up to two inches in diameter.

While the \$325 price tag may make the 90G impractical for small lots, I see it as a great trimmer for use on larger wooded or country lots, farms, and in many commercial applications.—M. L.



'81

Lawn mowers

Rider or walk-behind?
PS tries 17 models



Fuel economy, cutting time, handling, features—match them to your lawn

By MARK LINDSLEY

"Which one is best?" asked my neighbor who'd been watching me shoot the pictures of the mowers you see here.

I'd been checking the time and fuel it takes for different types of mowers to cut representative-size plots. The results won't surprise you: Larger, more powerful mowers cut faster, but they're also more expensive and use more fuel. In the process of using three kinds of machines, I'd also reached a lot of conclusions about other aspects of their performance and use, concerning such elements as:

- Handling, feel, and steering.
- Features and durability.
- Speed controls and shifting.
- Reverse shift convenience.
- Comfort.
- Service availability.

So, which one is best? Obviously there is no right answer for everyone. It depends on the priorities you give to your time, the cost of buying and using a larger mower, and the machine's suitability to your lawn. Our tests should help you make the best decision.

The tests

In this energy-conscious time, the question naturally arises: Can you make worthwhile savings in fuel and money by choosing the right mower? We decided to find out. The basic plan was straightforward. We got 17 different mowers, representative of all types now on the market, and used a sampling to cut a standard-size plot. We kept careful records of both time and fuel consumed.

Fuel was measured by volume in standard laboratory graduates. Flat, unobstructed test areas were carefully measured out and marked. (Naturally, you can expect slightly different results on a hilly, tree-filled plot of land, but the comparisons should be the same.)

I tested four classes of mowers:

Walk-behinds: mowers in the 19–22-inch cutting-width range, both hand-push and self-propelled.

Riders and lawn tractors: those designed primarily for grass cutting and, perhaps, light tractor chores.

Garden tractors: heavy-duty tractors that cut grass but also can be used

with ground-engaging accessories such as tillers.

Specials: mowers that do not fit into any of the other categories because of unique features or purposes.

All machines were fitted with dealer-recommended decks except the John Deere. (I'll explain why later.) Some were set up and prepped by the dealer; some, such as Snapper, were borrowed demonstration models; others came in factory crates. I ran the tests in as-received condition without any effort at fine-tuning or adjustment. I found that it made surprisingly little difference in performance whether the mowers were factory tuned or out of the crate.

The mowing-time and fuel-consumption graphs, which follow on later pages, are the results of careful testing. They're arranged on the basis of average class results to guide you in selecting a mower. To use the graphs, look down the column that represents your lawn size in feet. Compare time and fuel economy of all three types against each other—and against the price you'll pay to upgrade.

The graphs show no surprises. While the fuel consumption goes up on larger machines, the difference in total amount consumed between them and all others is small. Fuel consumption, therefore, should not be an important part of your selection. Your time, however, should be a consideration. You'll see a substantial saving when graduating from walk-behinds at approximately 15,000 square feet.

Hands on

After the tests, the impressions that stuck most in my mind were my personal reactions—handling, shifting, and other aspects of lawn-mower use. For example, I learned quite a few things about small hand-push and self-propelled walk-behinds that are important to know when you buy.

Take the small, basic Sears hand-push rotary mower, for example. Low and light, it easily sneaks into tight areas, under shrubs, and down culverts I'd been ignoring with my rider mower. The machine is so handy that I used it first to clean up the tight spots so I could run the rider full-out. I found it's more efficient than running the big mower first and doing the trimming later.

As a basic model, the Sears rotary does lack some things I value: a hand throttle, for one, and an easy way to adjust cutting height, for another.



OUTDOOR
POWER
EQUIPMENT

You *can* adjust it, but you'd need a wrench to do it.

Upgrading to more expensive mowers makes the choice more difficult. Personal tastes enter the picture. For example, my reaction to bagging attachments is that all rear baggers work well. But you may prefer one method over another when emptying the bag. Solution: Try it in the store before you buy.

My strongest feelings relate to the drive controls on self-propelled models. I particularly like the Toro drive handle, which extends across the full handle width. It makes one-handed swings in either direction easy. I also like its three-speed selection.

Lawn-Boy is equally good, with a full-width control and a speed control that progressively increases as the grip is moved forward. This allows going from full speed (with an optional lock-in) to a creep and back again almost instantaneously. Snapper's single-lever grip on one side is less convenient and was tiring to hang onto, but I like its six-speed transmission.

The huge, 10-hp Sears with 42-inch cut is really a specialty mower for large areas. It handles well with its castoring front wheels but definitely needs a power reverse. It was the only walk-behind tested with a blade brake, a feature we'll see more of in the future.

All the self-propelled walk-behinds were rear-wheel drive. This is desirable if you use a bagger because the weight of the grass moves the center of gravity back over the drive wheels. That gives better traction on an upward slope. But if you don't bother with bagging and have no major slopes, you might want to consider front-wheel drive. These mowers turn quickly and are highly maneuverable. You simply press down on the handle to lift the drive wheels, and the mower swings freely on its back wheels.

I also had strong personal reactions to the riders. These were tested on a 2,500-square-foot area. All are in the

Continued

Have it your way: For small lawns, there are walk-behind machines such as the Toro 20-inch electric mower/trimmer (far left). A cut above is Gilson's 11-hp lawn tractor with 38-inch rear-discharge deck. It would be used for larger areas.



A gallery of walk-behinds is shown (left to right): 42-inch Sears stops its blades in three seconds when drive is disengaged. It has five forward speeds. Toro's model 20790 has electric start for push-button

30- to 42-inch-width range and powered by eight- to 11-hp engines. The Ariens RM-830 and Simplicity 3110 Cavalier are rear-engine open-front types (skiff and front reach). The Toro 11-32 and Gilson 52060 and 53038 are front-engine tractor styles. The Gilson 53038 is a lawn *and* garden tractor and can use ground-engaging tools.

For close cutting and ground handling, the skiff type seems better to me than the tractor type. This is probably a matter of weight distribution; an open-front-type engine is over the rear wheels. The same advantage is apparent in the big but nimble 18-hp Gravelly.

Naturally, good steering is important for a rider that must be worked around trees and plantings. The easiest-handling riders, in my opinion, are the Simplicity Cavalier and Wheel Horse electric. (The electric's battery weight is over the rear wheels.) The Ariens' wheels turn so sharply that they may plow sideways at times. Toro is the best-handling of the tractor types and has a solid, comfortable feel.

Flexible speed control is equally as important as steering. Ariens' friction drive permits on-the-go shifting, since there are no gears to clash. Clutch engagement, however, tends to be harsh enough to snap the front wheels

convenience; handles are adjustable to your height. Two-cycle Lawn-Boy can be rigged for side discharge, side or rear bagging, mulching, and leaf shredding. The 20-inch Sears hand-push mows under

off the ground when starting from standstill. Simplicity, with gear drive, requires depressing the clutch to the midpoint before shifting. Its in-line shifting eliminates searching for a shift gate. Toro's dry-plate clutch (superior to a belt-tightener clutch but more expensive) permits slick on-the-go shifting.

Riders may have either a single, large-diameter cutting blade or twin, smaller-diameter blades. My experience in heavy cutting is that the twin blades are better able to handle the load. (They don't slow down the engine.)

Lawn and garden tractors

You won't save time or fuel by stepping up from a rider to a lawn tractor of equivalent horsepower. The numbers for the 2,500-square-foot plot were scattered on both sides of the mean 4.3 minutes and 8.1 ounces of fuel used. This projects to 32.2 minutes and 64.9 ounces of gas for 20,000 square feet. But a lawn tractor is more than a mower: Plow blades, carts, and bagging attachments are available as optional accessories for most, and some even have snow throwers available. If you're in a heavy snow area, however, you'll probably find these lightweight machines inadequate for efficient snow removal.

Tackling deep drifts, landscaping,

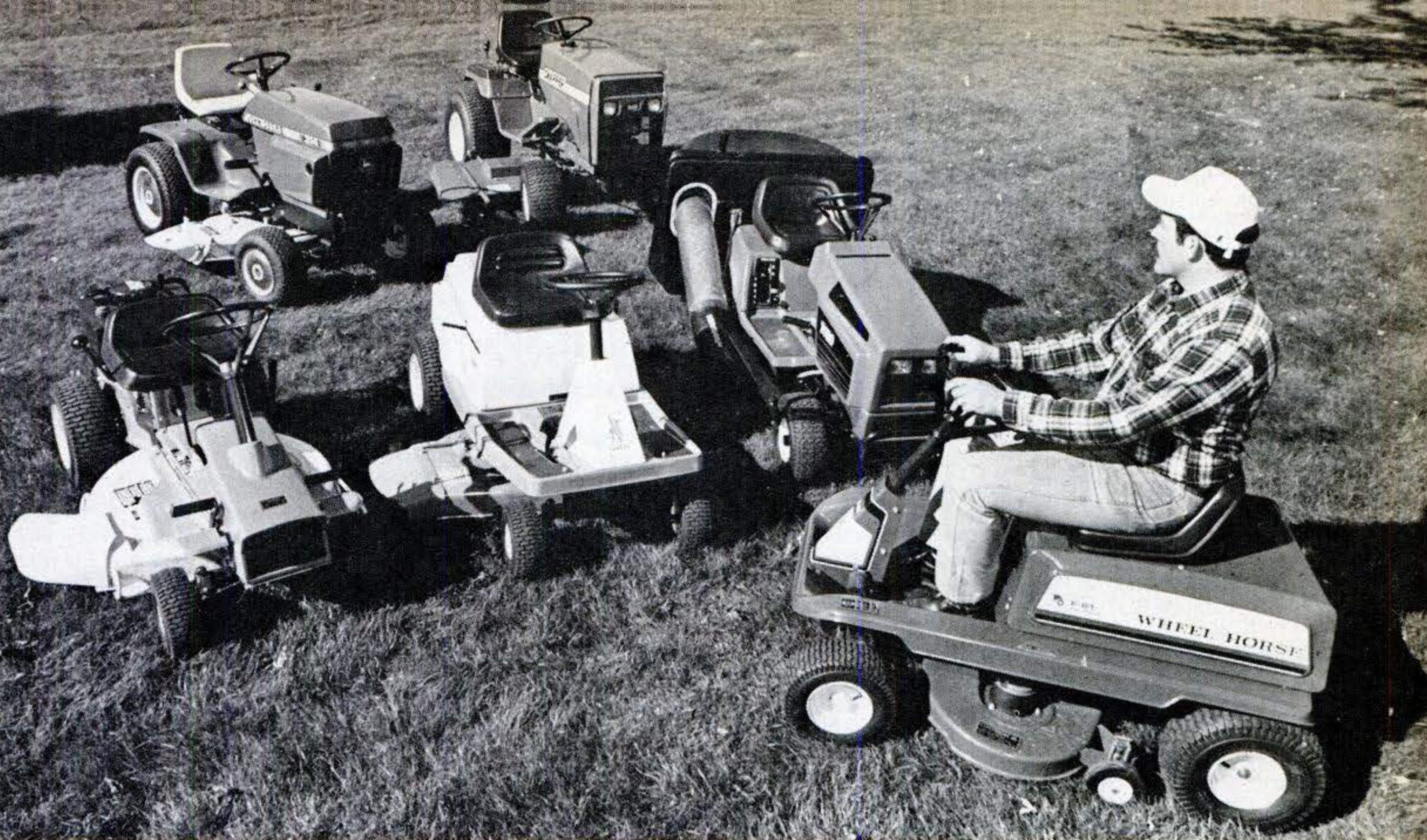
shrubs and in other tight spots. At under \$100, it's good for small plots or great as a backup for a tractor. One of Snapper's options is a thatcher: It attaches to the front axle and requires no blade change.

or tilling requires the low gearing and heavy frame of a garden tractor. And because of their big cutting decks, they also excel at lawn mowing.

Although most useful on large, open areas, many people (myself included) who own medium-size yards, big driveways, and gardens use garden tractors as multipurpose machines. Consequently, I tested my samples with 38- to 54-inch decks and 14- to 18-hp engines on the 2,500-square-foot area. They breezed through the plot in an average of 2.7 minutes using 10.7 ounces of gas—half the mowing time needed by a rider. But time is literally money: A garden tractor can cost three or more times more than a rider mower. If you're just mowing the grass, the projected figures at 20,000 square feet (21.7 minutes and 85.2 ounces of fuel) might steer you toward a big lawn tractor rather than the more expensive garden type.

I found maneuverability of the garden tractors to be directly related to weight distribution. All the test machines cornered well, but only Gravelly could be classified as truly light or nimble. With its rear-mounted 18-hp engine, the weight on the steering gear is just enough for good traction.

Cutting-deck width is another aspect of maneuverability. The 48-inch deck on the Simplicity 7117 is a fine



Quiet Wheel Horse electric (foreground) uses chain and sprocket for final drive. Three batteries supply cutting and drive power. Center row (left to right): Eight-hp Ariens is lightest of riders tested and has

six forward speeds and reverse; Simplicity 10-hp Cavalier has short wheelbase and two-blade deck for nimble, smooth cutting; Toro 11-32 uses automotive-type shifting. Back row: John Deere 314 (left)

has 4.5-gallon fuel tank that's well protected but convenient to fill; rear fender on the 18-hp Snapper (right) houses controls for P.T.O. (power takeoff), implement lift, and a two-speed axle.

example of deck-to-machine matching. The deck's cutting line lies outside the wheelbase, allowing you to cut close to obstacles and keep trimming to a minimum. The John Deere 314 was equipped with an undersize deck at my request. With the cutting line inside the wheel tread, I had to learn the proper steering arc to let me cut close to small obstructions, such as trees, without hooking a rear wheel. It was impossible to cut close to walls or fences.

Why did I ask for a smaller cutting deck? So I could park both the tractor and my car inside my garage. The narrow deck added about 10 minutes' mowing time to that needed for my one-acre lot—a fair trade for storing an expensive machine inside.

You'll find some attractive features on these big machines: hydraulic or electric equipment lifts (standard on many); optional attachments suitable for anything from truck farming to warehouse work; and a range of transmissions from gear drive to hydrostatic. (Some, such as the Gravely, combine performance characteristics of both.)

Special mowers

I didn't test mowing time or fuel economy for machines in the special class. Instead, I looked at the features

[Continued on page 136]

PS buyer's guide to 1981 lawn mowers

Manufacturer	Model	Type*	Price (\$)	Cut (in.)	Horsepower	Transmission/drive	Comments
Lawn-Boy	8237	W.B.	369.95	21	n.a.	Infinite thru single range	Two-cycle engine; multiple attachment and bagging optional
Sears	536.902034	W.B.	94	20	3	Hand push	Great for clean-up and trim
	10/42	W.B.	849.99	42	10	5 speeds	Three-blade deck; blade brake
Snapper	21-350P	W.B.	373.95	21	3.5	6 speeds	Options include thatcher
Toro	Electric mower/trimmer	W.B.	220	20	n.a.	Hand push	Two string-trimmer heads cut up to obstacles
	20790	W.B.	479.95	21	n.a.	Infinite speeds within 3 ranges	Electric start; ball-bearing metal wheels
Ariens	RM-830	R.M.	1,089.95	30	8	6 speeds and reverse	Shift on the run; electric start optional
Simplicity	3110	R.M.	1,450	36	10	5 speeds and reverse	Two-blade deck; electric start
Wheel Horse	E-81	R.M.	1,230	32	n.a.	5 speeds and reverse	Two-blade, two-motor deck; electric motor drive, battery powered
Gilson	52060	L.T.	n.a.	38	11	3 speeds and reverse	Two-blade rear-discharge deck
Toro	11-32	L.T.	1,949.95	32	11	5 speeds and reverse	Automotive clutch permits shift on run; one-blade deck
Bolens Iseki	G154	G.T.	4,841	48	15	6 forward, 2 reverse speeds	Diesel; four-wheel drive, three-speed P.T.O.
Gilson	53038	G.T.	2,014.95	42	11	4 speeds and reverse	Three-blade side-discharge deck
Gravely	8183T	G.T.	4,771 f.o.b.	50	18	8 forward, 2 reverse speeds	Rear engine and low center of gravity make for maneuverability; forward-reverse control stick is handy
John Deere	314	G.T.	3,794	38	14	Hydrostatic	A 48-in. deck is recommended.
	314	G.T.	3,848	48	14	Hydrostatic	
Simplicity	7117	G.T.	4,495	48	17	Hydrostatic	Smooth cut; positive handling
Snapper	1885	G.T.	5,500	54	18	4-range hydrostatic	Implement Lifts, two-speed axle, rear P.T.O.

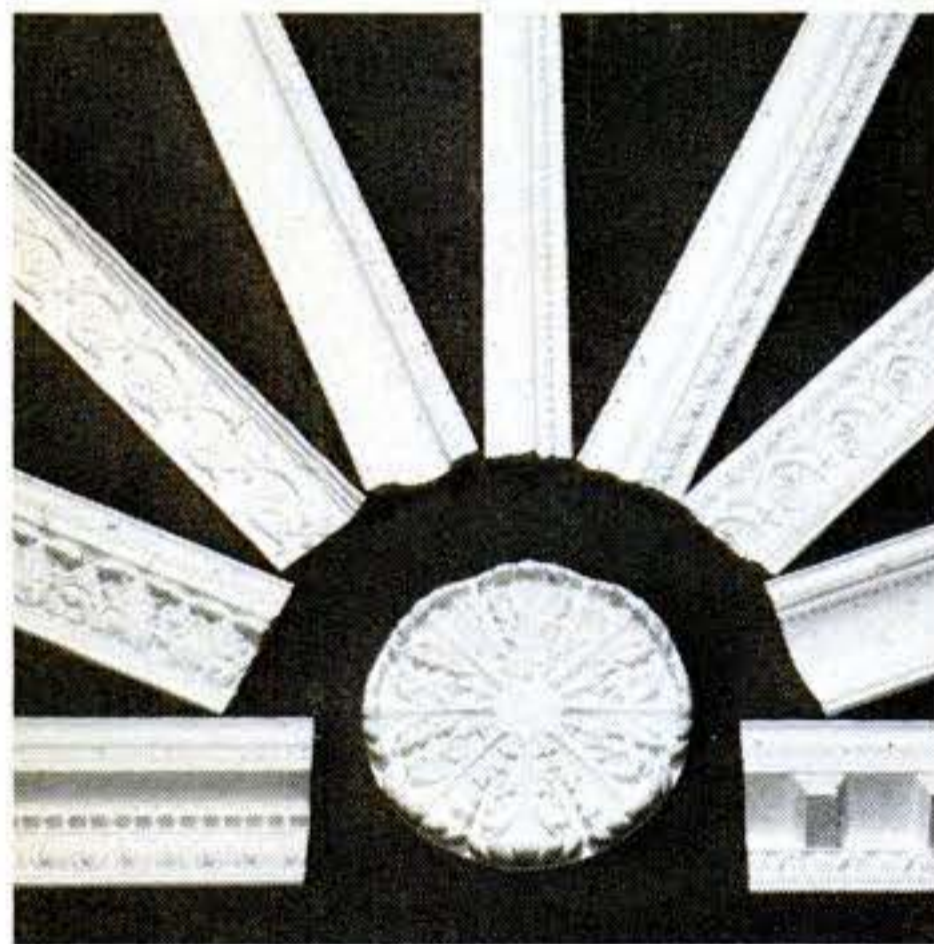
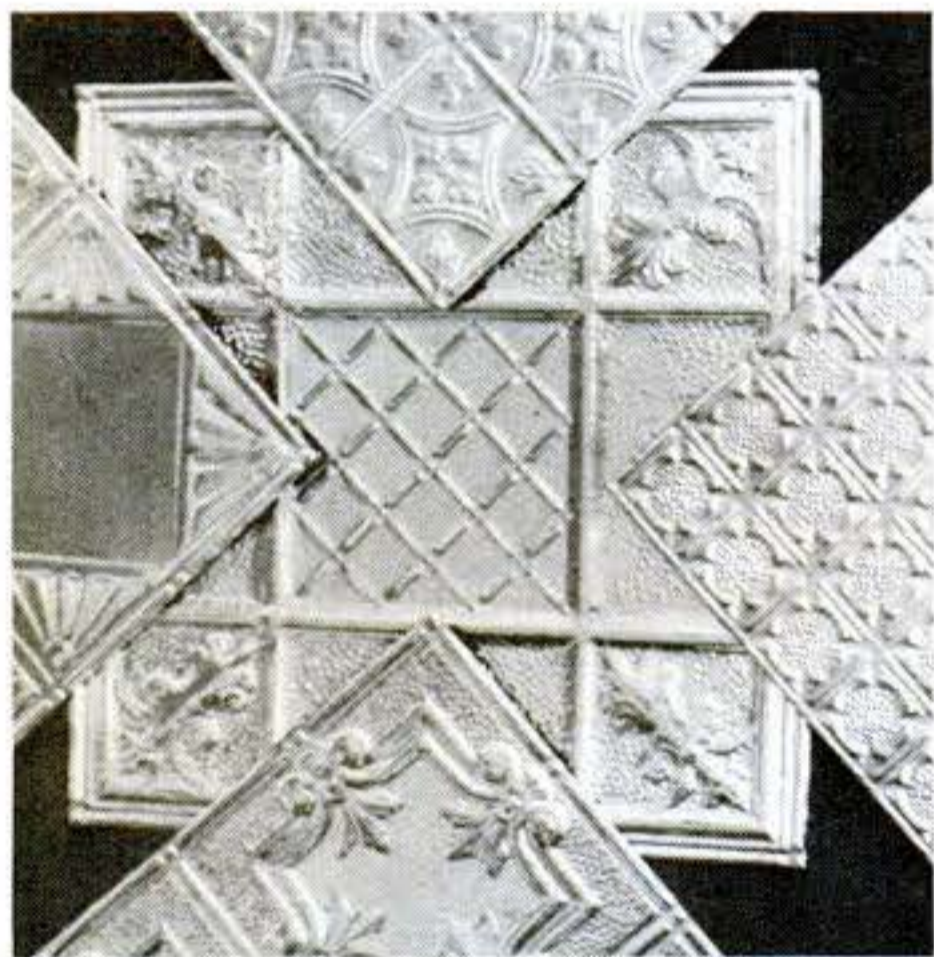
*W.B. = walk-behind, R.M. = rider mower, L.T. = lawn tractor, G.T. = lawn and garden tractor

SHOP TALK

By PAUL BOLON

Tradition!

If you don't fancy dropped ceilings or modernistic, bare cornices; if you find the ubiquitous quarter-round lacking in expression as a molding; if, in short, you are a traditionalist—at least in home decor—you may assume that reproducing the



charming, old-world decoration of yesteryear isn't possible today. Not so.

Showy pressed-tin ceilings, ornate plaster moldings, and dignified fireplace mantelpieces (see photos) are not only still available, but they are now fabricated so that they can be easily installed by today's homeowners.

Decorative Designs makes plaster cornices, panel moldings, and centerpieces in styles ranging from the filigreed and curlicued rococo and baroque to Gothic. The antique-style plaster pieces are reinforced with up-to-date glass-fiber webbing, and they also have an embedded-wood nailing hem, which makes them relatively simple to install.

Traditional installation required dampening each unit before raising it into wet plaster beds on the wall or ceiling, then a thorough shoring up until the plaster cured. With the new reinforced moldings you just drill small holes through the nailing strips, raise and nail into studs and ceiling joists, and spackle the nail holes. You can also use an adhesive with the installation. Miter cuts for inside corners can be made with a radial-arm saw or with a simple coping saw and a template for tracing a line. The company (Box 1692, 316 N. Main, Elkhart, Ind. 46515) offers a free catalog and how-to information.

The Chelsea Decorative Metal Co. (6115 Cheena, Houston, Tex. 77096) makes 18 designs of pressed-tin ceilings, stamped, the company says, from original dies dating back to the 19th century. Metal ceilings were originally introduced in the 1860's as a fast, cheap alternative to ornamental plasterwork. But by the turn of the century, tin ceilings actually had become fashionable. It just shows you how one generation's inexpensive imitation can become another's fashion—and, to a still later era, an honored tradition.

The tin sheets are made only in two-by-eight-foot sections and can be nailed directly to a ceiling or to furring strips. The sheets have a silvery finish that can be painted or left as is. Designs range from repeating squares and leafy motifs to snappy Art Deco, an American style of the 1920's–30's. Tin cornices are also available for finishing. The maker offers a free catalog of patterns.

Mantelpieces in hardwood veneers are made by Rustic Crafts (65 W. Sheffield Ave., Englewood, N.J. 07631) in classic, Early American, and traditional styles. Each style is made in nine different sizes, which the company says will accommodate most of the zero-clearance fireplaces now being sold, as well as older, built-in fireplaces. The mantelpieces can be

mounted to any non-combustible surface—brick, stone, slate, or tile, or their fireproof veneer imitations. After the three support pieces are nailed around the fireplace, the rest of the pieces assemble with an interlocking joint system that requires only a mallet tap to each added piece. Mantelpieces can be purchased with a dark pine or antique white finish, or unfinished. Rustic Crafts will send a free brochure and furnish the address of its nearest distributor.

Briefly noted

● *The Next Whole Earth Catalog* (Random House, New York) is again edited by Stewart Brand. It has the same format as the *Last Catalog* (1971) and the *Epilog* (1975), but *The Next* supercedes them, repeating only about 10 percent of the items in the original version, the editor reports. Although most of the items are different, the subjects are familiar. Most topics have been brought up to date; coverage of some, such as domes, has shrunk considerably, and other subjects, such as computers, expanded. As a reference tool the catalog still presents a sweeping smorgasbord of subject matter: cybernetics, knots, eco-ethics, firewood, hot tubs, guns, and biogas, for example. The topics have been organized into general sections and the karmic vibrations from contributors and editors considerably toned down from the original. It's still big (11 by 14 inches), voluminous (608 pages), and reasonably priced (\$12.50). Besides that, it's the only tome I know that includes its own cost and profit statement, calculates the number of trees required to print the first 100,000 copies (6,160 or 14 acres' worth, if you're interested), and it's fun.

● *Builder's Guide: Passive Solar Homes* by architect Rick Cowlshaw compares the cost of a new, standard developer-built home in Colorado with the same design having several different energy-saving features. The argument made by builders against energy-saving additions is that they increase the already high initial cost of housing. True, *buying* less is cheaper, but, as Cowlshaw documents with life-cycle costing, an energy-efficient design reduces the "rent" we pay for higher winter fuel bills so dramatically that *owning* such a house is cheaper—and the home's future value is enhanced. The pay-back period—when fuel savings overtake any higher mortgage costs—is about four years for a moderate investment. Of course, many passive-solar concepts (often ignored by developers) such as siting, orienting the house to the sun, and reducing the amount of north-facing glazing don't cost an extra penny in construction costs.

Builder's Guide is really directed to builders and contractors, but anyone building a house will be interested in this kind of cost analysis, although the actual dollar figures apply only to homes with the same weather and similar building costs as in Colorado. The 80-page ring-bound book is available for \$15 from Cowlshaw, Box 7604, Colorado Springs, Colo. 80933. P 5

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

8 mg. tar, 0.7 mg. nicotine av. per cigarette by FTC Method.

© Lorillard, U.S.A., 1981

**Golden Lights.
You really know you're smoking.**

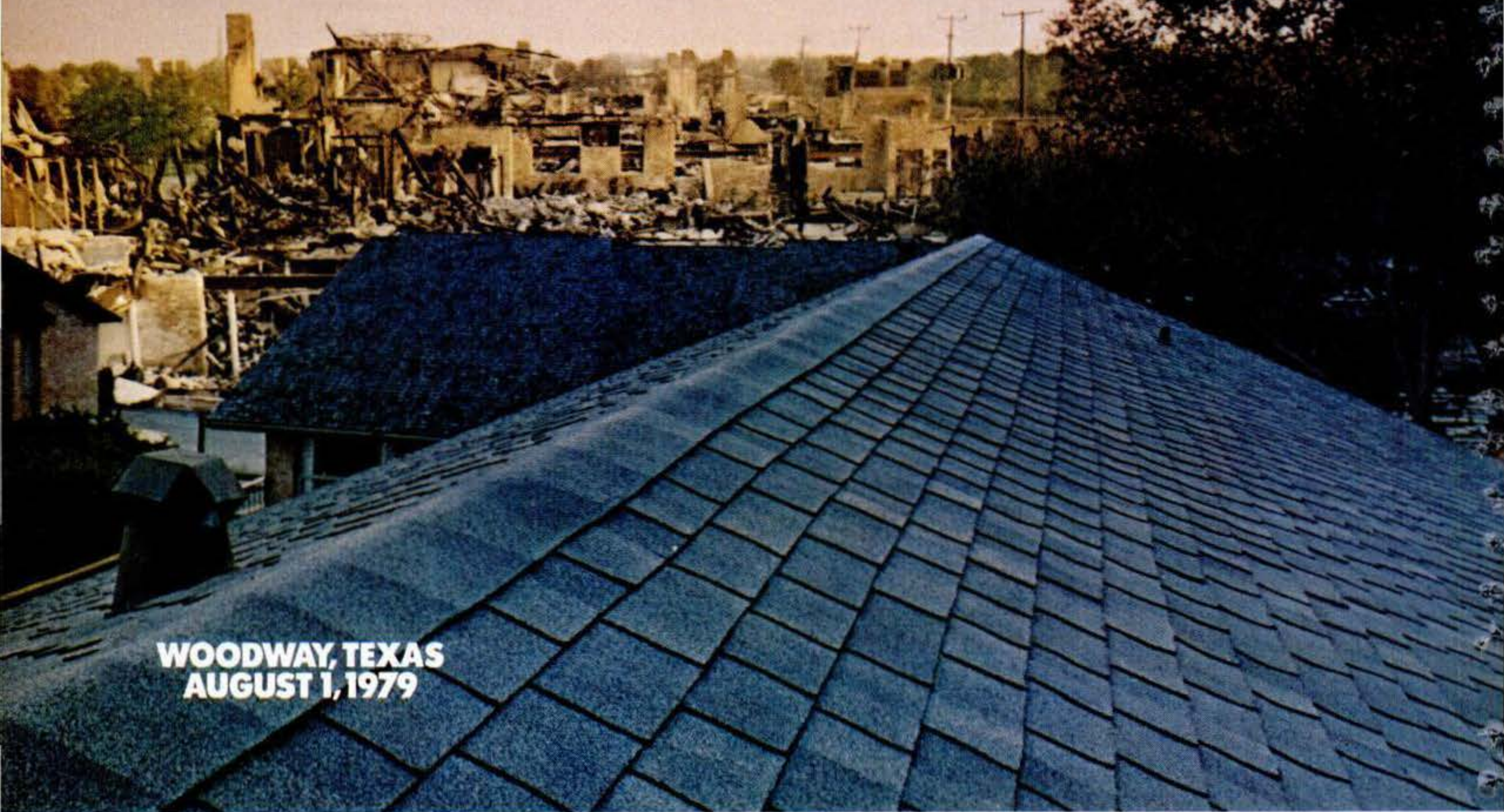
Give up double digit tar. But don't give up the pleasure.

Kings and 100s.
Regular and menthol.


**Golden
Lights**


**Go
Li**

HOW FIRE RESISTANT TIMBERLINE ASPHALT ROOFING EVEN HELPED KEEP SOME WOOD ROOFS FROM BURNING.



**WOODWAY, TEXAS
AUGUST 1, 1979**

In the Houston community of Woodway, a fire broke out that leveled a number of wood-shingled homes leaving hundreds homeless.

But more homes would have gone up in smoke if not for Timberline® asphalt shingles.

Burning embers set wood roof after roof ablaze. But these embers did not ignite fire resistant Timberline shingles with their granular ceramic baked surface. Since Timberline was able to fend for itself, firemen could spend valuable time saving other wood-shingled homes from sure destruction.

Of course, fire isn't the only thing Timberline shingles stand up to. Its self-sealing agent works with the sun to make sure your investment won't blow away.

Needless to say, Timberline shingles bear an uncanny resemblance to wood. Their unusual thickness and deep irregular shadow pattern make it hard to tell the two apart.

So buy Timberline shingles, either to put on your new home or the one you have now.

Because the only place in a home wood shingles belong, is in the fireplace.

GAF® **TIMBERLINE®**
ASPHALT ROOFING
On top of the industry.

For more information or the name of your nearest GAF dealer, look in the Yellow Pages or write the GAF Corporation, Building Materials, 140 West 51st Street, New York, New York 10020, or call toll free 800-223-0344. In New York State call 800-522-5250. Limited warranties from 5-25 years against manufacturing defects and wind damage. Length of warranty depends on choice of shingles. ©1981 GAF Corporation.

Copyrighted material



What to do when your **car won't start**

Getting a dead car back into action is usually easy—if you can trouble-shoot

By **RAY HILL**

You walk to your car, get in, and turn the ignition switch. The engine

doesn't crank. You try it again—and again—and again.

If this happened to you—and it's bound to—what would you do? The right answer can save you the cost and inconvenience of paying for a tow truck, a mechanic's service call—or both.

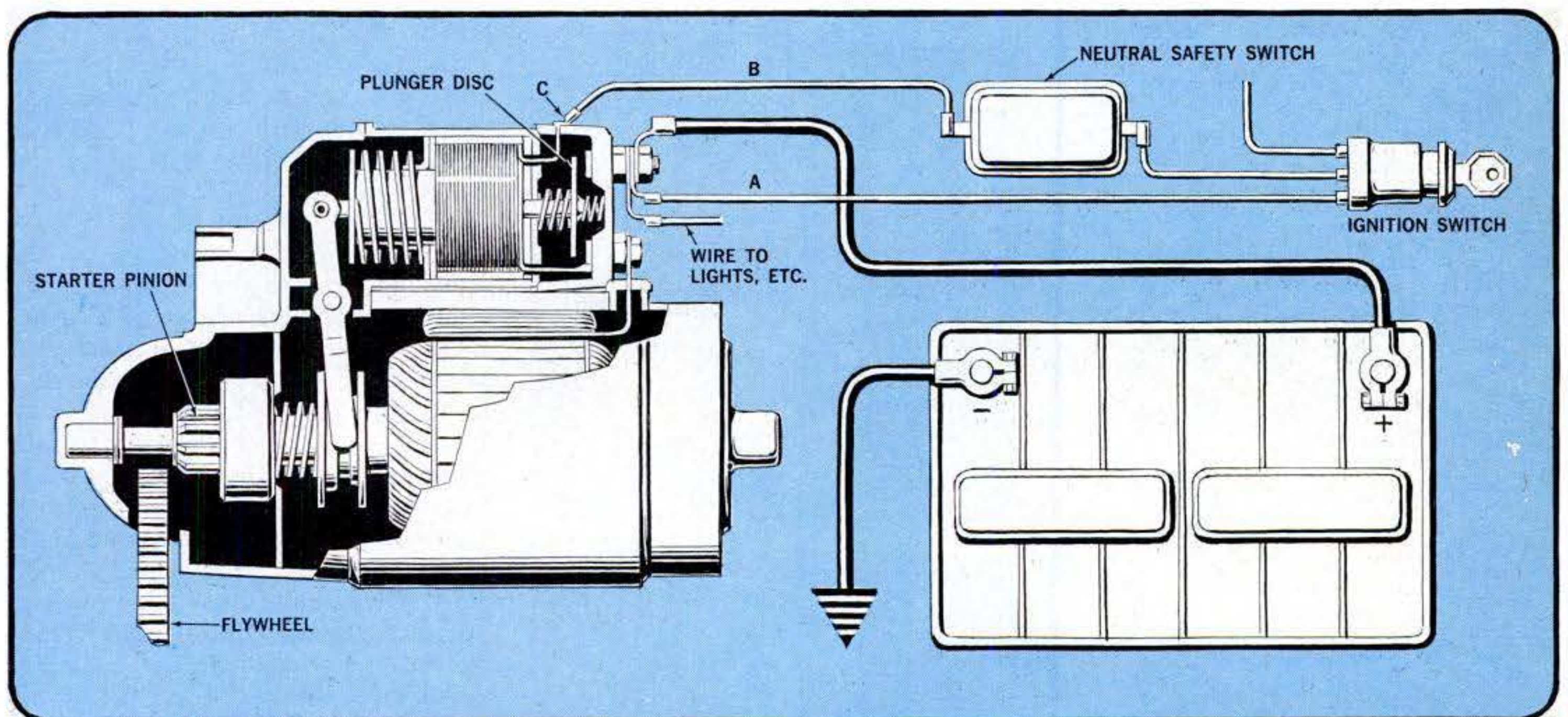
Basically there are four no-start conditions: no cranking and no noise,

no cranking accompanied by a clicking sound, slow cranking, and normal cranking. Let's trouble-shoot each problem.

No cranking, no noise

If you turn the key to the start position and absolutely nothing happens—the engine doesn't crank and there is

Continued



Typical GM cranking circuit: Battery current is always available at the battery-cable connection at the starter solenoid. Lights and other electrical items can receive power from this terminal, regardless of whether the ignition switch is on. When the ignition switch is turned to the crank position, current flows from small wire A at the solenoid-battery terminal through the ignition switch and along wire B to the small-wire solenoid terminal C. From here current flows through electrical windings creating a magnetic field that pulls the solenoid plunger against the solenoid switch contacts. When the

plunger disc touches these two contacts, battery current flows to the starter-motor to turn. At the same time, the shift lever, which is attached to the solenoid plunger, causes the starter pinion to move in and engage the flywheel. When this happens, the engine cranks.

Other car makers may use slightly different systems. For example, Ford's starter solenoid is mounted separately from the starter, on the fender well. Its job is to send battery current to the starter motor, a positive-engagement type. A movable pole shoe is attached to the starter's

pinion gear. When the key is turned to crank, current flows through the starter's field windings and the pole shoe is magnetically drawn to one of the field windings, thus engaging the starter pinion with the flywheel. A shop manual for your make and model car will give you the specs for your car's system and tell you where the parts are.

Chrysler cars use a solenoid to engage the starter pinion gear with the flywheel. But unlike GM, a starter relay is used to actuate the solenoid. When the ignition switch is turned to crank, the starter relay closes, sending current to the solenoid.

Window replacement?

Introducing exactly what you need in a replacement window



Andersen Windows

FREE

Don't replace your windows until you've read this fact-filled 16-page brochure. Find out the answers to your most important window replacement questions. And learn how you can use original quality Andersen® Perma-Shield® windows instead of special replacement windows.

Please send your free booklet, "Introducing exactly what you need in a replacement window." Mail to Andersen Corporation, Box 12, Bayport, MN 55003

Name _____
 Address _____
 City _____ Zip _____
 State _____

The beautiful way to save fuel®
Andersen® Windows®



022-0381

© 1977 Andersen Corp., Bayport, MN 55003

Car won't start

[Continued]

no noise—first try this. With an automatic transmission, be sure the gear-shift selector is in park. With a standard shift, be sure the clutch pedal is pressed all the way to the floor. Otherwise, the neutral safety switch (also referred to as the neutral start switch) will keep the engine from cranking.

If the transmission is in park, move the shift lever through the gears and put it in park again. If the transmission is a standard shift and you have

the clutch pedal pressed against the floor, release it and press it down a couple of times. The neutral safety switch is a mechanical switch and sometimes, if it's slightly out of adjustment or beginning to fail, it doesn't make good electrical contact. Jiggling the shift lever or clutch pedal sometimes restores electrical contact.

If this solves the problem, adjust or replace the neutral safety switch as soon as possible, following shop-manual instructions. If the engine still doesn't crank, turn the lights on.

If the headlights don't light, the most likely problem is a bad battery or a loose or corroded battery-cable connection. Connect a test lamp across the battery posts. If the lamp lights, you know battery current is available. Remove the battery cables from the battery and clean both the battery terminals and the cable connections. Then reconnect the cables, making sure each one is tight at its other end, too. Remove any corrosion.

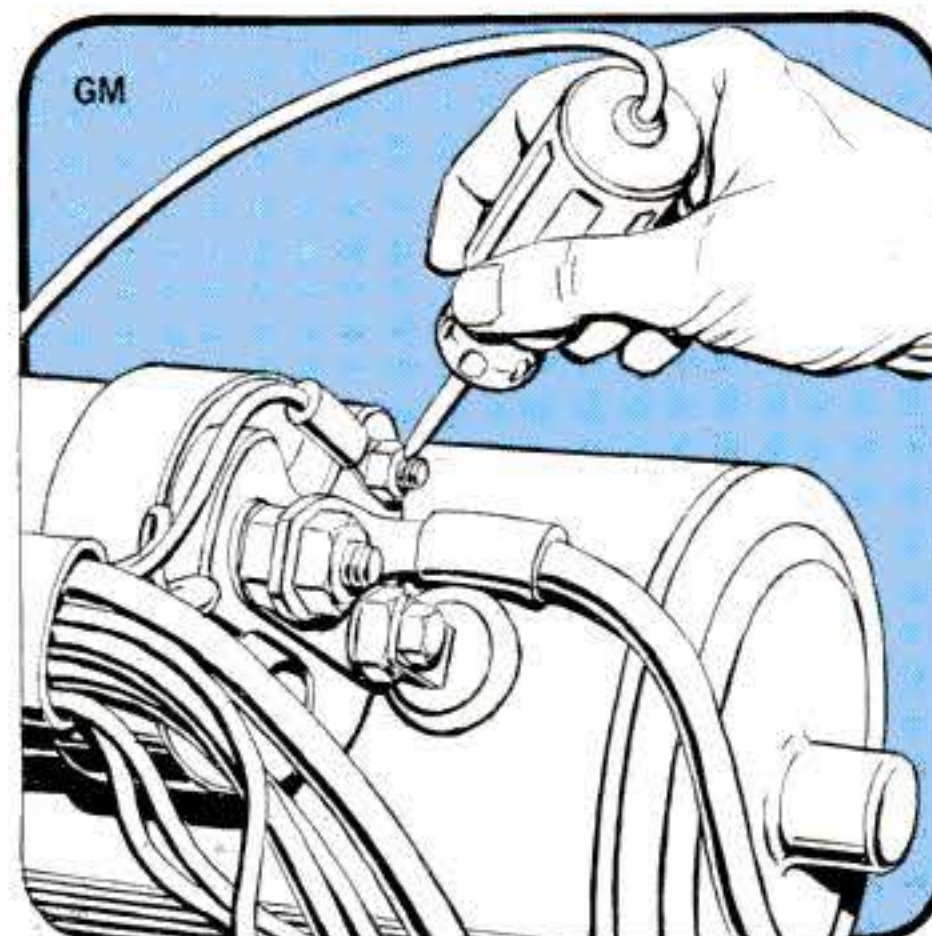
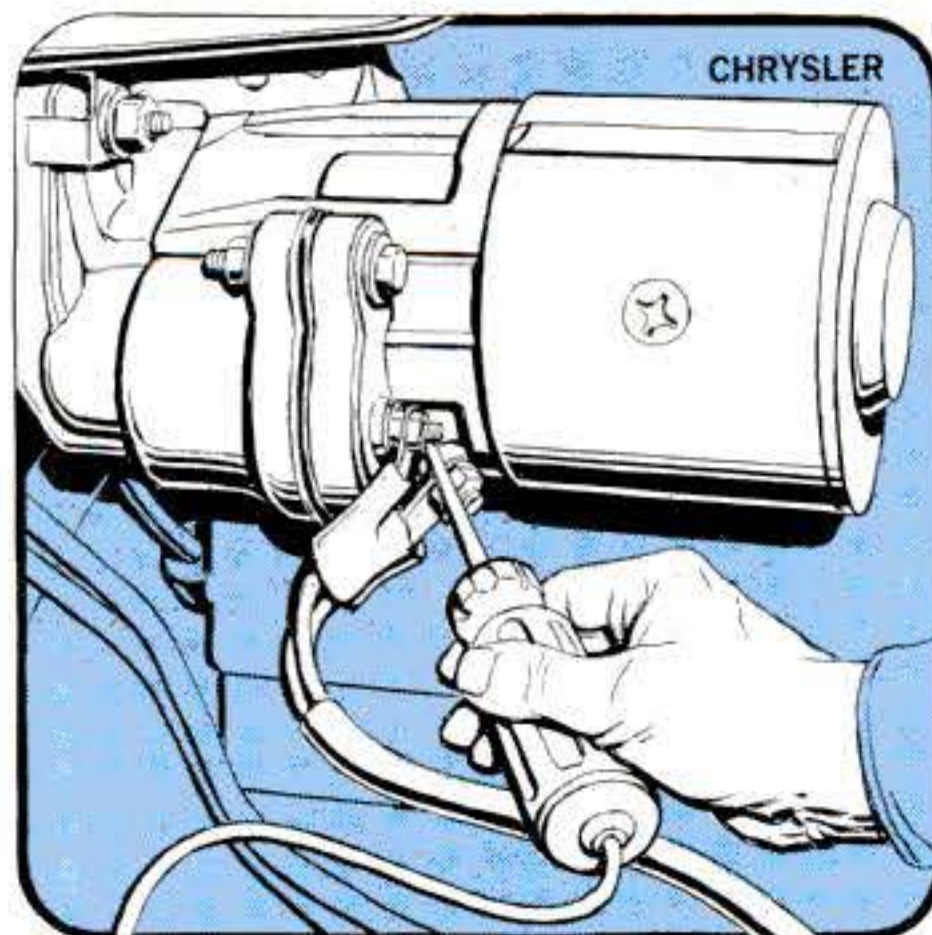
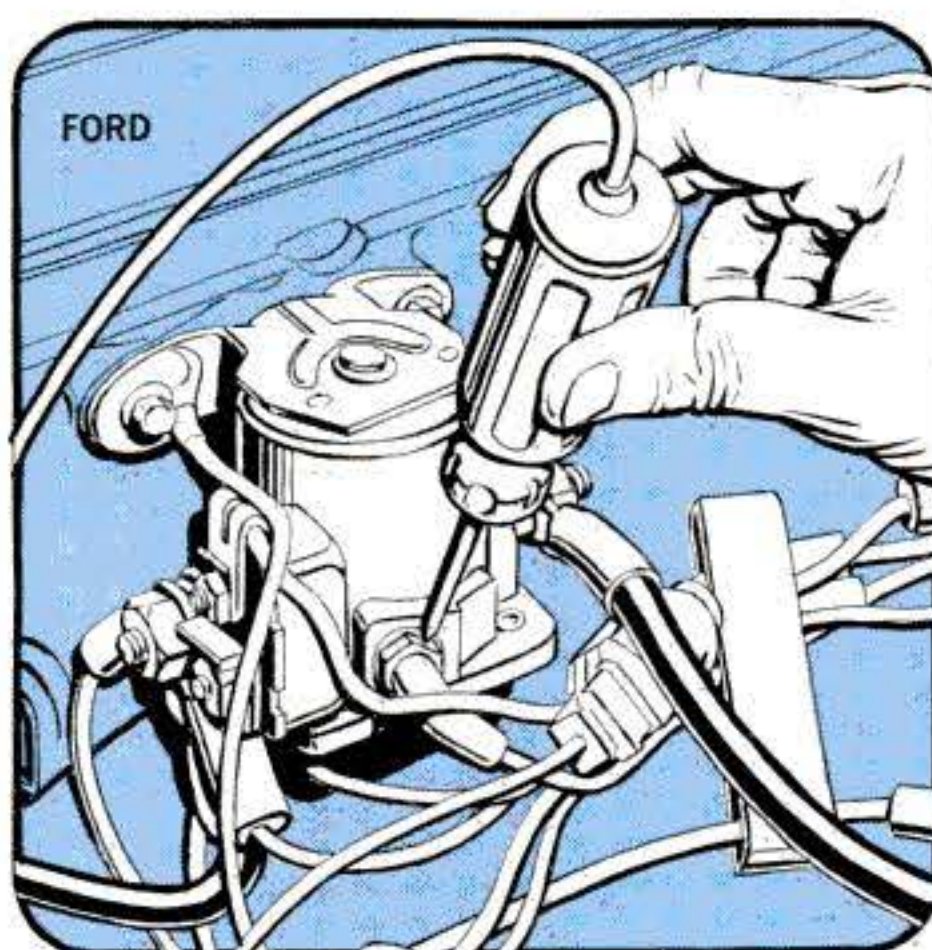
If the lights dim when the ignition switch is turned to crank, the most likely cause is a bad battery or starter. Check the battery as detailed later in this article. Check the starter according to shop-manual instructions. Here's what will probably happen, though: The lights will shine but won't dim when you turn the ignition switch to the start position. If that's the case, and you hear no noise, there is an open in the starter circuit.

Likely suspects are a loose or broken wire, a bad starter-motor solenoid, a bad neutral safety switch, a neutral safety switch that needs adjusting, or a bad ignition switch. Check to see if any wires are loose, broken, or disconnected at the starter relay (if your car has one) and at the starter solenoid. Some cars (Chrysler Corp.) have both a starter relay and starter solenoid. Others (GM) have only a starter solenoid.

All wires secure? The next step is to find out if current is reaching the starter solenoid. On Fords the solenoid will be on the fender well, usually close to the battery. On most other cars the solenoid will be attached to the starter.

Locate the large cable that connects the battery to the solenoid. Near its connection at the solenoid will be a connection for a much smaller wire. This is the wire from the ignition switch that actuates the solenoid when the switch is in the crank position. Hold the tip of a test lamp

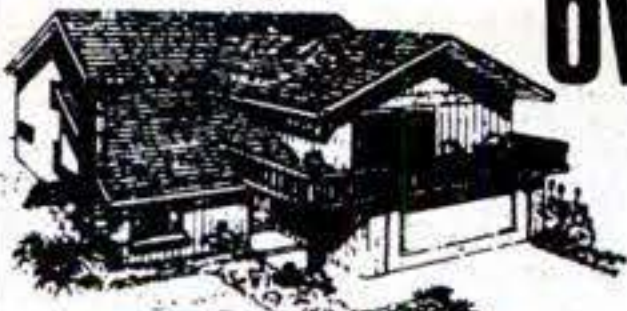
Continued



Testing a starter-solenoid small-wire connection to see if current is reaching the solenoid: With ignition switch turned to crank position, test lamp should light.

Copyrighted material

SATISFIED HOME OWNERS



INSIST ON

Thompson's

Waterproofing

Seal-Stain



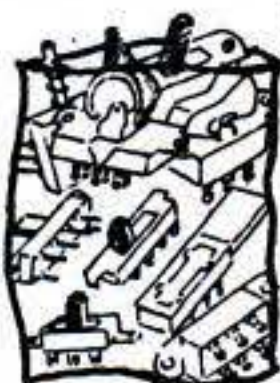
One can instead of two for total all-weather protection. Rich, deep penetrating stain. PLUS Thompson's Water Seal in one easy application. Works great on wood, concrete and masonry. Interior or exterior. Delivers years of colorful protection without chipping, cracking or peeling. Choose from 24 enhancing colors—solid or semi-transparent.

E.A. THOMPSON CO. INC.
703 Market Street, 15th Floor
San Francisco, CA 94103

Manufacturing Chemists
Since 1929
Write For Brochures

PRODUCTION OVER-RUNS ASSORTED... NEW MINIATURE SWITCHES

TOGGLES, ROCKERS, SLIDES, etc.
From one of America's
Leading Manufacturers
Original Cost to \$15 Each!



BAG OF \$1.00 5 BAGS
20 \$4.00

Fl. res. add els. tx.

Add 65¢ per bag, Shipping/Handling
No C.O.D.'s

AMF Electro-Components Division
P.O. Box 5055, Dept. PS
Ft. Lauderdale, FL 33310

Add bolts and love and what do you get?

SUPER BRONC



A quality machine that **YOU** built!

7 Tryke Models, and 6 Bike Models. Many accessories, including bench seat

SUPER TRYKE



For exploring, hunting, fishing, and occasionally even for work, these machines bring a lot of pleasure. If backwoods riding is your kind of fun, write today for a FREE color brochure, to:



SUPER TRYKE

Easy-to-build semi-kit saves you money. Engine is completely assembled, frame is welded and painted. With common tools and our 22" x 34", fully illustrated instruction sheet, you just bolt everything together and start riding!

- Rugged vehicles powered by 5 hp to 16 hp American-made engines.
- All have torque converters (no shifting), four-shock suspension and tough, tubular steel frames.
- Can be licensed for street riding in many states.
- Can be registered as farm machinery.
- Kit priced from \$479.95 to \$1099.95, less accessories.

Carl Heald, Inc. Dept. PS-83 P.O. Box 1148, Benton Harbor, MI 49022

From the Largest Maker of Bike and Tryke Kits in the World — Carl Heald

IF IT LOOKS LIKE JUST ANOTHER HAND GRINDER, LOOK AGAIN.

Do it easier and faster with Dremel. The Moto-Tool does projects that used to take many hours in a fraction of the time. Home repair projects become easier and more enjoyable to handle. Variable speed control (5,000 to 28,000) RPM lets you dial the speed to fit the job. The Dremel Moto-Tool—buy it wherever fine power tools are sold. Dremel, Div. of Emerson Electric Co., 4915-21st St., Racine, Wisconsin 53406.

DREMEL® MOTO-TOOL®
It shapes, sands, carves, saws, polishes, sharpens, drills and a whole lot more.



Comes with a large assortment of accessories that make Moto-Tool the most versatile tool in your workshop.

Also available, Model 232 Moto-Flex Tool. Gives finger-tip control for precision work.



Cut floor tile.



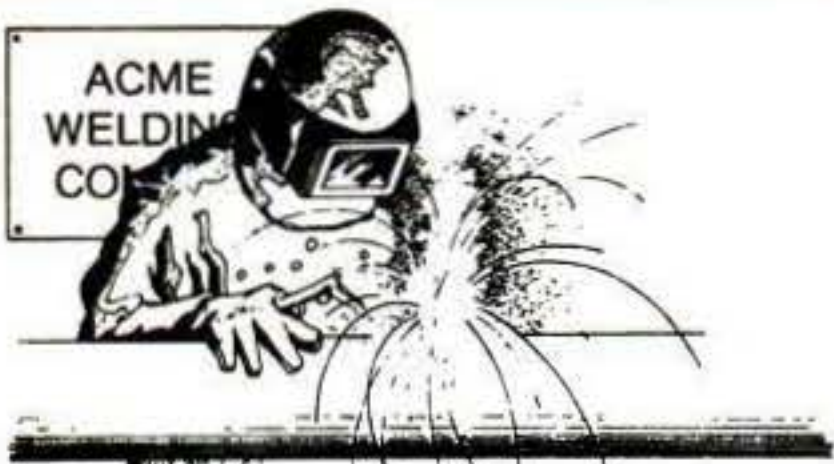
Cut tubing or pipe.



Sharpen yard tools.

DREMEL®

IF YOU DO THIS!



YOU NEED THE...

ATLAS BANDSAW

For fast, clean, accurate cutting to assure proper alignment for smooth welding.

- SAVES TIME
- ELIMINATES TEDIOUS CUTTING BY HAND
- TURNS OFF AUTOMATICALLY WHEN CUT IS COMPLETED

IT'S CONVERTIBLE

NOW AVAILABLE WITH ROLLER BLADE GUIDES & BALL BEARING GEAR BOX



ONLY **\$289⁰⁰** plus \$30 handling/shipping

Handles cuts in wide range of metals — steel, iron, brass, aluminum, copper. Complete with 1/3-HP, 1725 RPM motor. Accepts any shape stock, cuts at any angle from 90° to 45°. Max. cap. is 4" x 6". Three speeds 90, 155, 250 fpm. V-belt & worm gear drive with ball bearing drive wheel shaft. Swiveling rapid approach/release vise. Spring control feeds blade at proper speed for fast cuts. Stock stop for repeat cutting. Use in vertical position to contour, notch, slit, etc. in metal or wood. 41" L x 37" H x 16 1/2" W. Made in U.S.A.

ATLAS PRESS COMPANY, Dept. 475
2019 North Pitcher, Kalamazoo, MI 49007
Price subject to change without notice.

Mail To: ATLAS PRESS COMPANY, Dept 475
2019 North Pitcher, Kalamazoo, MI 49007

Please send me the Atlas Band Saw (Model 17601). Enclosed is my check or money order for \$319.00. (Includes shipping and handling) or charge my order to:

VISA Master Charge

Acct. # _____ Exp. Date _____

Name _____

Address _____

City/State/Zip _____

Send FREE Atlas Catalog.

Michigan and Indiana residents add 4% sales tax. Saw comes via motor freight. Shipping/Handling rate for contiguous 48 states. Alaska and Hawaii orders require additional freight to final destination.

FREE



Buyer's Guide

- 100 pages of car stereos, personal computers, home mini-stereos, portables, telephones, accessories, and much more.
- Industry's most quoted and prestigious publication.
- Plus important shopping information and discount prices on hundreds of products.

PUBLISHED BY

CRUTCHFIELD

- Nation's largest and most respected car stereo specialist
- 13 toll-free WATS order and assistance lines
- Same day shipping and overnight delivery on Federal Express orders
- Nationwide Installer Service
- Installation and Satisfaction Guarantees
- Huge inventories
- Master Card and VISA

Call or Write now for Your FREE Catalog

Use the coupon below or call toll-free:

800-446-1506

In Virginia Call 800-552-3961

* Featured car stereo is the Pioneer KP-7500

Send me your FREE catalog by Third Class Mail

Rush me your FREE catalog! I'm enclosing \$1 for First Class Mail

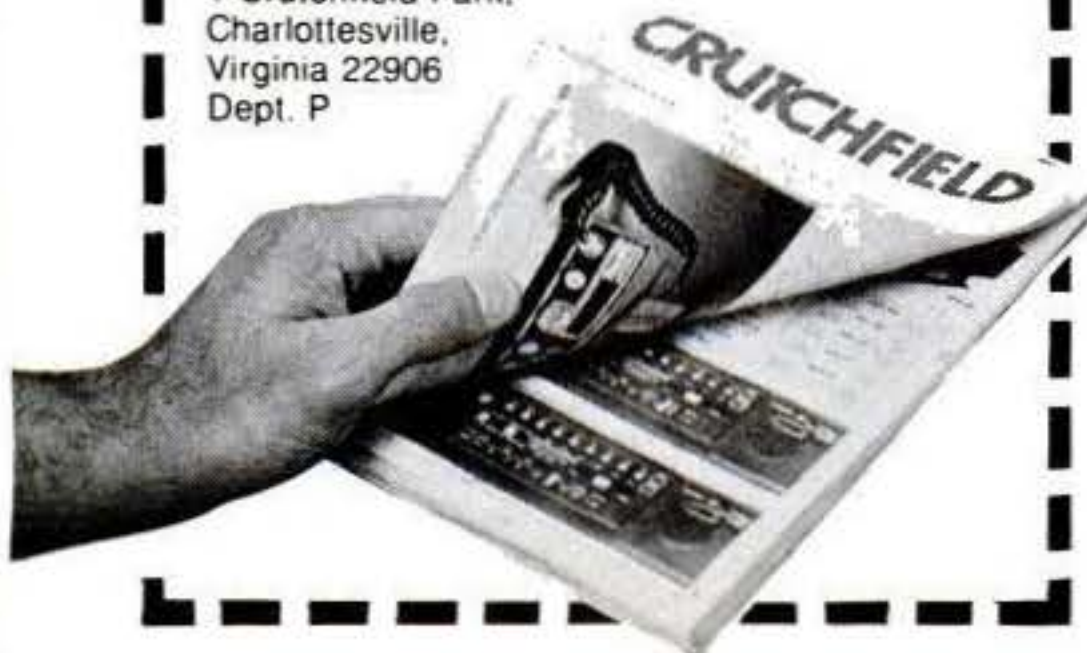
Name _____

Address _____

City _____

State _____ Zip _____

Send to CRUTCHFIELD
1 Crutchfield Park,
Charlottesville,
Virginia 22906
Dept. P



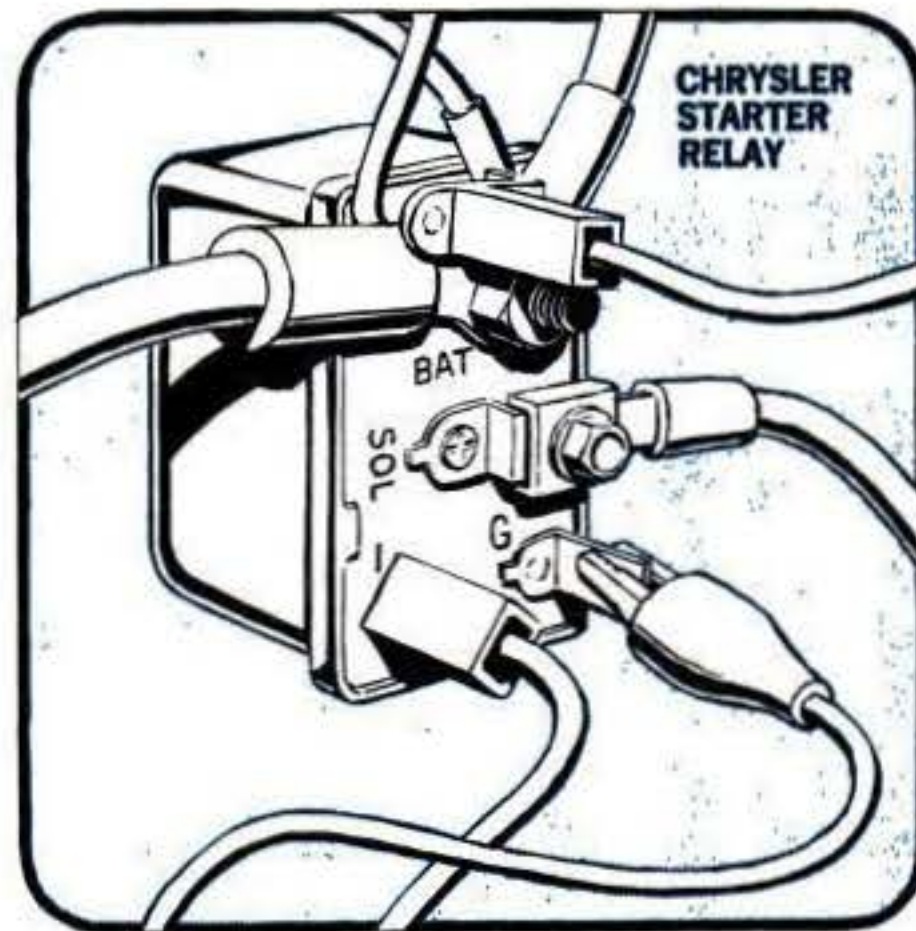
Car won't start

[Continued]

against the small-wire connection at the solenoid and ground the test-lamp lead. Have a friend turn the ignition switch to crank. The lamp should light.

If it lights (with a GM- or Chrysler-made car), you know the problem is in the solenoid or starter. At this point the solenoid and starter must be

Continued



Bypassing the neutral safety switch: With Chrysler cars, remove the G wire from the starter relay and use a jumper wire to connect the G terminal from the relay to a good ground. Turn the ignition switch to crank. If the engine cranks, the transmission linkage needs adjustment (to properly actuate the neutral safety switch), or the neutral safety switch needs replacement. With GM cars, remove the two-wire quick disconnect from the safety switch (safety-switch wires are usually purple) and bridge the gap with a paper clip. With other cars, the principle is the same. Locate the wires running to and from the neutral safety switch, disconnect them, then connect them together with a jumper wire or paper clip. If you use a paper clip, be sure you make good electrical connection. And don't hold the paper clip when the switch is turned to crank. If the switch connections are underneath, don't remain under the car while the key is turned to crank (should the car roll, you could be run over).

"You WILL Lose EVERY Unwanted Pound EVERY Unsightly Inch OR WE WILL PAY YOU \$100.00!!"

Aren't you tired of outrageous claims like these? We are too! But we've got the best waist belt system on the market and we want you to try it. Here's some straight talk—When you need to drop those unwanted pounds and lose those unsightly inches, just wrap our exclusively constructed belt around your waist or hips, adjust our special fastening system to fit snugly but comfortably, and already it starts working to make you trimmer, lighter and feeling fit. Yes, you just wrap it around you and those extra pounds and inches shrink away. That's why we call it Shrink-Wrap!

You Can Lose 2-3 Inches in 24 Hours!



Skin diver's miracle makes you lose pounds and inches effortlessly!

Here's The Secret!

Many years ago a funny thing was noticed by skin divers after they returned from a dive. When they changed from their wet suit to street clothes, their pants sometimes fell down: always, their pants were loose. After a while, somebody decided to check his weight on a scale. He and his fellow divers all thought that the scale was broken because in each case the reading was many pounds less than their most recent weight level. Then someone who didn't dive got on the scale. Lo and behold, it was the correct weight! Finally, one of the scientists figured it out. There were three reasons—all of them related to the special wet suit rubber that divers wore to protect themselves from the freezing water.

Reason #1—Wet suit rubber is the finest, most expensive made to provide insulation and warmth. It was so good that it actually retained and reflected the body's own heat causing excess fluids in the body's tissues to literally "melt away."

RESULT—Lost Pounds And Lost Inches!

Shrink-Wrap is made from the finest strongest wet suit rubber to make use of your body's own heat and concentrate it to melt away inches in areas of specific fluid retention like the waist and hips.

Reason #2—In order to function properly, a wet suit must be worn by the diver snugly, resulting in a constant force being applied to his body. This isometric effect can actually add tone to loose muscle tissue.

RESULT—Tighter Muscles, A Trimmer, Slimmer Body!

Shrink-Wrap can be adjusted as snug as you like for as long as you like. Put the isometric effect to work for you immediately. Readjust its special fastening system as needed for good circulation and a comfortable fit.

©1980 The New Body Boutique, Inc.
2105 Lakeland Ave., Ronkonkoma, N.Y. 11779



REASON #3—Diving and swimming are activities that burn additional calories. This is like adding coal to a fire. It amplifies the heating effect which is retained and reflected by the special wet suit rubber.

RESULT—More Lost Pounds And More Lost Inches!

Shrink-Wrap comes with its own 5 minute exercise program that will help you to add more fuel to your fire, fast. You'll shed unwanted pounds and lose unsightly inches even more rapidly.

Manufactured exclusively for The New Body Boutique, Inc. which is not connected with any other waist belt company.

Thousands sold at \$19.99...

NOW ONLY \$14.99!

The New Body Boutique, Dept. AMN108
2105 Lakeland Ave., Ronkonkoma, N.Y. 11779

Sirs: I have enclosed my check m.o. Visa M.C. Info. Please rush me the Super Action Shrink-Wrap System. If for any reason I am not satisfied, I'll return it for an immediate refund, no questions asked!
N.Y. Res. add sales tax.

Please give us your waist size for belt and shorts
Men's _____ Women's _____

— Rush 1 belt at \$14.99 plus \$1.50 p&h
— (SAVE \$3) Rush 2 belts at \$27.99 plus \$2 p&h
— Rush 1 pair of shorts at \$17.99 plus \$1.50 p&h

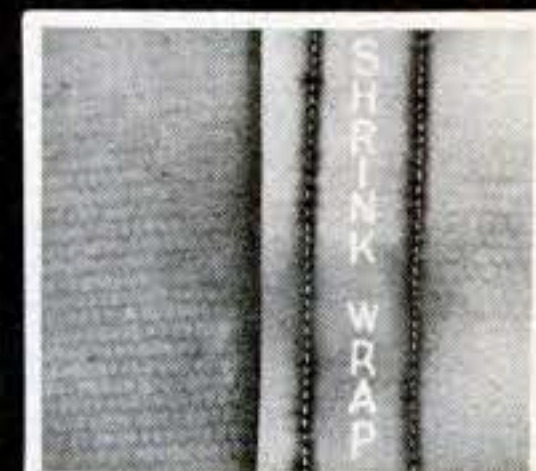
You Can Lose 4-6 Inches This Week!

COMPARE!!!

Shrink-Wrap is strong! It's reversible!
Get the real thing—SHRINK-WRAP!

Actually used in training by our Astronauts!

Yes, just one look at the distinctive pattern of our closed cell rubber and you know that you're getting the finest insulating rubber in the world!



No Nonsense Money Back Guarantee!

Look... We don't make outrageous claims. No waist belt can guarantee you the loss of every pound and every inch and no company will agree to pay you \$100.00. But we are so sure of our product's superior qualities that we can say that if you use Shrink-Wrap as directed whenever you need it:

- YOU WILL LOSE UNWANTED POUNDS AND UNSIGHTLY INCHES.
- YOU WILL BE COMPLETELY SATISFIED with how Shrink-Wrap feels around your body.
- YOU WILL BE HAPPY with the extra support Shrink-Wrap gives to tired and tense back muscles.
- YOU WILL BE TOTALLY DELIGHTED! OR you may return it at any time, for any reason for an immediate refund of your purchase price.

You can use the SHRINK-WRAP System anywhere: doing housework, office work, tennis or jogging.



SHRINK-WRAP SHORTS!

Yes, you can have all the benefits of form fit around your abdomen, buttocks, hips & upper thighs with these comfortable shorts made from neoprene rubber and bonded to U.S. 4-way stretch nylon for only \$17.99

Name _____
Address _____
City _____
State _____ Zip _____
Acct # _____
Interbank # _____ Expir. _____
Belts (Code #107) _____ Shorts (Code FF1) _____

Isn't it better to have a John Deere Lawn Tractor for 10 years than a "bargain" tractor for 4 or 5?



There's no denying you'll probably have to pay a little more for a John Deere. Up front, anyway.

But, when you consider how much longer they last, you're almost sure to save real money in the long run.

Look at it this way. John Deere Lawn Tractors that are 10 to 12 years old are not at all uncommon. In fact, many of our original lawn tractors, built in 1966, are still in use today. On the other hand, the average life span of "bargain" lawn tractors is estimated at only four to five years. So you can see why it pays to buy a John Deere.

You can actually feel the difference in a John Deere. They're built tighter. More solid. So they don't bounce you around so much.

And you can use them year-round. An optional 4-bushel rear bagger collects grass clippings in summer and leaves in fall. And a snow thrower or front blade takes care of snow removal chores in winter. Test drive our 8-hp lawn tractor with 30-inch cutting width. Or our 11-hp with extra-wide 38-inch cut.

See for yourself why in lawn tractors, the real bargain is the one that costs a little more.

For the name of the dealer nearest you, or a free folder, call 800-447-0606 toll free. (Illinois, call 800-322-0688.) Or write John Deere, Dept. 62, Moline, IL 61265. **DOWN-TO-EARTH VALUE.** \$10 off per hp. Buy a John Deere Lawn Tractor before May 31 and save up to \$110 at a participating dealer.

Nothing Runs Like a Deere[®]



Copyrighted material

Car won't start

[Continued]

removed, and replaced or repaired. With Ford cars, if the test lamp lights and there is no noise, the solenoid is bad and must be replaced.

If the test lamp doesn't light, bypass the neutral safety switch with a jumper wire to see if it's bad (see drawing on preceding page). When you do this, be sure the parking brake is engaged and the transmission is in park. With a standard shift, be sure the transmission is in neutral.

If you bypass the neutral safety switch and the engine cranks, the switch is either out of adjustment or bad. Check your shop manual for adjustment procedures. If the switch can't be adjusted, or if it doesn't work after it's adjusted, replace it.

If the car still doesn't crank after bypassing the neutral safety switch, use a test lamp to determine whether current is actually reaching the neutral safety switch. To do this with Ford or GM cars, remove the two-wire quick-disconnect connector, which may be located at the switch or somewhere along the two wires leading to the switch.

With the test lamp grounded to the vehicle and a friend holding the ignition switch in the crank position, touch the test-lamp tip inside both

wire terminals of the quick-disconnect. The lamp should light when it's touched to one of the terminals (the other terminal goes to a small-wire connection at the solenoid).

If the lamp doesn't light, the problem is probably either a bad ignition switch or a bad wire to the switch. To track down the problem, consult the shop-manual wiring diagram for your car and, using a test lamp, work back to the ignition switch to find the break in the circuit.

If the test lamp lights at one of the quick-disconnect terminals (you have already bypassed the neutral safety switch) and the car still won't crank, the problem is in the wire running from the neutral safety switch to the small-wire terminal of the solenoid (broken, corroded, disconnected, etc.).

With Chrysler cars, which use a starter relay in addition to the starter solenoid, if the car doesn't crank after bypassing the starter relay, find out if current is reaching the relay. With the G terminal of the relay grounded with a jumper wire, touch the tip of your test lamp (test lamp is grounded, of course) to the I terminal of the relay. (The relay terminals are marked with letters.) If the test lamp lights when

the ignition switch is turned to crank yet the starter doesn't crank, the relay is bad. Replace it.

If the test lamp doesn't light, there's a problem with the ignition switch or the wire running from the relay to the ignition switch. Trouble-shoot the ignition system using the wiring diagram in your shop manual. Usually, though, if you have a no-start condition with no noise when the key is turned to the crank position, the neutral safety switch is the cause of the problem.

A few cars with column-shift automatic transmission (some Fords, for example) do not have a neutral safety switch. The ignition-switch mechanism in the steering column is designed so the ignition switch can be turned to the start position only when the gear-selector lever is in the neutral or park position. (In this case, you would obviously eliminate the neutral-safety-switch checks.)

No cranking, clicking noise

Here, when the key is turned to crank, you hear a single clicking noise or a series of clicking noises. If it's a series, the cause is almost always a weak battery or bad connections.

Remove the battery cables at the battery and clean them. Use a battery post-and-cable cleaning brush and clean until the connections are bright and shiny. Then reconnect the cables. Check the battery cables, too, at the other end (starter solenoid, engine block, etc.). A cable that's loose or corroded at the other end can create the same problems as one that's loose or corroded at the battery.

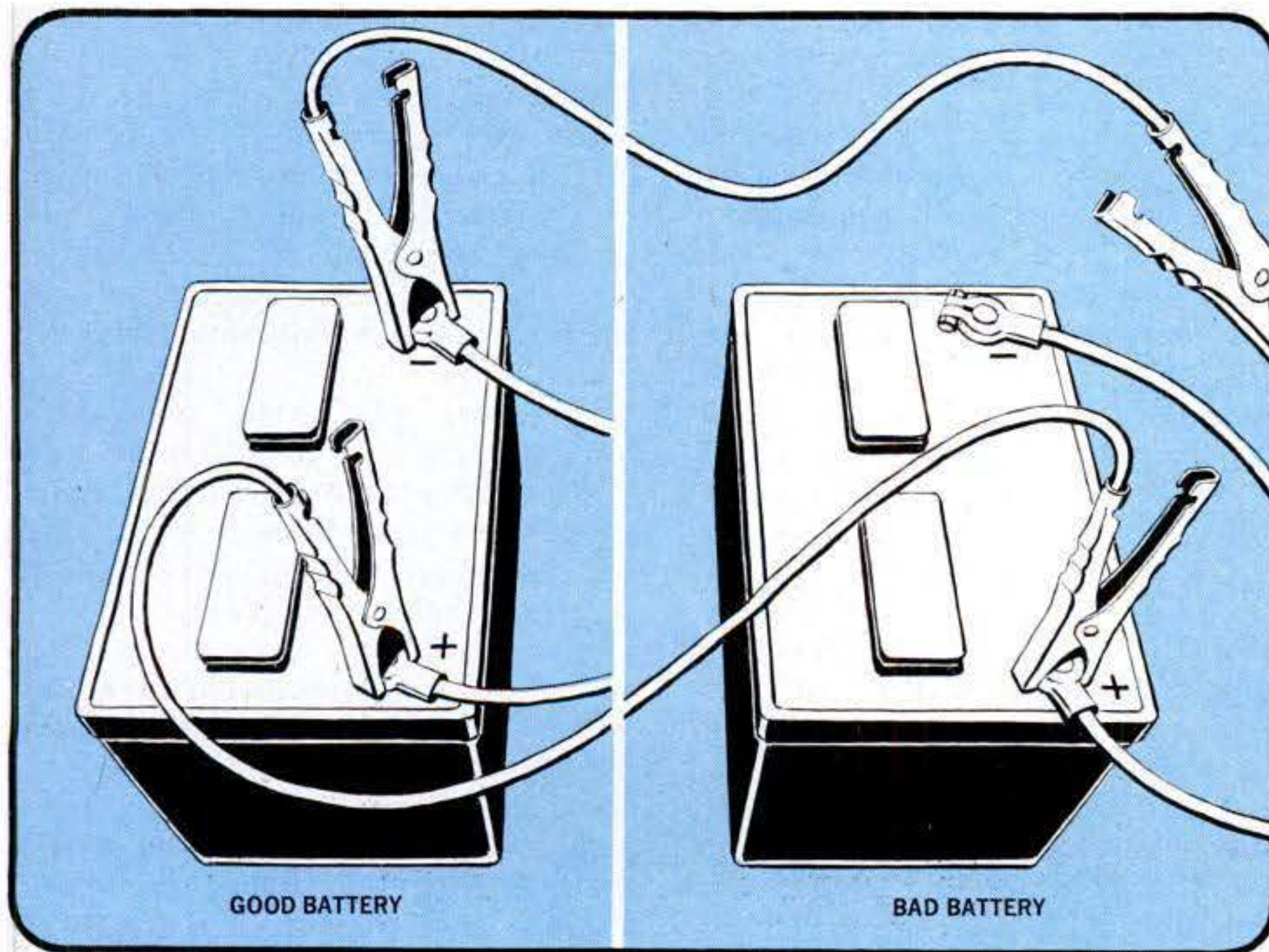
If the clicking continues after servicing the cables, try to boost-start the car. If the car starts, the battery is weak. Have it checked at a garage—or check it yourself as follows:

If it's a conventional battery, first check it with a hydrometer. Each cell should read 1.260 or better. If not, but all cells read low and even, use a charger to charge the battery (or have it charged) until each cell reads 1.260 or better.

If the engine cranks slowly after the battery is charged or if the battery won't charge enough, replace it. Buy a replacement of the size and type recommended for your vehicle by your owner's or shop manual. With a maintenance-free battery, follow the maker's recommendation about boost-starting, charging, and replacement.

If the clicking continues after the

Continued



To boost-start a car, attach a jumper cable to the positive post of the good battery, then attach the other end of the cable to the positive post of the bad battery. Attach one end of the other jumper cable to the negative post of the good battery and the other end to a good ground near the weak

battery. Start the engine of the car with the good battery. Now try to start the other car. When you disconnect the jumper cables, reverse the hookup sequence. Watch out for moving pulleys, belts, and fan blades as you disconnect the cables. (There's no need to lose any fingers.)

Car won't start

[Continued]

battery is charged, the solenoid is bad. Replace it.

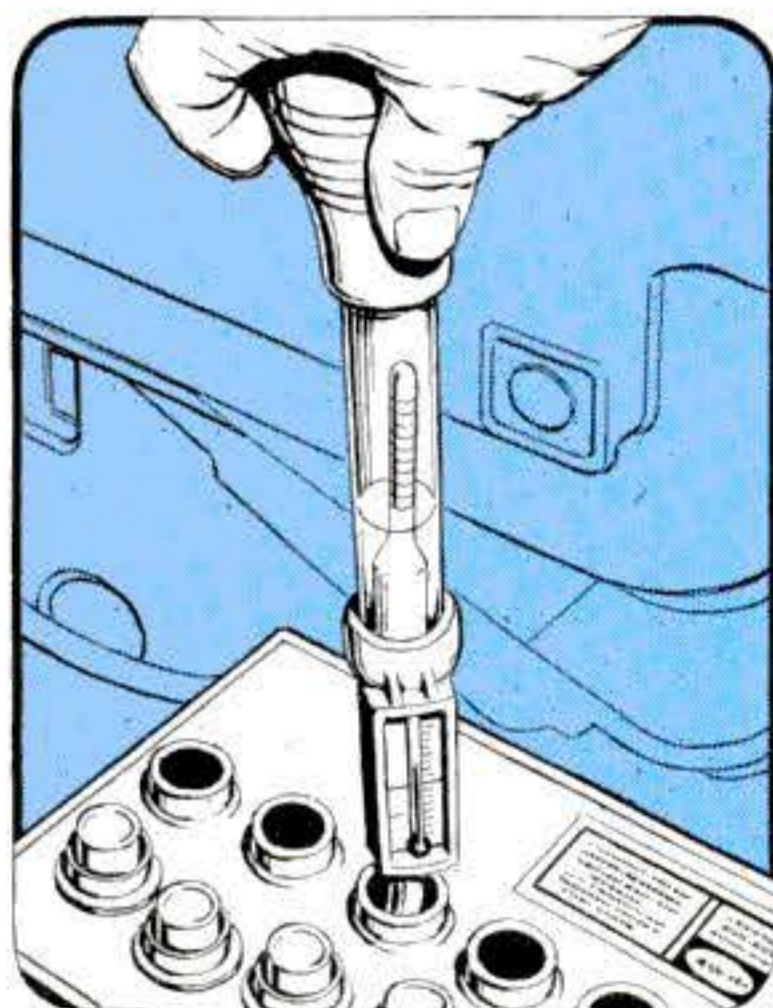
If, when you turn the key to crank, a single click occurs and the engine doesn't crank, check the battery cables and clean them. If the cables are clean and tight and the battery is fully charged, the problem is probably a bad starter or solenoid.

To determine which one is bad, bypass the starter solenoid. If the starter works, the solenoid is bad. If it doesn't, the starter is bad. To bypass the solenoid, connect a booster cable from the battery's positive terminal to the starter-motor terminal. Depending on the car, if the starter is good it will either spin or crank the engine. With Ford starters, the engine will crank. Most other starters will spin, but will not crank the engine. With Chrysler cars you can't bypass the solenoid in this way. If you've narrowed the problem down to the starter or solenoid, remove both and repair or replace according to shop-manual instructions.

Engine cranks slowly

If the engine turns over slowly but won't start, the problem usually is caused either by a bad battery or starter. First check battery-cable connections and the battery. If everything's okay there and the engine still turns over slowly, a bad starter is probably the culprit.

Check the mounting bolts that hold the starter in position. Occasionally they will loosen, allowing the starter to tilt at an angle that causes it to crank the engine slowly. (Part of the reason for this is that when the starter loosens, it no longer has a good ground.) If this is the case, tighten the



When using a battery hydrometer, draw up only enough fluid to lift the float. Too much fluid will cause the top of the float to hit the float stop, giving a wrong reading.

bolts and try to start the car again. If the car cranks slowly and the starter is mounted securely, remove the starter and repair or replace it. (Sometimes a tight engine will cause slow cranking. This could be the result of coolant leaking into the combustion chamber, rust in the cylinders, tight bearings, tight rings, etc. Usually, in a car that's driven every day, this isn't the cause of slow cranking. But it's worth bearing in mind if everything else checks out.)

Normal cranking

If the car cranks at normal speed but still doesn't start, check the fuel gauge. If there's gas in the tank, the next thing you want to know is whether it's reaching the engine. Remove the air cleaner and move the accelerator linkage (or have a friend press the gas pedal). Do it several times. You should get a good squirt into the carburetor throat each time with a single-barrel carb. With a two-barrel carb you should get a good squirt in each throat. If you do, fuel isn't the problem. If no gas squirts out, check the gas filter between the carburetor and fuel pump.

Remove the filter, attach a clean piece of hose to it, and blow through the hose. Put your finger over the filter; you should feel air flowing freely out. If the filter is clogged, replace it.

If the fuel filter is good, check fuel-pump pressure and volume. First, for safety, remove the coil high-tension lead from the distributor cap and ground it with jumper wire. With GM HEI ignitions that have the ignition coil in the top of the distributor cap, simply disconnect the BAT wire at the distributor. This disables the ignition so the car won't accidentally start while you're making the following checks.

Put a pressure gauge on the output end of the fuel pump or on the end of the gas line where it attaches to the carb. Crank the engine for 15 seconds. The pressure gauge should read at least three pounds. A pressure gauge is not expensive. You can get a combination vacuum/pressure gauge in many auto-parts stores.

To check volume, direct the fuel from the pump into a container and crank the engine for 15 seconds. You should get a half-pint of fuel in that time. (For safety reasons, it's best to attach a long, flexible fuel line to either the fuel-pump outlet or to the outlet of the fuel line that attaches to

the carburetor—so you can conduct the gasoline into a container outside the engine compartment. Have an approved fire extinguisher handy.)

If pressure and/or volume are low, check the vacuum on the tank side of the fuel pump. Remove the fuel line from the tank where it attaches to the fuel pump and attach a vacuum gauge to the pump. Crank the engine for about 15 seconds. You should get a vacuum reading of 10 inches. If the reading is below 10 inches and pressure and volume are low, the pump is probably bad. Replace it.

If the replacement pump doesn't cure the problem, a worn or loose fuel-pump drive eccentric (on the camshaft) is the cause of the problem. But this isn't common. If fuel squirts into the carb throat when the accelerator linkage is moved several times, you know that lack of fuel isn't the cause of the no-start condition. Check for spark.

Reinsert the coil high-tension lead into the distributor or reconnect the BAT wire. Remove a spark-plug wire from the spark plug. Rotate the boot back and forth until it breaks free, then pull up on the boot to remove it from the spark plug. Don't pull up on the wire itself—you risk breaking it.

On some cars, one or more of the spark-plug-wire boots may be difficult or impossible to reach with your hand. In this case, to remove the hard-to-reach wire (or wires), you'll need a pair of pliers especially designed to remove spark-plug boots. These pliers are also handy for removing spark-plug wires on a hot engine—so you don't burn your fingers on nearby metal parts.

However, even on the most cluttered engines, you should be able to remove some of the wires by hand when the engine is cold. As long as you can get one wire off, you can tell if spark is reaching the plugs.

Insert a Phillips screwdriver (with an insulated handle) inside the metal terminal that's inside the boot. Hold the shank of the screwdriver about one-quarter inch from a good ground and have a friend crank the engine. If there is a spark, remove the spark plugs to see if they are wet. If they're wet, the most likely causes are improper starting procedure, faulty plugs, or a carb problem. Follow the starting procedure recommended in your owner's manual. With later-model cars the drill usually goes like this: Press the accelerator pedal to the floor

Continued

Actual color-enhanced electron microscopy photograph of carbon magnified 3,000X.

**THIS IS THE ENEMY
OF YOUR SPARK PLUG.**



MOTORCRAFT BURNS IT AWAY.

Take a good look at the enemy. Sooty carbon on the tip of your spark plug. It blocks power. Robs gas mileage.

Motorcraft Extended Tip Spark Plugs burn carbon away. Actually clean themselves as you drive.

Motorcraft Spark Plugs from Ford.
For the future of your car.
For sure.



MOTORCRAFT

The finishing touch...

Begin by sanding smooth with successively finer grades of sandpaper...

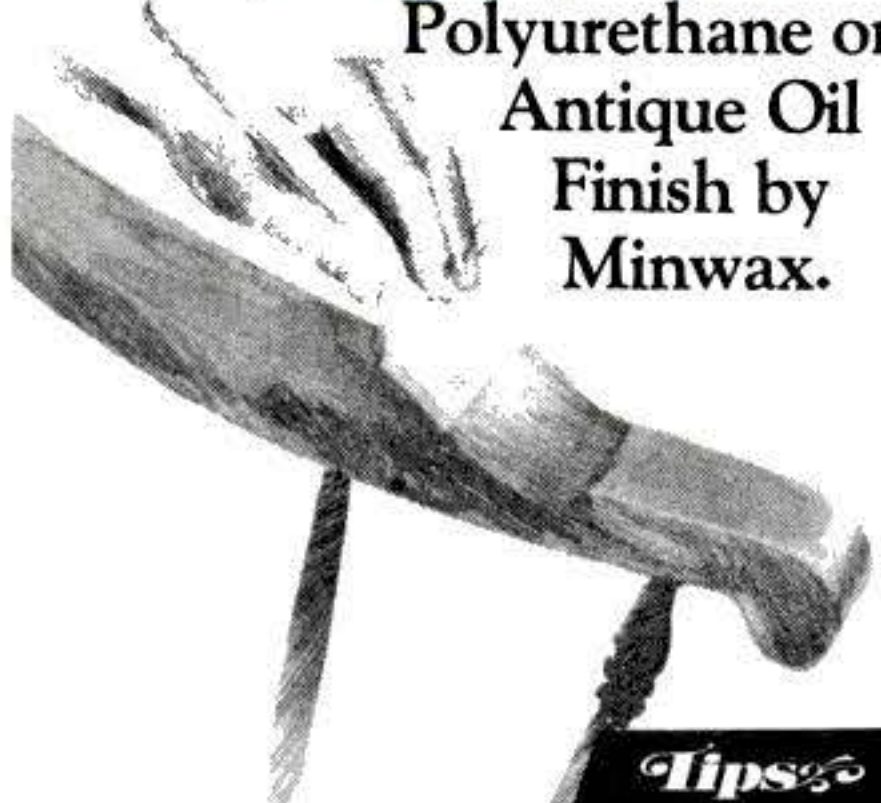


Then finish with the best... Wood Finish by Minwax...

to bring out the beauty in wood...



And for extra protection, brush-on Polyurethane or Antique Oil Finish by Minwax.



Our free 16-page booklet shows how easy it is.



MINWAX CO., INC., Dept. PS-31
Box 995, Clifton, N.J. 07014
Send FREE booklet, "Tips on Wood Finishing." Also, color card and name of my nearest dealer.

NAME _____
ADDRESS _____
CITY _____
STATE _____ ZIP _____

MINWAX

Car won't start

[Continued]

once, remove your foot from the pedal, and crank.

If you have observed the proper starting procedure, the plugs may be wet because they're improperly gapped or are simply too old. A new set of correctly gapped plugs should be installed at the car maker's recommended intervals. If the plugs are gapped properly and are otherwise okay, you may have a carb problem. The most common one is a sticking choke. To check, remove the top of the air cleaner, move the accelerator linkage about half open, and hold it there. The choke plate should be shut now. To open the choke, press the lower edge of the choke plate. (One edge of the plate will be a little lower than the choke pivot, even when the choke is fully closed.) The choke plate should open to vertical position.

There will be some resistance (from the choke's bimetal spring) as you open the plate, but it should open smoothly with no binding. Release the choke plate. It should snap shut quickly and smoothly. If the choke is stuck, the cause of the sticking (such as bent or dirty linkage) must be eliminated and the choke adjusted to shop-manual specs.

If the choke doesn't seem to bind, put the air cleaner back on (in case of backfire; you don't want to start a fire). Install a new set of correctly gapped spark plugs, or dry the old plugs and reinstall them if they're properly gapped and aren't past retirement age.

Push the accelerator pedal to the floor (this trips the choke unloader, which will partly open the choke). Hold it against the floor; don't pump it. Crank the engine for 15 seconds. If the car doesn't start, wait 15 seconds (while still holding the gas pedal to the floor), then try again for 15 seconds. If after three or four tries (waiting 15 seconds between tries) the car doesn't start, look at the carb. If there is gas around the base of the carb, it is flooding. In this case the carb must be repaired.

If the carb isn't wet, pull the spark plugs and look at them. The intake manifold may have been so badly flooded with gas that the plugs have been fouled again. If so, let the plugs remain out overnight if possible to let the gas evaporate from the manifold. Leave the throttle and choke plate open (with the top off the air cleaner) to aid the evaporation process.

If there is no spark, remove the coil's high-tension lead from the dis-

tributor cap and hold the end of the lead a quarter-inch from a good ground. Be sure you're holding the insulated part of the wire, not the metal terminal at the end of the wire.

Have a friend crank the engine. If a spark jumps the gap, you have a bad rotor or distributor cap, which must be replaced. A visual inspection will indicate which is bad. Look for cracks and burn marks.

If no spark jumps the gap, you have a problem in the ignition circuit, such as a bad resistor, bad pickup coil, bad module, etc. At this point consult your shop manual for the specifics on troubleshooting your individual ignition system.

With the GM HEI cars that have the ignition coil on top of the distributor cap, there is no high-tension coil wire. Check the cap and rotor for burns. If none are present, consult the shop manual on how to trouble-shoot the HEI.

If everything checks out okay to this point, you should take a compression check; compare it with the maker's specs. Low compression on all cylinders could indicate a bad timing chain or gears, bad rings, or other sealing problems. Usually, though, in a car that's been starting every day, low compression isn't the cause of the problem. The most common causes are a weak battery, faulty ignition, or fuel problem. And if you've followed this checklist so far, you've probably already got your car started.

Preventive maintenance

Of course, it's better if your car never refuses to start. Trouble-shooting on a cold, windy day isn't a lot of fun. With a little care you can greatly decrease the chances of a no-start occurring. Here's how:

- Check the battery regularly.
- Add fluid to the battery (with conventional ones) as needed.
- Keep cable connections clean and tightly fastened.
- See that the engine receives a tuneup at the intervals specified in your owner or shop manual. A tuneup will include fresh, properly gapped spark plugs, choke adjustment, and carburetor service—all common areas where no-start problems often develop.

A tuneup will also include a complete check of emission-related components, such as the PCV valve, EGR valve, and so on. In order for an engine to deliver optimum performance, these items must work well, too. **PE**

"SAY, SMOKEY—"

A clinic on cars by Smokey Yunick, America's most famous mechanic

Pinging

I have a 1977 Chevy Caprice 305 that has gone 63,000 miles. I use Amoco premium and Mobil premium fuel, but the car pings when going up the slightest grade. One mechanic claimed it's caused by a malfunction in the pollution-control system. Another said the only thing to do is retard the timing, but that would hurt performance. What do you think?

Tom R. Viviano, Tampa, Fla.

Find a good Chevrolet garage and have the EGR and vacuum timing operation checked. EGR slows the fuel-burning rate and slows down pinging. But too much EGR makes the engine run lean, and that increases pinging. Timing is intentionally very advanced at part throttle during light-load conditions. Timing has to be retarded considerably during acceleration. And you want a matching fuel enrichment at low vacuum, too. Unless everything jiggles together, pinging can be terrible.

Refrigerant in the engine

I recently helped a friend refill the air conditioner in his Audi Fox. While putting in the first can of refrigerant, the high-pressure hose ruptured. The rupture was next to the fuel-injection intake, so the can's entire contents was burned in the engine. The exhaust smelled terrible and burned my eyes and nose. A yellow foam came out the tailpipe and bleached my driveway. We're concerned about damage to the engine and exhaust system. What can you tell us?

Chuck Lacy, Tulsa, Okla.

Going through the engine, the refrigerant got too hot. The chemical reaction left a rubberlike residue, which is corrosive. Let's hope there's not much of it left in there.

Gasohol harmful?

I have a 1976 Volvo 264 GL with fuel injection and 27,500 miles on the odometer. I've been told by a Volvo mechanic that using gasohol will ruin the injector and damage the fuel pump. Is this true?

Alan T. Hammer, Lakehurst, N.J.

Wouldn't be surprised if it did.

Worried about electric fan

A year ago I purchased a 1980 Chevrolet Citation, which I like very much except for one thing. Since it is a front-wheel-drive car, the radiator fan is electric. According to the factory-installed temperature

gauge, the fan doesn't kick in until between 235 and 240 degrees. I feel this temperature is too high.

When I asked a mechanic at the Chevrolet garage, he told me that's how the cars were designed.

Robert V. McMaster, Napa, Calif.

They were designed to come on hot. We did a little checking, and I believe the 235 degrees F is a real 215–220 degrees. I think that's good—it shouldn't hurt the engine, and it will be good for mileage.

Can't make up his mind

Most of our driving is around town, but once a year we load up the car, pile in two adults and three kids, and drive more than 1,000 miles during our vacation. Our route goes over the Appalachian Mountains to Florida or the East Coast.

We like the looks of some of the new compacts, but for this kind of driving would we be better off with a four-cylinder or six-cylinder engine? We would like to keep our next car a long time.

Tom Molnar, Highland, Ind.

I don't think it's a question of a four or a six. I don't believe a six-cylinder is any more reliable than a four—or even a three-cylinder, for that matter.

After you choose a car that has the room and equipment you want, drive it in a demonstration ride. Consider its ability to operate all the gadgets and to perform at what you consider a reasonable level.

Remember, small engines really lose a lot with automatic transmissions and A/C in hot weather. Hills and mountains can sometimes seem steeper then.

Nobody builds the perfect car yet, but the biggest change in history is going on right now. It will take four or five years for the smoke to clear. So plan on owning this car for a shorter term.

Battery discharges

Our car is a '72 Cadillac. Recently it began to have starting trouble. The battery seemed to run down overnight or even after a short trip. The starter was rebuilt. A new battery was installed. Everything seemed fine until the car was not driven for a couple of days. Then the new battery ran down. It seems as though something is draining the battery. Once started, the car runs beautifully. How can I find the cause of this power drain?

R. Thomas, Sharon, Pa.

Remove the battery ground cable at the frame-engine connection. Put an ammeter

in between with all systems off. It should read zero. If it doesn't, head up the hot side looking for a short, or for a gadget left on.

A quick, easy check: Take one cable off when you know it's going to sit a couple of days, then put it back when you're ready to start it again. If it starts okay, you know you have to look for a current draw.

He's missing something

In 1975 I bought a new Olds 88 with a 350 engine. After about 35,000 miles, the alternator light started to glow faintly. As time went on it got brighter and brighter, until in about a month it was glowing very brightly.

I had the alternator repaired, which cured the problem for about a month. Then the same thing happened. I had it repaired again, and in about a month the same thing again occurred. This time I replaced the alternator, which cured it once again for about a month.

In August 1977, I traded it for a 1977 Olds 98 with a 350 engine. I had no problems with this car until recently. Then the alternator light began to glow very faintly, and soon it was glowing very brightly. I checked out the alternator and it was okay, but I replaced the voltage regulator anyway. This again seemed to cure the problem, but in a week's time the alternator light was glowing faintly once again. What am I missing?

W. T. Frey, Houston, Tex.

You're basing your repair needs on the wrong thing. Check voltage- and amperage-output specs. Probably most of the work you had done could have been settled with a simple voltage/amperage regulator adjustment and a slight increase in idle speed.

Wants a smaller engine

My 1973 Dodge Dart Swinger has gone over 122,600 miles on the original factory motor. It's limping along, burning oil, and is leaking from somewhere. It has a 318-cu.-in. engine, but for better gas economy, I would like to replace the engine with a smaller rebuilt one. Would this be practical? The Swinger has air conditioning, and I was told by the salesman when I bought it that a larger engine is required for air conditioning.

Marc Marquette, Sherman Oaks, Calif.

You can go a lot smaller and still have A/C, but performance will drop. I expect you'll get some stalling when idling during hot weather—not that it's impossible to make it stall-proof during idle. But it's harder to keep small engines from stalling at idle as you turn on the gadgets.

Each month in POPULAR SCIENCE Smokey Yunick answers questions on cars—family cars, high-performance jobs, hot rods, and racing cars—selected from those sent in by readers. Got a problem? Send it to: "Say Smokey—", Popular Science, 380 Madison Ave., New York, N.Y. 10017. Questions cannot be answered by mail.

DIXON

...the first real turnaround in mowing circles.



A yard with trees is a yard full of circles! Get your hands on a DIXON Zero Turning Radius mower and cut mowing time at every turn.

- Cuts clean without the usual back & forth acrobatics.
- Leaves no shaggy patches to backtrack and trim.
- Cuts inside or outside corners with a simple push or pull on a pair of hand levers — with no footwork at all!
- Saves half the mowing time — ask any owner.

See your DIXON Dealer and mow-test a 42" or 30" ZTR mower yourself. Or write for "Ask Any Owner" and read our fan mail!

NAME _____

ADDRESS _____

CITY, STATE _____ ZIP _____



DIXON INDUSTRIES, INC.
BOX 494, Dept. PSC
COFFEYVILLE, KS 67337
(316) 251-2000

© Dixon Industries, Inc.

The first real turnaround in mowing circles.

'81 lawn mowers

[Continued from page 121]

that make them special. Toro's 20-inch electric mower/trimmer uses monofilament lines instead of blades to mow and trim grass right up to an obstacle.

Its twin trimmer heads and a remote line release make this 30-lb. mower attractive for small areas or for cleaning up around hard-to-maneuver locations where a big machine may not be able to reach. All you add is a long extension cord.

I drew stares while testing the Wheel Horse E-81. This battery-powered electric rider with its 32-inch twin-motor deck performs as well as any gas-powered rider. But it moves so quietly I could hear the slight whine of the gear train over the whirr of the mower deck. Its three big deep-discharge batteries were sufficient to cut my acre in one mowing and can be recharged overnight. Overall, the E-

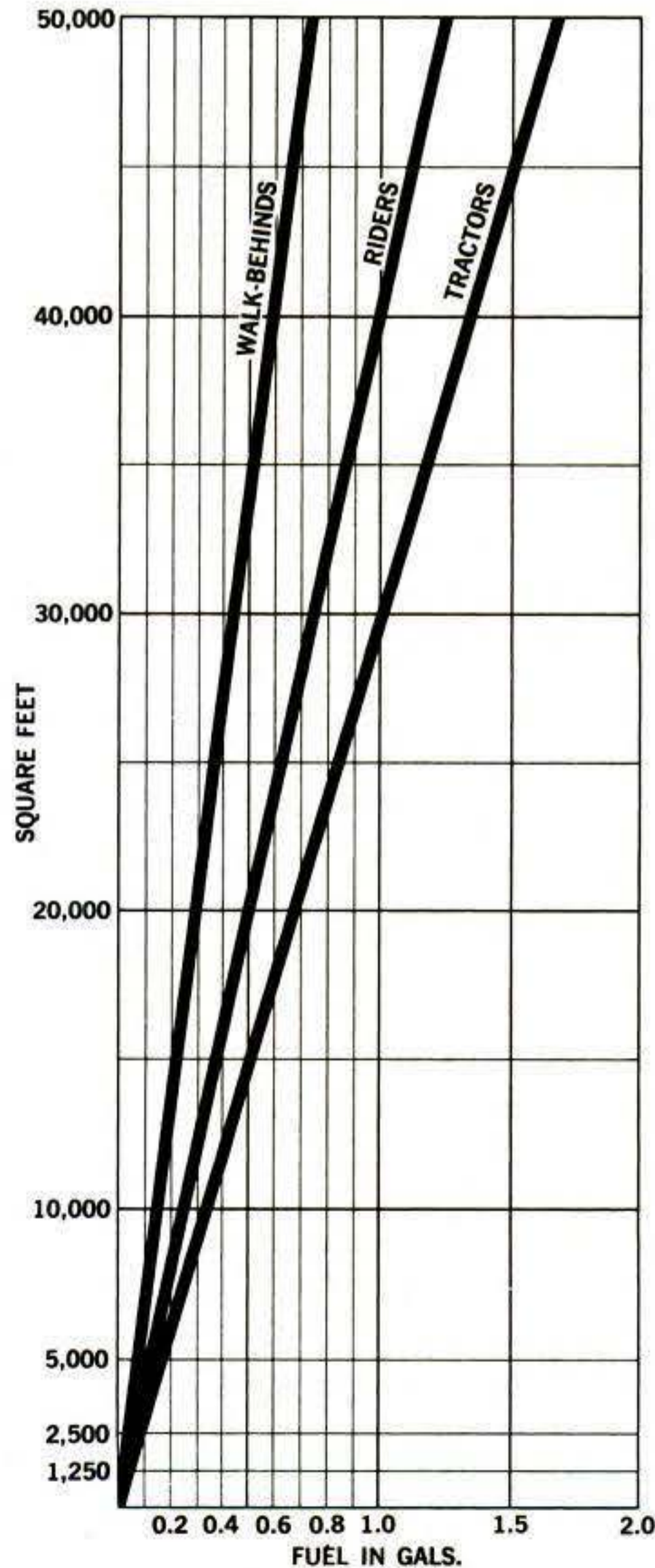
81 is an impressive machine—strong and silent, as you might expect.

Your choice

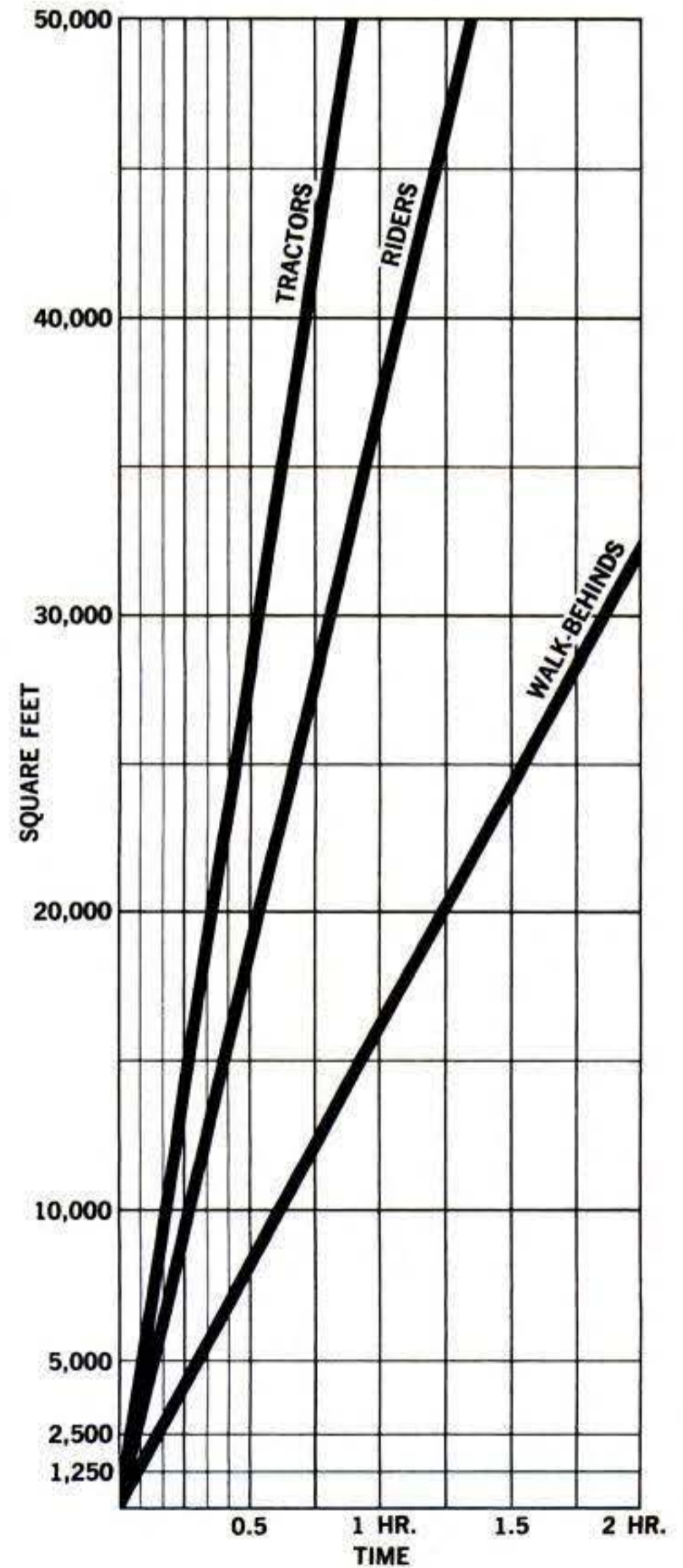
Unless you're very frugal, fuel costs are a secondary consideration. A garden tractor mowing a 20,000-square-foot plot 15 times (an average summer's work here) would use 10 gallons of gas; a rider, 7.6 gallons; a walk-behind, 4.5 gallons. The fuel saved between tractor and walk-behind only amounts to 5.5 gallons.

Time saving is another matter. Mowing the same plot with a tractor instead of a walk-behind can save you almost an hour per mowing, or about 13 hours for the summer. Rider savings aren't far behind: 10.4 hours.

But don't forget the other points: matching the mower to your lawn and personal preferences; features; durability; and service availability. **E**



Graph of fuel consumption shows little difference between machines. Lesson: Fueling costs should be low priority.



Importance of time saving is up to you. But graph shows penalty for walk-behinds on lawns larger than 15,000 sq. ft.



Know your car inside and out.

Know how to fix it...to tune it...to service it...to keep it running right. The TOTAL SERVICE MANUAL for your car will show you how to do everything from a minor adjustment to a major repair.

factory workshop manuals. Each one is carefully rewritten for use by the do-it-yourself car owner. Clear and easy to follow, yet complete and detailed enough even for professional use. You get all the important information plus hundreds of the best pictures, diagrams, and specifications.

TOTAL SERVICE MANUALS are digests of official

TOTAL SERVICE MANUALS

SATISFACTION GUARANTEED OR YOUR MONEY BACK

1713	ALFA ROMEO 62-79 for all Giulia, GT & Spider models	\$12.95
9641	ALFA ROMEO ALFETTA 73-79 covers all models	\$12.95
8677	AMC GREMLIN, HORNET, PACER 71-79 for all models	\$10.95
8190	AMC MATADOR, REBEL 67-74 covers all models	\$10.95
0991	ARROW, PLYMOUTH 76-77 for all models	\$10.95
9404	ASPEN, DODGE 76-79 covers all models	\$10.95
7122	AUDI 100 70-77 for all models inc 100L	\$10.95
0664	AUDI 5000 77-79	\$10.95
8749	AUDI FOX 73-79 covers all models	\$18.50
0916	AUSTIN AMERICA 68-71 covers all models inc 1100, 1300	\$10.95
1203	AUSTIN HEALEY 100/6, 3000 56-68 for all models	\$10.95
0752	AUSTIN MARINA 71-75 sedan and GT models	\$10.95
0379	BARRACUDA & 'CUDA 65-72 all 6 & V8 models	\$9.95
8154	BLAZER, CHEVY 67-79 all mdls plus Suburban & GMC Jimmy	\$10.95
1042	BMW 2000, 2002 66-76 covers all mdls inc CA, CS, TI	\$10.95
9813	BMW 320i 77-80	\$10.95
9326	BMW 75-79 inc 528i, 530i, 630i, 630CSi, 733i models	\$10.95
9760	BMW 2500, 2800, 3.0 all mdls inc Bavaria & CS	\$12.95
0504	BRONCO, FORD 66-77 all 2 & 4 whl drive models	\$9.95
0011	BUICK 66-68 factory shop manual... must give year	\$18.95
0025	BUICK 71-79 shop manual... must give year... no 1972-73	\$18.95
0727	CADILLAC 68-74 all models except El Dorado	\$10.95
8678	CAMARO 67-79 covers all 6 & V8 models	\$10.95
9557	CAPRI 70-76 for all 2000, 2600, 2800 mdls	\$10.95
6021	CAPRI 79-80 covers all models inc Ghia	\$10.95
0379	CHALLENGER 70-72 covers all 6 and V8 mdls	\$9.95
8331	CHARGER 67-70 for all models inc 500 & R/T	\$9.95
8212	CHARGER 71-75 covers all models	\$9.95
0383	CHEVELLE 64-79 inc Malibu, Monte Carlo, El Camino	\$9.95
0838	CHEVETTE 76-80 covers all models	\$10.95
1038	CHEVROLET 29-40 covers all 6-cyl models	\$16.00
0888	CHEVROLET 49-54 reprint of factory shop manual	\$17.00
0051	CHEVROLET 55 or 57 reprint factory manual... give year	\$19.95
8407	CHEVROLET 56 supplement to 55 manual	\$10.95
0870	CHEVROLET 68-79 for Biscayne, Bel Air, Impala, Caprice	\$9.95
8187	CHEVY II 62-68 covers all 4, 6 & V8 models	\$10.95
0779	CHEVY LUV 72-80 covers all pick-up models	\$10.95
8154	CHEVY PICK-UP 67-79 all 2 & 4-whl dr mdls plus GMC	\$10.95
1662	CHEVY VANS 67-80 for all models plus GMC models	\$10.95
1145	CHRYSLER 55-71 all inc Newport, 300, New Yorker	\$12.95
0020	CHRYSLER 72-79 factory manual... must give year	\$23.95
9148	CITATION, CHEVY also covers Omega, Phoenix, Skylark	\$9.95
9588	CITROEN ID, DS 67-75 covers all DS19, 20, 21 mdls	\$12.95
8264	COLT, DODGE 71-79 covers all models	\$10.95
9422	COMET 60-65 covers all models	\$8.95
8211	COMET 70-77 covers all models	\$8.95
8212	CORONET, DODGE 71-75 covers all models	\$9.95
0477	CORVAIR 60-69 covers all models manufactured	\$12.95
0478	CORVETTE 57-65 covers all 283 & 327 models	\$10.95
9481	CORVETTE 66-79 covers all 327, 350, 427, 454 models	\$10.95
1756	CRICKET, PLYMOUTH 70-73 also covers Hillman Avenger	\$10.95
9440	DART & DEMON 65-67 covers all models	\$9.95
8188	DART & DEMON 68-76 covers all models	\$9.95
1657	DATSUN F10 & 310 76-79 covers all models	\$10.95
1164	DATSUN 200SX 77-79 covers all models	\$10.95
8065	DATSUN 1200 & B210 71-78 covers all models	\$10.95
0783	DATSUN 210 79-80 covers all models imported	\$11.95
8127	DATSUN 240Z, 260Z, 280Z 70-78 covers all models	\$10.95
9152	DATSUN 280Z 79-80 covers all models inc 280ZX	\$9.95
1551	DATSUN 510 68-73 covers all sdn & wagon mdls	\$10.95
1074	DATSUN 510 78-79 covers all models	\$10.95
9583	DATSUN 610 68-77 covers all models	\$10.95
0935	DATSUN 710 73-76 covers all models	\$10.95
8271	DATSUN 810 77-80 covers all models imported	\$10.95
1258	DATSUN 311 sports car 1600/2000 SPL & SRL mdls	\$16.95
9297	DATSUN PICK-UP 68-80 covers all 521 & 620 models	\$10.95
1145	DODGE 55-71 all inc Coronet, Monaco, Polara	\$12.95

0871	DODGE 72-77 for all Monaco & Polara models	\$9.95
1259	DODGE OMNI 78-80 covers all models inc 0-24	\$10.95
8208	DODGE RAMCHARGER 74-75 covers all models	\$9.95
1298	DODGE PICK-UPS 71-79 covers all models	\$10.95
8203	DODGE VANS 67-70 all 1/2, 3/4 & 1 ton mdls inc Plymouth	\$9.95
6070	DODGE VANS 71-79 covers all models	\$10.95
8192	DUSTER 70-76 for all models inc. Scamp	\$9.95
8189	FAIRLANE, FORD 62-70 covers all models	\$9.95
8366	FAIRMONT, FORD 78-79 covers all models	\$10.95
9422	FALCON 60-64 covers all models inc Mercury Comet	\$9.95
9874	FALCON, FORD 6 64-70 covers all 6-cyl models	\$9.95
0480	FALCON, FORD V8 65-71 covers all V8 models	\$9.95
9776	FIAT 124 67-77 all inc sdn, sta wgn, TC, spcl	\$10.95
0844	FIAT 124 SPORT 68-78 all coupe & convertible models	\$10.95
9640	FIAT 128 72-79 for all models inc SL & Rally	\$10.95
8742	FIAT 131 75-77 covers all models inc Mirafiori	\$10.95
1201	FIAT 850 64-74 all sedan, coupe & spider mdls	\$10.95
0399	FIAT X1/9 73-78	\$10.95
1073	FIESTA, FORD 77-79 for all models	\$10.95
0675	FIREBIRD covers all models—67-74	\$9.95
6309	FIREBIRD 75-80 covers all models inc Trans Am	\$10.95
9611	FORD 71-78 inc LTD II, Ranchero, Thunderbird	\$9.95
0872	FORD 68-79 for Galaxie, LTD, Custom, XL & wagons	\$9.95
9369	FORD COURIER 72-77 covers all models imported	\$10.95
8205	FORD PICK-UP 65-68 all 2 & 4-whl dr mdls, 1/2-1 ton	\$9.95
0451	FORD PICK-UP 69-79 covers all models	\$10.95
8204	FORD VANS 61-68 for all 1/2, 3/4, & 1 ton models	\$9.95
0453	FORD VANS 69-79 covers all 6 & V8 models	\$10.95
9436	GRANADA, FORD 75-80 covers all models	\$9.95
0644	HONDA 360, 600, 67-75 for all models inc "Z"	\$10.95
0885	HONDA ACCORD 77-79 covers all models	\$10.95
8694	HONDA CIVIC, 73-79 covers all models inc CVCC	\$10.95
8206	INTERNATIONAL SCOUT 67-73 800, A, B, II mdls	\$9.95
8565	INTERNATIONAL 62-78 tune/maintain Scout, wagon, pick-up	\$9.95
1206	JAGUAR 55-69 sedan mdls 2.4, 3.4, 3.8, 240, 340	\$10.95
1043	JAGUAR E-TYPE 61-72 covers all 6-cylinder models	\$12.95
9612	JAGUAR E-TYPE V12 71-74 covers all models	\$12.95
9399	JAGUAR XJ6 68-78 covers all models	\$12.95
9617	JAGUAR XJ12 72-77 for all models inc Daimler	\$12.95
9769	JEEP 50-65 for 4 & 6 cyl station	\$16.95
8207	JEEP 66-79 for all Cherokee, Commando & Wagoneer mdls	\$9.95
9805	JEEP WAGONEER J-series with 230 ohc eng.	\$18.95
9806	JEEP UNIVERSAL CJ-2, CJ-3 reprint factory manual	\$18.95
0509	JEEP CJ-5, CJ-6, CJ-7, 55-79	\$9.95
8856	JEEP FC150, 170 covers all front cab models	\$18.95
8739	JENSEN-HEALEY reprint of factory manual	\$20.95
1254	LANDROVER 59-77 covers 2, 2A, 3, 3A & diesel models	\$10.95
9773	LINCOLN 71-77 all models inc Versailles	\$12.95
0481	MAVERICK 69-71 6 cyl, 170, 200, 250 cu. in. eng.	\$8.95
8211	MAVERICK 72-77 covers all models	\$8.95
1550	MAZDA GLC 77-79 covers all models	\$10.95
0370	MAZDA RX2 70-75 covers sedan & coupe mdls	\$10.95
0371	MAZDA RX-3, 100 70-74 covers all models	\$10.95
0444	MAZDA 71-78 includes RX4 and Cosmo models	\$9.95
9941	MAZDA RX7 79-80 covers all models	\$10.95
0880	MAZDA PICK-UP 72-75 B-1600 & rotary eng. mdls.	\$9.95
0593	MAZDA 808, 818 72-78 covers all models	\$10.95
0573	MAZDA 1500, 1800 67-74 covers all models	\$10.95
8197	MERCEDES-BENZ 59-70 all inc 190,200,300 & diesel mdls	\$9.95
0781	MERCEDES-BENZ 190SL reprint of owner's manual	\$8.95
1746	MERCEDES-BENZ 220 59-65 covers all mdls	\$12.95
9483	MERCEDES-BENZ 220 68-72 mdls except Diesel	\$12.95
1747	MERCEDES-BENZ 230 63-68 inc. 230S & SL	\$12.95
1748	MERCEDES-BENZ 250 65-68 covers all models	\$12.95
9485	MERCEDES-BENZ 250,280 68-72 all models plus 230	\$12.95

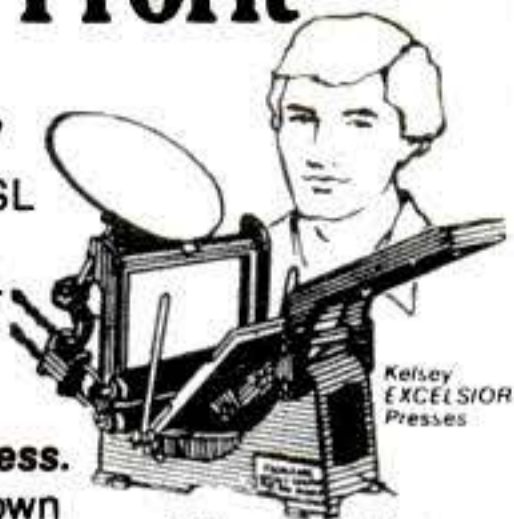
0416	MERCEDES-BENZ 68-73 inc 280, 300 & 350, 450 V8 mdls	\$10.95
8439	MERCEDES-BENZ 74-79 Covers all models inc Diesels	\$10.95
9773	MERCURY 71-77 for all models inc Cougar	\$12.95
1105	MG TA, TB, TC, TD, TF 36-55	\$12.95
1098	MG MIDGET 58-78 covers all models	\$10.95
6038	MGA 55-62 covers all models	\$12.95
0660	MGB 62-74 covers all models inc MGB GT	\$17.50
9698	MGB 75-80 covers all models inc MGB GT	\$17.50
8396	MGC reprint of factory manual	\$20.95
0917	MINI 59-78 covers all models inc Mini-Cooper	\$10.95
9436	MONARCH, MERCURY 75-80 covers all models	\$9.95
0884	MONZA, CHEVROLET 75-80 plus Astre,Starfire,Skylark	\$9.95
9876	MUSTANG 6 65-72 covers all 6-cylinder models	\$10.95
0479	MUSTANG V8 65-73 covers all models	\$10.95
8272	MUSTANG II 74-78 covers all 4, V6, & V8 models	\$10.95
9386	MUSTANG 79-80 covers all models inc Ghia	\$10.95
0951	NOVA, CHEVROLET 69-79 covers all models	\$10.95
7107	OLDS CUTLASS 70-80 covers all models inc 442	\$10.95
0002	OLDS 68, 71, 74 factory shop manual... must give year	\$14.95
0008	OLDS 75-79 factory shop manual... must give year	\$17.95
1724	OPEL KADETT 62-73 1000, 1100, 1200 models	\$12.95
1752	OPEL KADETT 67-73, 1500, 1700, 1900 mdls	\$12.95
8273	OPEL 66-79 for all models inc 1900 Manta & Isuzu	\$10.95
9589	OPEL GT 68-73 covers all 1900 models	\$12.95
0876	PEUGEOT 504 68-74 includes diesel models	\$9.95
7124	PEUGEOT 504 68-79 for all gasoline engine models	\$12.95
0883	PINTO 70-79 covers all models inc Mercury Bobcat	\$9.95
1145	PLYMOUTH 55-71 all inc Belvedere, Fury, Satellite	\$12.95
0874	PLYMOUTH 72-76 Fury, VIP, Gran, Suburban mdls	\$9.95
1660	PLYMOUTH HORIZON 78-79 covers all models	\$10.95
0030	PONTIAC 71-78 shop manual... give year... No 1974, 1976	\$18.95
0489	PONTIAC TEMPEST 68-73 all mdls inc GTO, Le Mans	\$9.95
1650	PORSCHE 356 57-65 covers A, B & C models	\$12.95
1591	PORSCHE 911 64-73 covers all models	\$12.95
8173	PORSCHE 911 74-77 includes N, S, Targa, Carrera	\$12.95
1590	PORSCHE 912 65-69 with 1582cc engine	\$12.95
9834	PORSCHE 914 70-76 all models inc 914/6	\$10.95
0993	PORSCHE 924 76-80 covers all models inc Turbo	\$10.95
0372	RENAULT 5 72-78 for all models inc Le Car	\$10.95
1224	RENAULT 8, 10 62-72 covers all models inc 1100	\$10.95
9429	RENAULT 12 69-79 covers all models inc auto trans	\$12.95
0645	RENAULT 15, 17 71-78 all mdls inc TL, TS	\$12.95
1554	RENAULT 16 65-78 covers all models	\$12.95
0395	ROADRUNNER & SATELLITE 68-73 all models	\$9.95
0750	SAAB 99 69-79 covers all models	\$10.95
8440	SAAB 67-79 covers all models inc Sonnet	\$10.95
1098	SPRITE 58-71 covers all Mk 1, 2, 3 & 4 models	\$10.95
8058	SUBARU 72-79 covers all models imported	\$10.95
0845	SUNBEAM TIGER reprint of factory shop manual	\$20.95
0489	TEMPEST, GTO, LE MANS 68-73 all models	\$9.95
9773	THUNDERBIRD 71-77 covers all models	\$12.95
8189	TORINO 68-75 all models inc Elite, Ranchero	\$9.95
0912	TOYOTA CELICA 70-77 covers all models imported	\$10.95
0829	TOYOTA CELICA 78-79	\$10.95
7127	TOYOTA COROLLA 68-74 for all models	\$10.95
9812	TOYOTA COROLLA 75-78 all models plus 5-spd trans	\$10.95
0926	TOYOTA CORONA 69-73 for all 4-cyl models inc MK II	\$10.95
0886	TOYOTA CORONA 74-77 covers all 4-cyl models	\$10.95
0754	TOYOTA CORONA Mk 2 72-76 for all 6 cylinder models	\$10.95
0647	TOYOTA HI-LUX 68-79 covers all pick-up models	\$10.95
8524	TOYOTA LAND CRUISER 66-77 covers all models	\$10.95
1200	TRIUMPH SPITFIRE 69-78 covers all models	\$10.95
1231	TRIUMPH TR4 61-67 covers all models	\$10.95
1015	TRIUMPH TR5, TR6, 67-76 all models inc TR250	\$10.95
8693	TRIUMPH TR7 75-79	\$10.95
8192	VALIANT 68-76 all mdls inc Scamp, Signette	\$9.95
0567	VEGA 72-73 all 140 CID & GT 140 CID models	\$9.95
0884	VEGA 74-77 all models inc Monza...except Cosworth/Vega	\$9.95
0782	VOLARE, PLYMOUTH 76-79 covers all models	\$10.95
1227	VOLKSWAGEN BEETLE 54-65 covers all models	\$10.95
9644	VOLKSWAGEN BEETLE 66-69 all mdls inc Karmann-Ghia	\$18.50
9647	VOLKSWAGEN BEETLE 70-79 all inc Super & Karmann-Ghia	\$18.50
0419	VOLKSWAGEN RABBIT, SCIROCCO 75-79 all gasoline models	\$18.50
6009	VOLKSWAGEN RABBIT 1980 gasoline mdls; also Scirocco	\$18.50
8166	VOLKSWAGEN RABBIT 77-80 covers diesel models only	\$18.50
1547	VOLKSWAGEN BUS 54-67 all camper, van, transporter mdls	\$10.95
0686	VOLKSWAGEN BUS 68-79 all camper, van, transporter mdls	\$18.50
9582	VOLKSWAGEN TYPE 3 62-73 for squareback, fastback	\$10.95
9778	VOLKSWAGEN 411, 412 68-74 covers all models	\$10.95
8748	VOLKSWAGEN DASHER 74-79 covers all models	\$18.95
9444	VOLVO P1800 60-73 all models inc E & ES	\$10.95
1754	VOLVO 142, 144, 145 66-74 for all models inc S & E	\$10.95
9558	VOLVO 164 68-75 for all models inc fuel injection	\$10.95
3729	VOLVO 242, 244, 245 74-79 for all inc fuel inj models	\$10.95
8311	VOLVO 264, 265 75-78 all models inc fuel injection	\$10.95

GENERAL REPAIR MANUALS — TUNING GUIDES — HOME REPAIR — TECHNICAL BOOKS

9407	CHILTON AUTO REPAIR 74-81 for all American cars	\$17.95
1264	CHILTON AUTO REPAIR 73-80 for all American cars	\$16.95
1226	CHILTON AUTO REPAIR 71-78... Reg \$13.95... Special	\$8.95
7137	CHILTON AUTO REPAIR 64-71 for all American cars	\$19.95
1763	CHILTON AUTO REPAIR 54-63 for all American cars	\$19.95
7111	CHILTON TRUCK REPAIR 73-80 American & imported mdls	\$19.95
8561	CHILTON TRUCK REPAIR MAN 61-71 for all 3/4-2 1/2 ton mdls	\$19.95
9700	CHILTON IMPORT CAR MANUAL 73-79 for ALL pop imports	\$18.95
0492	AUTO REPAIRS & PRICES flat rate times 74-79 U.S. cars	\$7.95
0445	CAR ECONOMY TUNING GUIDE getting most from the least	\$2.95
7125	AUTO AIR CONDITIONING... service & repair all	\$6.95
8726	TRANSISTOR IGNITION SYSTEMS covers them all	\$5.95
1067	MORE MILES PER GALLON GUIDE How to do it good & cheap	\$7.95
0546	ALCOHOL FUELS, How to make your own	\$4.95
7110	WEEKEND MECHANIC'S HANDBOOK ideal manual for beginner	\$8.95
9622	HOW TO TUNE YOUR CAR good for all cars	\$5.95
8030	POWER TUNING your car, truck, van or RV	\$5.95
8859	GM DIAGNOSIS & REPAIR MANUAL 70-80 for all GM cars	\$9.95
9671	BASIC CAR MAINTENANCE & REPAIR good one to start with	\$4.95
1712	BASIC AUTO REPAIR MANUAL a must for any car	\$5.95
1707	BASIC BODYWORK & PAINTING	\$4.95
1711	BASIC CARBURETORS & FUEL SYSTEMS for all U.S. makes	\$6.95
1706	BASIC CHASSIS, SUSPENSION, BRAKES... tune & service	\$4.95
0791	BASIC ENGINE HOTRODING	\$4.95
1708	BASIC IGNITION & ELECTRICAL SYSTEMS	\$6.95
0680	BASIC AUTO TROUBLESHOOTING for all cars	\$4.95
8359	BRAKE SERVICE GUIDE for repairing all makes & types	\$7.95
3759	ELECTRONIC FUEL INJ MAN 70-77 for all imported cars	\$9.95
9976	CARBURETOR BASICS troubleshooting/rebuild all U.S. makes	\$8.95
9411	HOLLEY carbs, all 2 & 4 bbl, tune & rebuild	\$5.95
9652	ROCHESTER carbs, all inc 4MV Quadrajet	\$9.95
9666	SOLEX CARBURETORS all 1 & 2 barrel downdraft models	\$3.95
6354	SU CARBURETORS tune & rebuild all to 1976	\$8.50
9423	STROMBERG CD CARBS tune/rebuild all to 19	

Print For Profit

Print cards, stationery, envelopes; advertising, labels, tickets; holiday, sympathy, birthday, QSL cards. Satisfying pastime/money-maker. Work with your hands, use your imagination, see results.



Own a Printing Business.

Send 25¢ for Kelsey Catalog

Have your own shop. Add to income. We supply instructions, hand presses and all supplies direct from factory. Famous since 1872. Send for catalog. Kelsey Presses, 81-CC, Meriden, CT 06450.

Telephone Listening Device

Record telephone conversations in your office or home. Connects between any cassette or tape recorder and your telephone or telephone LINE. Starts automatically when phone is answered. Records both sides of phone conversation. Stops recorder when phone is hung up. This device is not an answering service.



Each \$18.95
Qty. Disc. Avail.

Super Powerful Wireless Mic

10 times more powerful than other mics. Transmits up to 1/4 mile to any FM radio. Easy to assemble kit. 15V battery (not incl.)

Call (305) 725-1000 or send \$18.95 + \$1.00 shipping per item to USI Corp., P.O. Box P8-2052, Melbourne, FL 32901. COD's accept. For catalog of transmitters, voice scramblers and other specialty items, enclose \$2.00 to USI Corp.



How to Add Thousands of Dollars To The Value of Your Home . . . by Adding Just One Tool in Your Workshop!

Remodeling to add beauty to your bedroom.

Finish your walls with elegant wood paneling.

Build your own bookcase/stereo wall unit.

Customize your kitchen with cupboards you build yourself.

Design a built-in bar with matching stools.

Repair that creaky banister . . . design your dowels for a more attractive hallway.

Want to finish your kitchen with a built-in bar or customized cabinets? Or maybe you just want to make some simple repairs to window frames, sills or other woodwork around your home. These kinds of home improvements and maintenance could add thousands of dollars in value to your home — if they're done right. **But how do you get professional-looking results you need?**

Basically, you have three choices

You could run up a pretty hefty bill by hiring a professional at about \$16 an hour. But who can afford that much?

Or you could buy your own home workshop basics like a table saw, drill press, and more. Even if you have some of these tools, you could still shell out a fortune to complete a basic workshop.

Or, you could choose the Shopsmith MARK V — the professional quality home workshop that brings you the five most needed tools in one compact unit!

The Shopsmith MARK V is a really remarkable piece of equipment. It actually brings you the most basic and important workshop tools — 10" table saw, 12" disc sander, horizontal boring machine, 1 1/2" variable speed drill press and 34" lathe — as part of one free-standing floor unit.

What does that mean to you?

It means you save a bundle on equipment. Instead of buying five separate motors, you purchase only one precision-built motor. This one, fine-quality motor actually powers all five tools. The result: the finest precision tools for a fraction of what you'd expect to pay for such quality.

It means versatility. You can actually do more with the MARK V than you would with single-

purpose power tools. The MARK V enables you to apply features from one tool to another tool. What's more, it lets you add other tools and functions over the years.

It means economy. With the MARK V in your workshop, you'll find yourself actually saving money as you do your own "handyman" repairs. The MARK V is also economical from a space standpoint. It requires about as much space as an ordinary bicycle.

Find out more about how the MARK V can help add value to your home!

We'll send you all the information on the amazing MARK V and tell you how you can try it out at no risk. The information is free.

The Shopsmith MARK V — the tool to start with . . . the system you grow with.

Mail coupon for FREE information.



Shopsmith Inc.

The Home Workshop Company
750 Center Drive Dept. 2616
Vandalia, Ohio 45377

Yes! Please mail me your FREE Information Kit on the Shopsmith MARK V. I understand there is no obligation.

Name _____

Address _____

City _____

State _____ Zip _____

Tilt-engine V/STOL

[Continued from page 74]

about 100 feet, he is hovering completely on downward engine thrust. With the guide vanes in the exhaust (see drawing) he can move the plane laterally as fast as 30 mph. All during the approach, inertial sensors direct the controls; even violent wind gusts are automatically compensated for.

The last few feet onto a heaving deck demand fine adjustments beyond mere throttle changes. For such fine tuning, the inlet guide vanes can change the airflow and vary engine thrust in split seconds in response to the inertial sensors.

Enlightened approach

Design 698 is, of course, more than just a concept. Besides small-scale radio-controlled and high-speed wind-tunnel models, a full-scale mock-up equipped with a pair of TF-34-GE-100 turbofan engines has been tested in the giant 40-by-80-foot wind tunnel at NASA Ames Research Center in California (see photo). This \$6 million test model (costs shared equally by Grumman, NASA, and the Navy) is approximately twice as heavy as a 10-ton production model would be. A flying demonstrator would cost about \$100 million. Radar-equipped production models might cost \$10 million.

"If we had an enlightened and vigorous approach with enough money," Bob Kress told me, "we could have a demonstrator flying in about three years." How fast and how far development-funding will progress in the next few years is closely tied to future concepts of our Navy.

One possible riposte to the ongoing Soviet naval buildup would be to develop a new missile ship, based on existing destroyer designs, capable of carrying as many as 10 of the new Grumman V/STOL planes. Such ships might cost about \$500 million compared to \$2.5 billion for a new carrier — plus aircraft and supporting units.

But prospects for civil versions are also promising, both for offshore oil rigs and for business use. A nine-passenger business jet model, says Kress, could cost about \$9 million. It could take off from lower Manhattan and fly nonstop to Chicago in less than two hours, thus cutting downtown-to-downtown time for conventional commercial jets in half. Such time saving without requiring construction of new, multimillion-dollar airport runways would obviously be a boon to air travel in the future. Similar benefits would no doubt favor the use of such craft to distant offshore oil rigs. **P 5**

BE A LOCKSMITH



"I have already master keyed my Elks Lodge and 38 apartments... so you see my locksmith course is practically paid for."

You'll enjoy your work as a Locksmith because it is more fascinating than a hobby—and highly paid besides! You'll go on enjoying the fascinating work year after year, in good times or bad because you'll be the man in demand in an evergrowing field offering big pay jobs, big profits as your own boss. What more could you ask!

Train at Home — Earn Extra \$\$\$\$ Right Away!
LOCKSMITHING INSTITUTE
 Div. Technical Home Study Schools
 Dept. 111-031 Little Falls, N. J. 07424

Name _____ (Please print)
 Address _____
 City/State/Zip _____
 Check here if Eligible for Veteran Training

Super Magnet Lifts 100 Pounds

Powerful, pocket size magnets lift up to 100 pounds solid steel. Tested & Proven on steel block! Stronger than any other magnet at comparable size. Go treasure hunting. Do amazing stunts. Fish underwater. 1001 uses. 2 sizes available. 50 lb. lift magnet, 2" long, \$4.25 each. 100 lb. lift magnet, 4" long with sturdy strap handle, \$6.25 each; Add \$1.50 shipping & handling. Johnson Smith Co., Dept. 113, 35075 Automation, Mt. Clemens, Mich. 48043



175 Lb. Lift Magnet

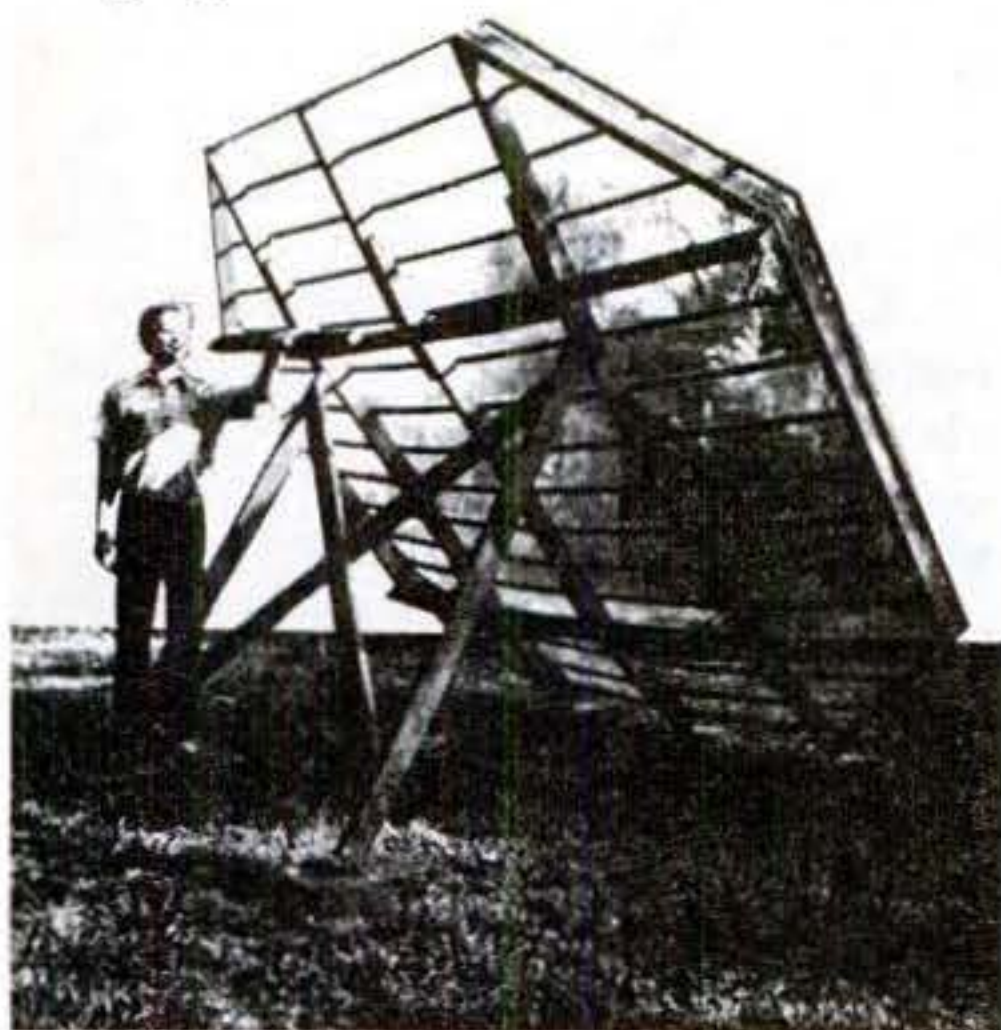
With Stainless Steel Handle
 Our most powerful magnet weighs only 1 lb., but lifts up to 175 lbs.! Made of 4 ceramic magnets sandwiched in series between 4 steel plates that concentrate magnetic power for maximum pull. Convenient stainless steel handle. Easy hand carrying of magnet & loads. For sport, hobby & industrial uses including "magnetic fishing" & tool retrieval. Only 1" x 1 1/4" x 4 3/8". Has hole drilled in handle to accept 1/4" screw. Send \$13.95 each. Add \$2.00 shipping & handling. Johnson Smith Co., Dept. 113, 35075 Automation, Mt. Clemens, Mich. 48043.

POLICE FLASHLIGHT

Built like a battleship. Knurled aircraft aluminum. Waterproof. Explosion proof. Lifetime guarantee. 4 D cells. (N.I.C.) Only flashlight you'll ever need. \$31.00 P.P.D. Order this "Best Buy" today. Send check, Visa, or M.C. No. (with exp. date) to

KENT FIELD'S
 50 Barber Ave., Dept. 3P
 San Anselmo, Ca. 94960

Enjoy Satellite TV Now



Better than Cable TV— Over 200 TV and radio services. Why waste money? Learn the whole story and build a video system the family can enjoy. No commercials, **FREE** movies, sports and Vegas shows—world wide, crystal clear reception connects to any TV set. Big (8 x 11 in.) book loaded with details, photos, plans kits—

TELLS EVERYTHING. Satisfaction Guaranteed.

GLOBAL TV ELECTRONICS

P.O. Box 219-A, Maitland, Florida 32751
 Send \$7.95 Today! Add \$2.00 for 1st class (airmail)
 or call our 24 hour C.O.D. Rush order line (305) 862-5068

Name _____
 Full Address _____

THE BOSS LOG SPLITTER!



Splits **EASIER & FASTER!**
 Only \$49.95 plus \$5 p. & h. for adaptable cone, or \$99.95 plus \$8 ready-to-attach to hub of car or light truck (specify vehicle). Pa.— send 6% sales tax. Free info—send stamped self addressed envelope. Good Products, Route 3 Box 88-A PS, Kutztown, Pa. 19530

Be a WELDER!



Learn at home in spare time—no previous experience needed. No need to quit your present job. We show you what to do, how to do it! Start doing small jobs in just a few weeks. Then you can start making money in your own full-time welding business or work for others. Everything explained step by step in easy-to-understand language. Welding kit included. **Send for free facts.**
 School of Welding, Dept. PC021
 1112 West Olympic Blvd., Los Angeles, CA 90015



SAVE

Assemble 16 hp. Big Wheel Tractor Kit for yourself or resell for profit. Factory direct savings. 30 attachments — 57" mower, plow, loader, backhoe, snowblower, etc. Catalog, 75c; "Build-it-Yourself" Plans, \$7 (refunded on any purchase).

Struck Kit, Dept. PS31T Cedarburg, Wis. 53012

The Air Bed Original Velveteen



\$49⁹⁵
 from

The lightweight Air Bed offers a revolutionary sleeping experience. Gently, but firmly supports you with 100% air. Features air coil construction with multiple controlled air chambers that hold your body evenly and independently.

Turns any room into a guest room. The ideal portable bed for holiday and vacation visitors...and it stores easily. Take it camping, in your van, on your boat, in your summer home; sunbathe and float on it!

Available in twin, double, queen and king sizes. Inflates in minutes with most air pumps or cannister vacuum. (High-power air pump available—optional.) Made of sturdy 20 gauge poly vinyl, cleans with soap and water. Repair kit and pump adapter included.

Don't be misled by imitations. Insist on the original, red velveteen The Air Bed. 10-day Free Trial. If not satisfied, return it within 10 days for refund. Order now!

CREDITCARD ORDERS **800-648-5600** Nevada Residents Call: 800-992-5710
 CALL TOLL FREE: OPERATOR NO. 48, 24 HOURS A DAY, 7 DAYS A WEEK
 790 Maple Lane, Bensenville, Illinois 60106

Contemporary Marketing, Inc.



Air Coil Construction



Stores Easily on Shelf

Please send me the following AIR BED(S):

Twin Size	(Item 2339)	\$49.95
Double Size	(Item 2354)	\$69.95
Queen Size	(Item 2360)	\$79.95
King Size	(Item 2374)	\$99.95

Add \$4.95 per bed for shipping and insurance.
 AC Air Pump (Item 0004) \$29.95
 DC Pump-12 volts-(Item 0005) \$29.95
 Illinois Residents include 5 1/4 % sales tax.
 Check/M.O. Enclosed Charge My Credit Card:
 Master Charge American Express Carte
 Visa Diners Club Blanche

Card No. _____ Exp. Date _____
 Name _____
 Address _____
 City _____
 State _____ Zip _____
 Signature _____

Contemporary Marketing, Inc.
 790 Maple Lane, Bensenville, IL 60106
 Dept. PSME-060 © CMI1980251

Underground Homes



The Primer To Earth Sheltered Living — 24 Page Booklet gives basic information on underground homes — advantages, site selection, planning, financing, building tips, construction and landscaping. \$3.50 ppd.

Plans For The Future — 44 Page Book features full color renditions of 25 different underground home designs, plus floor plans. Blueprints available. \$7.95 ppd.

Order Today! Satisfaction Guaranteed.
Underground Homes • Dept. PS3
 700 Masonic Bldg. • Portsmouth, OH 45662



STAIR-GLIDE® Stairway Lift

America's largest selling stairway lift is the ideal solution for people who can't or shouldn't climb stairs.

- Rental-Purchase Program
- Easily installed
- UL listed
- Will not mar walls or stairs
- Economy and Outdoor models available.

AMERICAN STAIR-GLIDE® CORP.
 4001 East 138th, Dept. PS-031
 Grandview, Missouri 64030



**Makes Over \$60 EXTRA a Week
In Own Sharpening Shop!**

"My Belsaw Sharp-All made me \$3,500 last year just in spare time. Now I'm going full time. It's great to be your own boss."

David Swanson — Utica, Michigan



Let Belsaw prove
**YOU can do it, too! On our
30-DAY FREE TRIAL OFFER**

You risk nothing by accepting this offer to see how easily you can turn your spare time into Big Cash Profits with your own Complete Sharpening Shop. No selling . . . No previous experience needed. Our famous Sharp-All and show-how instruction set you up to make \$200, \$500, \$700 a month CASH sharpening SAWS, KNIVES, SCISSORS, LAWNMOWERS, Shop and Garden tools . . . all cutting edges.

Send coupon for FREE facts on this money-making business. How we'll even finance you.

No Obligation — No Salesman Will Call

BELSAW SHARP-ALL CO.

701M Field Bldg. Kansas City, Mo. 64111



FREE BOOK

**JOIN THESE SHARP-ALL
MONEYMAKERS**

"Think the world of my Sharp-All. Am grossing \$4,000 a year on a part-time basis."

Lawrence Stevenson
E. Syracuse, New York

"There's excellent profit in sharpening . . . we now do about \$600.00 a month."

Ed Kisler, Jr.
Sarasota, Florida

"I average \$5.00 an hour part time and business gets better all the time."

Roy Jennings
Sandwich, Illinois

RUSH COUPON TODAY FOR FREE BOOK

BELSAW SHARP-ALL CO. Stan Field, Pres.

701M Field Bldg., Kansas City, Mo. 64111

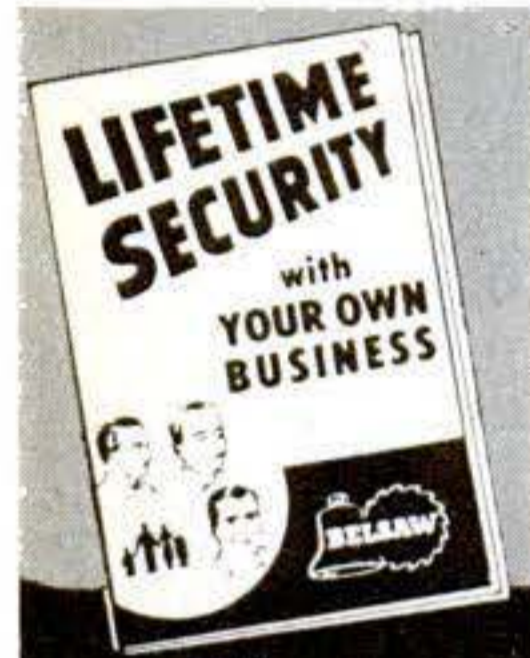
Send details of FREE TRIAL OFFER and Free Book "Lifetime Security"

Name _____

Address _____

City _____ State _____ Zip _____

No obligation . . . No salesman will call



FREE BLUEPRINTS and TRIAL LESSON
—for your greater success in Building

Beginners, craftsmen, even foremen and superintendents, have sent for these free blueprints and trial lesson in Plan Reading as a means of trying out Chicago Tech's home-study Builders training. Learn how you can master Plan Reading—Estimating—and the practical details of all types of construction in your spare time at home. Mail coupon below or phone TOLL FREE—see how you, too can prepare for a better job—higher income, or start your own contracting business.

• PHONE TOLL FREE (24 HRS.)
1-800-528-6050 Ext. 810

CHICAGO TECH/School for Builders
1737 S. Michigan Avenue, Chicago, Ill. 60616

CHICAGO TECH/School for Builders
Dept. PS-31 1737 S. Michigan Ave.,
Chicago, Ill. 60616

Veterans
Check
Here

Please mail me a Free Trial Lesson, Blueprints and Builders Catalog. I understand there is no obligation—no salesman will call.

NAME _____ AGE _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____

**You and a friend
can build this
Lincoln Log home
in ten days.**



We give you everything you need, down to the last nail. Dollar for dollar, the basic Lincoln Logs Home Package is the most complete in the industry, designed and engineered for quick, easy construction. We supply all blueprints, plans and an instruction manual that gives you the "How To" in simple language with easy-to-follow illustrations. And your local Lincoln Logs Distributor will give you 4 hours of on-site instruction to answer any questions you might have. Lincoln Logs will even assemble a package based on your floor plan or architectural design . . . AT NO EXTRA COST. Send just \$4 for your Lincoln Logs Home Planning Kit with plans for 17 different log homes.

(Dealer inquiries invited)



THE ORIGINAL

Lincoln Logs Ltd.

3 Spring Mill Road, Chestertown, New York 12817

1-518-494-2426

© 1980 Lincoln Logs, Ltd.

Saturn's secrets

[Continued from page 88]

etesimals—icy blocks of primordial matter—just as the planets were formed. If that is the case, the Saturnian system may become the textbook example of solar-system creation. "We may be seeing down to the accretion process itself," Soderblom said.

The large moon Titan is a story in itself. Known to be the only moon in the solar system with a substantial atmosphere, Titan is enveloped in a red haze that prevented Voyager's cameras from getting a view of its surface. Radio-wave soundings of the atmosphere indicated that the pressure on Titan's surface is several times greater than on Earth.

Ultraviolet measurements revealed that the atmosphere is not predominantly methane, as had been thought, but mainly nitrogen, as is Earth's. It also contains significant concentrations of hydrocarbons, including acetylene, ethane, and hydrogen cyanide. The latter molecule is believed to be a necessary precursor to formation of life. However, frigid temperatures on the surface—down to minus 180 degrees C—quash any hope that living forms may exist there.

"Titan may be a place where we can study pre-biotic chemistry," Stone said. "It's possible that it represents Earth as it was billions of years ago. It could be Earth in deep freeze."

Equatorial winds

Almost lost in the excitement over rings and moons was Saturn itself. Analysis of its muted bands and zones puzzled meteorologists, who are now rechecking their Jupiter data. On that planet, jet-stream winds crisscrossed the globe, flowing east, then west along the edges of the color bands.

On Saturn, one continuous jet stream, with winds up to 1,500 km/hr, streaks westward centered on the equator, contained inside the cloud bands. Such a wind is alien to any recognized weather pattern.

With Voyager 1 now heading toward the edge of the solar system, unsolved old mysteries and inexplicable new ones may clear up when Voyager 2 flies by Saturn. Meanwhile, project scientists will study their data—and will continue to marvel.

"I can't recall being in such a state of euphoria over any previous encounter," says Brad Smith, who has been on the science teams of many planetary missions. "We've learned more about the Saturn system in the past week than in the entire span of recorded history."

A COMPLETE SET OF ORANGE

SHOP TOWELS



FIRST TIME EVER... BRAND NEW 100% COTTON, LARGE ORANGE SHOP TOWELS!

(approximately 16" x 16" when washed)

ONE-THIRD GROSS... 48 TOWELS! SPECIAL OFFER... ONLY

\$14.99

plus \$2.90 shipping and handling

Order Today! Offer expires April 30, 1981

Re-order information shipped with each order!

SURPRISE FREE GIFT!!

To encourage you just to try a set of Shop Towels, we'll send you a valuable Surprise Free Gift - yours to keep even if you return your Shop Towels!

The same top-quality commercial-grade shop towels **RENTED** by service stations, garages, printing plants, repair shops, maintenance services and thousands of other businesses throughout the country... **NOW offered FOR SALE** at an almost unbelievable, direct-to-user price!!

- No more searching for clean rags!
- No more "making do" with non-absorbent, lint-filled, odd-sized rags!
- No more flimsy, fall-apart paper towels!
- No more waiting for laundry services!
- **NO MORE HIGH PRICES!** (Buying our Towels costs a fraction of renting!) Our shop towels are soft, strong, absorbent, washable and large. Great for home, office, shop, garage or plant... washing windows, dusting, cleaning anything!
- **not** used towels... **not** "seconds"
- **not** anything but brand new, quality commercial-grade towels.
- Return them anytime within 30 days for a full refund... if not completely satisfied.



INDUSTRIAL TEXTILES

A division of D.R.I. Industries, Inc. 11100 Hampshire Ave. So., Bloomington, MN 55438

ORDER TODAY... IT'S EASY! Fill in order form and send with check, money order, purchase order or credit card information. Credit card buyers can also call our 24-Hour Toll-Free Order Number: 800-228-5000 (In Nebraska 800-642-8777).



SPECIAL OFFER COUPON

Offer expires April 30, 1981

49623

100% MONEY BACK GUARANTEE

Send to & make remittance payable to:

D.R.I. Industries, Inc., DEPT. PS-381-2A
11100 Hampshire Ave. So., Bloomington, MN 55438

sets (48 Towels per set) @ \$14.99 plus \$2.90 shipping and handling for each set = \$ _____

(MN residents add 4% sales tax)

How Many? _____

- CHECK I've enclosed my check, money order or purchase order.
METHOD OF PAYMENT Charge it to VISA MasterCard American Express Diners Club Carte Blanche

Card No. _____

Exp. Date _____ / _____

Signature _____
(Need to sign only if charging order)

PLEASE PRINT MR. _____ MRS. _____ MISS _____ First M.I. Last

ADDRESS _____ Street & Number

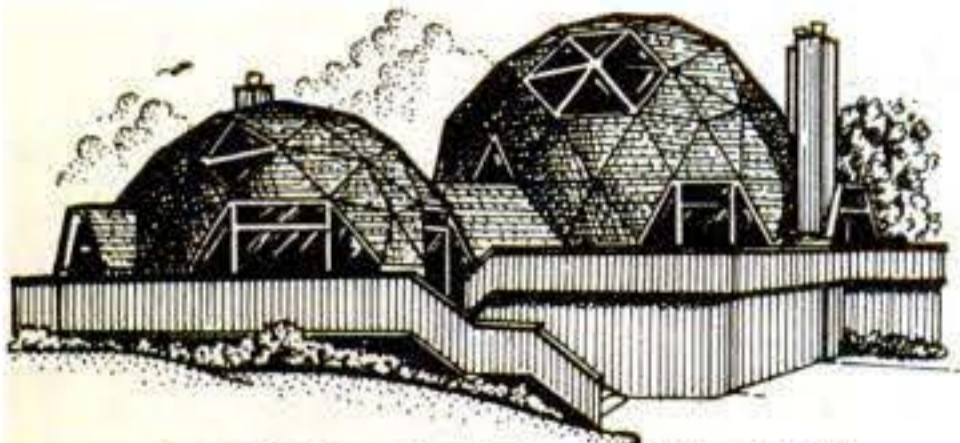
CITY _____ STATE _____ ZIP _____

PS-381

Shoppers' Showcase

A selection of products and services for Popular Science readers available direct by mail. Enjoy the fun and convenience of mail order shopping. Please order directly

from the advertiser. For advertising rates for this section, write Cathy Starrantino, Popular Science, 380 Madison Avenue, New York, N.Y. 10017.



EXPLORE A NEW HEMISPHERE FOR \$5.00

If you're considering a new home, the new Monterey Domes literature package is a must. It has 80 pages of exciting designs, color photographs, floor plans, solar applications and factual information. Learn why it is the world's most energy-efficient design. You can assemble your shell kit in a few days. Dozens of models. Extremely affordable. If you're a serious home-shopper, mail this coupon today.

Rush your new Literature Package. Enclosed is \$5.00, plus \$1.00 pstg./hdlg.
 Also send your Dome Assembly Manual for an additional \$5.00.

Name _____
 Address _____
 City _____ State _____ Zip _____
 Mail to: Monterey Domes,
 Dept. AR3, 1855 Iowa Avenue,
 Riverside, CA 92517

THROWING AWAY \$5 per lb.?

Everyone has thrown this little-known asset away. It is thrown away in every office, home, and all other buildings. Industries throw tons of it away annually. Only one person out of 1,000 save it, the other 999 don't realize its value, and the buyers want it kept that way! Hundreds of millions of dollars worth of it go unclaimed, discarded each year!

We pay \$5 per lb. for all of this material that you collect. Save yours, and buy it from other uninformed persons for \$2 to \$3 per lb. Our buyer's handbook will detail this \$5 a lb. item + 3,000 others worth \$1-\$7,440 per lb. (Average price we pay is \$12.42 per lb.) Two of these (metals) are worth more than Gold! Learn how to; find them, buy for huge profits, and how to ship (we pay shipping). This is a new field with huge income potential, can be done part time. Handbook cost is \$7 + \$3 postage & handling. We gladly refund this with 1st shipment, or within 10 days if dissatisfied.

Poley's Industrial Salvage Co.
 Supply Dept. P-24
 12389 Mingos Rd., Battle Creek, MI 49017

GARAGE DOOR OPENERS

- Radio Controlled
- Buy Factory Direct and Save
- Thousands In Use • Free Brochure
- Easy Homeowner Installation
- Immediate Shipment by UPS or PP

HELPMATE Equipment Co. Dept. PS-381 Baroda, MI 49101

MAKE CASH CLEANING CHIMNEYS

It's easy with the August West System — a proven method of cleaning residential wood-burning chimneys in less than an hour. (And the average charge for this service is \$45.00 a flue.)



Here's one heck of an opportunity. You can now live the life you want to live. And work when you want to work. Perform a much needed service. Wear a top hat to work. And clear more than \$100 a day! With the August West System YOU CAN DO IT! We'll show you how.

For FREE details on how you can
BE A CHIMNEY SWEEP
 Call TOLL FREE 800-243-5166
 Ask for Extension 225
 or write August West Systems, Inc.
 Dept. 2252, Box 603, Westport, CT 06881

APPROVED FOR VETERANS

Learn how to MAKE MONEY in DRAFTING

Train at home in spare time. No previous experience needed. Tools and materials included with course. No special talent required. We show you what to do, how to do it. **LEARN DRAFTING AT HOME!**

NAME _____ AGE _____
 ADDRESS _____
 CITY _____ STATE _____ ZIP _____

Accredited National Home Study Council

NORTH AMERICAN SCHOOL OF DRAFTING,
 4500 Campus Dr., Dept. PC021, Newport Beach, CA 92660

RICKA DUO-WHEEL CONVERSION KIT AND FIBERGLASS FENDERS



New wide tire adapters & fenders to fit most mini - 1/2, 3/4 & 1 ton trucks. Simple bolt on installation. Increases traction, tire capacity & life.

The ultimate in safety protection for your family.

RICKA MFG. DEPT. RPS-3

Pequot Lakes, MN 56472

INSTANT GAS SAVER!
JUST ADD A BIKE AND GET 200 MPG AT SPEEDS UP TO 35 MPH



FACTORY DIRECT SALE \$179.95

Reg. \$199.95

Ride over 3,000 miles FREE with special rebate offer

The air-cooled, 1.3 HP, 34 cc, 2-cycle BUMBLE-BIKE MOTOR installs easily with just two bolts. Motorcycle-type clutch and throttle controls. Does not interfere with normal pedaling. Satisfaction guaranteed.

WRITE FOR FREE BROCHURE AND SPECIAL FACTORY REBATE OFFER

Bumble-Bike®

Dept. 8-3, P.O. Box 1116
 Havana, FL 32333 U.S. Patent Pending

MAKE OR REPAIR for FUN and EXTRA INCOME!

Try Klokit's selection of super accurate QUARTZ Battery Clock Movements, Dials, Hands and Numerals at Bargain Prices! Free Catalog & Section: Creative Clock Making for the Whole Family!



SEND TODAY!

WRITE:

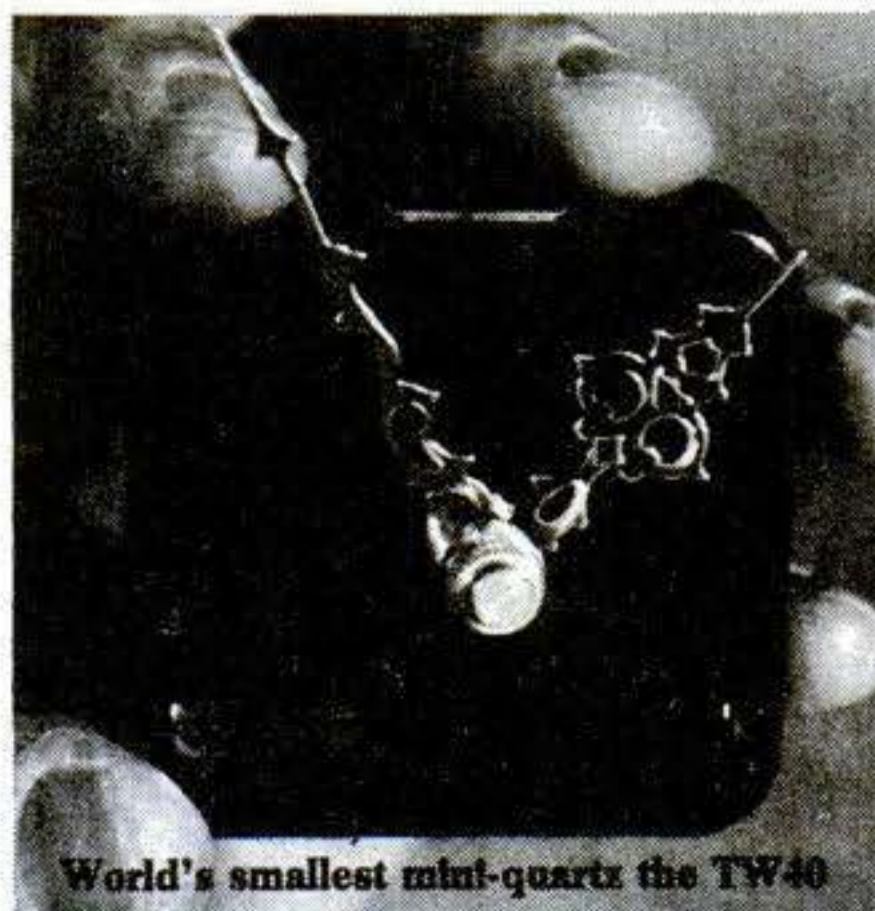
KLOCKIT

DEPT. PS3, P.O. BOX 629
 LAKE GENEVA, WISCONSIN 53147

FREE HANDS WITH EACH MINI MOVEMENT PURCHASED

We Welcome Phone Orders Call [414] 248-1150 • For 1st Class Catalog Delivery - Send 50¢

CLOCKS



World's smallest mini-quartz the TW40

ONE FOR ONLY \$7.25, 3 FOR ONLY \$6.80 ea.
 S-300 SWEEP: ONE FOR \$2.25, 3 FOR ONLY \$2.20 ea.
 Add \$1.75 for Shipping & Handling in U.S.A.

Almost Like Growing "INSTANT SHADE"!
Once Established, Amazing
Super-Soaring Hybrid

ZOOMS ROOF HIGH IN JUST ONE SINGLE YEAR!

—and keeps on skyrocketing 30—40—50—EVEN UP TO 60 FEET HIGH, OR MORE, in less time than most trees nudge themselves a few feet off the ground.

Actually Soars Up To A Tower Of ROOF-HIGH Beauty IN JUST ONE YEAR!

Yes! Based on amazing average weekly and yearly growth rates reported by plant scientists —It grows SO FAST... arches out SO WIDE... you can actually take a ruler and measure the incredible difference in height every 2 to 3 days! OR, to really leave your neighbors gasping in awe and wonder, give them a yardstick and let them measure the difference IN FEET, every 2 to 3 weeks!

GROWS MORE IN JUST ONE MONTH THAN MOST TREES GROW IN AN ENTIRE YEAR!

Because according to plant experts, Gov't scientists and Botanical Gardens who researched this wonder-hybrid... once established, you merely water it once-a-week, and be absolutely floored as it GROWS up to an average of A FULL 1/2 FOOT WEEKLY! during its SUPER-SOARING growing season!

That's right! Grows higher than even a full grown Flowering Dogwood IN JUST ONE SINGLE SEASON! Grows higher than even a full-grown Star Magnolia IN JUST ONE SINGLE YEAR! Yes, thrusts itself so high, so fast that it actually towers over even a Japanese Red Maple, Cherry Tree or even the most graceful silky Willow, in such a ridiculously short time you will simply refuse to believe your eyes!

PLANT NOW—REACH OUT AND TOUCH ITS LUSH, THICK BRANCHES FROM YOUR SECOND STORY BEDROOM WINDOW BY NEXT SUMMER!

Think of it—just 12 months or less! No doubt about it. There's just not another "Instant" Shade Tree like it on this planet! Because—this year, thanks to this miracle of plant science, instead of spending a small fortune on a tree and then waiting half a lifetime for it to grow... get set for the garden-wonder of your life as this super-soaring hybrid rockets forth from a tiny sapling to a tower of roof-high beauty IN JUST ONE SINGLE YEAR!

GROWS IN VIRTUALLY ANY SOIL—REQUIRES NO SPECIAL CARE—SOARS INTO A MASTERPIECE OF BEAUTY IN JUST A MATTER OF MONTHS!

Best of all, unlike most trees that demand constant care, constant pampering... about the only thing you do when you plant this super-growing wonder-hybrid is water it and enjoy it! That's why leading botanical gardens... landscape artists... garden editors... can't stop raving about its indescribable beauty... its trouble-free care... its surging, towering growth.

Small wonder that leading experts hail it in the most glowing terms... recommended it again and again for homeowners who want a stunning display of beauty, both a wind and privacy screen, and deep, cool shade... and with practically no more work than a thorough watering each week!

VITAL STATISTICS FROM LEADING EXPERTS MATURE GROWTH SIZE:

as much as 50 to 70 feet.

MATURE GROWTH SPREAD: as much as 30 to 35 feet.

ZONE OF HARDINESS: Hardy from deepest South to as far North as Vermont, Minn., Quebec, British Columbia, Winter hardy in areas where temp. drops as low as 50 degrees below zero!

LIGHT NEEDS: Grows best in sunny location.

DECORATIVE MERITS: Highly recommended by landscape architects as beautiful, decorative specimens for homes, parks, highways etc., where exceptional fast growth and beauty are required. Perfect for fast screening and privacy.

RAPID RATE OF GROWTH: Experts report growth rates of up to 9 FEET THE VERY FIRST YEAR ALONE on specimen trees. That's more than most shade trees grow in 3...4...5...even 7 years. Once established, will grow ranch-house-roof high IN JUST ONE SINGLE YEAR.

CARE: No special care required, just normal garden care. Water Fully once weekly. No spraying, no dusting, no special feeding. Naturally resistant to most diseases, pest or insects.

WE HAVE AT THIS MOMENT ONLY A LIMITED SUPPLY AVAILABLE FOR RELEASE TO THE PUBLIC—FULL SUPPLY WON'T BE READY UNTIL 1982. SO ACT NOW!

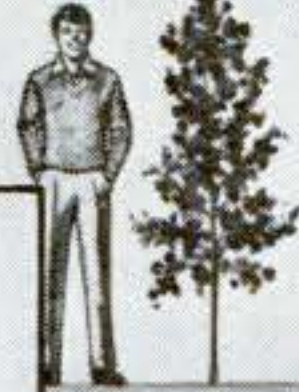
Now the price of this super growing shade tree is not \$20 or \$30 you might expect, but a mere \$3.95.

That's right, only \$3.95 for this magnificent Beauty that rewards you with such a glorious display of growth IN JUST ONE SINGLE YEAR. However our supply is limited! Full supplies from the growing fields will not be ready mid to late 1981 or early 1982. Therefore, all orders must be shipped on a first-come, first shipped basis. To make sure you don't miss out... **ACT NOW!**

SATISFACTION GUARANTEED OR MONEY BACK!

Remember: Satisfaction is fully guaranteed. You must be thrilled in every way with this spectacular f-a-s-t growing shade tree or RETURN AT ANYTIME within 90 days for a full refund of purchase price... ANYTIME within 1 year for free replacement. Could anything be fairer? Now is the time to order and plant—so send the no-risk coupon today!

FROM MAN HIGH First year



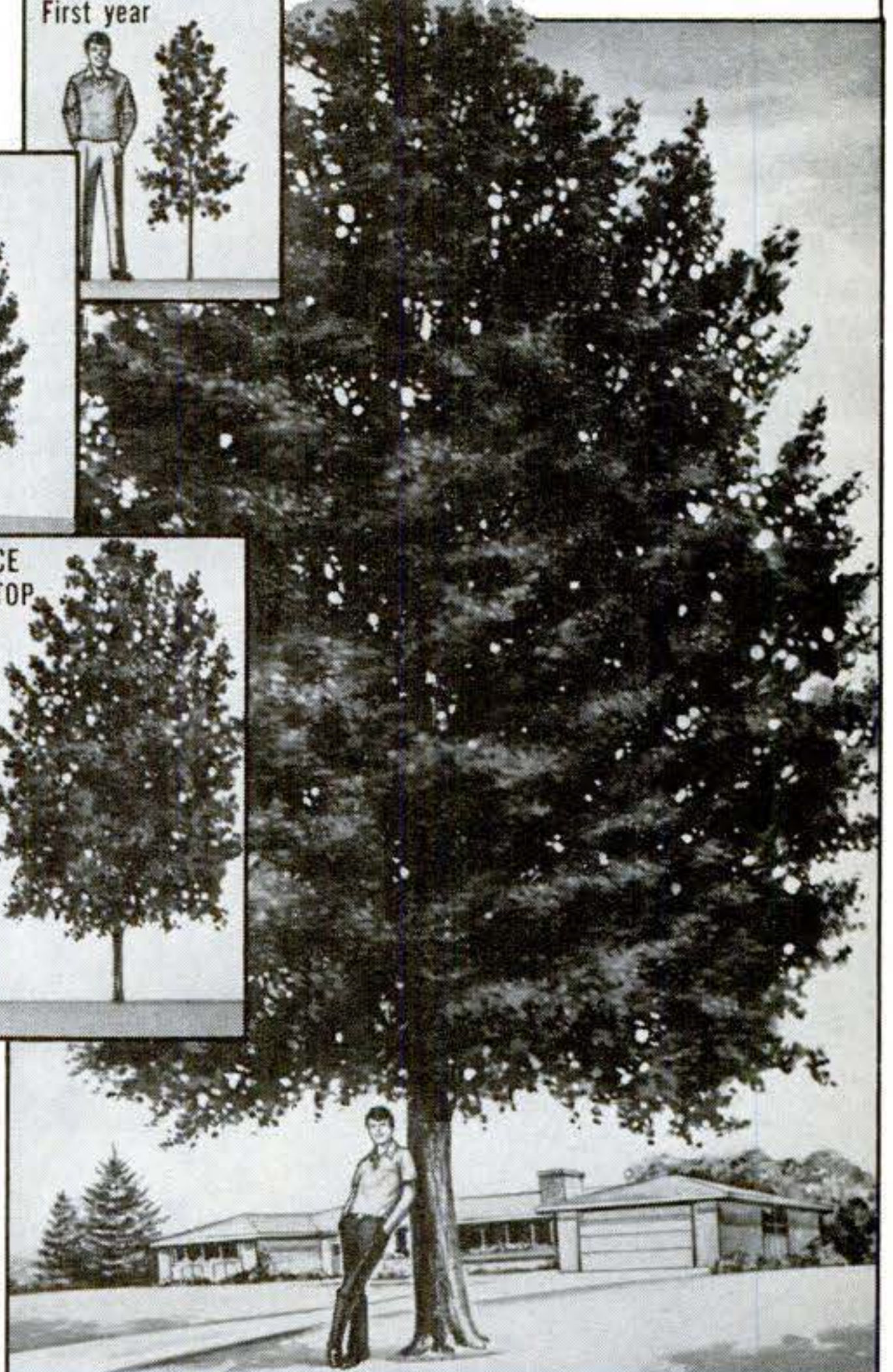
TO RANCH-HOUSE ROOF HIGH by next year



TO TWICE HOUSETOP TALL in just a few short years!



NOTHING ELSE CAN MATCH IT IN ALL OF NATURE!



Grows More In One Month Than Most Other Shade Trees Grow In AN ENTIRE YEAR—More In One Season Than Ordinary Shade Trees Grow In 2 Years, 3 Years or Even 5 Years! (Illustration shows magnificent size, spread and beauty of mature Populus Canadensis Eugenei.)

JUST MINUTES TO PLANT — SOARS UP TO ROOF-HIGH IN A SINGLE YEAR!



Here's a luxury sight you don't have to wait half a life-time growing — a matched pair of these towering show-pieces.

Picture your patio bathed in the cool, fragrant beauty of this show-stopping miracle tree from early spring to the first snows of winter.

Just a few minutes planting time, a few season's growing time, rewards you with twin towers of beauty.

© 1981, Willow River Nursery Sales, Inc.

MAIL NO-RISK COUPON TODAY

WILLOW RIVER NURSERY SALES, INC., Dept. RHT-60
346 Maple Ave., Westbury, N.Y. 11590

Yes, please rush me the SUPER GROWING SHADE TREE(S) indicated below:

- (#001) 1 for only \$3.95 plus 75¢ post. & hand.
- (#002) 2 for only \$6.95 (SAVE over \$1.00) plus \$1.00 post. & hand.
- (#004) 4 for only \$10.00 (SAVE over \$7.00) plus \$1.50 post. & hand.
- (#010) 10 for only \$20.00 (SAVE over \$20.00) plus \$3.00 post. and hand.
- (#020) 20 for only \$30.00 (SAVE over \$55.00) plus \$5.00 post. & hand.

If after receiving my order I am not fully delighted, I may return anytime within 90 days and you will refund my purchase price in full (less only postage and handling costs).

Total amount enclosed \$ _____ (N.Y. Residents add sales tax). No COD's please.

Name _____

Address _____

City _____ State _____ Zip _____

Weather conditions will determine date of shipment. Your trees will be shipped in early spring for proper planting time in your area.



This VET Did It - and YOU Can Do It Too!

"War injuries left me badly handicapped, but now I'm a financial success as a Locksmith, thanks to your training. Besides, the work is fascinating. If I can do it anybody can." - Glen Johnson, Larned, Kan.

Make Up to \$10 an Hour—even while learning!

Train FAST at Home!

Be a LOCKSMITH!

If you enjoy fixing things, you're a "natural" to make hundreds of EXTRA DOLLARS a year in the fascinating business of Locksmithing. Rising crime has increased demand for service a thousandfold. Yet there's only one Locksmith for every 17,000 people!

COLLECT CASH PROFITS ALMOST AT ONCE!

You're "in business" ready to make \$5 to \$10 an hour a few days after you begin Belsaw's shortcut training. Easy, illustrated lessons complete with ALL practice equipment PLUS

- ALL TOOLS YOURS TO KEEP
- KEY MACHINE YOURS TO KEEP
- EXPERT PERSONAL ASSISTANCE
- BUSINESS-BUILDING HELP

enable you to get your share of this always-profitable business. Hundreds we've trained are doing it. So can YOU.

MAIL COUPON to discover how Locksmithing can keep the extra money coming in during spare time—or in your own full-time business. Ideal for retirement—good jobs, too.

BELSAW INSTITUTE, 111M Field Bldg.
Kansas City, Mo. 64111
Accredited Member NHSC.



N. Hunt, Wilmington, Del.—"I make \$50 a week extra."

R. Davis, St. Louis, Mo.—"I cleared \$110 last Saturday."

Ed Boyle, Pittsburgh, Pa.—"My business going at top speed. I'm moving to bigger quarters."

FREE

MAIL THIS COUPON • NO SALESMAN WILL CALL

BELSAW INSTITUTE, 111M Field Bldg.
Kansas City, Mo. 64111

Rush **FREE** book, "Keys to your Future."

Name _____

Address _____

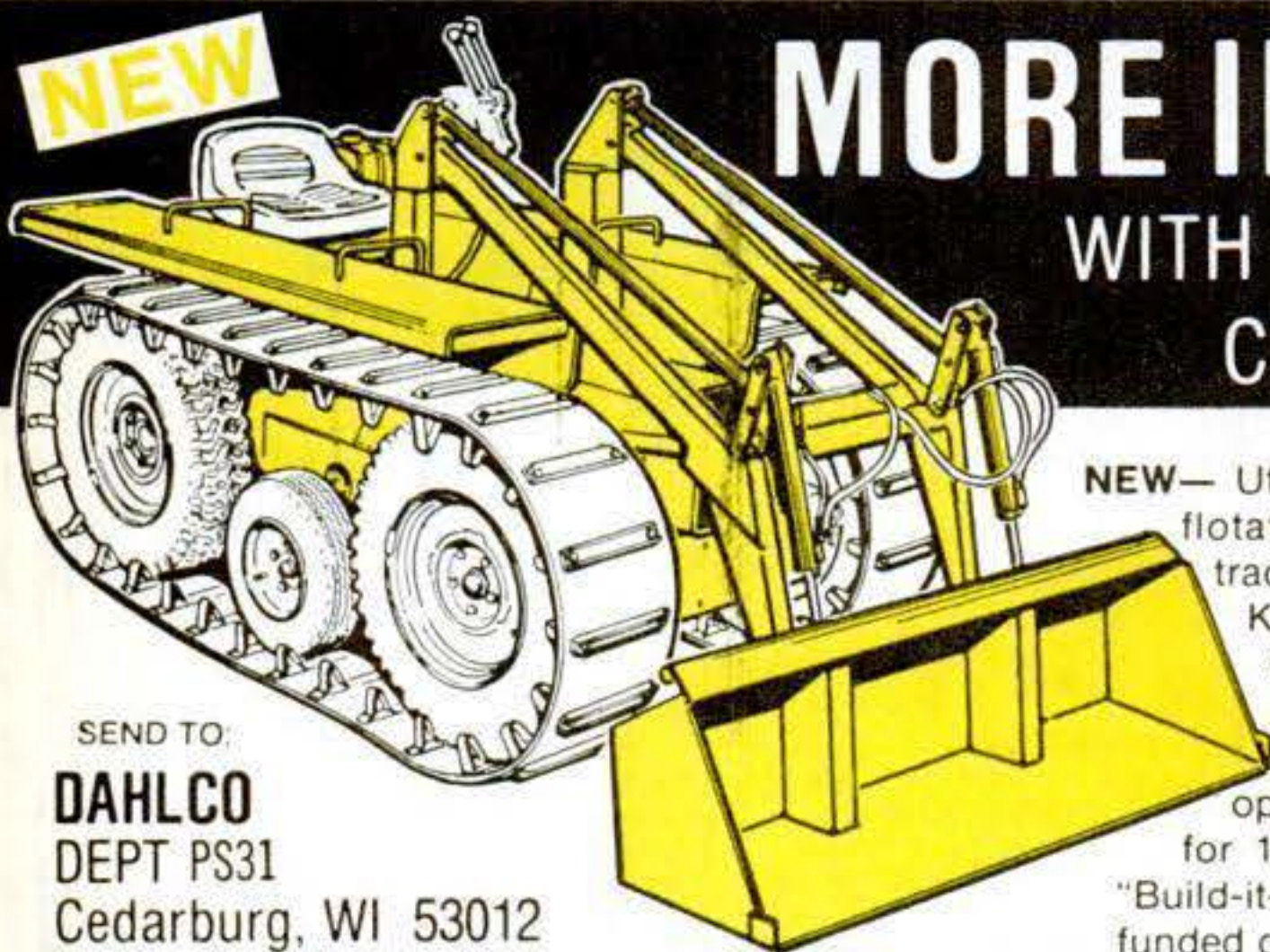
City _____ State _____ Zip _____



THIS DO-ALL PRO KEY MACHINE YOURS TO KEEP!



Can add \$25 to \$40 a week to your income... and doesn't cost you a penny extra!



MORE INCOME WITH A MAN-SIZED CRAWLER!

NEW— Utility Crawler Tractor, high flotation steel cleated rubber tracks. Buy Factory Direct in KIT or Completely Assembled. Over 30 attachments - backhoe, loader, blade, garden plow, etc. Odd job & resale opportunities are great! Send for 16 pg. Catalog 75¢, or for "Build-it-yourself" plans. \$7.00 (refunded on any order).

SEND TO:
DAHLCO
DEPT PS31
Cedarburg, WI 53012

DOMES HOMES Energy Efficient - Unique Interiors



Dome Plans & Building Guide
Combined color publication provides • 74 pages of scaled dome plans • an interior planning kit • construction details • decorating ideas • Solar & Earth Sheltered Domes • financing information • prices on Pre-cut Dome packages.

Enclose \$6.00 postage paid.



the big outdoors people

26600 Fallbrook Avenue
Wyoming, MN 55092
(612) 462-1011



REBEL FLAGS

Authentic looking Confederate Battle Flags. 100% Cotton. 2'x3' - \$8.50, 3'x5' - \$16.00, 4'x6' - \$21.50, 12'x18' - \$5.00. Send to:

BROWARD FLAG P.O. BOX 8593 - PS
Asheville, NC 28814

GUARANTEED 10 YEARS!

\$2.25 SALE



The knife for hunting, fishing and all around use. Mirror polished, imported stainless steel blade honed to a razor's edge. Rugged. Opens with lick of finger. Locks into position. Blade will not close when in use. Press button in handle to close Safety finger guard. Sure-grip handle. Balanced for target throwing. **IF BROKEN WITHIN 10 YEARS, WE WILL REPLACE AT NO CHARGE!** Use 30 days. Money back if not pleased. Regular price \$3.75. **SAVE! SPECIAL SALE ONLY \$2.25.** Add 74¢ postage, handling. Remit total \$2.99. **ORDER NOW!** Midwest Knife Co., Dept. A-3216, 9043 S. Western Ave., Chicago, Ill. 60620. Founded 1936. MAIL ORDERS ONLY. Sturdy leather belt case available - \$1.25 each. **BONUS!** 2 knives for \$4.98 postpaid. Excellent value.

DIRECT FROM U.S. OPTICS QUALITY SUNGLASSES AT FACTORY PRICES

Each pair features: Impact resistant lenses • Handcrafted • Polished glass lenses • Hardened metal frames • No non-sense guarantee.

FREE—limited time only—deluxe velour lined case with each pair of glasses ordered (a \$3.00 value). Credit cards accepted. Dealer inquiries invited.

NOTICE: Don't be fooled by cheap imitations. These glasses are made exclusively for U.S. Optics. To make sure you get the best, order now and if not completely satisfied return for refund within 30 days.



Only \$7.95

World Famous Pilot's Glasses

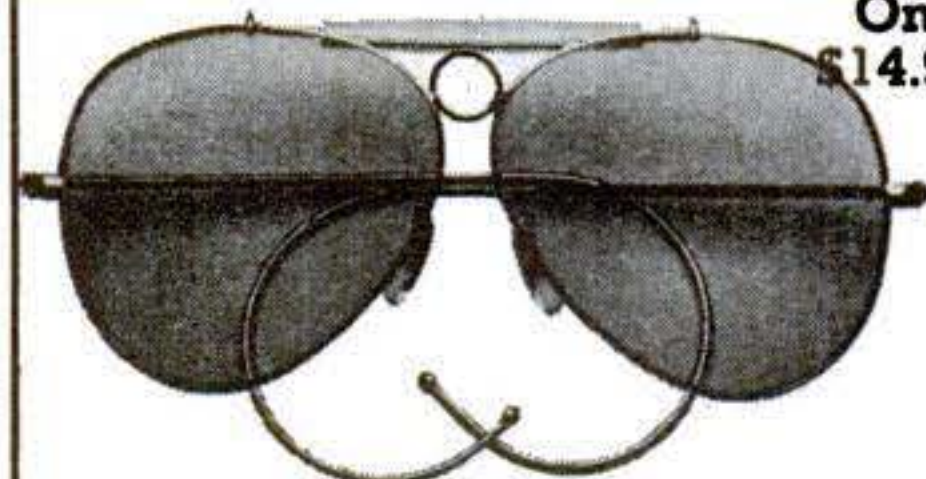
These precision flight glasses are now available to the public for only \$7.95. If you could buy them elsewhere, they'd probably cost you over \$20.00. #20P available in gold or silver frame. A \$20.00 value only \$7.95. Two pairs for \$14.00.



Only \$9.95

Aviator Teardrop Flight Glasses

Flexible cable temples. #30A gold frame only. A \$30.00 value only \$9.95. 2 pairs for \$18.00.



Only \$14.95

Professional Driving & Shooting Glasses

Wide angle amber lens brightens visibility. #30D gold frame only. A \$30.00 value only \$14.95. 2 pairs for \$28.00.

To order send check or money order to **U.S. Optics, Dept. 749, P.O. Box 14206, Atlanta, Georgia 30324.** Credit card customers please fill in card # and Exp. date

QUANTITY	MODEL #	GOLD	SILVER	PRICE
	20P			
	30A	X		
	30D	X		

Add Postage, Handling, and Insurance \$1.00 per pair

Total _____

Visa or Master Charge # _____ Exp. Date _____

Name _____

Address _____

City _____ State _____ Zip _____

FREE case with each pair.

Look-Alike "Security System" FOOLS BURGLARS



Helps Protect Your Home, Factory Store, Cabin, etc.

Stop thieves at the door and turn them back. That's the easiest way to protect your property. "Felony Fighter," a replica of an expensive burglar alarm system, can be an effective way to do it. Just place the ingenious "alarm" terminal at each of your doors and switch on its light. No burglar can know the activator control panel is not a real, high-priced complete alarm system. The glowing red light, and realistic steel switch plate look to any crook like an expensive alarm system costing \$1,000 or more.

FELONY FIGHTER™

"alarm" light works on one 9-volt battery (not included). Keep it on night and day for pennies a month! An ever-vigilant warning. Only \$9.98. At that price you can afford one at each door. (You save when you order 2 or more.) Mail coupon for prompt delivery.

FREE BONUS



Security Decals

TMM Felony Fighter, Dept. PS-031
Box 9569, Church St. Sta., New York, N.Y. 10249

Rush new Felony Fighter™ at only \$9.98 each (plus 85¢ post. & hdg.) Satisfaction guaranteed or money back. Also include my FREE Security Decals.

SAVE! Order two Alarms, one for each door, for just \$18.98 (plus \$1.50 post. & hdg.)

Enclosed is \$_____

Charge Visa Master Charge Exp. Date _____

Card No. _____

Name _____

Address _____

City _____ State _____ Zip _____

Add applicable sales tax in AZ, CA, CO, FL, IL, NY, PA, VA, VT, WI

SUPER KNIFE SPECIAL

Compare These Prices Anywhere

- 19" overall
- 15" edge
- steel blade
- canvas sheath

A BUSHWHACKER

C BOLO MACHETE

B MACHETE

- 23" overall
- 18" edge
- steel blade
- canvas sheath

- 20" overall
- 18" edge
- steel blade
- canvas sheath

D SAWTOOTH MACHETE

- 25" overall
- sawteeth on back

E HATCHET

- wooden handle
- 15½" overall
- 2 lbs.

F CAMP AXE

- fiberglass handle
- 15½" overall
- 1½ lbs.

G COMBAT KNIFE

H MARINE KNIFE

- 10½" overall
- 5" edge
- steel blade
- sheath

- 12" overall
- 7" edge
- steel blade
- sheath

LIMITED TIME OFFER

ONLY

\$5.95

Each

Plus Postage:

- 9½" overall
- 5" edge
- steel blade
- sawteeth on back
- sheath
- whetstone

I SURVIVAL KNIFE

Send \$2.00 for complete catalog. Catalog free with order.

Please send me _____ knife(s) at the Limited Time Offer of \$5.95 each or \$5.00 each in quantities of 3 or more. Add \$1.00 postage for first knife and 50 cents for each additional knife. Make checks or money orders payable to TIFFIN INTERNATIONAL.

Alabama residents add 6% sales tax

Knives Available (Enter number(s) desired)

Quan.	Quan.	Quan.	Quan.	Quan.
A _____	C _____	E _____	G _____	
B _____	D _____	F _____	H _____	I _____

Name _____

Address _____

City _____ State _____ Zip _____

_____ VISA _____ MASTER CHARGE

Exp. Date _____ Card Number _____

Signature _____

Mail to: TIFFIN INTERNATIONAL,

P.O. Box 881, Dept. PS-3 Clanton, AL 35045.

Dealer Inquiries Invited

130 FULL SIZE SPORTS CARS You Can Build from Kits



Just Published
Giant Buyers Guide
160 Pages, 500 Photos

Discover 130 full-size kit-built sports cars like the one shown here. Most sell for a fraction of their apparent value and virtually all are easy to assemble at home. See and compare all the latest kit cars and manufacturers. Brand new Buyers Guide is packed full of Photos • Specs • Comparisons • Tech Data • Articles. Everything from 40 mpg roadsters to sizzling V8s and electric conversions. Hundreds of dollars worth of valuable information not available anywhere else.



★ 14 Day Money Back Guarantee ★

AUTO LOGIC PUBL. Please mail my copy
P.O. Box 9312 \$8 (3rd Class. US only)
Department PS381 \$11 (1st Class. US/Can.)
Wilmington, DE 19809 \$12 (Foreign Air)

Name _____ (print)

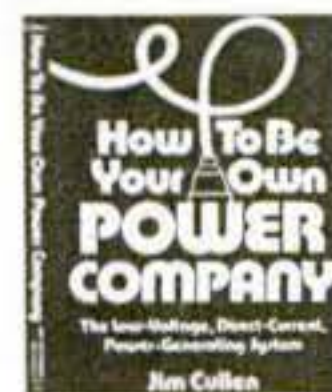
Address _____

City _____ State _____ Zip _____

Master Charge Visa Exp. Date _____

Order TOLL-FREE by phone. Master Charge or VISA REQUIRED!
(800) 331-1000 Day or Night.
(918) 664-8300 in Okla. call collect.

NEW EDITION! NEW LOW PRICE!



An expanded and updated version of the original The Wilderness Home Powersystem And How To Do It. The first complete guide to home installation of low-voltage technology for energy self-sufficiency! Send \$10.95 (U.S.) (\$14.95 Canada and Foreign U.S. \$) to Jim Cullen, Box 732P (44850 Highway 101 N.) Laytonville, Ca. 95454 & receive free our 88-page catalog worth \$2.50. Visa/MC Okay. Phone (707) 984-6186.

Rare TECHNICAL INFORMATION!

If you're one of those few knowledgeable people who have a real need for hard-to-find "how-to" technical data, you should have this free catalog. You'll find the newest and most unusual collection of pamphlets, manuals, paperbacks, textbooks, engineering and professional handbooks on lathes, machine tools, electric and steam autos, fuel alcohol, wind and water power, steam engines, methane, welders, alternator secrets, electric motors, foundry, woodworking, home-steading, small business, inverters and much, much more. All fairly priced and guaranteed! This is not a book club. Buy only what you want, when you want. If you need rare technical information, write today for your copy of the latest catalog. Please include 45¢ in stamps for 1st class postage.



LINDSAY, BOX 12-AQ, BRADLEY IL 60915

NOW! Get in on the PROFITS in

SMALL ENGINE REPAIR!



Start your own money making business!

Work part time, full time—right at home—we help you every step of the way.

No doubt about it... as a small engine pro, you can cash in on the huge demand for qualified men in one of America's fastest growing industries. You'll be able to command top hourly rates of from \$10.00 to \$15.00 per hour—and that's just for labor. A simple tune-up earns as much as \$17.50 for less than an hours work, and parts, engines and accessories will add even more to the profits.

Plenty of business waiting for qualified men. 46,000,000 Small Engines Are In Use Today!

That's the official count from the Engine Service Assn., and one-million new engines are being built each month. With fully accredited Belsaw training, you can soon have the skill and knowledge to make top money servicing these engines. People will seek you out and pay you well to service their lawnmowers, tillers, edgers, power rakes, garden tractors, chain saws, mini-bikes, snowmobiles, generators, go-carts, paint sprayers, snow-blowers...the list is almost endless.



Professional Tools And Equipment PLUS 4 HP Clinton Engine...

...ALL YOURS TO KEEP—...All At No Extra Cost!

NO EXPERIENCE NECESSARY!

You don't need to be a 'born mechanic' or have any prior experience. You can master this profitable trade right at home in your sparetime. Lessons are fully illustrated...so clear you can't go wrong, and with our famous 'learn-by-doing' method you get practical 'hands-on' experience. We also show you how to get business, what to charge, where to get supplies wholesale...all the inside tricks of the trade you need to assure success right from the start.

Send for FREE Facts—Do It TODAY!

NO Obligation—NO Salesman Calls!

You risk nothing by accepting this offer to see how easily you can learn the skills you need to increase your income in a high-profit business of your own. Just fill in and mail coupon below (or send postcard with name and address) to receive full information by return mail.

RUSH COUPON TODAY

BELSAW INSTITUTE
531M FIELD BUILDING
KANSAS CITY, MO 64111



FREE BOOKLET!

Send for your copy today!

BELSAW INSTITUTE
531M FIELD BUILDING
KANSAS CITY, MO 64111

Accredited Member National Home Study Council



YES, please send me the FREE booklet that gives full details about starting my own business in Small Engine Repair. I understand there is No Obligation and that No Salesman will call on me.

NAME _____

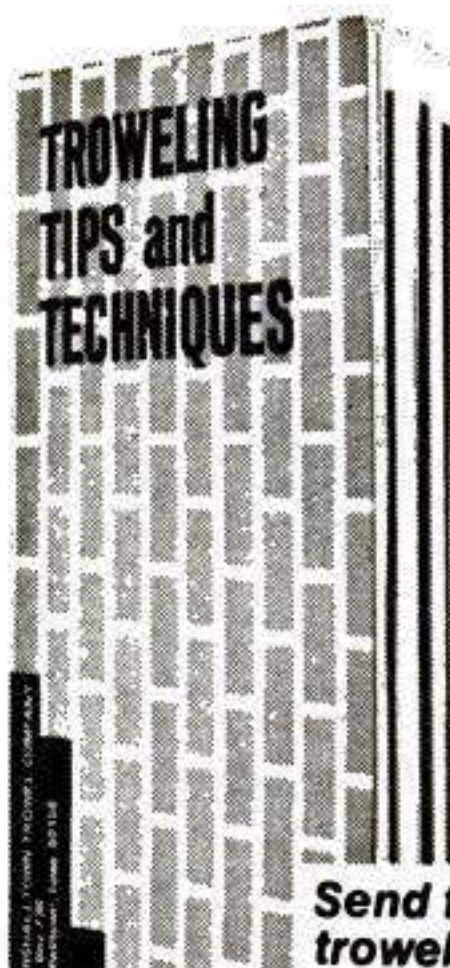
ADDRESS _____

CITY _____

STATE _____ ZIP _____

HOW-TO

A Money-Saving Troweling Tips Booklet



- 24-page illustrated booklet
- Easy to understand... saves you time
- List of tools needed for each job
- Tips on cement, block, and brick work; plaster repair and dry wall
- Used by many vocational schools and training centers
- Just 75¢ (includes mailing)

Send for your professional troweling tips booklet today!

Enclosed is _____ for _____ "Troweling Tips" booklets at 75¢ each.

Name _____

Address _____

City _____

State _____ Zip _____

Send to:
Marshalltown Trowel Company
104 Eighth Avenue • Dept. PS-3
P.O. Box 738 • Marshalltown, Ia. 50158

Solar Heat Your Home

Cut Heating Costs - 40% Tax Credit



PASSIVE SOLAR GREENHOUSE

- Triple Glazing with G.E. Lexan panels.
- Solarium converts to Screen Room
- Free "Energy Source" - 40%-Tax Credit
- Provides Heat to your home
- Lean-To, Free Stdg. & Window units
- Curved Eave, Bronze Tone Finish

SAMPLE WINDOW KIT: Enclose \$4. for our Greenhouse Sample Kit with aluminum frames, G.E. Lexan™ glazing, assembly manual and heating guide.

FREE COLOR CATALOG: write, phone or visit our main showroom - (516) 694-4400.



FOUR SEASONS GREENHOUSES

Dept. PS-003
910 Route 110
Farmingdale N.Y. 11735

NEW THERMAL '81 ENERGY RODS FREE WITH EVERY GREENHOUSE.

(SHIPPED FACTORY DIRECT ONLY)

TV TO STEREO SOUND ADAPTER



GET SIMULATED STEREO SOUND FROM YOUR TELEVISION!

TELEDAPTER® easily connects to your own TV and stereo system to give you full rich simulated stereo sound through your amplifier and speakers. TELEDAPTER'S electronic circuitry matches the impedance between your TV and stereo amplifiers' aux., tape, or tuner input, while completely transformer isolating the TV's & stereo's chassis, for safety. The matrix circuitry provides two channels of output that plug directly into your stereo. Those ball-games and movies will never be the same after you hear the realistic thundering sound. Complete with hookup instructions, 2 year warranty. If not satisfied after 15 days, return for full refund.

\$29⁰⁰ plus \$2⁰⁰ shipping & handling

To order: enclose check • VISA or Master Card # _____

Expiration Date _____ Bank # _____

Name _____

Address _____

City _____

State _____ Zip _____

RHOADES
NATIONAL CORPORATION

P.O. Box 1052 Dept PS
Columbia, Tenn. 38401
(615) 381-9001

SEND FREE CATALOG

WANTED: GOLD & SILVER

We'll make immediate payment for class rings, wedding bands, gold jewelry, dental gold, silverware, silver coins. We are a refiner, we pay more than the middlemen. After receipt, you will be contacted and informed of the value, the decision is yours to sell or not. You may safely send valuables through the mail protected by the Mail Fraud Act. Be sure to insure your package and include address and phone number. Send to: **COLEMAN AND COMPANY, 5400 Phoenix NE, Suite 107, Box 103, Albuquerque, NM 87110, 505-345-9225.**

MAKE MONEY! REPAIR HYDRAULIC JACKS



Earn while you learn at home. Millions of jacks in gas and auto service stations, trucking firms, body shops, riggers, factories and farms need servicing... most of which you can learn to repair. We show you HOW. Start spare time in your basement or garage. Big opportunity for mechanics. ACT NOW!

Write for folder No. PS-3 and free bonus 'Hydraulic Jack Repair Manual Co., Inc. G.P.O. BOX 3 • STATEN ISLAND N.Y. 10314'

Burglar-Fire Protection



Protect Your Life, Home, Business, Auto, etc.

• Our catalog shows how. Install your own alarm systems and devices and save \$\$\$\$ We offer FREE write-in engineering service.

FREE CATALOG Lowest Prices on Reliable, High-Quality Alarm Systems and Devices

Burdex Security Co. Box 82802-PS Lincoln, Ne. 68501

SAVE YOUR HOT AIR

5 TO 12% OF THE HOT AIR LOSS IN YOUR HOME COULD BE GOING THROUGH THE VENT IN YOUR KITCHEN RANGE HOOD

THE THERMOMISER™ AUTOMATIC DAMPER IS DESIGNED TO STOP THIS LOSS...

- EASILY INSTALLED
- FITS ANY SIZE VENT
- STOPS COLD DRAFTS
- NO WIRING NEEDED
- SATISFACTION GUARANTEED
- QUALIFIES FOR 15% FED. TAX REBATE

SEND ONLY \$8.95 (CA RES. ADD 54¢ SALES TAX)
ZT ENGINEERING, DEPT. PS3 • 472 LOTUS LANE
P.O. BOX 125 • MOUNTAIN VIEW • CA 94042

EQUIPMENT AND TRAINING NO OTHER SCHOOL CAN MATCH!

Explore micro-computers, digital systems and more, with state-of-the-art equipment you build and keep!



EXCLUSIVE! TRAIN WITH THE NEW H89 NTS/HEATH ALL-IN-ONE MICROCOMPUTER! NTS's Master Course in Microcomputers now includes this remarkable new desk-top computer. Features floppy disk storage, "smart" video terminal (terminal has its own microprocessor, doesn't share one with computer as do most desk models), two Z80 microprocessors, 16K RAM expandable to 48K, professional keyboard.



The new H89 (pictured above) is here and NTS home training has it! An exciting way to explore the very latest in microprocessor technology.

Of course if your interests lie in other areas of electronics, NTS has many programs to choose from. And they include the widest array of solid-state and digital equipment ever offered by any home-study school.



FM Transceiver

Besides the latest in microcomputers, students may work with the NTS/HEATH digital color TV (25" diagonal with optional programming capabilities), digital test equipment, an NTS/Heath 2-Meter FM transceiver, plus much more field-type equipment to make your training exciting and relevant.

Each NTS program uses step-by-step lessons and manuals to guide you through experiments, testing, and kit building as you develop skills. The NTS Project Method of training is one of the many reasons students quickly acquire practical know-how.



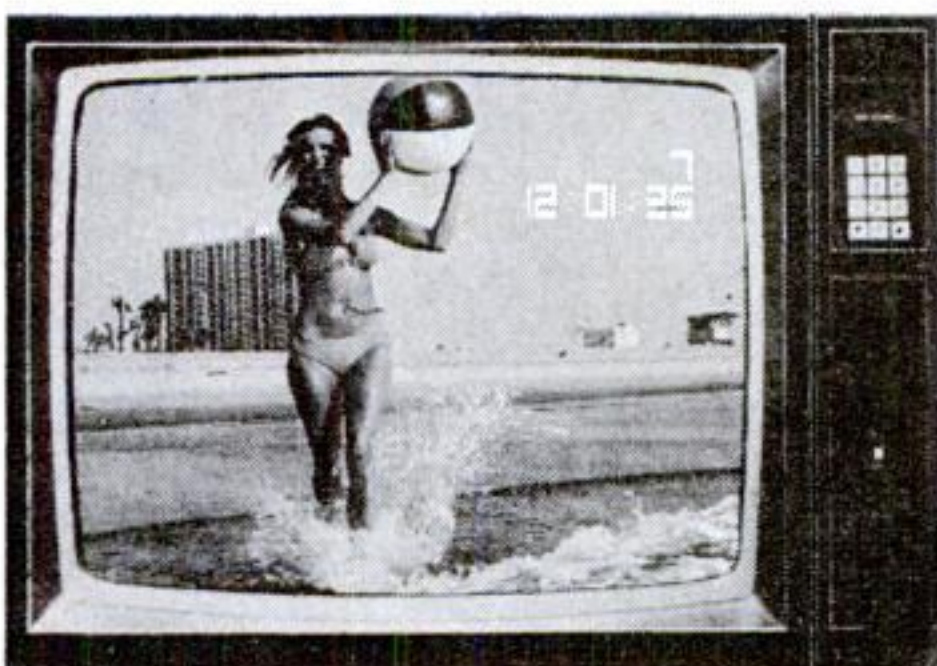
Digital Multimeter

Our new full color catalog shows you what each course covers, and identifies every unit of equipment included. Send for it today and discover for yourself the *many advantages* of NTS electronics training, and how you can benefit.



Technical-Trade Training Since 1905
Resident and Home-Study Schools
4000 S. FIGUEROA, LOS ANGELES, CA 90037

NO OBLIGATION. NO SALESMAN WILL CALL. APPROVED FOR VETERAN TRAINING.



Simulated TV Reception

NTS also offers courses in Auto Mechanics, Air Conditioning and Home Appliances. Check card for more information.



NATIONAL TECHNICAL SCHOOLS

4000 South Figueroa Street, Dept. 202-031
Los Angeles, California 90037

Please rush **FREE** color catalog on course checked below

- | | |
|---|---|
| <input type="checkbox"/> MicroComputers/MicroProcessors | <input type="checkbox"/> Auto Mechanics |
| <input type="checkbox"/> Communications Electronics | <input type="checkbox"/> Air Conditioning |
| <input type="checkbox"/> Digital Electronics | <input type="checkbox"/> Home Appliances |
| <input type="checkbox"/> Industrial Technology | <input type="checkbox"/> Color TV Servicing |

Name _____ Age _____

Address _____

Apt. _____ City _____

State _____ Zip _____

- Check if interested in G.I. information.
 Check if interested **ONLY** in classroom training in Los Angeles.



**WEEDHOPPER -
The Ultimate Fun
Flying Machine**



Build your own airplane in 40 hrs and fly off to adventure without a pilot's license. Complete kit goes together with hand tools. Will carry 220-lb pilot up to 50 mph. Price: \$2,995 - \$3,395. Send \$5 for information. **Weedhopper Of Utah • Box 2253C • Ogden, UT 84404**

..... GREAT OUTDOOR FUN.

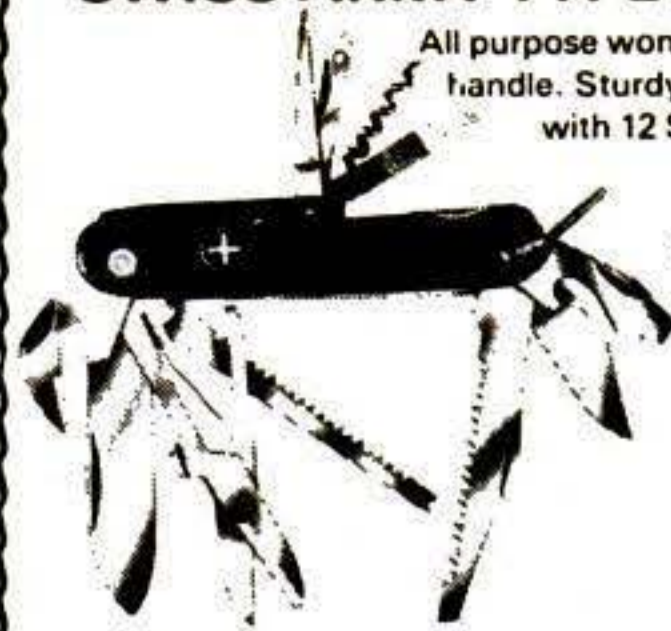
SEARCH ELECTRONICALLY FOR ... gold, silver, coins and relics with White's Electronics mineral/metal detectors. Pays for itself. U.S. Patented. For your nearest dealer and free catalog **CALL TOLL FREE 1-800-547-6911**



White's Electronics, Inc. Dept. PB-1

Sweet Home, OR 97386

SWISS ARMY TYPE KNIFE



All purpose wonder knife. Red handle. Sturdy survival knife with 12 Stainless Steel Blades. perfect for fishing, camping, work and play. Guaranteed **4.50 ea.**

Add 50¢

Post & Handl

Westbury Sales P.O. Box 434, 373 Maple Ave. Westbury, N.Y. 11590 Dept. E-3-PS

BEAT HIGH GAS PRICES!

EXTRA CASH

WITH A **STRUCK KIT**



ASSEMBLE IT YOURSELF

ALL GEAR **MAGNATRAC KIT** with BACKHOE

You're only hours away from a **Business of Your Own** when you start to assemble your Struck-Kit Tractor. Once assembled (a weekend project), your Struck Tractor will allow you to turn your spare hours into **Cash!** Over 30 attachments allow you to tackle almost any "compact-size" construction, landscaping or gardening job. You'll be able to get in places where the "big rigs" can't and then charge your own price! Buy factory direct from the leader in the small crawler field and be one of the thousands of satisfied customers.

Send now to:



LOW COST MINI-DOZER KIT

30 Attachments

STRUCK KIT, Dept. PS31 Cedarburg, WI 53012

- Catalog showing Struck Tractor Kit construction & uses (specify Magnatrac or Mini-Dozer) — 75¢. Both catalogs — \$1.00
- Plans for fabricating Struck Tractor (specify Magnatrac or Mini-Dozer) from local materials — \$7.00. Both plans — \$10.00 (Refunded on any purchase).

Name _____

Address _____

City, State, Zip _____ (Dealer Inquiries Invited)

EUREKA LOG HOMES

America's Leading Internationally Advertised Log Home Program's Offer YOU
 • Your Own Complete Business • Large Full Color Catalogs
 • FREE Color Brochures • FREE Log Home Delivery in U.S.A.
 Turn Your Dreams Into Success, Call Today
FREE Information — Call Toll Free 1-800-643-8344
EUREKA LOG HOMES, INC.
 Berryville, Arkansas 72616

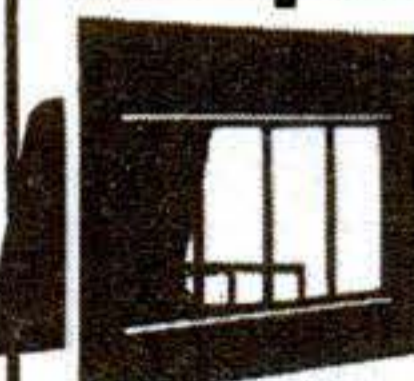


PANELIZED DOMES SHIPPED WORLDWIDE

BROCHURE/PLAN PACKAGE \$4.00 DEALER INFO \$5.00
 VACATION OR YEAR-ROUND LIVING. ENERGY EFFICIENT. DESIGN YOUR OWN PLAN OR SELECT ONE OF OURS. PRE-MANUFACTURED TRIANGULAR SECTIONS BOLT TOGETHER IN HOURS.

NATURAL HABITAT DOMES
 1100 South 19th Street Sheboygan, Wisconsin 53081

Clearance Sale of Top Quality Fireplace Inserts



Prices as low as **\$299 ... savings up to \$270!**

Limited Quantities

Warehouse Clearance of Enviro-style OPTIMA and U.L. Listed THERMOGRATE high efficiency, high output fireplace glass door/heat exchanger combination units.

Limited Time Offer!

Envirostyle™ Direct
 P.O. Box 43021, Dept. 860-103
 St. Paul, MN 55113
 Call TOLL-FREE: 1-800-328-0882

Electrify Your Bike!



Travel with **PEDALPOWER®**, low-cost electric drive for your bike or adult trike. Just 10¢ worth of electricity gives you 100 miles of effortless riding. Save on gas, taxis, stop begging rides from friends. Perfect for shopping, visiting, commuting, just plain fun!

PEDALPOWER fits men's, women's, children's bikes and adult trikes, installs in minutes without special tools. Safe single-lever handlebar control, instant start without pedaling, up to a 40-mile range on a single charge. Satisfaction guaranteed. Send coupon for free catalog showing **PEDALPOWER** motors, Take-Apart bikes, and adult trikes. Get **PEDALPOWER** and laugh at gas prices!

SEND TODAY FOR FREE CATALOG



5284 Mantua Blvd., Sewell, N.J. 08080

Rush me my FREE Pedalpower catalog by first-class mail.



Name _____

Street _____

City _____

State _____ Zip _____

Be an Electrician



**CONSTRUCTION
MAINTENANCE
CONTRACTOR**

Train at home
in spare time

MAKE MORE MONEY! Check out Electrician's wages against the kind of money you make now!

Even before you're ready to go after a full-time job as an electrician, you could be making extra money doing odd jobs for friends and neighbors. And think of the money you'll be able to save doing your own electrical work. Learn to specify and install wiring, operate and control motors and generators, use and maintain transformers and storage batteries.

We show you how to troubleshoot for short circuits, overloads and open wires. You'll be ready to take almost any electrician licensing examination offered by state, city or county. Because opportunities vary from time to time and from one part of the country to another, we encourage you to check on the job market in your area. Mail coupon for free facts and results of survey showing employment success of our graduates.



APPROVED FOR VETERANS

NO NEED TO QUIT YOUR JOB OR REGULAR SCHOOL

Everything explained in easy-to-understand language with plenty of drawings, diagrams and photos. Tools, materials, test equipment included with course. You learn at your own pace. No time wasted traveling to class. Teachers are as close as your telephone. No charge! Use our toll-free 24-hour home-study hotline as soon as you enroll. **MAIL COUPON TODAY!**



ELECTRICIAN SCHOOL, Dept. PC021
ICS Center, Scranton, PA 18515

Rush free facts that tell how I can train at home in spare time to be an electrician. No obligation, no salesman will call!

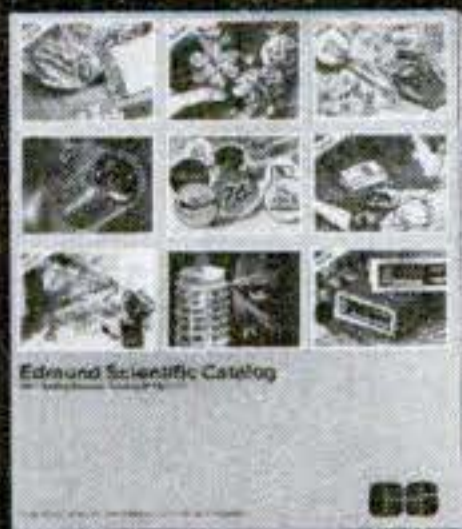
NAME.....AGE.....

ADDRESS.....

CITY/STATE/ZIP.....

Free!

Edmund Scientific Catalog



OUR 40th YEAR!

Astronomy, Microscopy, Biofeedback, Weather, Alternate Energy, Binoculars, Optics, Magnets, Magnifiers, Tools, Unique Lighting, Lab Equipment, and much more. Over 4,000 unique and fascinating products. Send for our **FREE 112-page, colorful 1981 Edmund Scientific Catalog. . . Today!**

Rush me your free catalog!

Name _____

Address _____

City _____

State _____ Zip _____

Clip And Mail Coupon Today To:
Edmund Scientific Co., Dept. 3016 N-06
Edscorp Bldg., Barrington, N.J. 08007

No. 226 *1981 Edmund Scientific Co.

Fabulous Folboting NOW

Avoid the risks and discomfort of tippy canoes, skimpy kayaks, wobbly inflatable rafts! NOW, you GLIDE securely in perfected Folbot, completely relaxed in EXCLUSIVE swivelback COMFORT. America's foremost small craft in various styles and colors from 1 to 4 seaters, GLIDE smoother, faster with EASIER lightweight double blades, efficient yacht-smart sails, small motors. Perfect for nature study, scouting, float cruising, supreme in White Water, Surf, Marsh and Sea. Most INEXPENSIVE in EASY PREFAB Kits or ready FACTORY BUILT; also travel-smart FOLDING types to fit inside trunk or aircraft.

FOLBOT

Travel Craft at **BIG SAVINGS**

Easy PREFAB Kits from \$162 or cartop **FACTORY BUILT** from \$273

FOLDING from \$475
ideal Sail Rig \$239



Smart Economic **BASIC Kits**
12 foot Single \$36
16 foot Double \$46
Big Sailer 16 foot \$57

FREE

Action Color Catalog With Facts & Figures
For rush inc. \$1 First Class Postage

Mail coupon or address

to: FOLBOT CORP. PS 381
Charleston, S. C. 29405

Print Name _____

Address _____

City _____ State _____ Zip Code _____

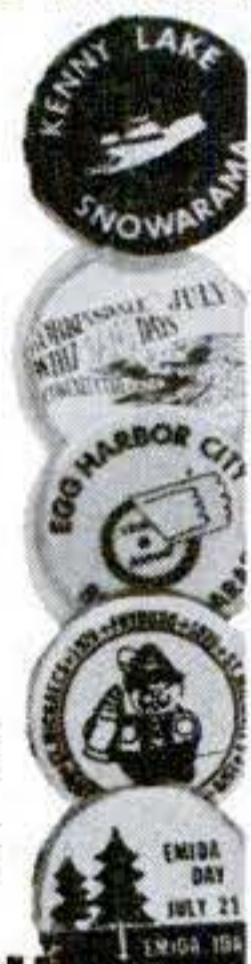
EARN EXTRA INCOME

NOW! BADGE-A-MINIT makes it possible for you to fill orders for pin-back badges you make yourself for every community use. Clubs, political groups, schools, businesses and lodges have many needs for badges throughout the year to promote their activities and identify members. With BADGE-A-MINIT you create for all those needs with badge parts that cost just pennies each. Finished badges sell for much more!

Here's the lowest price ever for a complete badgemaking system. New starter kit includes sturdy Lexan die press; color-coded, BUT-N-LOK dies; quality, pin-back badge parts; and easy-to-follow instructions. Discover badge power for only \$17.95.



NEW LOW PRICE only \$17.95



BADGE-A-MINIT, Ltd., Dept. PS381
Box 618, Civic Industrial Park, LaSalle, IL 61301

- YES, RUSH ME the Badge-A-Minit starter kit for only \$17.95 plus \$1.75 shipping. (Ill. res. add \$.90 tax)
- Personal check or m.o. enclosed.
- Use charge card below:
- VISA Mastercharge Am. Express Diners Club
- SEND ME FREE, the all color Badge-A-Minit catalog.

Credit Card # _____

Interbank # (MC) _____ Exp. date _____

Signature _____

Name _____

Address _____

City _____

State _____ Zip _____

UNCONDITIONAL MONEY BACK GUARANTEE

12 Ways To Get RICH!



Check the ones that **INTEREST YOU!** Then cut out this **ENTIRE AD AND MAIL IT BACK TO US FOR FREE FACTS!**

- MAIL ORDER
- SUB-WHOLESALING
- CATALOG DISTRIBUTOR
- FLEA MARKETS
- PARTY PLANS
- WAGON JOBBING
- RACK MERCHANDISE
- ADVERTISING SPECIALTIES
- BUSINESS GIFTS
- FUND RAISING SALES
- DROP SHIP SALES
- GENERAL WHOLESALING

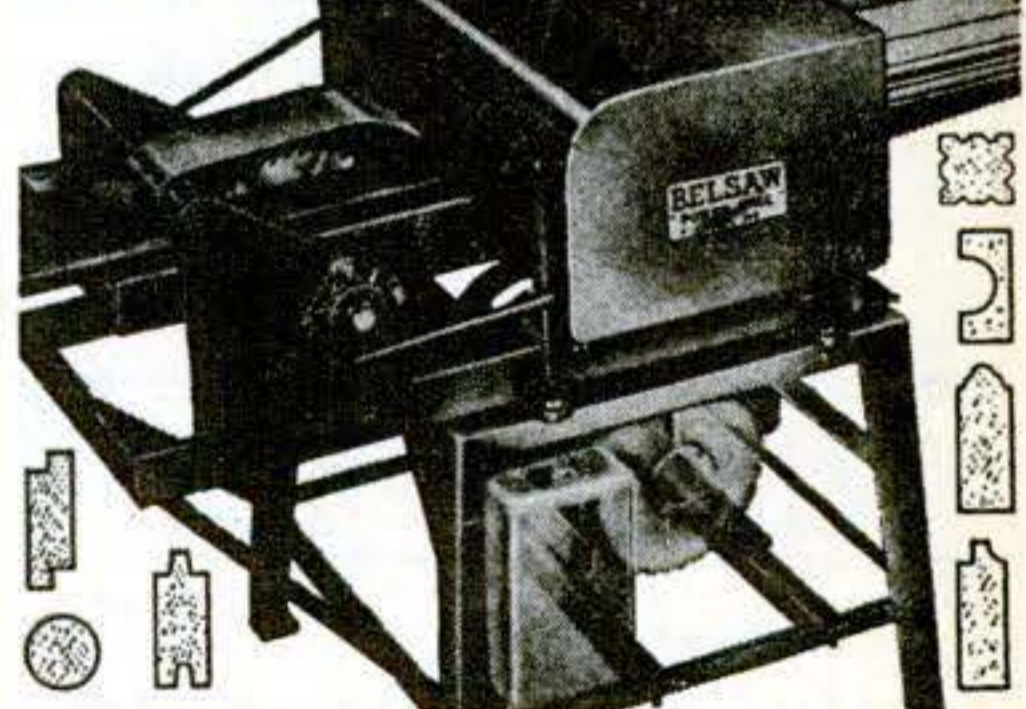
We will mail complete information on how to get started. It's easy... because we supply everything you need from sales plan to catalogs to top quality, high-profit merchandise

There's no other COMPANY like...
SMC SPECIALTY MERCHANDISE CORP.
6061 De Soto Ave. Dept. 307-03
Woodland Hills, CA 91365

Name _____
Address _____
City _____ State _____ Zip _____

Planer Molder Saw

3 Power TOOLS in 1
Feed



Now you can use this ONE power-feed shop to turn rough lumber into moldings, trim, flooring, furniture —ALL popular patterns. RIP-PLANE-MOLD . . . separately or all at once with a single motor. Low Cost . . . You can own this power tool for only \$50 down.

30-Day FREE Trial! SEND FOR **NO OBLIGATION—NO SALESMAN WILL CALL** EXCITING FACTS
RUSH COUPON BELSAW POWER TOOLS CO.
TODAY! 921M Field Bldg.
Kansas City, Mo. 64111

BELSAW POWER TOOLS
921M Field Bldg., Kansas City, Mo. 64111

YES Please send me complete facts about **PLANER—MOLDER—SAW** and details about 30-day trial offer.

Name _____
Address _____
City _____
State _____ Zip _____

EXCITING MAIL ORDER DISCOUNTS

Apple II 16K computer

Disk II with Controller \$535 ... without \$429
Nearly Everything for Apple



\$949

APPLE II 32K \$1049
APPLE II 48K \$1149
DOS 3.3 with upgrade kit \$54

APPLE II ACCESSORIES

Apple Joystick	47
ATY Numeric Input Keyboard	99
ALF Music Synthesizer	245
AD DA Board from Min Comp	315
Clear Cover for Apple Computer	25
CCS Programmable Timer Module	159
Dan Payne Lower Case Kit (Model I)	59
Dan Payne Lower Case Kit (Model II)	59
Hayes Microdram	335
Eslander Board	27
Graphics Input Tablet	649
Intral X-10 Remote Control System	239
Intral X-10 Controller Only	164
M&R Sup-R-Term 80 Column Board	325
Microsoft Z-80 Soft Card	299
Novation Cat Modem	158
Romwriter	148
Speechlink 2000/64 Word Vocabulary	215
SuperTalker Speech Synthesizer	239
Sup-R-Mod RF TV Modulator	25
SVA II Disc Controller Card	329
Verse-Writer Digitizer Drawing System	209
Video Video Iam	339

SOFTWARE

Adventure	27
Apple Bowl	14
Assembler/Disassembler	60
Debugger	27
Apple Graph & Plot System	59
Applepost Mailing List System	44
Applesoft Utility Programs by Hayden	27
Applewriter Word Processor	65
Bill Budget Space Game Album	39
Bill Budgets Trilogy of Games	29
The Cashier Retail Management System	189
CCA Data Management	
by Personal Software	84
The Contributed Volumes 1-5	
w/manuals	29
Desktop Plan by Personal Software	79
Dow Jones Portfolio Evaluator	44
Forth II by SofTap Software	45
Fortran for use with Language System	159
Pascal Language System	419
Shell Games	37
Sargon II Chess Game-cassette	27
Sargon II Chess Game-disk	35
Shell Games	37
Space Invader-Cassette	18
Space Invader-disk	25
Sub-Logic FS-1 Flight Simulator	23
Cassette	

Sub-Logic FS-1 Flight Simulator-disk.... 29
Syber Apple 80 8080 Simulator..... 17
Vcalc by Personal Software..... 119
Business Package..... 595
AND MUCH MORE... JUST CALL!

APPLE COMPUTER INTERFACE CARDS

Asynchronous Serial Interface #7710A	\$145
Apple II II Firmware Card	149
CCS Arithmetic Processor Card #7811B	329
CCS Parallel Interface Card #7720A	155
Centronics Printer Interface Card	179
Apple Clock/Calendar Card	
by Mountain Hardware	229
Communications Card & DB25 Cable	179
Integer Basic Firmware Card	149
Parallel Printer Interface Card	129
Prototyping Hobby Card	22
Romplus Card with keyboard filter	169
Romplus Card without keyboard filter	159
SSM AIO Serial/Parallel I/O	
Assembled & Tested	169
Serial Interface Card	139
Syntec Light Pen Card	214

PRINTERS, MONITORS, DISCS

Daisy Wheel Printer	1795
Anades DP8000	850
Centronics without cable	819
Epson TX80-B w/Graphics	799
Epson MX80	645
MPI 88T	650
NEC Spinwriter #5510	2695
Paper Tiger 460G	1394
Silentype with Interface Card	510
Leedes Video 100-12" B&W	129
Sanyo 9" B&W	169
Dyson disks (pkg 10)	50
Memorex (pkg 10)	40
Verbatim (pkg 10)	30



IN STOCK, CALL FOR PRICES!

WE SHIP FAST!

COUNTERFEIT GUNS

FULL-SIZE PRECISION METAL REPLICA MODELS®

These working metal models of classic firearms look, feel, weigh and handle like the originals and consist of over 30 blued, machined-metal, hand-assembled parts. You can spin the cylinders, work the slide actions, release the clips and "field-strip" these models. CANNOT CHAMBER OF FIRE REAL AMMO.

MONEY BACK IF YOU'RE NOT SATISFIED

Lgth: 35"
Wt: 9.5 lbs.
THOMPSON MODEL 1921
As used by FBI & US combat troops in WWII.
R700.....\$159.95
(Add \$6 postage/handling)
Over 59 Parts
DELIVERED FULLY ASSEMBLED

GOVERNMENT .45
Standard sidearm of GI's and combat troops.
Lgth: 9.5" Wt: 2.5 lbs.
R300.....\$47.95
(Add \$3 postage/handling)
Over 30 Parts

SEND FOR FREE CATALOG OF OVER 50 CLASSIC FIREARM MODELS AND 100's OF MILITARY COLLECTIBLES-SOUVENIRS

THE COLLECTOR'S ARMOURY, Dept. PS
Box 1061, 800 Slaters Lane, Alexandria, VA 22313

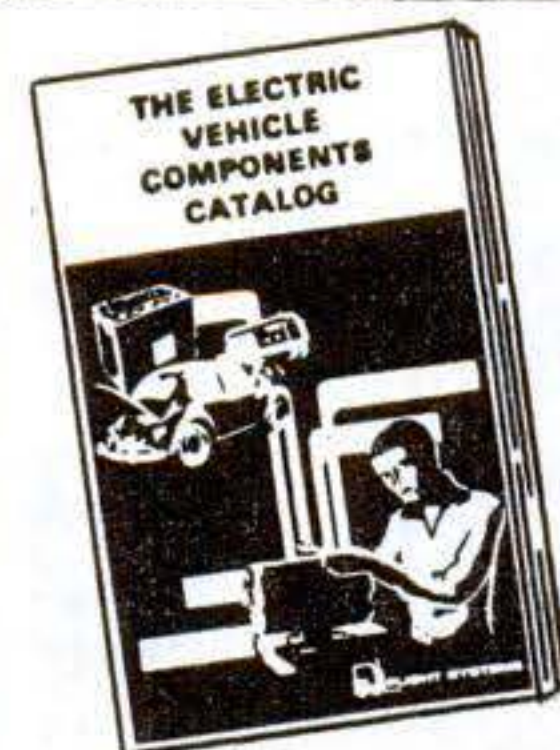
(MONEY BACK, LESS POSTAGE, IF NOT SATISFIED)

SEA EAGLE

THE TOUGHEST PVC INFLATABLES of heavyweight canoes and dinghies. \$100.-\$220. All pack small. All last years.

Send for FREE color brochure.
Sea Eagle, Dept PS3, St. James, NY 11780 • phone 516-724-8900

SAVE YOUR GAS... let YOUR mail do the shopping



NEW SECOND EDITION has more parts for

ELECTRIC VEHICLES

Our latest edition of the ELECTRIC VEHICLE COMPONENTS CATALOG has expanded selections of all components - more motors, adaptors, control systems and accessories. PLUSHard-to-find Parts for "Mother Earth News" And Quincy-Lynn TRIMUTER Plans

Send \$3.00 check or money order. (\$4.00 First Class and Canada/\$5.00 overseas) to:

FLIGHT SYSTEMS
EVCC, Dept. EV-4
P.O. Box 25
Mechanicsburg, PA 17055



ATARI 800 PERSONAL COMPUTER SYSTEM

\$747

- *High resolution COLOR Graphics
- *10K Basic in ROM
- *RAM expandable to 48K
- *Built-in RF TV modulator
- *High speed serial I/O port

*57 key full stroke keyboard
If Atari makes it, we sell it!

Atari 400 Computer	\$469
Atari 820 Printer	489
Atari 810 Disk Drive	569
Atari 410 Program Recorder	69
Atari 16K RAM Module	149
Atari 8K RAM Module	99
Atari Basic ROM	45
Atari Visicalc	180
Basketball	30
Video Easel	30
Super Breakout	30
Music Composer	45
Computer Chess	30
Star Raiders	39
3D Tic-Tac-Toe	30
Joystick	19
Assembler/Editor	45

"BEST PRINTER VALUE IN THE WORLD"
Check our prices on THE ULTIMATE IN QUALITY

Epson Printers

APPLE & MOST OTHER COMPUTERS

NEW! MX80, 40, 80, 132 columns

LIST \$645

TX 80 col. w/Graphics

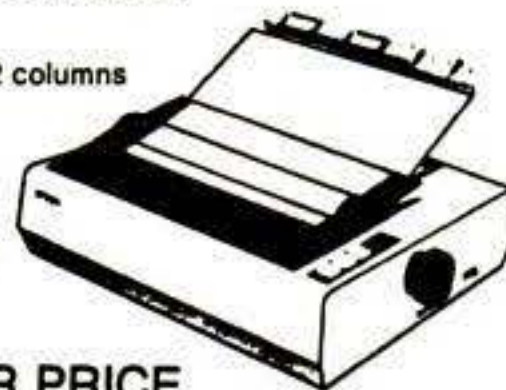
LIST \$799

Apple Controller & Card & Cable

LIST \$110

CALL FOR OUR PRICE

- Most reliable small printers ever sold!
- Uses standard printed paper.
- Dumps Apple screen graphics right on the paper - with graphics option.



ORDER DESK 1-800-854-2833 INFO. 714-579-0330

TO ORDER: Phone orders invited using Visa, Mastercard, or bank wire transfers. Visa & MC credit card service charge of 2%. Mail orders may send charge card number (include expiration date), cashiers check, money order, or personal check (allow 10 business days for checks to clear). Please include phone number. Include 3% shipping, handling, and insurance (\$5.00 minimum) in USA. Shipments within

Calif. add 6% sales tax. Foreign orders include 1% handling-shipped freight collect. Foreign orders over \$1000 allow 3 weeks extra and include \$25 license fee. All equipment is in factory cartons with the manufacturer's warranty. Equipment is subject to price change and availability. We ship the same day on most orders. No C.O.D.s accepted. Retail store prices defer from mail order prices.



MAIL TO: 1251 BROADWAY EL CAJON CA., 92021

COMPUTER SPECIALTIES

Portable Steam Cleaner
Steam in 60 seconds
CLEAN: Engines, Air Filters, Lawn Mowers. 3 year guarantee on fire box, coils. Uses liquid soap, propane fired. Weight 120 lbs. Auxiliary pump required on low water pressure.
WEDCO MFG. INC., Dept. 5-9,
Scott Lane • Box D, Jackson, WY. 83001

FREE SAMPLE IMPORT MEN WOMEN START MAIL ORDER HOME IMPORT BUSINESS
I'll send you a free sample import to prove you can make big money in your own spare/full time business. No investment in stock. World's most famous importer will guide you. Clip this ad, good for free sample and big Free Report - tells all! Offer limited to adults. Mail this ad today. THE MELLINGER CO., 6100 Variel Ave., Dept. W2243, Woodland Hills, CA 91364.

the New Look from Elite
The ultimate in a GT Sports Car Kit for a VW chassis.
Send \$3.00 Color Brochure, and Price or \$29.95 for Full Pack (Refundable with Kit Purchase) Color Brochure, Prices, Assembly Manual, Color Chart, Free Flight Information.
ELITE ENTERPRISES, INC. PS3-81
890 E. Third St. Coonap, MN 55321
To order \$29.95 Full Pack call Toll Free 1-800-329-6898.
Refundable with Kit Purchase. Major Credit Cards Accepted.
Fly to Mpls./St. Paul FREE* to personally order your LASER 917
* This information included in Full Pack only

ANTIQUE LAMP DESIGNS
THE WORDEN SYSTEM
Build Tiffany Style Lamps For Hobby & Profit At Most Stained Glass Dealers
BIG COLOR CATALOG \$1.00
H.L. WORDEN CO. (PS80)
Box 519, 118 Main St.
Granger, WA 98932
SC20-7 Floral Border

EXCLUSIVE DESIGN

THE AMAZING

It's a hand truck . . .
 It's a flat-bed cart . . .
 It's a dolly . . .
 It's a lawn & garden cart
 (special swing up trash bag holder) . . .

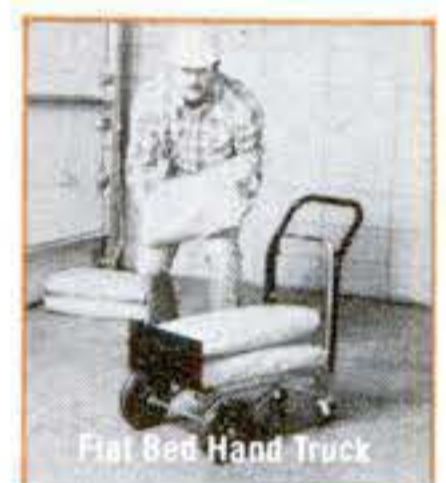
Check these fantastic features!

- 300 lb. capacity in vertical position.
- 500 lb. capacity in horizontal position.
- Heavy 16-gauge steel-tube, metal handle and frame.
- Quick release hitch-pin locks handle in place.
- Toe plate of thick 10-gauge steel, measures 6½" x 14" . . . quickly converts to upright or flat use.
- Solid rubber, ball bearing, swivel casters . . . big 3" diameter.
- Large semi-pneumatic rubber main wheels . . . 8" diameter x 1¾" wide.
- Handles are height adjustable from 36" to 46".
- Heavy-duty construction . . . total weight 27 lbs.
- Folds up to a compact 36" long x 19" wide x 11" high.



4-WHEEL WONDER T.M.

INDUSTRIAL LOAD CAPACITY HAND TRUCK & DOLLY



Save time, money, effort, damage and most of all back strain . . . turn tough jobs to easy ones.

The 4-wheel design and interchangeable handle allows you to use it **vertically** or **horizontally** . . . it's like having an extra worker for every job! Handymen, yardworkers, homemakers, office workers, maintenance workers and warehouse personnel will all get a helping hand.

The Ultimate Heavy-Duty Helper!

Use it to move furniture, shop equipment, garage items, trash cans, heavy TV sets, appliances, office furniture. Use it as a lawn & garden cart . . . converts quickly to hold plastic bags for leaves and trash.

An Almost Unbelievable Value!

You won't find anything comparable anywhere at such a low price. We urge you to price compare! You'll find other carts with less features would easily cost you twice as much!!

A **heavy-duty** industrial hand truck (not a "drugstore" quality cart) at a price everyone can afford! Nothing like it available . . . anywhere else!

All For An Amazing LOW

\$39.95

plus \$6.90 shipping & handling.



Heavy-Duty, yet versatile & compact!

To Order: Fill in form below and send with check, money order, purchase order or credit card information to D.R.I. Industries, Inc., 11100 Hampshire Ave. So., Bloomington, MN 55438
 Credit card buyers can also call our Toll Free number: 800-228-5000 (In Nebraska 800-642-8777)

PLUS FREE GIFTS

Just for trying the 4-Wheel Wonder, we'll send you a Free 6-Piece Screwdriver Set with a handy hanging rack. PLUS a Valuable Surprise Free Gift. Both Gifts are yours to keep, whether or not you keep your order!

© Copyright 1980
 D.R.I. Industries, Inc.,
 Bloomington, MN.

QUALITY ASSURED

100% Money-Back Guarantee! Plus A One-Year Warranty On Parts!

You must be completely satisfied or you may return your order within thirty (30) days for a complete refund or credit (including shipping and handling).

D.R.I. Industries warrants this product to the original purchaser to be free from defective materials and workmanship for 1 (one) year from the purchase date and will repair or replace any such defective part at no cost to the purchaser for 1 (one) year. To make a claim under this warranty, the purchaser of this product must give written notification of such defect to D.R.I. Industries at the address stated below. Any product or parts needing repair or replacement should be shipped post paid to D.R.I. Industries.

D.R.I. INDUSTRIES WILL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES CAUSED BY BREACH OF THIS WARRANTY AND UNDER NO CIRCUMSTANCES SHALL ITS LIABILITY EXCEED THE PRICE OF DEFECTIVE PRODUCTS OR PARTS. Some states do not allow the exclusion or limitation of incidental or consequential damages, so that the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

D.R.I. Industries, Inc.
 11100 Hampshire Avenue South, Bloomington, Minnesota 55438

49595 **SEND YOUR ORDER TODAY - CHARGE IT IF YOU LIKE** PS-381

30-DAY NO-OBLIGATION FREE TRIAL CARD

If not totally satisfied, you can return your order anytime within 30 days for a full refund, including shipping and handling.

SEND TO AND MAKE REMITTANCE PAYABLE TO:
 D.R.I. INDUSTRIES, INC.

11100 Hampshire Ave. South, Bloomington, Minnesota 55438 DEPT PS-381-1

INDICATE ORDER

_____ 4-Wheel Wonder(s) at \$39.95 plus \$6.90 shipping and handling each.

CHECK METHOD OF PAYMENT

- Check, money order or purchase order enclosed (MN residents add 4% sales tax).
- Charge it to: VISA MasterCard American Express Diners Club Carte Blanche

Card No. _____ Exp. Date _____

PLEASE PRINT

SIGNATURE X _____ (Need to sign only if charging order.)

NAME

Mr. _____
 Mrs. _____
 Miss _____

ADDRESS

Street & No. _____

CITY

STATE _____ ZIP _____

"WORK SHOPS" and "4-Wheel Wonder" are trademarks of D.R.I. Industries, Inc.

BELSAW **ONE MAN SAWMILL**

NOW! BEAT Inflation and HIGH Lumberyard Prices!
No need to stop your important projects.

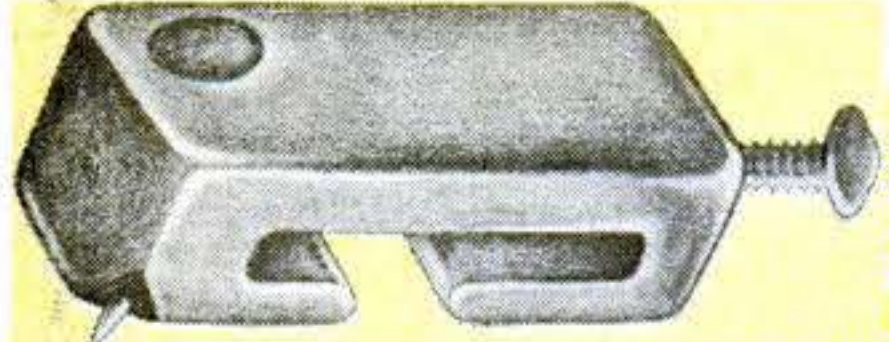
Take this portable mill right to the trees—turn out smooth, true lumber every time—no experience needed. Saw your own logs or lumber for others and make excellent spare-time income—no crew needed. Use any power—tractor PTO, diesel, electric. Time payments may be arranged. Send for FREE details—mail coupon below or postcard TODAY! No Obligation and No Salesman Will Call.

World Famous Since 1928

BELSAW MACHINERY Co. 371 M Field Bldg. Kansas City, Mo. 64111 **RUSH COUPON TODAY!**


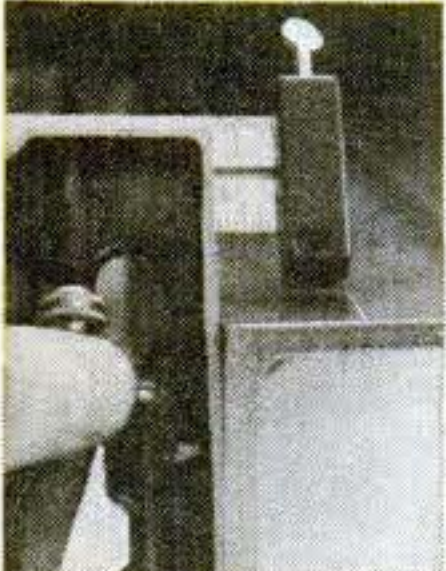
Name _____ (Please Print)
Address _____
City-State _____ Zip _____

NEW!
COMBINATION SCRIBE



WITH CARBIDE TIP AND PENCIL HOLE

Quickly locks and zeroes on any COMBINATION square blade. Easy, Fast & Accurate Scribing of Metals, wood, plastic, pipe, paneling. Scribing may be done with one hand free and on difficult shapes and contours. Scribing is consistently accurate. Invaluable for high production layout. Excellent for marking lumber, paneling, doors, windows, shelving, furniture and fine woodwork, etc., by DO-IT-YOURSELFERS, WOODCRAFTERS and HOBBYISTS.

Lumber, paneling — metals Introductory offer Reg. \$3.99 NOW only \$3.49 Plus .50¢ for postage and Handling or .50¢ for Brochure to

**FOREST RIVERS
BOX 657
FALL CITY, WASH. 98024**
(Washington Residents Add 5% Sales Tax. No COD, USA Only)

SAVINGS WITHOUT COMPROMISE

ARAPAHOE VEST KIT \$29

Trim design in sturdy Mountain Cloth with Thinsulate® insulation. Snap-down storm covered zipper, zipped pockets, elasticized waistband. One of over 200 money saving kits, custom sewn and ready-made products. SAVE 30-50%



Circle size and color.
Men's S, M, L in Slate Blue w/tan & navy or Rust w/tan & navy. \$29.00
postage and handling \$1.50

Name _____
Address _____
City _____ State _____ Zip _____

Please rush me your full color catalog of kits, custom sewn kits and ready-made products.

Frostline kits

**Frostline Circle
Dept. PS3550
Denver, CO 80241
303-457-4484**

FREE CATALOG

WARRANTY
Kits may be returned before, during, or after construction. Any product may be returned any time for a full refund... SINCE 1966.

GAS TO ELECTRIC CONVERSION KIT

2 bulb fixture duplicates the *charm* and increases the light output of any existing double mantle gas lamp. Kit includes on-at-dusk, off-at-dawn photo control, fixture, bulbs, detailed instructions. As low as 40¢ per month to operate compared to \$6.00 with gas. The 'RELITE' kit is available in both 115 volts and 12 volts (with plug in transformer). Ask for the 'RELITE' kit at your local hardware store or write for more information. Dealers and installers inquiries also invited.

YARDLIGHTING SYSTEMS INC.
1039 CHARLES AVE., DEPT 10 • ST. PAUL, MN 55104



Make Rubber Stamps for BIG PAY

Need more money? Earn \$200-\$300 a week, spare time, at home making rubber stamps for offices, factories individuals. Hundreds of uses. Hundreds of prospects—everywhere. Right in your own community. Turn out special stamps for names, addresses, notices, prices, etc., in minutes with table-top machine. We furnish everything and help finance you, at less than bank rates. Write for free facts.

Rubber Stamp Div., 1512 Jarvis, Dept. R-3-KC Chicago 60626



CHECK IT OUT!

There are more opportunities, products and services offered in the "Classified Opportunity Mart," immediately following this section. You may find just what you've been looking for.

10-DAY FREE TRIAL COUPON

POPULAR SCIENCE BOOKS P13P
Box 2018, Latham, N.Y. 12111

Please rush _____ copy (ies) of HOW TO BUILD GREENHOUSES, GARDEN SHELTERS AND SHEDS (No. 118) to me.

I enclose \$11.95 now for each copy ordered. (You will pay delivery charges.)


Bill me later for \$11.95 for each copy ordered plus delivery and handling charges.

Name _____
Address _____
City _____ State _____ Zip _____
Money back within 10 days if not fully satisfied.

Design and Build your own home GREENHOUSE

...in any size space, on any size property

A BRAND NEW ORIGINAL POPULAR SCIENCE BOOK



ONLY \$11.95

Take this book for 10 DAYS FREE

Enhance your property... have a thriving garden all year long... expand your outdoor living and storage space... plan and build just about any size home greenhouse or backyard shelter you desire... this original book from Popular Science shows you how start-to-finish.

HOW TO BUILD GREENHOUSES, GARDEN SHELTERS AND SHEDS is yours, without charge, for 10 days to read and use. You'll find out exactly how to: select the best designs and sizes for your property... orient the structures to make the best use of the sun... put in foundations and erect framing... install light-gathering shells... provide drainage, heat and ventilation... choose and work with glass, fiberglass and film... install professional fittings and weatherseals... compute your heating needs... lay a concrete foundation with vapor barrier... install anchor bolts, angle fasteners... work with wood, concrete, man-made materials... and so much more. You'll learn what's new in equipment and materials—and how to buy them inexpensively and handle them like a pro.

LAUNCH YOUR GREENHOUSE PROJECT RIGHT AWAY

Whether you design your own structure, follow plans in the book, or assemble a project from a kit, this book helps you each step of the way. Take advantage of this 10 day free trial offer from Popular Science now—look through the book and pick out the complete plans for the greenhouse or shelter you want to build. Don't hesitate... mail the above coupon today!

OVER 200 ILLUSTRATIONS, PHOTOGRAPHS, BUILDING PLANS SHOW YOU HOW TO BUILD IT YOURSELF—AT A BARGAIN

10 DAY FREE TRIAL COUPON

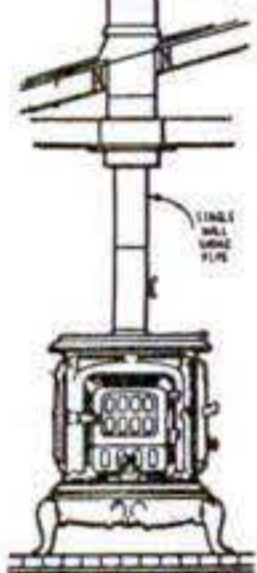
POPULAR SCIENCE BOOKS P13P
Box 2018, Latham, N.Y. 12111

Please rush _____ copy (ies) of HOME ENERGY HOW-TO (No. 119) to me.

- I enclose \$10.95 now for each copy ordered. (You will pay delivery charges.)
- Bill me later for \$10.95 for each copy ordered plus delivery and handling charges.

Name _____
Address _____
City _____ State _____ Zip _____
Money back within 10 days if not fully satisfied.

See how easy it is to produce your own energy—dramatically cut fuel and electricity use.



Learn hundreds of ways to conserve energy easily and inexpensively. How to produce your own energy sources. Up-to-the-minute research by alternate energy authority and Popular Science editor A. J. Hand shows you how to upgrade your home insulation, cut fuel and electricity use (and bills!). For 10 days, without charge, this definitive homeowner's energy how-to handbook is yours to read and use.

The book is divided into two parts. Part I concentrates on the ways you can conserve energy through living habits and home modifications.

Tackle insulation first. Initial expense is low, the effectiveness lasts for years. Get step-by-step instructions for insulating with urethane foam, ureaformaldehyde (you shoot it from a gun), mineral wool, styrofoam, vermiculite, perlite, and more.

Get pros and cons on the different types of caulk, learn where caulking is needed, how to prepare the surface, how to caulk. Get the same type of detailed directions on weatherstripping.

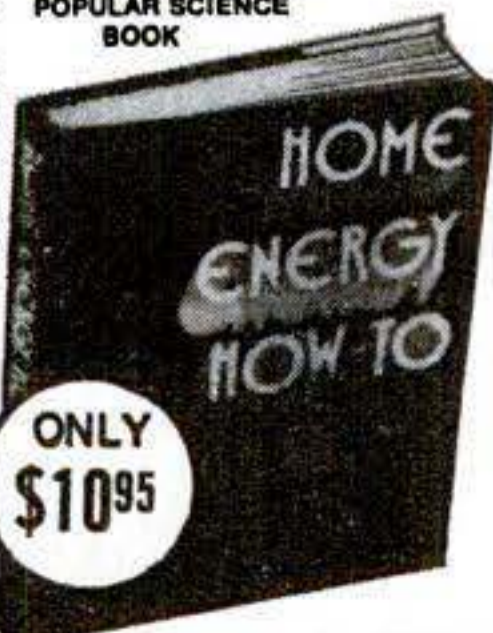
See how to double or triple glaze your windows to cut heat loss. How to clean, rest, change a thermostat.

Learn exactly how to cool your house efficiently—with air conditioning, ventilating, a roof sprinkler, even a lighter roof color.

Part II describes ways you can harness alternate forms of energy. Build your own solar, wind, water power systems. Produce energy with solar collectors, wind and water generators, biofuel plants and woodburners. Learn about all the latest non-polluting energy systems—the theories, the techniques, the materials (by brand name, with addresses!), the actual step-by-step how-to that'll help you meet the ever-increasing prices of conventional fuels comfortably.

You'll be amazed how easily you can create a completely energy-efficient environment with the help of HOME ENERGY HOW-TO. Take advantage of this trial offer from Popular Science now... Clip and mail the coupon above to get your copy right away!

AN ORIGINAL POPULAR SCIENCE BOOK



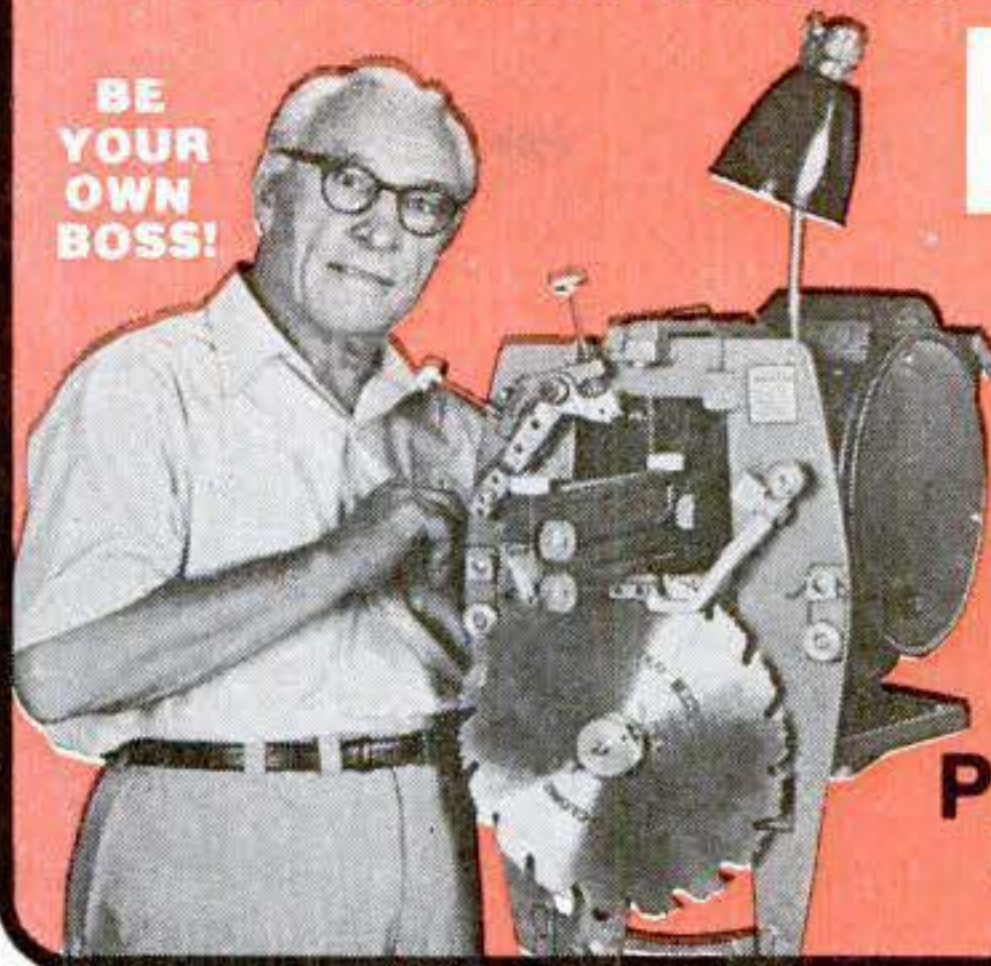
200 EASY-TO-FOLLOW SHOW-HOW ILLUSTRATIONS

ONLY \$10.95

TAKE THIS BOOK FOR 10 DAYS FREE

Now you can cash in on the huge demand for SHARPENING SAWS and TOOLS.

BE YOUR OWN BOSS!



Make \$8⁰⁰ an hour...

or more. Work part time, full time, right at home. No layoffs. No strikes. Provides a steady source of year round income.

This can be one of the most important decisions you ever make
Going into business for yourself can be the most exciting and rewarding decision you're likely to make in your lifetime.

Owning your own business brings you a sense of independence. You're the boss, setting your own work hours. Your own effort builds the business for yourself and your family. You can achieve great satisfaction and profits, if you choose and manage your business wisely. That's why so many men, just like you, are cashing in on the big profits to be made in this fast-growing service field.

The sharpening business allows you to get started with only a minimum investment, requiring little space and effort for a successful operation. It lets you build and expand as fast, or as slowly as you like. You pocket most of the money you take in, because there are exceptionally high profits with no investment in merchandise.

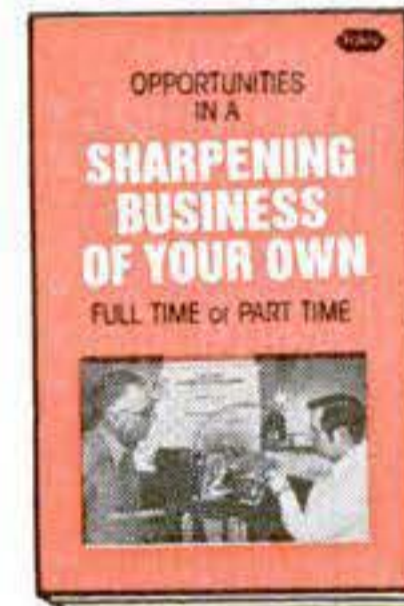
If you need only \$200 or \$400 extra income each month, a sharpening business is ideal for spare time. The additional dollars can be SPENT for more of the good things of life. Or they can be SAVED in a rainy-day fund that the family can bank on.

More sharpening businesses are needed every year

As original equipment continues to climb in cost, owners are becoming more concerned that the equipment be maintained so that it performs like new. This means more companies, contractors, carpenters and home owners are having their old saw blades and tools resharpened many times, where in the past, they would have replaced them with new blades or tools. This is where you

can step in with the much needed service of sharpening saws and practically any kind of tool.

SEND FOR FREE FACTS TODAY!



This FREE booklet has helped thousands

Thousands of good men have been inspired by this fact-filled book into making that first important step of starting their own business. It can be yours just for the asking.

It covers these important subjects...

- How much money can you make
- Age, education not a factor
- No selling is required — customers bring their business to you
- Lawn mowers and chain saws
- Sharpening business is year-round
- Sharpening opportunities in small towns and large cities
- A sharpening business provides excellent retirement income
- How Foley helps you start
- No experience needed, any age can succeed

Act today, so you can have a brighter, more secure tomorrow

Right now, while this is still fresh in your mind, fill-in the coupon below. We will send your FREE copy of "Opportunities in a Sharpening Business of Your Own". There is absolutely no obligation and there are no franchise fees in starting your Foley Sharpening Business.

Send your name and address to: Foley Manufacturing Co. 5126 Foley Building, Minneapolis, Minnesota 55418



FREE BOOKLET

Send NOW For Your Free Copy!

This little book has helped change the lives of thousands of good people, just like you. Just complete the coupon, clip it out and mail it to us today. Get started now for a brighter, more prosperous tomorrow!

24-HOUR ANSWERING SERVICE
CALL TOLL FREE 1-(800)-328-7140
(Except in Hawaii or Alaska)

RUSH COUPON TODAY!

Foley Manufacturing Company
5126 Foley Building
Minneapolis, Minn. 55418



YES, I would like to receive complete details about how I can easily start a profitable, Foley-equipped sharpening shop. Please rush me your FREE booklet, without any cost or obligation, that gives me full details on how I can quickly start my own business.

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

CLASSIFIED OPPORTUNITY MART

1 AUTOMOBILES

ALCOHOL Fuels: How To Make Your Own. 182 pages. \$4.95 plus \$1 postage. ARCsoft, Box 132B, Woodsboro, MD 21798.

EXTRA GAS FREE at Self-Serve Stations. Legal, Honest Technique. Details \$4.00. Oakster, Box 1582, Beaverton, OR 97075.

INCREDIBLE, but true! SAVE hundreds. Know the complete story behind fuel economy. \$5. Ecofuel, Box 2472, Bismarck, ND 58502.

AUTOMOBILE RE-TUNING FOR MAXIMIZED ECONOMY. Details FREE! Technoering, Box 12191C, Norfolk, VA 23502.

V-8 TO V-4 conversion. Dramatic fuel savings. Instructions, \$12.95. Bonnington Research, 15136 Penrod, Detroit, MI 48223.

DUAL Fuel Conversion Kits. UL Approved. Everything included except tanks, \$392. Satisfaction Guaranteed. As used by major motor home manufacturer. Visa and MC. American Conversion Equipment, P. O. Box 505, Palm Harbor, FL 33563.

LEGAL ALCOHOL FUEL 30c/Gallon! Solar/Conventional Still Plans. Mash Formulae. Federal Permit Information! RDA, Box 873, Concord, NC 28025.

WATER Injection - Build Easily, Inexpensively! Free Details - sase. U&I, Box 4873-PS3, Boise, ID 83704.

SECRETS OF FANTASTIC GAS ECONOMY!! - Details FREE! - AYTEK, Box 5202-L3, Rockford, Illinois 61125.

TRUE or False? 50 MPG carburetors. Box 206-8, Berea, KY 40403.



Pride of Ownership Your Personalized Hood Ornament

The ultimate automobile accessory. Custom-made to your order, with a choice of two or three initials. Readable on both sides. Constructed of chrome-plated die-cast metal with a spring-load base. The classic design complements any vehicle. Easily installed, requiring only three holes drilled in the mounting surface. Soundly secured by two lockwashers and nuts.

State initials wanted. \$29.95 ea. plus \$2.00 shipping & hdlg. (Add applicable sales tax in AZ, CA, CO, FL, IL, NY, PA, VA, VT, WI.) Allow 4-6 weeks for delivery. Send check or MO., or to charge Visa, Master Charge, Amer. Exp., or Diners Club, give name of card, account number & expiration date.

TMM HOOD ORNAMENT, Dept. PS031
P.O. Box 9569, New York, NY 10249

CLASSIFIED ADS \$6.00 per word, per insertion. Minimum 10 words. Payment with order, or charge to your Visa or Master Charge (give number & expiration date). First word in bold capital letters, rest of ad upper & lower case. Other bold cap words, \$1 per word extra. Bold headline or white space, \$24 per line. **DISPLAY-CLASSIFIED \$330 per inch, per month.** Advertisers using a P.O. Box number must furnish complete name and street address for our records.

CLOSING DATE for May issue (on Sale April 15) is February 28. Send orders to Mary C. Ansbro, Classified Adv. Mgr., Popular Science, P.O. Box 9643, Church Street Sta., New York, NY 10249.

OLD CAR FANS:

Subscribe to **HEMMINGS MOTOR NEWS**, world's largest old car marketplace since 1954. Over 450 pages of ads each month, crammed with thousands of old cars for sale—plus parts, literature, restoration shops and more. Only \$9.75 for 12 giant issues. Subscribe to the 'bible' of old car nuts today. Send to:

HEMMINGS MOTOR NEWS
Dept. PS, Box 100
Bennington, Vermont 05201

2 AUTO SUPPLIES & EQUIPMENT

100 MPG Carburetors? Drawings and Details \$10.00. Carbu, Rt. 1, Hitchcock, SD 57348.

ALTERNATOR Generator Rebuilding Book. Details: Hedlund Engineering, 7505 Barkentine, Las Vegas, NV 89128.

AUTORAMPS Easy to use, Simple to make. Requires only low cost common material. Plans \$2.00. Autoramps, 4448 Lee Ave., Downers Grove, Illinois 60515.

CORVAIR PARTS - 300 page illustrated catalog: \$3.50. **CLARK'S CORVAIR PARTS, INC., SHELburne, MA 01370.**

BATTERY Service Manual. By Battery Experts, 62 pages, \$5.00 to: Emanuel, Box 27015, Milwaukee, WI 53227

FOREIGN CAR PARTS! Information - \$1.00 - Refundable. A.I.A.P., 1009 Society, Albany, GA 31701.

SAVE MONEY! Tires, Custom Wheels, Auto Accessories - Buy Direct And Save. Send \$2.00 For Catalog. Tyres International, 619 E. Tallmadge Ave., Akron, Ohio 44310.

3 AUTO TRAILERS & CAMPERS

CAMPER/TRAILER KITS - PLANS - Fifth Wheels - Vans - Covers - Motorhomes - Simple construction - Save! Catalog \$1.00. **GLEN-L R-V'S**, 9152 PS Rosecrans, Bellflower, CA 90706.

4 MOTORCYCLES, BICYCLES & SUPPLIES

GO-KARTS, Factory Direct with all welding done. Ranging from \$49.95 to \$179.95. Send \$1.00 for catalog: Schmieder Motors, RD #1, Doylestown, PA 18901.



- Easy to Build PLANS
- GO KART .. \$2.50
 - MINI BIKE .. \$2.00
 - THREE WHEELER .. \$3.00
 - MINI CAR .. \$3.00
 - PEDAL BOAT .. \$4.00
 - 12' SAIL BOAT .. \$4.00
 - SAIL BOARD .. \$2.00
 - SOAP BOX .. \$3.00
 - 8'-HYDROPLANE .. \$2.00
 - 2 People MINI JEEP .. \$3.00
 - THREE WHEELER A.T.V. .. \$5.00
 - SNOWMOBILE SLEIGH .. \$3.00
 - FRONT TRACTION GO-KART W/ GEARLESS DIFFERENTIAL .. \$10.00
 - 8 H.P. TRACTOR .. \$10.00



MINI VEHICLES PLANS
Dept. A, Chazy, N.Y. 12921

5 AVIATION

BOOMERANGS — INCREDIBLE RETURN! You can do it. Exciting! Order your **FREE** catalog today. Boomerang-Man, 312 Park, Monroe, LA 71201.

AIRBOAT Gyrocopter Hovercraft Propellers. Hubs, Informative Catalog \$1.00. Aerial Propellers, Box 692, Greenville, TX 75401.

ONE-MAN JET HELICOPTER — Easy, inexpensive to build! Uses inexpensive fuel! Plans — completely illustrated — \$8.00. **HELICOPTER EXPERIMENTER'S HANDBOOK** — \$5.00. Both — \$11.00. Helicraft, Box 16488-A, Baltimore, Maryland 21217.

ROCKET PROPULSION SYSTEM



Build your own hot gas generator that propels you approximately 85 feet high at 60 MPH! Send \$10.98 for info-pack to:

PROPULSION
P.O. Box 2624
Arlington, Va. 22202

AIRCRAFT KITS

Complete Detailed Plans

Fuel-efficient & High-performance Aerobatic & Cross-country



1, 2 & 4 Seat
MANY TYPES
CATALOG—\$5.00 (FOR PLAN ALSO \$1.00)
SEND TO: **LIGHT FLIGHT PRO.**
Dept. C ★ P.O. Box 19828 ★ Houston, Texas 77024

5A HOVERCRAFT

AERO-CAR Amazing Hovercraft built easily with ordinary tools. Lawnmower engine powered. Carries one man plus. Flies over land/snow/water. Complete plans and booklet, \$9.95. Aero-Projects, Box 5118PS, Clinton, NJ 08809.

BARTLETT Flying Saucer. Complete Plans/Supply Sources: \$3.00. Write: Herb Bartlett, P.O. Box 156-S, Silverdale, WA 98383.

HOVERCRAFT Plans. Catalog \$1.00. Universal Hovercraft, Box 281, Cordova, IL 61242.

6 ASTRONAUTICS

ANTI-GRAVITY No moving parts, magnets, gases or exotic fuels. Solid-state electronic levitation. Build flying models. Data, schematics, diagrams. 78 pages 8x10 mimeo \$15 ppd. Guaranteed. **A.E.S.**, Box 132-A, Eureka Springs, Ar 72632.

ANTIGRAVITY Propulsion Devise. Free Brochure, RDA, Box 873-N, Concord, NC 28025.

SUPPORT THE SPACE PROGRAM Bumper Sticker. \$2 ppd. Stafford, 3250 Alder Street, Victoria, B.C. Canada. V8X IP2.

7 BOATS, INBOARD & OUTBOARD MOTORS

EVINRUDE 1980 Bargains... all sizes... \$1.00 handling... Scott-McCulloch parts... Electra Marine, 610 Merrick Road, Lynbrook, NY 11563.

BOAT KITS—27 Trailerable models — **POWER and SAIL** - 11' - 30'. Molded fiberglass hulls and decks come factory assembled - you install factory supplied interior. Save half factory-built cost. No experience required. **FREE** 48 page Catalog. Luger, Dept. AC-81, 3800 West Highway 13, Burnsville, MN 55337. (612) 890-3000.

BOATKITS - PLANS - PATTERNS - FRAME-PACS - FIBERGLASS - Worlds largest Catalogues - 300 - designs - 8'/80' - plywood - fiberglass - steel - **POWERBOATS** - Inboard - outboard - jets cruisers - sportfishers - hydroplanes - runabouts - **SAILBOATS** - Daysailers - Trailer-sailers - Multihulls - motorsailers - (**KYACK-CANOEES** - large selection wood - canvas - fiberglass) **BOATBUILDING** - materials - hardware - fastenings - rigging - sails - plywood - **FIBERGLASS** - polyester epoxies - foams - cloth - mats - C-Flex - special section boatbuilding with wood epoxy saturation system - catalogues \$2.00 (Book "One-Off Boatbuilding" \$6.00) also (Book "Fiberglassing How To" \$6.00)

CLARKCRAFT

16-S Aqualane Tonawanda NY 14150

BOATING ENTHUSIASTS:

Subscribe to **SMALL BOAT JOURNAL**, the bi-monthly magazine devoted to boats under 30'. Covers everything from sail and motor boats to canoes and rowboats—deepwater and inland. Plus tests, designs, repairs, how-to tips, maintenance and more. Just \$10 for a year-long adventure in small boating. Send to:

SMALL BOAT JOURNAL
Dept. PS, Box 400
Bennington, Vermont 05201

WHOLESALE-Boats, Motors, Marine Supplies Compare our prices and save on Evinrude, OMC, & Crusader Engines, Electronics, Paints, Fiberglass, Fastners, Propellers, Controls & Steering Systems, Safety Gear & Appliances are only a few of over 300 Marine Manufacturers that we represent. We also have a 400 page catalog available for only \$10.00 on request our monthly mailing list of specials free of charge consisting of items at or below dealer cost.

WAGNER WHOLESALE MARINE
3700 Lapaico Blvd. Harvey, La. 70058
or phone 504/340-9221 Ask for Warren
Serving The Marine Industry For Over 40 Years

BOAT PLANS - FRAME KITS - PATTERNS - Powerboats - Sailboats - Outboards - Canoes - Kayaks - Rowboats - Duckboats - Houseboats - Runabouts - Dorries - Workboats - Fishing Boats - 8' to 49' - Construct In - Plywood - Cold Molded - Wood/Epoxy - Fiberglass - Steel. Lowest cost, highest quality! Easy, proven methods include instructions especially for amateurs. No lofting! **SUPPLIES** - Fastenings - Fiberglass - Resins - Glues - Spars - Books - Trailer Plans. **HUGE 144-page catalog** - \$2.00 - Includes **FREE "BOATBUILDING SUPPLIES"** brochure. **GLEN-L Marine**, 9152 Rosecrans, Dept. SP, Bellflower, CA 90706.

11 DO-IT-YOURSELF

LASER HANDBOOK with burning, cutting, Ruby Reds, Co's complete plans, books, and parts. Send \$4.00 to: Famco, Dept. PS, Box 1902, Rochester NH 03867.

ELECTROPLATING, Complete Textbook. All Metals. Electroplate Metallic/Nonmetallic Items, \$9.95, Details Free. Tropic, Box 95P, Palm Bay, FL 32905.

ION GENERATORS, Outperform \$200 Models, Kit \$64.50, Complete \$79.50. Professional Ionizers, 204 N. Hydraulic, Wichita, KS 67214.

BUILD YOUR OWN LOG SPLITTER 140 PAGES instruction, 50 pages parts, both \$9.95. Parts catalog only \$2.50. Hardy's Equipment, Box 142P, Candia, NH 03034.

"PROFESSIONAL" GIANT SCREEN PROJECTION TV - "Don't Be Fooled By Cheap Imitations" - "Build The Best!" - Simple Construction! - **FREE** Information! - **POLI-VISION**, 168R Dunmore St., Throop, PA 18512.

NEW! Exclusive, Automatic, Chimney Fire Detector and Extinguisher. Plans \$4.98. Sky High Enterprises, Box 84-PS21, Puslinch, Ontario, Canada, NOB 2J0.

Continued on page 160

Take this giant \$29⁵⁰ book

FREE

when you join POPULAR SCIENCE BOOK CLUB

A huge treasury of creative woodworking and master cabinetmaking techniques. Helps you become an expert at using hand and power tools—even lathes, routers, shapers. Shows you how to build furniture, do fine interior and exterior work.

This extraordinary book tells and shows you everything about CABINETMAKING & MILLWORK.

- Learn the latest furniture-building shortcuts
- Master every cabinetmaking trick and technique
- Get all the up-to-date news and breakthroughs on materials, tools, finishing how-to and much more.

If you're like most do-it-yourselfers, you probably do most of the routine woodworking jobs around the house yourself and *pay* to get the fancier work done. Yet the real satisfaction of woodworking comes from doing those fancy jobs yourself: making a wall of handsomely grained built-ins...wood-paneling an entire room...constructing a table with a perfectly matched veneer top. Yes, you can do all of these fancy jobs yourself *even without experience* when you've got a copy of CABINETMAKING AND MILLWORK as your guide.

Thousands of show-how pictures guarantee success!

This excellent, 928-page volume is a complete education in fine woodworking. It teaches you exactly how to do every step of every woodworking job you'll ever want to do. Thousands of explanatory pictures (including many full-color photographs), charts, assembly drawings, finishing illustrations, construction details and more make this book very easy to use...*even for a novice!* (Think of the money you can save by building, repairing, finishing and refinishing all kinds of home woodworking projects *yourself!*)

Super-clear how-to on tools, materials!

More than 200 pages on how to use hand tools, power saws, shapers, routers, drills, boring machines, lathes and more. More than 300 pages of specific construction plans for built-ins, kitchen cabinets, room dividers, tables, bookcases, furniture of every description. Every detail you need to know is given the complete, clear-cut treatment. You'll use this great book for years as one of your favorite "handyman's tools."

Your first Club selection is
BASIC HOUSE WIRING by Monte Burch



Custom-written specially for Popular Science Book Club. BASIC HOUSE WIRING tells and shows you everything you need to know to be your own home electrician. This big 7³/₈" x 9³/₈" hardbound book features more than 500 step-by-step photos that show you how to do each job yourself and do it right. You'll learn exactly how to repair, improve, install and troubleshoot your home's entire electrical system. How to rewire an old house, wire a new home, determine wiring needs, plan "go-aheads", eliminate hazards — all according to the latest National Electrical Code. Much more on installing new fixtures, switches, 3-ways, low-voltage devices, rural buildings, appliances, entrance panels — everything! Indispensable how-to for every homeowner. Published at \$13.95, yours now for only \$9.95 plus delivery and handling, along with your *free* CABINETMAKING & MILLWORK.

FEIRER
CABINETMAKING
AND MILLWORK

- Nearly 1,000 pages.
- Big 7³/₈" x 9³/₈" format.
- Thousands of explanatory pictures.

How Popular Science Book Club Works

Club membership entitles you to choose the best new handyman books on home repairs and improvements, housebuilding, woodworking, home workshops, masonry, carpentry, tools, wiring, home energy, much more. Club books are comparable in every way to the original publishers' editions, yet members can save up to 50% and more on hundreds of bargains offered each year. You also get first choice of original Popular Science Books, custom-written for the Club and available nowhere else at discount.

To start the bargains coming your way, simply fill out the card and mail. You'll receive your FREE copy of CABINETMAKING & MILLWORK (regular price \$29.50) and your first Club selection BASIC HOUSE WIRING (regular price \$13.95) for just \$9.95 plus delivery and handling. That's \$43.45 worth of books!

Then, about every four weeks (13 times a year) you'll receive a special Club bulletin describing the current main selection and alternate books available. If you want the main selection only, do nothing. It will be sent automatically. If you don't want the main selection, or want an alternate book, or no books, simply indicate your wishes on the handy form provided and return to us by date shown (no envelope needed). You will always have at least 10 days in which to do this, but in the unlikely event that you don't, and you receive an unwanted book, you may return it.

Your only obligation is to take just two more books of your choice within a year. After that, membership may be cancelled by either you or the Club. What a great way to build a valuable how-to library at big savings. Mail the card today!

If card is missing write to: POPULAR SCIENCE BOOK CLUB, P.O. Box 2006, Latham, N.Y. 12111

SATELLITE TELEVISION - Inexpensive system, receive anything, build antenna under \$175.00. Plans and manual \$19.95. **MONEY BACK GUARANTEE.** Sattetecco, Box 265, Salem, Ohio 44460.

HOME Selling Made Easy. Save Commissions. Trade Secrets Revealed. \$4.95. Wittengale Corporation, Box 421, Morgan, PA 15064.

TELEPHONE Installation Booklet. \$5.00. PGS Publications, 8A Asbury, Churchville, MD 21028.

KEEP YOUR HAIR! Make hormone hairgrower. Under 2c Day! Effective, easy formula, ingredient sources, complete instructions \$3.00. Harry, 932 Moreau, Jefferson City, MO 65101.

SATELLITE TELEVISION build yourself complete dish & mounting plans \$7.00. Northtech, Box 1008, Delta, B.C. Canada, V4M-3T2.

HOBBY Clock, detailed drawings \$2.00. Hobby Clock, 2213 Harbor St., Pittsburgh, PA 15212.

ELECTROPLATING Metals, Non-Metals. Complete Processes, Formulas, instructions \$6.95. Educational Digest, Box 90575, Rochester, NY 14892.

SOLAR BUSINESS Valuable information on starting your own business. Federal Grants Systems. What and where to buy products. Manufacturers Tax Incentives Schools and more \$5.00. Marrich, Box 8034, Garden City, RI 02920.

SAVE YOURSELF and your property from burglaries. Info, write: Jack Fisher (2-C), Box 522174, Miami, FL 33152.

SPEAKER SYSTEMS AT HALF PRICE. Info, Write: Jack Fisher (2-C), Box 522174, Miami, FL 33152.

GREENHOUSE. Simple Glue Together Frame. Plans \$5.00. Greenhouse, 6173 Vista, Ferndale, WA 98248.

ROBOTICS- associations, books, kit makers, computer controlled robots, send \$2.50 to: Metallic Technology, P.O. Box 49, New Hyde Park, NY 11040.

\$75.00 GREENHOUSE, Plan \$3.00. W. Price, Box 310-PS, Mt. Sinai, NY 11766.

FUMES Extractor - Embarrassed by odor when toilet is used? Build cheap simple system. Attaches toilet. Works 100%. \$2.00 and s.a.s.e. Plans. Olson, Box 19, Meadowlands, MN 55765.

LASER PLANS-PARTS CATALOG-\$2, FIVE Laser Plans-\$10.00 Solaser, (PS81), Box 1015, Claremont, California, 91711.

PROJECTION TV . . . convert your TV to project 7 Foot picture . . . Results equal to \$2,500 projector . . . Total cost less than \$20.00. **PLANS & LENS** \$16.00. Illustrated information **FREE.** Macrocomaag, Washington Crossing, PA 18977.

GREAT SAUSAGE RECIPES
227 page illustrated book explains sausage making plus home curing and smoking of meat, fowl and fish. Over 100 recipes. Free equipment and supply catalog has more information. For yours, send to:
The SAUSAGE MAKER Dept. 12
177 Military Rd. Buffalo, N.Y. 14207

Satellite TV
Sick of Network TV?
FOR THE HOME



Our receiver lets you get over 75 channels of television directly from earth-orbiting cable TV satellites! HBO, Showtime, super stations, sports and movies.

We don't just sell information! We Manufacture Hardware!

From offshore oil rigs, data links to hotels and backyard installations, we wrote the book. Constantly updated, our 94 Page technical information book and catalog gives you all the facts. Inexpensive dishes, feeds, telemetry software, kits and more. Recommended reading by NASA, The Office of Consumer Affairs and quality companies like Rockwell/Collins. Send \$7.95 today!

CALL
24-hrs. C.O.D. Hotline
(305) 339-7600

SPACECOAST
RESEARCH CORPORATION
P.O. Box 442-B, Altamonte Spgs, FL 32701

SATELLITE TELEVISION
SATELLITE TELEVISION
SATELLITE TELEVISION



We manufacture the highest spec 3-meter data & video dish in the world 41db gain! We also sell direct. Immediate delivery or you pick up. Complete details including satellite TV information, aiming service and discount schedule. Send \$1.25 for postage & handling to:
TIGER TENNAS
P. O. Box 561
Casselberry, Florida 32707


BUY DIRECT

BIG SCREEN TV \$499!



Brilliant 4-foot picture from your own TV. Guaranteed! 60-day free trial. Free 10-page brochure from
VSR, 433 Airport Blvd, Suite 419PS, Burlingame CA 94010

Wind/Methane Solar/Fuel Cells



Enjoy free heat & power. Send for energy Encyclopedia. Complete list of Mfg., cost, specifications, on most alternate sources of energy - Plus Catalog of Plans available for do-it-yourselfers. —\$4.00
Energy Service
14A Hughey St., Nashua, NH 03060

GENERATE FREE POWER



Cut heat and electric bills. Enlarged encyclopedic windmill/generator report gives sources, costs, instructions, capacities, specifications of equipment you can buy today. Only \$4.98. Also Henry Clews' authoritative Electric Power from the Wind: \$2.98. Both, \$6.98. And famous Dwyer precision, portable wind speed indicator: \$8.95. All three \$14.98. FREE with order: U.S. brochure Solar Energy for Heating and Cooling. Shipped in 2 days. Add \$1 for postage and handling.
MONEY BACK GUARANTEE.
ENERGY UNLIMITED, Dept. 113
219 Thorndike St. Palmer, Mass. 01069

LASER



LASER OR MASER PISTOL — Complete Plans for Building—\$3.00 each
INVISIBLE FORCE FIELD—\$2.00. **MOON MAN ROBOT**—\$2.00
SOUND LASER \$2.00
Ion Aeronautical Lift System\$5.75
Real Ruby Crystal 1/4"x2" for educational use\$225.00
High Power CO₂ Laser\$5.75
Catalog of super Science Projects—75¢.
JACK FORD SCIENCE PROJECTS
PO Box 948A, Duluth, GA 30136

AMAZING SCIENTIFIC and ELECTRONIC DEVICES

PHASER shockwave and invisible FORCE FIELD generators. LASERS for weapons, cutting, burning, cloud writing, holography and special effects. NUCLEAR particle accelerators and detectors. PLASMA, ION, HIGH VOLTAGE, HIGH FREQUENCY TESLA COILS and LIGHTNING generators. TRANSMITTERS and CONTROL devices for security, telephones, intrusion detection, nature listening. PLUS PLUS INFRASONICS, ULTRASONICS, ENERGY, CHEMICAL and PERSONAL PROTECTION and SAFETY DEVICES. SEND \$1 for catalog of plans, kits and completed items to:
INFORMATION UNLIMITED, INC.
P. O. BOX 716, Dept. P8
Amherst, N. H. 03031

PUMP
DRAIN • IRRIGATE
CIRCULATE • SPRAY



Heavy-duty rustproof ball-bearing pump. Stainless shaft. 1 HP 1200GPH 60" high or 3000 GPH 25" well. 5200GPH max. 1 1/4" in. 1" out. Belt or direct drive. Use 1/4 HP or larger. Money back guarantee. Add \$2 patge & hndlng \$21.95
LABAWCO Box 35, Belle Mead, N.J. 08502

LASERS UNLIMITED
Complete plans and parts sources

- RUBY LASER RAY GUN \$15.00
- CO₂ LASER FOR BURNING/CUTTING \$15.00
- BEGINNERS LASER VISIBLE RED and IR \$10.00
- LASER PISTOL and RIFLE \$10.00
- HELIUM NEON VISIBLE RED LASER \$ 7.00
- MULTI COLOR LASERS \$15.00
- LASER LIGHT SHOWS \$12.00
- LISTING OF ALL LASER COMPANIES \$ 5.00

LASERS UNLIMITED
Dept. L1, Box 716, Amherst, N. H. 03031

HYDROGEN FUEL

Now, you can generate your own hydrogen and convert your automobile to operate on hydrogen fuel. You get electrolyzer and auto conversion plans and instructions, plus details on safe hydrogen storage and generating hydrogen **FREE!** Complete package: only \$10.00
RESEARCH & DEVELOPMENT
Post Office Box 873
Concord, North Carolina 28025

SCIENTIFIC SYSTEMS INC.
Now at last offers in kit or completed form such unique products as: Nighttime vision devices, super sensitive directional mikes, low and high powered lasers, micro-mini-voice transmitters, ultra sonic devices, super high voltage generators, intrusion and sensing devices, scientific personal protection items, and many other hard to find products. Send \$1.00 for catalog: **SCIENTIFIC SYSTEMS INC.** Dept. S1, Box 716 Amherst, NH 03031

METHANE GAS SYSTEM



Build this simple generator and produce **FREE METHANE GAS** for cooking, heating, lighting- even running vehicles! Uses ANAEROBIC DIGESTION to produce Methane from normally discarded waste materials! **COMPLETE PLANS** including application methods: \$7.95
GLENVALE PRODUCTS,
Dept 71, MPO Box 1368,
Niagara Falls NY, 14302

FANTASTIC SCIENCE PLANS

- Stero-Controlled Laser Show \$ 8.00
- Methane Fuel (400 pages) 15.00
- Hydrogen Generator/Hydrogen Car 10.00
- Propane/Gasoline Auto Conversion 10.00
- MHO Electrical Generator 10.00
- Low-Cost/One-Man Hovercraft 7.00
- Easy-to-Build X-Ray Machine 10.00
- Solid State Laser 6.00
- Visible-Red He-Ne Laser 6.00
- 25 KV Tesla Coil 5.00
- Computerized Electronic Robot 10.00

MONEY-BACK GUARANTEE
— CATALOG \$1.00 —
RESEARCH & DEVELOPMENT
Post Office Box 873
Concord, North Carolina 28025

12A FOR THE HOME

At last there's something you can do to prevent water damage



FLOOD ALERT™
Warns you instantly when water threatens

New electronic Flood Alert stands guard 24 hours a day. Every day of the year. Wherever you place it.

The instant any water touches its two "sensors", it lets you know—loud and clear. Sounds a high-pitched warning that continues until you stop it.

Protects you from costly water damage at home (in cellars, bathrooms, kitchen). Protects boats, factories, boiler rooms, mobile homes, campers, etc. Remote sensors with 30 ft. of wire available for boat bilges, hard-to-reach areas.

Use a Flood Alert unit wherever you suspect water may creep up (or in) before you notice it. Only \$16.95 per unit. Remote sensor(s) with wall bracket for easy attaching to bilge, cellar walls, etc. \$4.95 per set.

Compact, easy to move around—each Flood Alert unit measures only 5 1/2" x 2 5/8" x 1 7/8".

Built to last of high-impact ABS plastic, with 100% solid-state electronics. Operates on one 9V battery (not included). Reliable at range from 0° to 125° F. Weighs just 4 oz., with battery.

Why risk another storm or plumbing calamity? Send for Flood Alert now. \$16.95 per unit, plus \$1.25 shipping & handling. (We pay shipping on 3 or more). Remote sensors, \$4.95 each. (Add applicable sales tax in AZ, CA, CO, FL, IL, NY, PA, VA, VT, WI)

Mail to:
TMM FLOOD ALERT, Dept. PS031
P.O. Box 9569, New York, NY 10249.
Or, to charge credit cards
(Visa, Master Charge or Amer. Exp.)
Give name of card, account number, and expiration date.

12 HOME CRAFTSMAN

"GETTING Started in Stained Glass"
50c. Whittemore, Box 2065X, Hanover, MA 02339.

WOODWORKERS' STORE CATALOG - 112 page full color 1981 Catalog/Manual containing hardwoods, veneers, kits, tools, plans and specialty hardware. Send \$1.00 to: The Woodworkers' Store, Rogers, MN 55374.

FREE HOBBY TOOL Catalog. (Wholesale Prices). Postcards Only. International Curio Shoppe, Box D, Mountain Dale, NY 12763.

Ratchet Pistol Grip Gives Double Power 20-PIECE TOOL KIT



Gives you twice the turning power and speed. Tightens or loosens screws and nuts in a few easy turns. Works forward and reverse fast. No pressure; no fumbling. Speeds up any job or adjustment.

Tools include: 8 different socket wrenches, 2 regular and 2 Phillips screwdrivers, Awl for starting screws. All rugged, lifetime tools. Complete set in a handsome, fitted waterproof vinyl case with zipper. Keeps everything organized. Stows handily in drawer or glove compartment.

Only \$9.95 complete + \$2.25 shipping & handling. (Res. of AZ, CA, CO, FL, IL, NY, PA, VA, VT, WI add applicable sales tax.)
Mail order with payment to:
POPULAR SCIENCE TOOL KIT
Dept. PS031, P.O. Box 9569
Church St. Sta., New York, NY 10249



For Fast Repairs At Home, in Car or Boat

13 TOOLS & MACHINERY

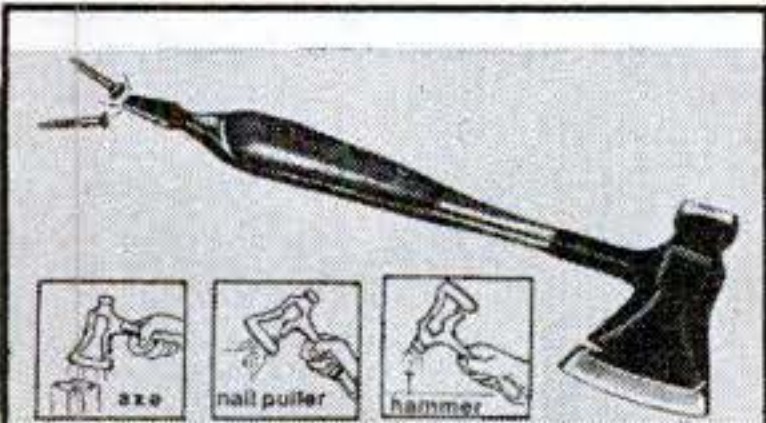
LATHES — Unimat — Maximat — Sherline — Machinex. Catalog \$1.00. Shop Supplies \$1.00. Campbell, 2100 Selma Road, Springfield, OH 45505.

SMALL FOUNDRY Furnace, Supplies. Free Literature. Pyramid Products, Dept. M, 3736 South 7th Avenue, Phoenix, AZ 85041.

MACHINIST'S WALL CHART. Just introduced. Makes all other reference charts obsolete. Combines U.S. threads with tapping and clearance drills, English threads, inch decimal equivalents and drill sizes, U.S. pipe threads, other useful data on 24x37 oil-resistant chart. Write for information. Chester River Machine Tool Company, Drawer 119B, Chestertown, Maryland 21620.

4" METAL Cutting Lathe \$76.25. Taig, 15048 Proctor, Industry, CA 91746.

AFFORDABLE FLAME CUTTING MACHINES cut shapes, straight lines in steel plate using your manual torch & wooden templates. Variable cutting speeds. **FREE** details. **TORCHMATE**, 687 Lofstrand Lane, Unit T, Dept. PS, Rockville, MD 20850. 301/251-0430.



HANDY AXE TOOL

This sturdy steel axe and hammer tool is also a magnetic screwdriver, nail puller and magnet. All made of one piece of sturdy, solid steel with wood inlay for comfortable grip handle. 9" overall with 3 1/2" head.

Excellent for home, car and camping. Just \$4.98 each + \$1.25 postage & handling. **SAVE!** Order 2 tools for \$8.98 + \$1.75 post. & hdlg. Res. of AZ, CA, CO, FL, IL, NY, PA, VA, VT, WI add applicable sales tax.

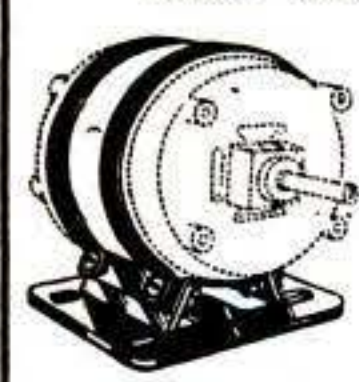
TMM AXE TOOL, Dept. PS031

Box 9569, Church St. Sta.
New York, NY 10249

14 ENGINES & MOTORS

ENGINES to 19 H.P. for Mowers, Tillers, Hobby. Repair manuals parts. Tremendous savings. Fast, dependable. Illustrated price catalog \$1.00. Ashland Small Engines, Ashland, MO 65010.

MOTOR HOLDER



Puts firm base under end mounted motors 5 1/16 to 6 11/16 diameter.
Steel Quantity Alum.
\$ 3.75 one \$ 3.45
\$ 6.50 two \$ 5.90
\$ 8.75 three \$ 7.85
\$16.00 six \$14.20
All price postpaid
E. Walstedt Co.
11801 92nd Ave. N.
Osseo, MN 55369

15 HOME REPAIRS, REMODELING

FORMICA. Repairs & Installations Simplified. Send \$3.95 for Pamphlet. J.R. Enterprises, Dept D-11, 3495 E. McDowell, Phoenix, AZ 85008.

15A ENERGY SAVING

SLOW DOWN YOUR ELECTRIC METER. It's perfectly legal. Details \$5.00. Arnesco, Box 1061-PS, Woodland Hills, CA 91365.

HOMEOWNERS - Proven Energy Saving Methods Compiled by Building Managers. \$5.00. Art McWilliams, P.O. Box 4126(A), Baton Rouge, LA 70821.

LATEST ENERGY CONSERVATION TECHNIQUES. Bimonthly Newsletter - Subscription \$7.95. **ENERGY POTENTIAL**, Box 888462, Atlanta, GA 30338.

VERY Warm. Build Kotatsu, energy saver, to Table. Simple, Safe. Free information. Mr. Kotatsu, Box 145, Green Creek, NJ 08219.

INSIDE Storm windows - very effective. Cheap, Easy, no attachments to house. Plans, License, \$3.50. KIS, 10 College Lane, Methuen, MA 01844.

SAVE hundreds of dollars on home/business energy bills! Energy Manual shows you how. Guaranteed. \$9.95. W. Band, 77 Davisville 2102 A, Toronto, Ontario, M4S 1G4.

SAVE \$ - Save Energy . . . Low Flow showerheads that also give a quality shower . . . Pays for itself in a few short weeks . . . \$12.95 each includes postage and handling to: The Energy Bank, P.O. Box 10859, Edgemont Branch, Golden, CO 80401.

SAVE ENERGY, SAVE MONEY. On your gas water heater. Do it yourself plans \$5.00. Energy Inserts Incorporated, Box 14884, Columbus, OH 43214.

SAVE \$\$\$. New scientific breakthrough. Reduces electricity consumption 50%. Light bulbs last 8 years. Only \$2.95 each. Order Now. All Clean Lite Savers, 8756 S.W. 129 St., Miami, FL 33176. (305) 232-1124.

MAKE Easy Money. Free Details. Box 262, Dept 2A, Oldsmar, FL 33557.

BULB MISER SAVES ENERGY



Now you can prolong the life of your light bulbs by over 400%. Simply put Bulb Miser in socket & screw in bulb. Guaranteed. Order today.

\$3.50 Ea. 3 for \$9.95 Ppd.

INDCO, INC. P.O. Box 589
New Albany, IN 47150

15B ALTERNATE ENERGY

HYDROGEN-ELECTROLYZER Plans \$10.00. Inquires \$1.00. L. Spicer, Lineville, IA 50147.

SOLAR Home That Works. Send stamped envelope for Free Brochure. Judron Associates, Box 1200, Conway, NH 03818.

HYDROGEN — Triple power of gasoline. Complete directions - home manufacture. No special equipment necessary \$2.00. Box 3334, Enfield, Connecticut 06082.

FREE ENERGY! Patents, plans, diagrams, specifications, secret information. Extract free energy from permanent magnets, cosmic radiation, spacetime! First time anywhere! Only \$10.00. Satisfaction Guaranteed! RDA 873, Concord, NC 28025.

TELSA Bibliography. \$3.00. Carella, 2335 Elden #3, Costa Mesa, CA 92627.

OPTIMIZE Solar Power by Positioning Panels precisely. We compute sun angle your location for equinox and solstices. 1' accuracy. Immediate reply. \$2.00. Watson, 95-575 Wehewehe Loop, Mililani, HI 96789.

KALWALL'S SOLAR HEATING CATALOG

Full line of solar heating components, including Sun-Lite® glazing and tubes. Order all materials from one source. Send \$2.00 for catalog.

Solar Components

Dept. P, P.O. Box 237
Manchester, NH 03105

17 BURGLAR/FIRE ALARMS

HOME SECURITY NOW! Join National Security Association; monthly newsletter, do-it-yourself, security tips, save thousands, possibly your family's lives. Details \$2. Box 5206, Huntington Beach, CA 92646.

QUALITY Burglar/Fire Alarm Systems & Accessories — Home, Office, Auto. **LOW PRICES** — Catalog 50c. **RAM SECURITY SYSTEMS**, P.O. Box 168, Oaklawn, IL 60454.

THE FALSE TELEVISION CAMERA

A real crime fighter for home or business. Beautifully detailed and illuminated, with wall plate, cables, lens, all hardware. \$29.95 includes shipping. Scanner also available.

PACIFIC VIDEO
10396 Ahern Court
San Diego 92126

21 HOBBIES/COLLECTIONS

COLLECT Military Medals. List 50c. Vernon, Box 387PS, Baldwin, NY 11510.

25 FORMULAS, PLANS

20,000 MONEymaking FORMULAS! CATALOG - \$2.00 - REFUNDABLE! GWA6, Box 193, Brookfield, WI 53005.

PENNY FORMULAS, 1,000. Easily Prepared Product Formulas. Send \$10.00 to: Nile, Box 3520, Nashua, NH 03061.

HENLEY'S

20th Century Book of
10,000 Recipes, Formulas & Processes
(Latest Edition)

Here is a wealth of practical, accurate and clear information and instruction that can save you thousands, or make you a fortune! Housewives, manufacturers, farmers, handy-men, home experimenters, electricians, chemists, people in every walk of life, refer to Henley's daily. In this gold-mine of a book, you too will find formulas and recipes for almost everything used in the home, farm, workshop or industry. Discover the trade secrets of thousands of commercial products—learn new money-savings and exciting way of doing things. As indispensable as a dictionary. Satisfaction guaranteed. 900 pages hard cover-cloth binding. Only \$12.95 plus \$1.75 postage & handling.

Dealer's Inquiries Invited

EMBASSY SALES Dept. PS-50
Box 67, East Elmhurst, N.Y. 11369

26 SCIENCE & CHEMISTRY

CHEMICAL Apparatus. Lowest prices. Catalog one dollar. Avatar, P.O. Box 213, St. Charles, MO 63301.

NEW 200 Page 1981-82 catalog, listing thousands of chemicals, science equipment and labware. Send \$2.00 to: Merrell Scientific, 1665 Buffalo Road, Rochester, New York 14624.

CHEMICALS -Apparatus -Glassware, Catalogue \$1.00. Starr Scientific, 916 Madison Street, Manitowoc, Wisconsin 54220.

ECONOMICALLY Priced! Chemicals -Apparatus. Catalogue-\$1.00. Hagen Laboratories, 1302 Washington, Manitowoc, Wisconsin 54220.

CHEMICALS apparatus, project books, wide selection. Catalog \$1.00. Send to: Pioneer Industries, 14A Hughey Street, Nashua, NH 03060.

GRAVITATION Association's **BREAKTHROUGH** Book, \$3.00, Refundable. 3204 Breeze, Austin, TX 78722.

LIVE IN LOS ANGELES? **CHEMICALS** Glassware Low Prices. Chem Lab Supplies, 1409 Hermosa Ave. Hermosa Beach, CA 90254. Call for info. 213-376-3430.

27 PLASTICS

PLASTIC Resin. Clock Movements, Cypress Wood. Wholesale Catalogue \$2.00. Nature, 194 South Columbus, Mt. Vernon, NY 10553.

CASTOLITE Liquid Plastics. Crystal clear, colors. For casting, embedding, coating, fiberglassing; in industry, laboratories, craft work. Reproduce your designs with our mold materials. Profitable. Illustrated Catalog \$1.00. Castolite, Dept. 81C/PS, Box 391, Woodstock, IL 60098.

31 NURSERY STOCK

GROW GINSENG! \$50 pound. Have seeds, roots. Goldenseal. Information. Collins, Viola, IA 52350.

31A GARDENING

SUBURBAN HOMESTEADER, the monthly newsletter, shows how to slash your food costs by farming your suburban lot. Raised beds, container planting, dwarf fruit and nut trees plus reviews of latest varieties, products, and techniques vital to the suburban homesteader. **SUBURBAN HOMESTEADER**, P.O. 594-C, Acworth, Georgia, 30101, twelve dollars per year.

32 REAL ESTATE

CANADIAN Vacation and Lakefront Properties from 1,650. Great hunting and fishing investment. 12 month exchange privilege. Catalogue \$1.00. Canadian Estates, Dept. 22c, 286 Lawrence Ave., W., Toronto, Canada, M5M 3A8.

BIG . . . FREE . . . CATALOG! Over 2,800 top values coast to coast! **UNITED FARM AGENCY**, 612-PS West 47th, Kansas City, MO 64112.

MINERAL Hot Springs - Colorado - Scenic lot, \$135/down full price \$2,975. \$34/month. National Land Company, 2373 Wilt Road, Dept. P, Fallbrook, California 92028.

GOVERNMENT LANDS - from \$7.50 Acre! "Buyer's Guide" . . . plus nationwide listings - \$2.00. Surplus Lands, Box 19107-FC, Washington, DC 20036.

42,000,000 ACRES Valuable Government land available low as \$6.80 per acre. Campsites, farms, homesites. Fabulous business opportunities. Latest report! Send \$2.00. Satisfaction Guaranteed. American Land Disposal, Box 913-B, Holland, MI 49423.

ARKANSAS Ozarks Free 1981 Real Estate Catalog - Lake Bull Shoals - White River - Farms - Ranches - Wild Rough Ozark Hill Land. Write To: Baker Co. P.O. Box 10, Yellville, AR 72687.

CALIFORNIA. Acreage. Lots. \$30 down. \$30 monthly. 4602 Ethel, Sherman Oaks, CA 91423.

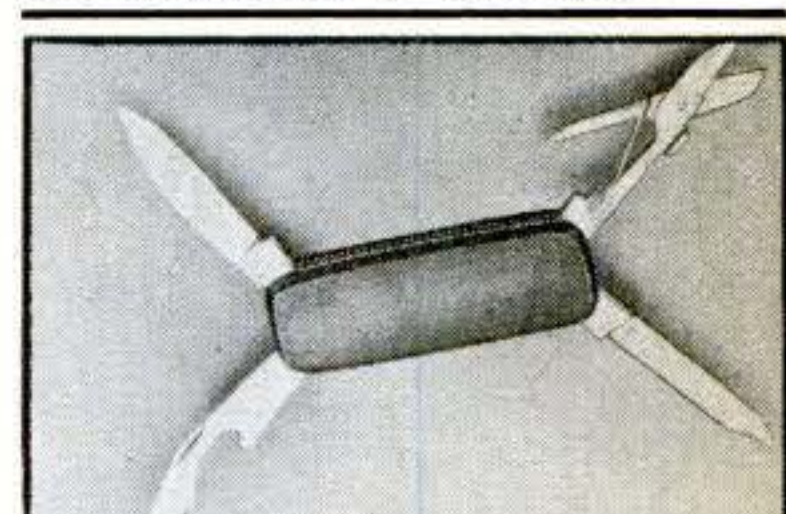
FREE Big Spring Catalog! Over 5,400 country properties described, pictured! Land, Farms, Homes, Businesses, Recreation, Retirement buys! Selected best thruout the U.S. Over 700 offices, 43 states All Across America! Yours **FREE** from the World's Largest! **STROUT REALTY, Inc.**, 7 S. Dearborn, Dept. 5810, Chicago, IL 60603.

10-20 ACRES in fabulous Northern IDAHO. Choice land in beautiful timbered settings. In the heart of lake, hunting & recreation country. Reasonably priced. Terms. Parcels with domestic water and power available. A unique opportunity for country living at its best. Write for free information:

NATIONAL ASSOCIATED PROPERTIES

Dept. NC, 1121 Sherman
Coeur d'Alene, ID 83814
(208/664-8161)

33B KNIVES & STONES



"POCKET PAL" COMBINATION KNIFE

Thin, slim, smart vinyl covered knife opens to reveal a sharp scissors that really cuts, a screwdriver, bottle opener, nail file and razor-sharp knife. All the utilities a man needs and uses every day. Made of top quality drop forged steel for durability. Measures just 2 3/4" when closed. Only \$5.98 each + 75c postage & handling, 2 for \$9.98 + \$1 post. & hdlg. Res. of AZ, CA, CO, FL, IL, NY, PA, VT, VA, WI add applicable sales tax.

TMM POCKET PAL
Dept. PS031, Box 9569
New York, NY 10249

34 CAMPING EQUIPMENT & TENTS

FREE Catalog. Everything for Camping. Campmor, Box 407P, Bogota, NJ 07603.

34A SURVIVAL EQUIPMENT

SAVE 20% - 50% on quality self-reliance products, emergency supplies and survival foods. Write: Provision Discount, 289 Central Ave, Coos Bay, Oregon 97420.

35 AQUARIUM SUPPLIES

LIVE SEA HORSES \$398

Kit includes 4 adults & up to 30 ponies from pregnant male, marine salt, food, live plant, live snail & instructions. Above kit with Custom Aquarium, sea horse tree, seashells, coral, silica sand + 2 ghost shrimp \$7.95. **Large Deluxe Aquarium** with all custom kit accessories & 10 adult sea horses (2 preg. males-up to 60 sea horses) \$12.95. *Kits sent ppd. Live delivery guaranteed. via air mail.* Sea Horses Inc. Dept. PS 31, Box 1477, Coral Gables, FL 33134

39 EARTHWORMS, CRICKETS, FROGS

FREE Literature. Raise Fishworms, Crickets, Red wigglers — 1000 — \$6.95, 5000 — \$32.50. Postpaid with free book on How and Where to Sell. Carter Farm — 12, Plains, GA 31780.

40 HUNTING & FISHING INFORMATION

QUAIL AND EQUIPMENT CATALOG. Also booklet "How To Produce And Sell Quail Year Around." Send 25c. GQF Manufacturing, P. O. Box 1552-K, Savannah, GA 31402.

41 TAXIDERMMY

EXOTIC Butterflies, Beetles. 64 Page Catalog. \$1.00. Complete Scientific, POB 307, Round Lake, Illinois 60073.

42 FIELD GLASSES, TELESCOPES

FREE Catalogue! Thousands War surplus optical bargains. Lenses, Prisms, Telescopes, Binoculars, etc. Jaegers, 691G Merrick Road, Lynbrook, NY 11563.

43 GOV'T. SURPLUS

JEeps \$52.40, Airplanes \$75.01, Boats \$7.50, direct from government. Directory and Surplus Catalog \$2.00. Midwest Surplus, Box 401-PS, Dayton, Ohio 45401.

JEeps - \$18.88. 675,000 Items! Buy In Your Area! How! Where! "Moneyback GUARANTEED 1981 Government SURPLUS Directory" including: "Buy G-LANDS" - "G-Oil/G-Gas LOTTERIES," \$2.00. GSURPLUS, Box 2009-C, Syracuse, NY 13220.

MX, Military Exchange. Countless ads monthly. Buy and sell everything military. \$6.00 for year's subscription. MX, P.O. Box 3, Dept. PS, Torrington, CT 06790.

SURPLUS JEeps - \$19.30! - CARS - \$13.50! - 650,000 ITEMS! - GOVERNMENT SURPLUS - MOST COMPREHENSIVE DIRECTORY AVAILABLE TELLS HOW, WHERE TO BUY - YOUR AREA - \$2 - MONEYBACK GUARANTEE - "GOVERNMENT INFORMATION SERVICES," DEPARTMENT A-3, BOX 99249, SAN FRANCISCO, CALIFORNIA 94109.

"GOVERNMENT SURPLUS Directory." Buy 500,000 items (including Jeeps) ... low as 2c on dollar ... direct from Government! \$2.00 (guaranteed). DISPOSAL, Box 19107-FC, WASHINGTON, DC 20036.

1981 SURPLUS Army, Navy store 64 page illustrated catalog. Send \$1.00. Ruvel, 3037 North Clark, Dept. M3, Chicago, IL 60657.

45 BODY-BUILDING, SELF-DEFENSE COURSE

SELF-Defense device, electronic. Build for \$5.00. Send for plans to: P.O. Box 6022, Akron, OH 44312.

BUILD Massive Muscles! Free booklet! Mus-L-Up, Box 982H, Redondo Beach, CA 90277.

46 PROFITABLE OCCUPATIONS

SURPRISE Everybody. Become Notary Public now. We guide you, free. We sell notary needs. Raise your image, job value, income. Assistance nationwide. Brochure: Gulf, 234 Club-B, San Antonio, TX 78201.

FREE Catalog. Repair Air Conditioning, refrigeration. Tools, supplies, full instructions. Doolin, 2016 Canton, Dallas, TX 75201.

MECHANICALLY INCLINED INDIVIDUALS

Assemble electronic devices in your home. Knowledge or experience not necessary. Get started in spare time. Above average profits. \$300-\$600/wk. possible. Sales handled by others. No investment - Write for free details.

ELECTRONIC DEVELOPMENT LAB
Box 1560G, Pinellas Park, FL 33565

47 BOOKS & MAGAZINES

BOOK SALE! You too can cut your electric bill 50%. ONLY \$2.00 POST-PAID Worth much more in savings! Free catalog! Cargen-S, 1829 Euterpe, New Orleans, LA 70113. Call toll free: 800-327-9009 Ext. 134, 24 hrs, 7 days.

HORSE RACING RACETRACK LIES. How to win funds and influence horse races. A frank and funny paperback, \$5.00. B & W Services, 4913 Ross Rd, Baltimore, Maryland 21214.

INDEX for 1980 POPULAR SCIENCE magazines ready now: \$1.75. Or get all 9 available Indexes—1972 to 1980—for \$9.00 (\$1.75 each for less than full set). Send check to POPULAR SCIENCE INDEX, 380 Madison Ave., New York, NY 10017. Allow 4 weeks for delivery.

"A BETTER FUTURE WORLD: IMAGINING IT, PLANNING IT, CREATING IT" by Edward Cornish, a booklet describing the new field of futurism. Plus 56-Page catalog of books, tapes, etc. Send \$2 to: World Future Society, Dept. 310, 4916 St. Elmo Ave., Washington, DC 20014.

HOW TO SUCCEED IN YOUR BUSINESS AND PERSONAL LIFE BY

True Success and True Happiness can only come when you learn our GOD GIVEN technique for achieving SUCCESS. Our Success MANUAL and CASSETTE TAPE is the best way to get started. Send only \$10.00 Cash, Check or Money Order. 100% Guarantee or Money Back. Send To: B & B SUCCESS MANUALS, PA-3A, 2 Dunlap Ave., Pennsville, NJ 08070

48 TOYS & GAMES

EXCITING NEW Game of Mermaids - Shellmate. Instructions plus exquisite seashells. Money back guarantee. Send \$4.95. Art-Facts, 50S, Los Robles #197, Pasadena, California 91101.

49 JOKES & NOVELTIES

FREE—World's Leading Novelty Catalog. 1600 Jokes, Tricks, Science, Sports, Hobbies, Johnson-Smith, C-11, Mt. Clemens, MI 48043.

50 MAGIC TRICKS, PUZZLES, ETC.

FREE! \$2.00 Trick, huge catalog, both \$1.00. Abracadabra-SP, Scotch Plains, New Jersey 07076.

51 COINS & CURRENCY

FREE BHUTAN COIN. Buy Or Return Foreign Approvals. Cointree, Box 277, Newtonville, MA 02160.

52 STAMP COLLECTING

50 DIFFERENT Old U.S. between 1861 and 1939 \$1.00. Ed Roush, 423 Shepard, Mansfield, OH 44907.

UNITED NATIONS 3 Complete Mint Sets 25c, Approvals. Cornetta, POB 1509-P, Lake Placid, FL 33852.

FREE — 220 United States and Worldwide Stamps, Approvals. Stamps Pops, Box 1427, Bellflower, CA 90706.

200 DIFFERENT U.S. Used Stamps \$1.00; 500 Different \$5.00; 750 Different \$11.00. Burke's Stamps, Box 219-P, Glenshaw, PA 15116.

50 YEARS Old, fifteen different United States, over fifty years old 25c with approvals. Jaxon, Box C11, New Rochelle, NY 10804.

FREE Worldwide packet. Penny approvals. Froelich, Box 412-B, Morton Grove, IL 60053.

OLD U.S. Stamps on approval. Chester, Box 15355, Philadelphia, PA 19111.

FREE, U.S. Mint Set. Approvals. Hildebrand, Box 4867, Santa Clara, CA 95054.

PENNY Approvals! Regardless Catalogue! Kloster, 4164—52nd Street, San Diego, CA 92105.

FREE Surprise collection sent with approvals. Jay, 1784 Union, San Francisco 94123.

WORLDWIDE COLLECTION - 100 different stamps - only 10c with fantastic worldwide approvals. Nazlo, Box 423-OE, Audubon, PA 19407.

OLD U.S. "Unfine" used medium and higher values, bargain priced. For mature adults seeking a worthwhile and different approval service. (No mint). Rivertown, Dept. 152SB, Ada, Michigan 49301.

2,000,000 STAMPS - 150 countries 2c each. Belden, Box 4149, Dearborn, 48126.

FIFTY Free Stamps With Approvals. J&D Stamps, Box 747, Melbourne Beach, FL 32951.

U.S. 6 commemorative plate blocks \$1.00! Approvals. Gordon Davison, Key Largo, Fla. 33037.

SEND only 10c for nice collection of U.S. Stamps including \$5.00 issue and scarce mint Sipex Souvenir Sheet. Attractive price lists of other beautiful stamps and collectors supplies included. Mystic Stamps, SS-2, Camden, NY 13316.

WOW! 110 All Different Germany 10c. Commemoratives, Airmails, High Values, Big Catalog, bargain lists. Also, fine stamps from our approval service, buy any or none, return promptly, please. Jamestown Stamp, Dept. A 31PS, Jamestown, NY 14701.

MICKEY MOUSE (Apollo Moon Landing Anniversary), Minnie Mouse, Donald Duck, Goofy (Hippopotamus), Anguilla Triangle. Only 10c when requesting approvals. State age. Douglas Cook, Dept. PS-10, Las Vegas, Nevada 89119.

FREE! Big Bargain Catalog — New Edition listing thousands of bargains including U.S. & B.N.A. stamps, packets, albums, accessories and supplies. Also, fine stamps from our approval service, buy any or none, return promptly, please. Jamestown Stamp, Dept. E31PS, Jamestown, NY 14701.

54 RADIO, TELEVISION

36c TUBES. Radio & TV! Free Color Catalog. Cornell, 4217S University, San Diego, CA 92105.

POLICE Scanners, Crystals, Radar Detectors. HPR, Box 19224, Denver, CO 80219.

RECEIVE FREE Uninterrupted movies, sports with your own **AMATEUR MICROWAVE SUBSCRIPTION TV ANTENNA.** Build yourself, Guaranteed \$9.95. Phillips-Tech Electronics, Dept. SP-2, 5025 North 68th Street, Scottsdale, AZ 85253.

CABLE TV DESCRAMBLERS AND CONVERTERS. MICROWAVE ANTENNAS AND DOWNCONVERTERS. Plans and Parts. Build or buy. For information send \$2.00. C&D Company, P.O. Box 21, Jenison, MI 49428.

RECEIVE SUBSCRIPTION OR CABLE TV on the 2000MHz to 2500MHz band, with our fully guaranteed, complete, detailed MDS antenna plans. Send \$9.95 to: AMA, Dept. SS-10, 45 Madrid Plaza, Mesa, AZ 85201.

FREE Educational Electronics Catalog. Edukits Workshop, Department 808-A, Hewlett, NY 11557.

BUILD YOUR OWN TV CAMERA! "Ideal for home & business"

Whether for FUN or PROFIT, we challenge you to the exciting field of TV telecasting. Complete kit only \$185.00. Solid-state. Also available assembled. Connects to any TV set. Reviewed in this magazine, August, '73 issue.

PHONE OR WRITE FOR FREE ILLUSTRATED CATALOG OF KITS ... DIAL 402-987-3771 (today)

ATV Research
1305 BROADWAY ST. N., DAKOTA CITY, NEBR. 68731

54A CB RADIO

INCREASE CB RANGE — Legally! Free Information. "SKIPPER", Box 130-C2, Paradise, CA 95969.

55 ELECTRONICS, STEREO, HI-FI

LINEARS - Send Stamp For Details - Matco Electronics - Box 316D - Cadillac, MI 49601.

39⁹⁵ 30 CHANNEL CABLE TV CONVERTER

ADD \$2.50 FOR POSTAGE

ORDER No. 175AE047

FREE! UNUSUAL 96 PAGE ELECTRONIC PARTS & IDEAS CATALOG!

ETICO ROUTE 9N PLATTSBURGH, N.Y. 12901 Tel.: (518) 561-8700.

BUILD AN ORCHESTRA THE WERSI WAY

Preview the world's most advanced Do-It-Yourself Organs, Pianos, Synthesizers, Amps, etc. Send \$6.00 for our famous "Sight & Sound" pack. WERSI Electronics, Inc., Dept. M3, P.O. Box 5318, 1720 Hempstead Rd., Lancaster, PA 17601.

55A COMPUTER

COMPUTER systems & supplies for business and home. Datagroup Inc., P.O. Box 13309, Greensboro, NC 27405.

DISCOUNT TRS-80[®] DEALER A301
COMPUTER SPECIALISTS

FREE COMPUTER CATALOG UPON REQUEST

\$ Discount \$ on TRS-80's

26-3001 4K Color.....\$360.00
26-1062 16K III888.00
26-4002 64K I DRIVE...3440.00

1-800-841-0860 TOLL FREE
MICRO MANAGEMENT SYSTEMS, INC.
Downtown Plaza Shopping Center
115 C. Second Av., S.W.
Cairo, Georgia 31728
(912) 377-7120 Co. Phone No.

56 RECORDS, TAPES, etc.

OLD Radio Programs On Cassettes. Free Catalog. Nostalgic, Box 16365-P, St. Louis, MO 63125.

RECORDS - TAPES! Discounts to 73%; all labels; no purchase obligations; newsletter; discount dividend certificates; 100% guarantees. Free details. Discount Music Club, 650 Main Street, Dept. 4-0381, New Rochelle, NY 10801.

57 MUSICAL INSTRUMENTS

DULCIMERS Kits From \$29.00. Brochure. Here Inc., 29 Southeast Main, #S, Minneapolis, MN 55414.

MUSICAL SAWS - Since 1921. Details, FREE "Sawing News". **MUSSEHL-WESTPHAL**, 130 PS, Delavan, Wisconsin 53115.

INTERNATIONAL Catalog valuable to makers, repairers of stringed instruments. Imported woods, parts, accessories, kits. Fine German-made violins, violas, cellos, basses and bows. Send 25c for catalog. 10% Credit certificate will be enclosed. International Violin Company, Ltd., Dept. MS, 4026 W. Belvedere Ave., Baltimore, MD 21215.

SAVE ON ACCORDIONS

40 Models! Famous Makes! SAVE! Direct from Importer. Models for students, teachers, professionals. Standard or Electronic. Terms. Trades welcome. Home Trial. Hohner Button models too. FREE catalog and Importer prices.

ACCORDION CORPORATION
5535 (PX) Belmont Avenue, Chicago, Ill. 60641

58 SONG WRITERS

POEMS - SONGS WANTED. Free Publishing/Promotions. Broadway Music, Box 7438-PS, Sarasota, FL 33578.

POEMS set to music, Nashville Music Productions, Box 40001-PS, Nashville, TN 37204.

59 IMPORT-EXPORT

2500 "Fast" Sellers. Free Brochures! Brightco, Box 91309-X3, Cleveland, OH 44101

60 BUSINESS OPPORTUNITIES

SYNTHETIC OIL DEALERS Needed. Exciting Products & Opportunities. Make More Spare Time Than in Present Business or Job. Call: 800-835-3342.

REPAIR HYDRAULIC JACKS—Free details. Hydraulic Parts Supply, Dept. S, Box 4157, Brownsville, TX 78520.

\$92.00 FROM Square Foot Plywood (Huge Demand). Revealing Proof 25c (Refundable). Woodwins, Bridgewater, MA 02324.

BELTS And Buckles. Complete Line Fast Sellers, including Westerns, Trucks, Motorcycles, Wildlife, etc. Big Profits. Complete dealer set up. Free Catalog. Anchor, Box 3958-BPS, North Providence, RI 02911.

PIANO Tuning quickly learned with home study course. Diploma granted. American Tuning School, 17050 Telfer Drive, Morgan Hill, CA 95037.

MECHANICALLY inclined individuals desiring High Weekly Profits operating Small Manufacturing business Without Investment write: Businesses, 92-P Brighton 11th, Brooklyn, NY 11235.

NEW Tax Loopholes Discovered. Everyone eligible. Free Sample Newsletter. Write: ULC, Box 179-00, Clarkston, GA 30021.

BUMPERSTICKER Printer. Easy. Fun. Details. POB 22791 (LLC), Tampa, FL 33622.

MAKE MONEY PRINTING business cards, pencils, matches in Gold. Easy. Details: POB 24986 (LLC), Tampa, FL 33623.

GET RICH!! Secret law smashes debts —brings cash and credit! Details FREE!! WealthKit-S, Billings, NY 12510.

HUNDREDS WEEKLY POSSIBLE MAILING PROGRAM. Nationwide, Box 58806, Dallas, TX 75258.

WIN at Dice! 582 to 1 odds your favor! Free Proof. Baker, Box 196B, Brooklyn, NY 11218.

P.O. BOX SHORTAGE CRITICAL! Private mailbox rentals booming. New 25,000 word manual shows how we gross \$60,000 per year. Free information. MailCenter #4, 16783 Beach Blvd., Huntington Beach, CA 92647.

VENDING Machine. No selling. Routes earn amazing profits. Big Catalogue Free. Parkway Corporation, 1930PSB Greenspring Drive, Timonium, Maryland 21093.

FREE Inflation-Beater Book "2042 Unique, Proven Enterprises." Fabulous "Little Knowns." Work Home! Haylings-E, Carlsbad, CA 92008.

FREE Mailorder Dropship Business Journal! Mailer's World, Box 1355-P, Sioux Falls, SD 57101.

PIANO Tuning learned quickly at home! Free information. Empire School, Box 1014, Jupiter, Florida 33458.

LEARN Sewing Machine Repairing. Men, Women, Lucrative profits. Gresslin Correspondence School, Box 927, Spencer, IA 51301.

SOLAR DEALERSHIP Opportunity. Write for Details. Sunpower, 6612 W. 47th, Sioux Falls, SD 57106.

VINYL'S Where the money is! Professionally repair, refinish, recolor furniture, luggage, car tops. Quick, easy. Two small \$20 jobs a day earn you \$1,000 a month. Homes, cars, offices, restaurants, unlimited customers. Start earning after a few days practice. Sensational details Free, VIP, 2036 Montrose, Chicago 60618.

LEARN TO REFINER YOUR GOLD • SILVER • PLATINUM
STEP By Step Home Method. Also Testing Precious Metals For Value \$14.50. The Silver Palace Precious Metal Refinery, 8064 Melrose Ave., Los Angeles, CA 90046.

START A Correspondence School. Careers, Box 2046E, Covina, CA 91722.

MINI-BUSINESS REPORT, Financial Independence At Home. Free Information S.A.S.E. Mini-Business Publications, Box B, New Waterford, OH 44445.

SALES REPS for Canadian Automobile Invention. No gimmick! Tremendous program. Complete manual \$5.00. Revised Holdings, R.R. #2, Balzac, Alberta, Canada, TOM 0E0.

ABANDONED INDUSTRIAL SILVER—take it! Details: Silver, Box 548, Woodville, TX 75979.

MAKE \$2,000.00 Monthly Spare Time. Unique proven enterprise. No selling. No capital to start. Free brochure. Kashbuilder, Box 1132-PK, Indianapolis, IN 46225.

MAKE Durable Building Plastic Easily. Waterproof, Fireproof, Economical. Bays Laboratory, 2086—2075 Drive, Cedar-edge, CO 81413.

MAILORDER Opportunity! Start profitable home business without experience or capital. Write for free book, plus details. Mail Order Associates, Dept. 771, Montvale, NJ 07645.

PREPARE Tax Returns - Housewife Jo Ann Netzler made \$5,500 last season. VA approved. National Tax Training School, Monsey, 1CN, New York 10952.

UNSURPASSED OPPORTUNITY! Former Shaklee President heads new organization. Free information. Enhance, Box 552-P, Fort Payne, Alabama 35967.

MAILORDER dealers needed. Gain terrific profits by tested programs. Executive type business. JAL, Box 7021-P, Los Angeles, CA 90022.

FREE report: How to sell information profitably. Make \$20,000, \$70,000. JAL, Box 7021-U, Los Angeles, CA 90022.

MAKE Over \$22.50 an hour. Spare time at home! Rubber Stamp industry needs small manufacturers. We furnish all equipment and know-how! Particulars free! Write: Roberts, Room RC-3-KC, 1512 Jarvis, Chicago, IL 60626.

"SHROUD of Turin" secret revealed! Capture portrait image of anyone, instantly! JADCO, Box 383, San Pedro, CA 90731.

OPERATE VIDEO GAMES for profit! Empty quarters from Asteroids, Space Invaders... **BIG CASH BUSINESS.** Booklet tells how - \$10.00. HSM-PA, 307 Ramon Drive, Los Altos, CA 94022.

MAKE Rubber Stamps for profit. Inexpensive machine. Very easy. Free Details. POB 22809 (LLC), Tampa, FL 33622.

SCREEN Print T-Shirts, other items. Inexpensive, professional kits. Free Details. "T-Printer", POB 23991(LLC), Tampa, FL 33623.

PLASTERCRAFT — Profitable Home Business. Over 1,000 molds available. Details: Lynnette, 6251R Mentor Park, Mentor, OH 44060.

SPROFITS From Exercise Program, Lose Weight, Earn Money, Expenses Tax Deductible. Personal of Business Opportunity. All ages, Male or Female. Complete Information Packet. Send \$10.00, Ron, Box 1256, Maitland, Florida 32751.

TAKE Catalog Orders. We dropship 2500 Best-selling specialty products. Lowest below-wholesale prices. Immediate delivery. Spectacular home business opportunity. Free Book. SMC, 6061 De Soto Ave., Dept. 28-03, Woodland Hills, CA 91365.

MONEY SECRETS
HELP people and businesses get money. Easy home business. Fantastic profits. No experience - own hours. Continuous assistance. Free Details: DFC, Dept. 11-G-3, 1145 Reservoir Avenue, Cranston, Rhode Island 02920.

NAME your own income. No selling. Work home. Guaranteed. Profits Daily. Grow big fast. New book reveals secrets, tells how. Free Details. Browne, Box 1645, So. Miami, FL 33143.

GOVERNMENT-TESTED OIL TREATMENT — Incredible Gasoline savings! Free **PERMALUBE™** Dealership. Almqvist, Dept. PS3E, Millford, PA 18337.

PLASTERCRAFT! Moneymaking home business. Details. Mailway, 24949-EF3, Nashville, TN 37202.

SELL SENSATIONAL LOW-COST BURGLAR ALARM. Lightning seller. Exceptional margin. Samples for trial. Northwest Electric, Ave. 163, Mitchell, SD 57301.

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. C2693, Woodland Hills, CA 91367.

I HAVE MADE A FORTUNE IN MAIL-ORDER, selling information! Let me show you how. **FREE** proof. Mailorder Information Services, 2385 Roscomare, D-11/153, Los Angeles, California 90024.

PERSONALIZED POSTERS, photos all sizes! Earn Money from Home! Free samples, including "Profits in Pictures". Postermatic 02-A3, East Providence, RI 02914.

PROJECTION TV... Make \$200.00 + per evening assembling Projectors... Easy... Results equal to \$2,500 projectors... Your total cost less than \$15.00... **PLANS, LENS & Dealer's** information \$14.00... Illustrated information **FREE**... Macrocomagx, Washington Crossing, Pennsylvania 18977.

BUMPER STICKER PRINTING DEVICE

FUN, INEXPENSIVE, PORTABLE, EASY-NO TRAINING NEEDED. ANY MESSAGE IN MINUTES. Get FREE DETAILS. P. O. BOX 22791 (LL), TAMPA, FLA. 33622.

BIG PROFITS ELECTRONIC ASSEMBLY BUSINESS
Start home, spare time. Investment, knowledge or experience unnecessary. **BIG DEMAND** assembling electronic devices. Sales handled by professionals. Unusual business opportunity.
FREE: Complete illustrated literature
BARTA, Box 248-SP
Walnut Creek, Calif. 94597

be a TAX CONSULTANT

Income unlimited in full or part time home business preparing tax returns in busy tax season, plus year-round monthly fees to \$50 from business tax service. No bookkeeping experience needed. We train you at home, help you start. Accredited Member NHSC. Free literature. No salesman will call. Vet Approved. National Tax Training School, Monsey, 1CN, N.Y. 10952

PROVEN SUCCESS

For over 50 years Americans have been buying - millions of pairs - of **KNAPP Cushioned Comfort shoes**. That makes selling them an ideal way to supplement your income part time; or enjoy the many rewards selling full time. Set your own hours. Be your own boss. Knapp offers high commissions on every sale, bonuses plus incentives. No investment. No experience necessary. Free training and selling kit to qualified applicants. Invest in yourself. Explore your future with America's #1 direct selling shoe company. Write: Scott McCutcheon, Knapp Shoes, 5077 Knapp Centre, Brockton, MA 02401 Tel. (617) 588-9000.

Made in America
KNAPP
America works in Knapp shoes.

61 MONEYMAKING OPPORTUNITIES

\$56.40 DAILY Starting next week. Details send 15c poststamp: Sbiatox, Box 4099, North Hollywood, CA 91607.

THOUSANDS in mailorder home operated. Free details. J/M Enterprises, Box 272-PS7, Pickerington, OH 43147.

EARN money collecting names! Write: Day, 104-P Third, Salem, MO 65560.

LEARN The Secrets of Repairing Junk Batteries. "Fabulous Profits", small investment. Apex Engineering, 5454 Bolsa Road, Atascadero, CA 93422.

GET RICH!! Secret law smashes debts - - - brings Cash, credit! **FREE** report!! WealthKit-S, Billings, NY 12510.

NEED MORE MONEY? Examine over 1,000 ways to earn it full time, spare time, part time on weekends! Get 5 issues of Opportunity Magazine Free! Write: Opportunity, Dept. 604, 6 N. Michigan, Chicago 60602.

500 JOB-Opportunity Books etc. Catalog \$1.00. Rujon, Box 451-PS, Palatka, FL 32077.

MAKE \$25.00 An Hour! No experience needed - spare time at home becoming supplier to major industry through electroplating small parts and metalizing non-metals. We furnish all equipment and know-how! Write for free particulars: Malloy, Dept. MC-3-KC, 1512 Jarvis, Chicago, IL 60626.

NEW Discovery in Battery Reconditioning. Eighteen Months Guarantee Means "Big Profits Fast." Electroan, 7415 Gable Drive, Little Rock, AR 72205.

GAMBLERS! Experts show how to rake in big bucks! Send \$3.00 to: R.L.T. III, P.O. Box 5690, Beaumont, TX 77702.

\$500.00 Weekly mailing books for corporations from home! (Guaranteed Program!!) — Tribune PS-3c, Box 18553, Wichita, KS 67218.

\$10.00 PER hour. Learn skill at home in week. Complete Instructions \$2.00. Guaranteed Satisfaction, or refund. J. Clifford, 1920 McNicoll, Vancouver, B.C. V6J 1A6.

1500 % SELLING Information by Mail. No experience, show you how. Reprint Rights. Eldee, Box P1831, Cornwall, Ont. Can. K6H 6N6.

MAKE TOP MONEY IN STAINED GLASS. Our self-study program teaches you at home. Includes illustrated lessons - plus free with program all professional tools, many interesting projects, and more. For information send \$1.00 to: REGINA CAREERS, LTD., 33 E. MAIN STREET, DEPT. PSG31, ROUND LAKE PARK, IL 60073.

DEBTS WIPED OUT with secret Federal Law!! Fortune-building **FREE REPORT!!** Blueprints, S3, LaGrangeville, NY 12540.

WIN BIG OIL MONEY
Plus Tax Benefits
The U.S. Government sponsors a little-known oil and gas lease drawing. If you are a U.S. citizen, you can compete for a fortune in oil. A \$30 (tax deductible) filing fee could bring you \$100,000 immediately, plus possible payments. For free information Call Toll-Free 1-800-525-2541, Ext. 8, in Colorado Call Collect 1-447-1399, Ext. 8, Or Write...
F. Milligan, Inc.
1942 20th St., Drawer 3408PS
Boulder, CO. 80307

62 EMPLOYMENT INFORMATION

AUSTRALIA - New Zealand! Big pay! 50,000 jobs. Free transportation. Listings \$2.00. Information 68 countries. Austco, Box 772, Cypress, CA 90630.

ROCKY MOUNTAIN EMPLOYMENT NEWSLETTER!! Colorado, Idaho, Montana, Wyoming!! Current openings - all occupations!! **FREE** details: Intermountain-C, 3506 Birch, Cheyenne, WY 82001.

JOBS OVERSEAS (including Alaska). Free Details. Global Employment, Box 808-PS, National City, CA 92050.

GOING ON A JOB INTERVIEW? — Don't Blow It! Successful Interview Techniques \$3.00 - Guaranteed. Free-form Press, 73 Cuttermill Rd., Great Neck, New York 11021.

"AUSTRALIA 1981" offers excellent employment, climate, lifestyle. Australian Author's detailed analysis including best locations, relocation advisement, \$3.00. Australian Services, Box 3311 "A" Villa La Jolla, La Jolla, CA 92038.

AUSTRALIAN EMPLOYMENT OPPORTUNITIES. Actual classified airmailed. State Trade/Profession. Send \$7.00. Kelget Enterprises, G.P.O. Box 76, Sydney, N.S.W. 2001 Australia.

\$21,000.00 TO \$40,000.00 as Tractor Tractor Operators Men and Women are needed. Free info on learning. PDH INC., 5030 Paradise Rd., Suite B107PS, Las Vegas, NV 89119. **INEXPERIENCED ONLY**

OVERSEAS... \$20,000 - \$60,000 +. Free Report! Employment, Box 29217-FC, Indianapolis, IN 46229.

62A HELP WANTED

\$180 Per Week Part Time at Home. Webster, America's foremost dictionary company needs home workers to update local mailing lists. All ages, experience unnecessary. Call 1-716-845-5670 Ext. CN.

63 SPECIAL SERVICES

INFORMATION On Anything. Ferguson Research Specialists, 60-15 Woodside Avenue, Woodside, NY 11377.

ZIP CODE BLUES? Computerize your mailing list. Free details. QCS-A, Box 151, Nashua, NH 03061.

66 AGENTS WANTED

FREE SHOES!
RETAIL VALUE OVER \$45
I'll show you how you can earn free shoes or boots for yourself PLUS up to \$300 a month in extra income. Show friends and neighbors how they can save \$15 to \$20 a pair on high quality shoes or boots. Selling kit free. Write: Gordon King, Hanover Shoe, Inc. Dept. 2786, Hanover, Pa. 17331

67 SALESPERSONS—DISTRIBUTORS WANTED

TEXAS REFINERY CORP. offers PLENTY OF MONEY plus cash bonuses, fringe benefits to mature individual in your area. Regardless of experience, write W. E. Sears, Pres., Texas Refinery Corp., Box 711, Fort Worth, Texas 76101.

INDEPENDENCE, FUTURE, SECOND INCOME. Write for details. Three Star Quality Marketing, Box 279, Coquille, Oregon 97423.

FREE Sample! Full size Dyn-O-Brite! Amazing all-purpose polish! Startling 3-second demonstration. Instantly cleans, polishes, protects cruddiest metal, tile, porcelain. \$2.98 retailer pays 320% profit! Carded for stores. Exclusive territory. Send 25c sample postage. RBS, Dept. 6531, 1312 Washington, Saint Louis, MO 63103.

FREE Sample! Super Shriek Alarm! Piercing "screech" scares away attackers, rapists, muggers. 1-second demonstration! \$3.49 retail — 329% profit. Exclusive territory. Enclose 25c for sample postage. Barry, Dept. 6431, 1312 Washington, Saint Louis, MO 63103.

69A LOTTERIES

WIN Instant Millions in Canadian Government Lotteries. Free Details. Winfall, Dept. P, Box 554, Town of Mount Royal, Quebec, Canada, H3P 3C7.

72 EDUCATION & INSTRUCTION

MEMORY, Sleep Learning, Free Publication. DLP, Box 487, Anaheim, CA 92805.

ELECTRONICS Degree (BSET) by correspondence. Grantham College, 2500 La Cienega, Los Angeles, CA 90034.

LEARN WHILE ASLEEP! Astonishing New Method! Strange Catalog Free! Autosuggestion, Box 24-A, Olympia, WA 98507.

FREE! "NEW CAREER OPPORTUNITIES IN JET/GAS TURBINE POWER!" Plus Home-study course outlines for mechanically inclined — American Jet School, Dept. PS-2, Darby, Montana 59829.

ACHIEVE success through easily learned practical approaches to business, people and self-related subjects. Information s.a.s.e. Business Insight, 902 Eastmont, Centralia, MO 65240.

COMPUTER TECHNOLOGY. Complete list of schools which will train you in this high paying profession. Send \$2. Educational Consultants, Box 128, Burtonsville, Maryland 20730.

DIGITAL TECHNOLOGY training. Free description. Innovative Home Study, Box 1046 S, Indian Rocks Beach, FL 33535.

COLLEGE Degrees for Life, Work Experience. Write: AIU, 386 North 2nd, Phoenix, Arizona 85003.

FCC LICENSE, 1st & 2nd Class. Electronics Career courses by mail. G.I. Bill. **FREE** School Catalog and Information. School rep will try to call. Write Cleveland Institute of Electronics, Inc. (CIE), Dept. WPS-69, 1776 East 17th Street, Cleveland, OH 44114.

HIGH SCHOOL DIPLOMA AT HOME FAST! Diploma in just 1-6 months! Tests taken at home. Low tuition/Only \$49 down. Nationally recognized. Individual counseling. Free school ring. Call Free 1-800-327-8103. Cambridge Academy, PS-3, 409 E. Osceola, Stuart, FL 33494.

DRAFTING is a great career! Men, women. No previous experience or special talent needed. We train you at home in spare time. Get free facts. Write: North American School of Drafting, Dept. PCCCO, 4500 Campus, Newport Beach, CA 92660.

EARN Extension Degrees in Homeopathy, Radionics, Botanic Medicine, Naturopathy, Philosophy, Psychology, etc. School Founded 1961, Prospectus \$1.00. Airmailed. Secretary PA/PS, Brantridge Forest School, Highfield, Danehill, Sussex, England RH17 7EX.

DEGREES, Thesis Method. Brochure, \$1. North, Box 3388, Tulsa, OK 74101.

MEDICAL ELECTRONICS TECHNOLOGY. Home study. Troubleshoot Medical Instruments. MDC-PS, P.O. Box 124, Pinedale, CA 93650.

FREE Lifetime Ordination. Become Chaplain, Missionary Evangelist, Bishop. Box 744-PS, McKeesport, PA 15134.

REISCH WORLD WIDE COLLEGE OF AUCTIONEERING, INC., World's Largest. Free Catalog. Approved for VA. Modern Auction Library "FREE" with enrollment. 515-423-5242, Col. Gordon E. Taylor, P.O. Box 949, Dept 3, Mason City, IA 50401.

LEARN Dowsing, Radionics, Radiesthesia and E.S.P. Subjects. Free Illustrated Catalog. Courses and Equipment. (Airmailed \$2.00.) Established 30 Years: Bruce Copen, Highfield, Danehill, Sussex, England RH17 7EX.

BRITISH DEGREES. Obtain yours now from London. Bachelors, Masters, Doctorates. Most subjects. Free Prospectus. (Airmail \$1 refundable). College Registrar, Dept. 1032, BCM-Collegiate, London WC1V 6XX, England.

CLOCK AND WATCH REPAIR books. Free catalog. North American, Box 77BCA, Fox River Grove, Illinois 60021.

UNIVERSITY DEGREES! No Classes. Fast, Economical. Accredited. FREE Revealing Details. Success, Box 13151-S3, Columbus, OH 43213

UNIVERSITY DEGREES BY MAIL! Bachelors, Masters, PH.D.s . . . Free revealing details. Counseling, Box 389-PS3, Tustin, CA 92680.

BARTENDING - Cocktail Waitress Home Study. Includes powerful Career-Motivation. Free details. Professional Schools - Box 7296 - B., Kansas City, MO 64113.

TECHNICIAN? ENGINEER?

Ambitious? Want to become Top-Notch? A TROUBLE-SHOOTING & PROBLEM-SOLVING ACE? A costly industrial seminar is now available in manual form for only \$15. Written by an expert for experts, it contains the most effective insights to top technical performance. Order "THE MASTERMIND" from the author at full-refund, one year trial, guarantee.

ALEX BOTTAI

4020/10 Brandongate, Malton Ontario, Canada L4T 3W8

INSTANT MEMORY

The new way to remember

A short, simple method of acquiring a powerful memory. No memorization, no keywords. Release your photographic memory. Learn "how" you remember, "why" you forget. Discover your natural ability to recall everything. Send for free information to:

INSTITUTE of ADVANCED THINKING
845PS ViaLaPaz, Pacific Palisades, CA 90272

73 CARTOONING, SIGN PAINTING

CARTOON for Fun and Money!!! Free booklet!! Cartoons, Box 40614B, Detroit, Michigan 48240.

LEARN Sign Painting—Free Catalogue. Kaufmann Supply, Centertown, MO 65023.

76 DETECTIVES

FINGERPRINTING - exciting scientific career. Home study course teaches everything. Certificate on completion. Many openings; prepare now. Professional Investigators Training School, Dept. FP, P.O. Box 1890, San Pedro, CA 90733.

DETECTIVE Profession, easy home study: free tie-tack or lapel pin, certificate, future. Professional Investigators Training School, Dept. CB, P.O. Box 1890, San Pedro, CA 90733.

77 LOANS BY MAIL

IMMEDIATE Loans and Outright Grants to individuals refused elsewhere. 98 % Accepted! Associates, Box 98-P3, Brooklyn, NY 11235.

BORROW \$25,000 "overnight." Any purpose. Keep indefinitely! Free Report! Success Research, Box 29070-FC, Indianapolis, Indiana 46229.

QUICK \$Cash\$ Signature Loans! Write: Elite, Box 454-PS, Lynbrook, New York 11563.

BORROW \$30,000 without interest! Repay anytime. Free details. Infohouse, Box 1004-PS3, New York, NY 10003.

BORROW FROM HOME

ANY amount, any worthwhile purpose, within 30 days. Competitive Rates. Also, you can earn substantial income as a Money Agent. No experience - own hours. National Company to assist every way possible. No Gimmicks! Free Details: DFC, Dept. 11-C-3, 1145 Reservoir Avenue, Cranston, Rhode Island 02920.

BORROW By Mail! Free Details! MBG-PS481, Box 2298, Sandusky, OH 44870.

78 WINEMAKING

WINEMAKERS—BEERMAKERS Free Catalog. Fast Service. Large Selection. Kraus, Box 7850-N, Independence, MO 64053.

WINEMAKERS — BEERMAKERS — GASOHOL. Free Catalog. Equipment Supplies. Continental, Box 68016-PS, Indianapolis, IN 46268.

BREW finest beer from quality ingredients. Free catalogue. Bacchanalia, Box 51PS, Central Village, MA 02790.

BEST kits. Fastest supplies. Free catalogue. **BRICKSTOREBREW**, Strafford, Vermont 05072.

FREE ENCYCLOPEDIA WINEMAKING BEERMAKING, supplies, equipment, ingredients. Vynox Industries, Box S7498, Rochester, NY 14615.

WINEMAKERS - Beermakers: Free Illustrated catalog of supplies. Semplex, P.O. Box 12276H, Minneapolis, MN 55412.

WINEMAKERS - BEERMAKERS — Fresh Stocks. Fast Service. Free Catalog. O'Brien's, Box 284A, Wayne, IL 60184.

CATALOG. Finest equipment, ingredients. Fully guaranteed. SPI, Box 784-S, Chapel Hill, NC 27514.

BEERMAKERS Catalog/Newsletter. Free! William's Brewing, Box 461-P3, Oakland, California 94604.

BEERLOVERS! Save \$1.00 every six-pack — Drink homebrew. Free handbook; Duane's, Department PS031C, 508 Canal, New York 10013.

79 BUY IT WHOLESALE

400,000 BARGAINS Below Wholesale! Many Free! Liquidations . . . Closeouts! . . . Job Lots . . . Single Samples. Free details. Worldwide Bargainhunters, Box 730-B, Holland, MI 49423.

REPLACEMENT PARTS for Chainsaw, motorcycle, snowmobile, small engines. Energy saving items. Wholesale prices. Free catalog. Manufacturer's Supply, Box 157PS5, Dorchester, WI 54425.

BUY for pennies! Sell for dollars! Buy direct from importers, manufacturers, distributors, closeout specialists. Our publications used by 80,000 knowledgeable buyers! Free details. Insiders, Box 879a, New Hyde Park, New York 11040.

80 ADVERTISING AGENCIES & SERVICES

EXPERT Assistance for mailorder, advertisers. Ratebook leading newspapers, magazines \$1.00. Chicago Advertising Agency, 28-ES Jackson, Chicago 60604.

83 RUBBER STAMPS & OFFICE SUPPLIES

RUBBER STAMPS, 3 lines, \$3.65. D&L Stamps, Box 813, So. Windsor, CT 06074.

85 PRINTING & RUBBER STAMP OUTFITS

PRINT YOUR OWN — Printing Presses. Type. Supplies Direct From Factory. Send 25c for Catalog and Samples to: Kelsey Company, DS, Meriden, CT 06450.

87 TOBACCO, PIPES, CIGARS

TOBACCO - one 2oz bag of each of our best selling blends with Free Catalog \$5.00. Bradley's Pipe & Gift Gallery, 202 Cypress, Dept. PS, Abilene, TX 79601.

88 OLD GOLD, JEWELRY WANTED

HIGHEST CASH IMMEDIATELY for Old Gold, Silver, Platinum, Jewelry, Gold Teeth, Watches, Diamonds, Spectacles. Free Information. Rose Industries, 29-Y East Madison, Chicago, IL 60602. Established 1934.

TOP DOLLAR NOW for Gold Jewelry, Watches, Teeth, Platinum, Coins, Sterling. Immediate Payment on Receipt. L.A. LeBrie Co., P.O. Box 1860-S, Grass Valley, CA 95945.

HIGHEST CASH for Gold, Jewelry, Gold Teeth, Rings, Diamonds, Watches, Silver, Platinum, Mail Articles Today. Free gift with information. Chicago Gold & Precious Metals, 6 E. Monroe, Dept. 757, Chicago 60603.

89 WATCHES, CLOCKS— SALES & SERVICE

WATCH and Clock Repairing Books, Tools, Materials. Free Catalogs. North American, Box 77-BC, Fox River Grove, IL 60021.

91 OF INTEREST TO ALL

NEVER WON ANYTHING? Anyone can win Sweepstakes contests! Free details. Elmhurst Gifts, 94-07 58th Avenue-S, Elmhurst NY 11373.

COLORADO OIL SHALE SAMPLES! \$4.00 Postpaid. Troy Clark, 0077 Ptarmigan, Glenwood Springs, CO 81601.

94 FOR INVENTORS

REGISTERED PATENT ATTORNEY. Applications and Searches. Mail Service. FREE Preliminary Review Of Your Disclosure. Box 392PS, Millwood, New York 10546.

PATENT IT ECONOMICALLY! Free details. N. Rainer, 2008 Fondulac Rd., Richmond, VA 23229.

INVENTION EVALUATION. Have your confidentially disclosed invention objectively evaluated by technical experts. For policy statement and description of services write: **WATERLOO SELF-PATENTING INSTITUTE**, Box 697, Waterloo, Ontario, Canada. N2J 4B8

PATENT AND MARKET IT ECONOMICALLY! Free Details. Box 213PS, Stonybrook, New York 11790.

IDEAS, inventions, new products needed by innovative manufacturers. Marketing assistance available to individuals, tinkerers, universities, companies with feasible concepts. Write for Kit-PS, IMI, 701 Smithfield Street, Pittsburgh, PA 15222.

INVENTORS, send for details of our service, no obligation. Wilmak Services, 132 Main St. E., Grimsby, Ontario, Canada - L3M 1P1.

PATENT Your Invention Yourself! Inexpensively! Retired Examiner, 7400-PS, Washington, DC 20044.

86 RAZOR BLADES, SHAVERS



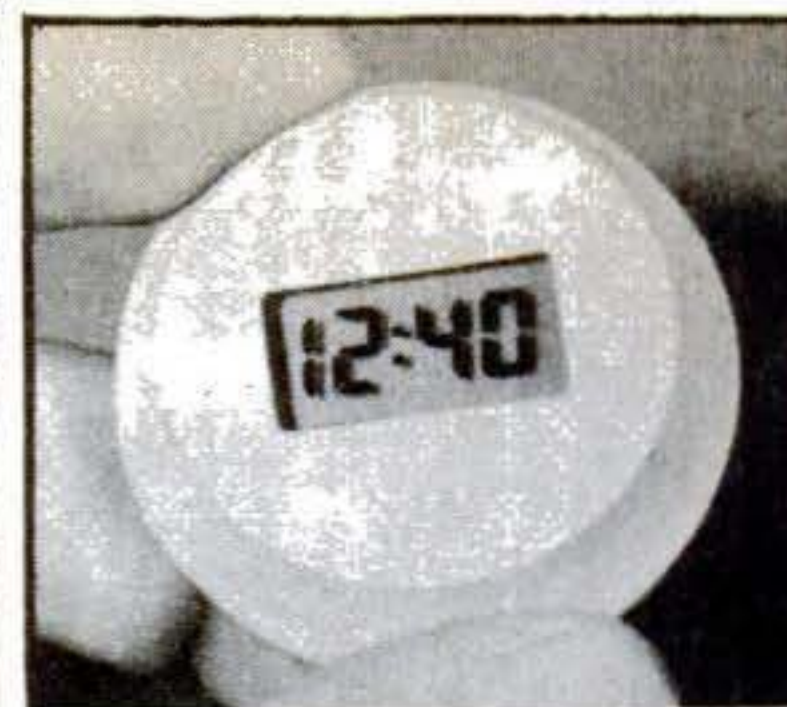
Fantastic Sharpener KEEPS YOUR NORELCO® SHAVER SUPER SHARP

Special, scientifically-designed sharpener fits all Norelco® and other rotary shavers. Guarantees smoother, faster shaves. Makes shaver good as new in seconds. Safe, easy to use — lasts for years, saves buying replacement blades.

Gives your shaver the sharpest cutting edge possible. Use just once a month to keep your razor operating at peak efficiency. Get cleaner, smoother, better-than-ever shaves.

Only \$2.98, plus 70¢ postage, handling. Order 2 for only \$5.50 + \$1 post. & hdlg. Res. of AZ, CA, CO, FL, IL, NY, PA, VA, VT, WI add appropriate sales tax.

POPULAR SCIENCE SHARPENER
Dept. PS031, P.O. Box 9569
New York, N.Y. 10249



TINY (1 1/2" Diam.) ALL-PURPOSE DIGITAL CLOCK Can Be Mounted Anywhere

Auto Dash, Boat, Cycle, TV Set, Telephone

Flashes large, clear LCD read-out of time and date (alternately at two-second interval). Dependable, accurate. Set it once and forget it. Automatically adjusts for long and short months.

Quartz movement. Comes with 12-month replacable battery, full instructions for re-setting and for installing new battery.

Special detachable adhesive backing makes it easy to affix to any surface from telephone to bathroom mirror to car visor or dashboard. Easily re-mounted if you want to move it.

Available in Beige, Red or Yellow. Only \$22.98 + \$2 postage & handling. (Res. of AZ, CA, CO, FL, IL, NY, PA, VA, VT, WI add applicable sales tax.)

Send payment (state color desired) or to charge Visa, Master Charge or American Express, give name of card, account number and expiration date.

TMM SPOT-O-TIME, Dept. PS031
Box 9569, Church St. Sta.
New York, NY 10249

END BLIND SPOTS

With Wide-Angle Rear View Mirror



Extra-Wide — 13 3/4 x 3" Clips on over present mirror

Now see all the road behind you. Be sure you're safe before you change lanes. See cars, trucks, vans coming up on either side.

Panoramic safety rear view mirror clips right on over your present standard mirror. It's non-glare and shatter resistant. Extra wide sweep of road on both sides makes driving safer, easier.

Only \$9.95 each plus \$1.50 ea. postage and handling. Residents of AZ, CA, CO, FL, IL, NY, PA, VA, VT, WI add appropriate sales tax.

POPULAR SCIENCE SAFETY MIRROR
Dept. 880 P.O. Box PS031
New York, N. Y. 10249

NEED FINANCING FOR YOUR INVENTION? We bring inventors and private investors together. Call: 800-835-1027 toll free. In Kansas: 316-221-0552. Investment Connections, 421 State Bank Bldg., Dept. J, Winfield, Kansas 67156.

INVENTORS: If you have an invention for sale or license, write for free booklet explaining how we can help you. Kessler Sales Corp., C-73-FI, Fremont, OH 43420.

MAIL SERVICE. Applications and searches. Free preliminary review and estimate. Enrolled by U.S. Patent Office. Nelson Berman, 1006 Iliff, Pacific Palisades, California 90272.

INVENTORS UNITE:

High marketing cost and product development fees have smothered many good ideas and inventions. Change must come about in this process to get our inventions on the market. Join us! Get involved with our information exchange. Send \$2.50 for 3 Mo. trial membership and monthly publication to:

INVENTORS ALLIANCE
P.O. Box 297
Saline, MI 48176

95 INVENTORS WANTED

MANUFACTURER SEEKING INVENTIONS. ADVANTEK INTERNATIONAL, 1100 17th NW., WASHINGTON, DC 20036.

INVENTORS: Free information on offering your invention for sale. Kessler Sales Corporation, C-73-IW, Fremont, OH 43420.

IDEAS and inventions wanted! Non-profit organization has grant money available for research and development. Details free: Earth/Space Innovations, Van Etten, NY 14889.

INVENTIONS WANTED

FREE CONSULTATION • NO IDEA TOO SMALL
Disclosure registration. Potential cash or royalties from manufacturers seeking new ideas. For free information on how to register your ideas. Call or Write

American Inventors Corp.

59 Interstate Dr. Dept PS
West Springfield, MA 01089 (413) 737-5376
A Fee Based Marketing Company

97 GOOD EATING

GOURMET HAMBURGER CASSE-ROLES. Great for amateurs or chefs. \$2.45. Chef Elizabeth, Box 2128, West Lafayette, IN 47906.

99 FOR SALE MISC.

SAVE ON MAJOR APPLIANCE PARTS. Send description, and model number. Blough's, 776 Pontius, Mogadore, OH 44260.

100 WANTED TO BUY

QUICKSILVER, platinum, silver, gold! Ores analyzed. Mercury Terminal, Norwood, MA 02062.

SCRAP SILVER ELECTRICAL CONTACTS, Forklift Contacts Industrial Scrap Silver, Sterling, Silver Solder. Send sample for my offer. All samples Returned. Robert Leszczak, 652 Myrtle St., Elizabeth, NJ 07202.

GOLD, Silver, Platinum! Jewelry, Industrial! Highest immediate cash paid! We're established National Buyers and can pay more! Ship/write: American Metals, POB 30009PS, Charleston, SC 29407. Telephone 803-795-4847.

CARBIDE, Tantalum, Stellite, Gold and Silver. Top Prices. Poley's Industrial Salvage, 12389 Mingos, Battle Creek, MI 49017. (616) 979-4075.

AUTOMOBILE LITERATURE WANTED 1900-1975. I buy automobile sales brochures, manuals, etc. Walter Miller, 315 Wedgewood, DeWitt, NY 13214. 315/446-6644.

102 TREASURE FINDERS, METAL DETECTORS

FIND old coins, jewelry, gold nuggets. New patented revolutionary device. Free catalog. Gardiner, 4729L N. 7th Ave., Phoenix, AZ 85013.

105 MISCELLANEOUS

FREE BOOK. Prophet Elijah Coming Before Christ. Megiddo Mission, Dept. 58, 481 Thurston Road, Rochester, NY 14819.

COLLEGE Students! — Improve your grades! — Term paper catalog — 306 pages — 10,278 titles — Rush \$1.00 (Refundable!) — Research, Box 25918Q, Los Angeles, 90025. (213) 477-8226.

ORNAMENTAL Iron designs. Book of 1600 beautiful, practical designs for railings, columns, etc. Free literature. Cunningham, 3881 South 3200 West-P.O. Box 20005-S, Salt Lake City, UT 84120.

106 PERSONAL

INVESTIGATORS. Latest Electronic Aids. Write: Clifton, Box 220-F, Miami, FL 33168.

ADVANCED TITLES/DEGREES Ministers, Honorary Doctorates, other Services available. Omnidenominational. Free Details. Acquarian Church, 432-PS PCH, Hermosa Beach, Ca 90254.

DIVORCE? Don't lose! Literature, Attorneys. **MEN'S RIGHTS ASSOCIATION,** 189A, Forest Lake, MN 55025.

UNIVERSITY DEGREES BY MAIL. Legal, Fast, inexpensive. Free revealing details. Counseling, Box 389-SP4, Tus-tin, CA 92680.

PHOTO ID. Sealed in plastic. All states, provinces. 24-hours. Guaranteed. Free birth certificate. Send \$5.00 (2/\$8.00), photo, name, address, height, weight, hair, eyes, birthdate. Cardinal, Box 5200-DR257, Jacksonville, Florida 32207.

107 HEARING AIDS

HUGE SAVINGS. Eliminate dealer markup. Free Trial. Batteries wholesale. Terms Arranged. Lloyds-PSC, Rockford, IL 61104.

NEW - Hearing Aids, Batteries, Discount Prices. Free details. Write: Rhodes, Dept. 69-P, Brookport, Illinois 62910.

HEARING AIDS 1/2 PRICE CATALOG FREE!

SUPER SAVINGS! Newest, Finest. All types. Buy DIRECT & save up to HALF! No salesmen. Sold by AIR MAIL on HOME TRIAL. FREE Catalog. Write: **MONEYSAVERS,** Dept. PS-3D, 9530 Langdon Ave., Sepulveda, Cal. 91343
Not sold in California.



Carry Glasses, Pen or Pencil in this easy-to-reach HOLSTER

End the nuisance (and expense) of glasses falling out of your pocket when you bend down; of misplacing glasses when you need them most. Or, not having pencil or pen handy when you want it. End bulging pockets, too — or ink-stained shirt and jacket pockets.

Handy quick-draw belt holster will carry your glasses and pen at the ready, and out of the way, right on your belt. Especially designed for every size or shape of glasses (sun glasses, too), and for easy in and out carrying and removal.

Leather-grained plast-o-hide for long wear. Lined inside to protect and clean lenses.

A lifetime value at only \$2.98, plus 65¢ postage & handling. Residents of AZ, CA, CO, FL, IL, NY, PA, VA, VT, WI add applicable sales tax. To order, send check or money order to:

TMM HOLSTER, Dept. PS031
Box 9569, Church St. Sta., New York, N.Y. 10249

REWIRE AN OLD HOUSE • INSTALL DIMMER SWITCHES • SET UP AN INTERCOM AND DOOR CHIMES • PUT IN WIRING FOR HEAVY-DUTY APPLIANCES • CORRECT ELECTRICAL CODE VIOLATIONS AND FIRE HAZARDS • GROUND YOUR TV AND RADIO ANTENNA • WIRE YOUR GARDEN, POOL OR FOUNTAIN • PLAN AND INSTALL ALL THE WIRING FOR A NEW HOUSE, VACATION HOME, RANCH OR FARM • AND MUCH MORE.

10 DAY FREE TRIAL COUPON

POPULAR SCIENCE BOOKS P13P
Box 2018, Latham, N.Y. 12111

Please rush _____ copy (ies) of **BASIC HOUSE WIRING** (No. 109) to me.

I enclose \$13.95 now for each copy ordered. (You will pay delivery charges.)

Bill me later for \$13.95 for each copy ordered plus delivery and handling charges.

Name _____

Address _____

City _____ State _____ Zip _____

Money back within 10 days if not fully satisfied.



An Original Popular Science Book
ONLY \$13.95
Postpaid

TAKE THIS BOOK FOR 10 DAYS FREE

It's easy to be your own home electrician with just this book as your guide... Basic House WIRING

By Monte Burch

WITH this new book at your side, you have a master electrician in pictures and print guiding your every step whenever you tackle any electrical wiring job—large or small—around your home, farm or ranch.

Over 500 illustrations show you how, step-by-step. You see how to do it in close-up photos and precise drawings of all the hardware, tools, systems and techniques. So absolute beginners as well as experienced handymen can accomplish any wiring job easily, professionally—with confidence and safety.

Speaking of safety, the entire book—text as well as illustrations—has been prepared with the assistance of the Fire Protection Association, publisher of the NATIONAL ELECTRICAL CODE. So you know the technical savvy is first-rate.

Covers basics and advanced jobs

Beginners will appreciate the chapter on "Basic Wiring" that provides super-clear explanations on stripping wire and all kinds of splices and connections, using the latest

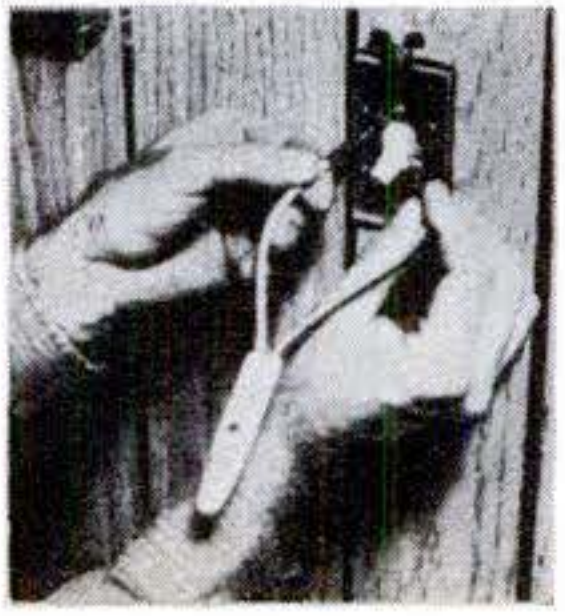
hardware, tools and professional shortcuts. In no time, you'll be able to handle all sizes of wire, armored cable and plastic-sheathed conduit and connect them to any fixture, switch, junction box or other device. How to wire door chimes and other low-voltage devices.

Once you master the simpler jobs, you'll be ready for more complex ones. For example, rewiring an older home, including the planning and installation of 240-volt circuits for heavy-duty appliances. Installing fused and circuit breaker entrance panels.

You'll even be competent to plan and install all the electrical service for a farm or ranch, from setting up "yard poles" to jet pumps.

From testing to troubleshooting and planning to installation of any electrical service in your home, ranch or farm, this excellent guide is a master teacher that can improve your skill and save you money.

Take advantage of this 10 day free trial offer right away—mail in the above coupon today!



Booklets, catalogs, and folders listed below provide reliable information, illustrations, and specifications to help you in planning the purchase of a variety of products or services offered by these dependable companies. The convenient order form will save you time and postage.

301 Modular Tub & Shower Units Brochure offers a fine selection of colorful, decorative, modular acrylic shower stalls and combination tub-and-shower units. Also includes installation instructions for the home handyman. From Acrylic Tubs. Free

302 Windows & Gliding Doors Galore This informative booklet from Andersen Corporation answers a wide range of questions the consumer may have regarding windows or gliding doors. Beautifully illustrated, this booklet is a must for any homeowner. Free

303 Now Get over 60 Mpg B. A. E.'s Rabbit Diesel Turbocharger, capable of providing over 60 mpg, is EPA-certified. Catalog illustrates many true bolt-on B. A. E. turbocharger systems that are available for most popular gas or diesel versions of foreign and domestic cars. \$3

304 Black & Decker Consumer Products The 92-page catalog shows its complete line of power tools and accessories, trade tools, and lawn, garden, and household products. \$1

305 A Touch of Southern Comfort Famous recipe guide from Brown-Forman Distillers tells how to improve drinks mixed at home. Includes the top 20 cocktails and recipes for many of the new "in" drinks. Free

306 Buck Knives Guide contains a brief history of Buck Knives, tips on selecting and using a knife, and even a how-to section on deer dressing. Free

307 1980 Knife Catalog Camillus Cutlery catalog features its full line of outdoor pocket knives, sheaths, and sharpening stones. It also includes illustrated articles on field dressing deer and game birds, boning deer, filleting fish, and much more. \$1

308 More on Pocket Knives Illustrated brochure shows the diverse styles of knives, blade shapes, cutting edges, and grinds. It also gives tips on sharpening and caring for pocket and hunting knives. From Case Cutlery. 25¢

309 Cathedralite Dome Homes Package offers floor plans, building process information, and a color booklet that features interior and exterior photographs of dramatic, energy-efficient Cathedralite Dome Homes. \$4

310 Install Your Own Ceiling Pamphlets from Celotex Corporation provide step-by-step directions for installing suspended or tile ceilings easily and economically. Free

311 Electronic Speed Control Literature describes the safety, comfort, and economy of Dana's Speedostat. It's easy to install and operate in almost any car. Free

312 Lawn & Garden Safety John Deere's 16-page booklet illustrates safety information for users of mowers, tillers, snow throwers, and chain saws. Free

313 Energy-Efficient Dryer Vent Deflect-O's brochure announces its revolutionary design in dryer vents. The design increases dryer efficiency by allowing for an unrestricted upward natural rise of warm air. The streamlined-design vent is said to be easily installed, fitting flush to any surface to which it's applied. Free

314 Power Tools A color leaflet from Dremel shows a full array of creative power tools for do-it-yourselfers, hobbyists, and craftsmen—a tool for almost any project imaginable. Free

315 Speaker Control System Flyer from Dubie Corporation explains this unique system. It allows you to dub, record, play back, and mix sound on sound, while controlling up to four sets of speakers, with no loss of power. Free

316 Outdoor Footgear Color leaflet displays the complete selection of hiking, hunting, and work boots from Dunham. Free

317 Improve Your Vehicle's Performance Edelbrock's complete brochure describes a variety of manifolds designed to improve vehicle performance yet provide fuel economy. Free

318 Custom-Built Capp Homes Evans Products' 100-page Capp home-planning booklet features over 50 designs and floor plans that can be completely and economically customized to complement your individual ideas. \$2

319 Patios, Fences, & Home Greenhouses Complete plans from Filon offer easy-to-follow instructions and materials lists for three do-it-yourself projects. 75¢

320 Metal Finisher Pamphlet illustrates the beautiful way to protect metal surfaces from rust and corrosion with a plastic finish that doesn't require a primer. From Flecto. Free

321 Rechargeable Batteries Consumer brochure from General Electric describes rechargeable nickel-cadmium batteries—economical alternatives to throwaway types. Free

322 Woodworking Projects Plans from Georgia-Pacific include 24 pages of instructions, diagrams, list of materials, and suggestions for 10 projects that can be built with pre-cut G-P plywood and lumber. Free

323 Hot Water without Plumbing Flyer details this safe and economical hot-water electric baseboard heating system that's fully adaptable to homes as well as other buildings. From Intertherm. Free

324 Mariner Outboard Motors Brochure gives complete specification information on the latest line of outboards from Mercury Marine. Includes over 50 models, from two to 200 horsepower. Free

325 Remodeling Ideas New color brochure offers ideas and suggestions on how to remodel with red cedar shingles and hand-split shakes. Photographs show remarkable step-by-step transformation of a home. From the Red Cedar Shingle & Hand-split Shake Bureau. 25¢

326 Kitchen Cabinets Colorful literature from Riviera Kitchens features a large selection of kitchen cabinets in a wide variety of styles, colors, and special accessories. Free

327 Auto Wheel Coatings Flyer from Sperex describes VHT polyurethane wheel coatings, which can easily restore and maintain a factory-fresh appearance on standard and custom wheels. Free

328 Picture-Perfect Photos A precise and complete pocket manual covers many valuable tips and suggestions for taking perfect 35-mm pictures. From Union Carbide. Free

329 Do-It-Yourself Wall Paneling Weyerhaeuser's 20-page booklet contains step-by-step instructions for installing paneling to existing rooms or new walls. Free

330 Play Olympic Golf Whispering Palms Golf and Country Club in Rancho Santa Fe, Calif., offers a new playing-range concept to sharpen your shooting skills. Free

FILL IN COUPON AND MAIL TODAY

POPULAR SCIENCE P.O. Box 2748, Clinton, Iowa 52735

Note: Popular Science Iowa address is for Product Information only. Subscription inquiries should be directed to the address at the foot of the table-of-contents page.

Please send the items checked below. I am enclosing 50¢ handling charge (any number of items) plus amount required for priced items.

- | | | | | | |
|----------------------------------|----------------------------------|------------------------------|----------------------------------|----------------------------------|------------------------------|
| <input type="checkbox"/> 301 | <input type="checkbox"/> 306 | <input type="checkbox"/> 311 | <input type="checkbox"/> 316 | <input type="checkbox"/> 321 | <input type="checkbox"/> 326 |
| <input type="checkbox"/> 302 | <input type="checkbox"/> 307 \$1 | <input type="checkbox"/> 312 | <input type="checkbox"/> 317 | <input type="checkbox"/> 322 | <input type="checkbox"/> 327 |
| <input type="checkbox"/> 303 \$3 | <input type="checkbox"/> 308 25¢ | <input type="checkbox"/> 313 | <input type="checkbox"/> 318 \$2 | <input type="checkbox"/> 323 | <input type="checkbox"/> 328 |
| <input type="checkbox"/> 304 \$1 | <input type="checkbox"/> 309 \$4 | <input type="checkbox"/> 314 | <input type="checkbox"/> 319 75¢ | <input type="checkbox"/> 324 | <input type="checkbox"/> 329 |
| <input type="checkbox"/> 305 | <input type="checkbox"/> 310 | <input type="checkbox"/> 315 | <input type="checkbox"/> 320 | <input type="checkbox"/> 325 25¢ | <input type="checkbox"/> 330 |

Name (please print) _____

Address _____ City & State _____ Zip _____

Please send cash, check, or money order made out to Popular Science. No stamps or foreign currency. Allow approximately six weeks delivery.

THIS COUPON EXPIRES APRIL 30, 1981

I AM ENCLOSING

\$ _____ for priced items

50¢ for handling

\$ _____ **TOTAL REMITTANCE**

POPULAR SCIENCE MARCH 1981

ON SALE
MARCH 16 - 28

Miter box
\$9.97

Hacksaw
\$6.88

Stanley Wants to Hand it to You.

At a K mart price.

Stanley and K mart help you get the job done with this basic assortment of carefully crafted hand tools, now on sale at savings of 33 to 42 percent.

Stanley quality at K mart prices — now that's a handy arrangement! These fine Stanley hand tools are available at more than 1,700 K mart stores throughout the U.S.A.

Hammer
\$6.88

Powerlock rule
\$6.88

Surform file
\$3.77

Measuring tape
\$6.88

Block plane
\$9.97

Stanley quality at a K mart price. Nice.

Kmart[®]
The Saving PlaceSM

Marlboro Country



Famous Marlboro Red and Marlboro Lights—
either way you get a lot to like.

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

Lights: 12 mg "tar," 0.8 mg nicotine—Kings: 17 mg "tar,"
1.1 mg nicotine av. per cigarette, FTC Report Dec. '79