



Unfortunately, if the telephone you buy today isn't a Panasonic, it may be out of date tomorrow. If it lasts that long.

Choose a built-in answering machine. Speakerphone. Built-in dialer. But choose carefully, because it's built to last. After all, it's a Panasonic.

Now you can buy your own telephone. So it's important to buy the one that's right for you.

On one hand, you don't want to spend too much for a phone. Or buy one that does more than you need. On the other, you don't want to spend too little. Or the phone may become out of date in a few months. If it lasts that long.

Let Panasonic help you reach the right decision. We have the right phone for you. And the right price to go

with it. No matter what your needs or budget.

Choose from phones with answering machines built in. Speakerphones that let you talk without holding the phone. And phones with automatic dialers. And most of our phones are compatible with alternate long distance services. Such as Sprint® and MCI.

Whichever Panasonic telephone you choose, it will have one thing in common with our entire family of phones. Panasonic dependability.

And should your phone ever need service, we have a nationwide network of service centers.

Panasonic telephones. They won't be out of date today. Or tomorrow.

Speakerphone. Dialer. And answering machine. Even lets you call in for messages. Without a remote device. From any push-button tone phone.

This phone remembers 28 numbers. And will dial them for you automatically. Even redials a busy number. Up to 15 times in 10 minutes.





This slim-line phone has an automatic dialer. Call family. Friends. Emergency numbers. Up to 16 digits long. At the touch of a button.



This phone lets you connect two incoming lines. So you can put your first call on hold, while you answer a second. Also has an automatic dialer.



® Sprint is a registered service mark of GTE Sprint Communications Corp.

Panasonic.

just slightly ahead of our time.



NOVEMBER 1984 Founded in 1872/Vol. 225, No. 5

Highlights of this issue

79 Now: Skid-control brakes

Ever fall victim to a terrifying spin out? Now you can have no-slip stopping on slick surfaces.

72

Probing the mysteries of the polar vortex

On the most intensive North Pole research flyby ever, a NASA team makes startling discoveries.

98

DIY wireless security systems

You can install safeguard systems that protect your home with no strings attached. Here's how.

108

PS showdown: 7 top home computers

These popular machines are tested head-on and scored on their word-processing abilities.

Cover photographs by Greg Sharko and Jack Keebler

PHOTOCOPY PERMISSION: Permission is granted by Popular Science for libraries and others registered with the Copyright Clearance Center (CCC) to photocopy articles in this issue for the flat fee of \$1 per copy of each article or any part of an article. Send correspondence and payment to CCC (21 Congress St., Salem, Mass. 01970); specify CCC code 0161-7370/84/\$1.00 + 0.00. Copying done for other than personal or reference use without the written permission of Popular Science is prohibited. Address requests for permission on bulk orders to Chief Editorial Asst., Popular Science, 380 Madison Ave., New York, N.Y. 10017.

The What's New Digest 90–97	
Science and Technology Science newsfront	E
Computers and Electronics Computer images add dazzle to car design	Н
What's new in electronics	1
Detroit report	
Energy News This gas turbine burns sawdust	3
Recreation Take-along folding scooter	
Home, Shop, and Yard	
Products Plastic float valve	SD S
Plans and Projects Announcing: ninth annual panel-project contest	1
Home Energy Management Alternate-energy answers)
Tools and Techniques What's new in tools	3
Car Care Car-care quiz	2
Additional Features	

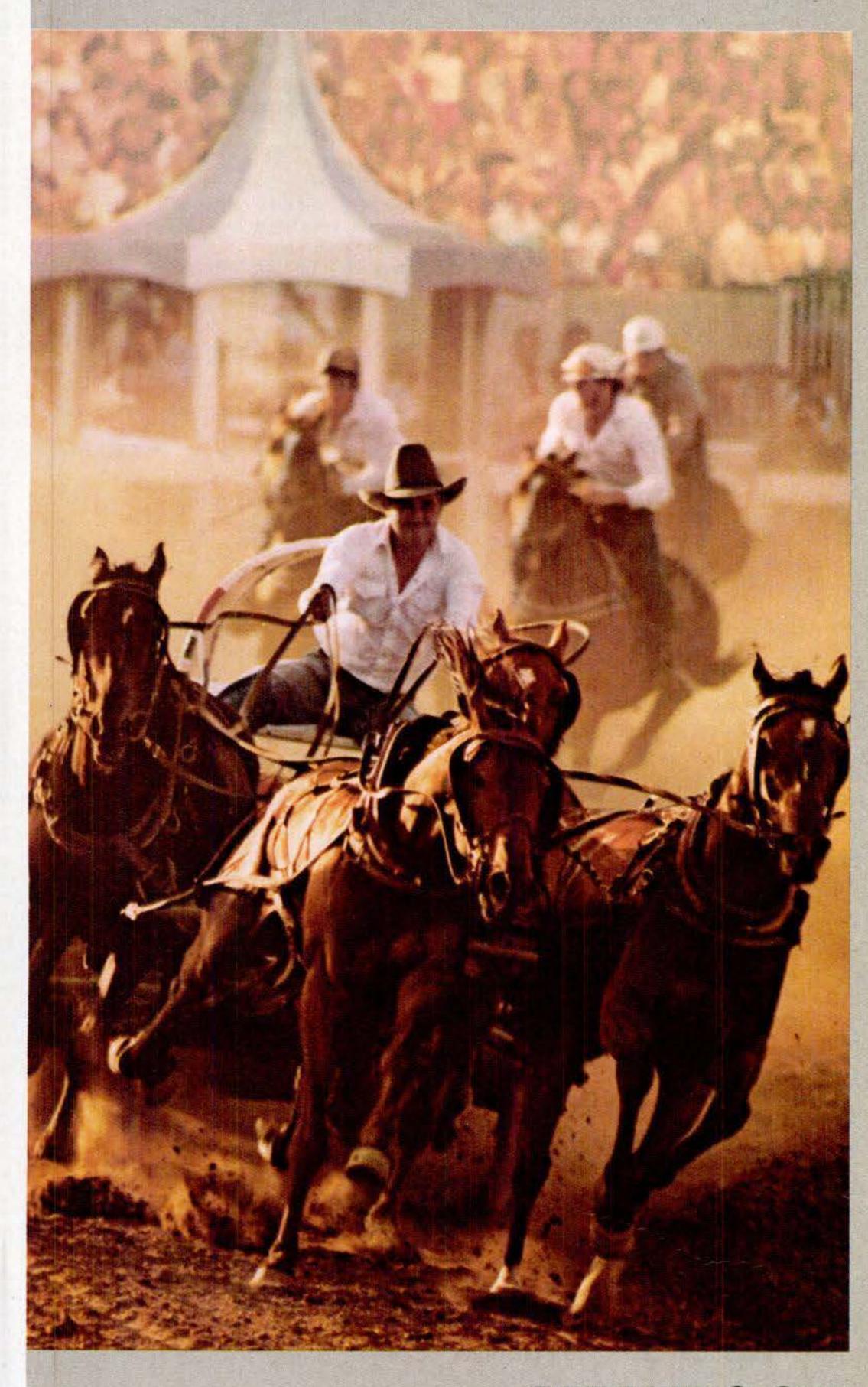
Readers talk back 4

What's news 71

Wordless workshop 126

Product information 150

Calgary. A rugged place for a smooth whisky to start.



WINDSOR CANADA'S SMOOTHEST WHISKY.

ALBERTA, CANADA—The Calgary Stampede, the world's richest rodeo. It attracts the nastiest bulls, the most ornery broncs, and the best cowboys anywhere to ride them. There's a chuck wagon race that'll make your bones rattle and a motorized barstool race that'll leave you black and blue for a month.

For ten days every July, ever since 1912, people come from all over to recapture the spirit of the Canadian West.

This is where Windsor Canadian comes from. We get rye from the rich fields around Calgary. We get water from the glacier-fed streams west of town. We age the whisky in the high, dry air, until it's so consistently smooth, you'd never guess it could come from a place so rugged.



Readers Talk Back

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

Popular Science

Rain of destruction

Your report on acid rain ["How Scientists Are Tracking Acid Rain," Aug.] was informative, but the sidebar, How to Reduce Acid Rain, omitted an important option: The conversion of coal and natural gas as well as other biomass to methanol should get top priority. This fuel would almost eliminate the presence of sulfur and high levels of NO_x in the atmosphere.

Charles B. Wood, Prescott, Ariz.

Thanks for the interesting article on acid rain. But I wonder why the effects of acid rain were not noted during the many years of our industrial revolution, when coal was almost the only source of fuel.

George P. Schmid, Deerfield, Ill.

The data from the map on page 71 of "How Scientists Are Tracking Acid Rain" appear to disprove the theory that power plants in Ohio are a source of acid rain in Canada. Also, how could you draw the lower dashed line on the map when there were no sampling sites in the vicinity?

Chris Benjamin, Silver Spring, Md.

Rob Gannon replies: "Acid rain seems relatively new for several reasons. Total emissions, including those from autos, have increased. Emissions damage was local until 500-to-1,000-foot smokestacks were built that lofted pollutants into the atmosphere where they could be carried unsullied over great distances. The buffering capacity of land (primarily due to limestone soils) varies and in some cases has taken decades to be overwhelmed. Finally, the effects accumulated gradually, so that the scale of the problem remained unrecognized until relatively recently. Trout streams were losing fish 25 years ago, but no one recognized it as a nearnational phenomenon.

"The map was picked at random from those available at the time the story was written. It shows that on that particular day the bulk of the tracer gas took two main paths at average altitudes. One headed across Pennsylvania, the other more southerly. On other days, including the one detailed in the article, winds carried the gas farther north or south. Paths were de-

termined even in areas with few collection stations by three means: weather balloons launched from 20 sites and tracked by radio; tetroons released in Dayton that sent back Loran-C location signals; and aircraft actually capturing the gas while aloft."

Brains aren't everything

"Super-Smart Cars" [Aug.] led me to think about driving and safety. A "heads-up" display of information on the windshield, as used in some aircraft, could be the only semi-safe way of giving the driver information. Even this method, however, could be distracting. And as your story implied, the time needed to decipher the proliferation of readouts could cause the accident rate to skyrocket.

Harry C. Wiersdorfer, Hamburg, N.Y.

I had to laugh when I read "Super-Smart Cars." How can Chrysler hope to offer an advanced satellite navigation system as a \$500 option in four years when it currently offers an AM-FM cassette deck with special speaker—certainly not a new technology—as a \$550 option?

Burch Seymour, Santa Clara, Calif.

I can't believe all that electronic gadgetry in super-smart cars is anything but just that. Most of it won't be worth a hoot to anyone who does his own maintenance. Give me a car I can work on without the need for a knowledge of advanced electronics.

U.S. James, Santa Fe, N.M.

Shedding light on headlights

I'd be happy if smaller headlights ["The Incredible Shrinking Headlight," July] shrunk price along with size, but they don't. Nor will they aid fuel economy. There was never any problem with streamlining headlights, as dozens of custom and foreign cars attest. Even the old Volkswagen had crude streamlined covers over full-size headlights. The reason the headlight is shrinking now? So that we consumers can pay for it.

William A. Vandiver, Waverly, Tenn.

The drive toward the shrinking headlight is a misdirected engineering Continued Editor-in-Chief C. P. Gilmore
Editor Everett H. Ortner
Executive Editor Herbert Shuldiner
Art Director W. David Houser

GROUP EDITORS

Arthur Fisher

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

copy CHIEF Timothy O. Bakke

SENIOR EDITORS

Jim Dunne Automotive, John Free Technology, William J. Hawkins Electronics, E. F. Lindsley Engineering, Susan Renner-Smith, V. Elaine Smay

ASSOCIATE EDITORS

Stuart F. Brown, Jack Keebler Automotive, Richard Layne

Copy Editors: Jay E. Blickstein, Michael S. Neubarth

Staff Photographer: Gregory Sharko

Home & Shop Editor: Alfred W. Lees
Art Editors: John F. Crowley, Richard J. Meyer

Art Associate: Hugo Salhuana West Coast Editor: Jim Schefter Southeast Editor: Evan Powell European Editor: David Scott

Editorial Assistants: Adeline Hooper (Chief),

Genevieve Capowski, Sherrill Clarke, Julie W. Hauptman Senior Production Manager: Henry W. Kazmirowski

Business Manager: Anna Dallas

CONSULTING EDITORS

Richard Day, Horne & Shop
R. J. DeCristoforo, Tools & Techniques
Robert Gannon, Science
A. J. Hand, Photography
Ben Kocivar, Aviation
Stephen Mercaldo, Auto Maintenance
Jim Schefter, Space
Smokey Yunick, Auto Mechanics

POPULAR SCIENCE: Publication No. ISSN-0161-7370

POSTMASTER: Send notices of undelivered copies (form 3579) to Popular Science, Box 2871, Boulder, Colo. 80322.

SUBSCRIPTION INQUIRIES: Send new or renewal notices or changes of address (send both new and old addresses) to Popular Science, Box 2871, Boulder, Colo. 80322. Allow six to eight weeks for change of address.

EDITORIAL OFFICES: 380 Madison Ave. New York, N.Y. 10017

Published monthly by TIMES MIRROR MAGAZINES, INC. c/o Communications Dept., Los Angeles Times Times Mirror Square, Los Angeles, Calif. 90053

Popular Science entered as second-class postage at Los Angeles, Calif., and additional mailing offices. Also entered as second-class matter at the P.O. Dept., Canada.

SUBSCRIPTIONS: U.S. and its possessions, 1 year \$13.94; 2 years \$24.97; 3 years \$34.97. Canada and elsewhere, 1 year \$17.94; 2 years \$32.97; 3 years \$46.97. Subscriptions processed electronically.

Microfilm editions are available from Xerox University Microfilms, Serial Bid Coordinator, 300 North Zeeb Rd., Ann Arbor, Mich. 48106.

EDITORIAL: Address contributions to Editorial Dept., Popular Science, 380 Madison Ave., New York, N.Y. 10017. We are not responsible for loss of unsolicited queries, manuscripts, or other materials. They will not be returned unless accompanied by return postage.

Copyright © 1984 by Times Mirror Magazines, Inc.
All rights reserved. Contents may not be reprinted or otherwise reproduced without written permission.

Popular Science* Mechanics and Handicraft*



GE TAKES THE KITCHEN RADIO TO NEW HEIGHTS.



INTRODUCING THE GE SPACEMAKER® RADIO.

The GE Spacemaker Kitchen Companion Radio mounts right under your kitchen cabinet. So you can listen to bright, clear AM or FM radio without giving up an inch of kitchen counter space. And without adding to your kitchen chores, because its "touch pad" controls are easy to use, better yet, easy to clean.

It helps with the cooking, too.

The Spacemaker Radio is more than just an entertaining addition to your kitchen. It also lends a hand with the work.

With a programmable timed appliance outlet that lets you control kitchen appliances even when you're not in the kitchen. So now your coffee can be ready when you are. And it even has a countdown timer that helps with your cooking and baking.

It's never in the way.

Best of all-it's always out of the way. Mounted simply and neatly under your cabinet, it proves that your love of music needn't interfere with the joy of cooking.

We bring good things to life.





Readers Talk Back

effort. Mere lamp shape has little affect on fuel economy and aerodynamic problems when driving at sensible speeds. A needed improvement that would have some effect is a pivoting headlamp that sweeps the beam left or right in a generous arc in synchronization with the front wheels. This would illuminate the road where the front wheels are going instead of where the car is pointing.

Andy Vena, Philadelphia, Pa.

Jim Dunne replies: "It's true that smaller lights are expensive and that looks alone may account for their appeal to buyers of Lincolns, Cadillacs, and many European imports. But these new headlights reduce wind resistance substantially without the complication of headlight covers, and this aerodynamic styling will increase the mpg for the life of the car—it doesn't wear out. "A sweeping headlight is certainly

Popular science

TERENCE E. MOYES Publisher JAMES M. BYRNE JR. Advertising Director

ADVERTISING OFFICES

NEW YORK

380 Madison Ave., New York, N.Y. 10017 (212) 687-3000 Bruce England, Montie Horton, Frank Marshall, Geoffrey Marshall, Sam Messiter, Yvonne King Make-Up Manager, Mary Ansbro Classified Advertising Director, Clare Farella Assistant to Publisher. Brenda Charles, Marie Trupia

CHICAGO

875 N. Michigan Ave., Chicago, III. 60611 (312) 337-7717 Richard C. Moderhack Manager, Jim King, Cheryl Cliff, Marsha Major, Joyce Suttner

WEST COAST

3550 Wilshire Blvd., Los Angeles, Calif. 90010 (213) 380-1936 K. Michael Foss Manager, Jacque Kelly, Vicki Johnson

SOUTHWEST

16990 Dallas Pkwy., Suite 151-L, Dallas, Texas 75248 (214) 380-0416 Joe T. Kelly & Associates, Harry Weiss

DETROIT

1025 E. Maple, Birmingham, Mich. 48011 (313) 642-7273 Richard Hartle Assoc.: Barbara Cliff, Richard Hartle, Don Heth, Jean Safford

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

ISSN 0161-7370

HERBERT K. SCHNALL Chairman of the Board JOHN A. SCOTT President JOHN CONDON Executive Vice-President E. MACFARLAN MOORE Vice-President/Advertising MICHAEL HAUGH Treasurer GERTRUD BORCHARDT Manufacturing Director WILLIAM H. HUNTTING JR. Research Director

ANITA JACOBSSEN Media Communications Manager

a good idea. Another method for illuminating the road ahead calls for extra lamps that switch on when the steering wheel is turned. But it would take a regulation change to get these ideas in production cars."

Wagner's wonder

Dr. Gunter Wagner's use of existing things ["Wagner's Wonderful Wind Machine," Aug.] such as old ships, marine winches, and truck axles should help him clear the hurdle that separates a useful idea from an invention that's in full-scale production. I hope the government recognizes Wagner's genius and lends a hand—I'd like to see those noisy wind machines moved offshore.

Forrest Gagnon, Littleton, Colo.

Going underground

I read the debate between Charles Woods and William Shurcliff ["Shop Talk," Aug.] with interest. I think Shurcliff is wrong about the necessary thickness of walls in underground houses to withstand lateral pressures. I plan to build an underground house with standard-size concrete blocks. These blocks are used in the cellars of homes throughout my area-the Adirondack Mountains, where temperatures range from 95 to -30 degrees F—and hold up just fine.

Frederick H. Johnson Lake Luzerne, N.Y.

Colt superiority

As the driver of a Dodge Colt turbo, let me assure you that all the Colt needs to out-handle the current crop of turbo cars ["PS Car Test: Little Turbos," July] is a set of 185/60R13 tires. Besides, where else can you get so much performance for so little money?

> W. Pegram Winston-Salem, N.C.

Luxury-sedan scam

I can't see why you chose to test Chrysler's four-cylinder New Yorker ["PS Car Test: Modern-Age American Luxury Sedans," Aug.] over the Fifth Avenue. The size, V8 engine, weight, cost, and finish of the Fifth Avenue are comparable to those of the other luxury cars.

Herman A. Kosengarten Nassau, N.Y.

Jack Keebler replies: "Indeed, our original request to Chrysler was for a Fifth Avenue. But Chrysler officials argued instead that their best new technology in luxury sedans was represented by the turbocharged front-drive New Yorker. We found that although the New Yorker may look like a luxury sedan on paper, it just isn't in the same class as the Fifth Avenue."

Spark-plug gaps

Surely you jest in "Maintenance Tips That Improve Gas Mileage" [Aug.]. Closing or opening spark-plug gaps by 0.02 inch couldn't possibly cause the largest decrease in mpg.

Daniel W. Saxton Fort Washington, Md.

George Sears replies: "The spark-plug gap for the Ford Tempo is 0.042 inch. I opened or closed the gap by 50 percent (0.02 inch) and tested the car under those conditions. The decrease I reported is accurate." PS

Popular Science SUBSCRIPTION SERVICE CHANGE OF ADDRESS OR RENEWAL ailing label from the front cover rvice or a change of address. If you ur mailing label in this space and s in the space provided below. ZIP CODE (PLEASE PRINT) Please attach your mailing label fr when writing about service or a ch are moving, place your mailing lat write your new address in the spac Allow 6 weeks advance notice. ADDRESS NAME S TO SUBSCRIBE OR RENEW: ☐ 1 YEAR \$13.94 ☐ New subscription □ 2 YEARS \$24.97 □ Renewal □ Payment enclosed Canada and Foreign. Bill me later ☐ 1 YEAR \$17.94 Mail to: POPULAR SCIENCE P.O. Box 2871 Boulder, CO 80322 Occasionally, we make our mailing list available to reputable organizations whose products or services may be of interest to

you. If you'd like your name removed from this list, please

Please remove my name from your list.

check the box below.

Your screwdriver just became obsolete.

Once you've used the Skil Cordless Screwdriver, you won't want to go back to your old screwdriver. The Skil Cordless Screwdriver weighs mere ounces and is so small it fits into your pocket. Yet its high torque motor has the power to drive up to 500 screws on a single charge. The Skil Cordless Screwdriver recharges in 3 hours or less and even has a special built-in feature to help prevent stripping of screws. And since it's cordless, it's perfect for everything from everyday fixups in or out of the house, to serious do-it-yourself projects. With everything it can do, you'd think the Skil Cordless Screwdriver would be expensive, but it's not. Not at all. And its surprisingly low price makes it a great gift. So forget about all the stripped screws, tired arms and blisters that went with your ordinary screwdriver. The Skil Cordless Screwdriver just made them obsolete.

. We build tools

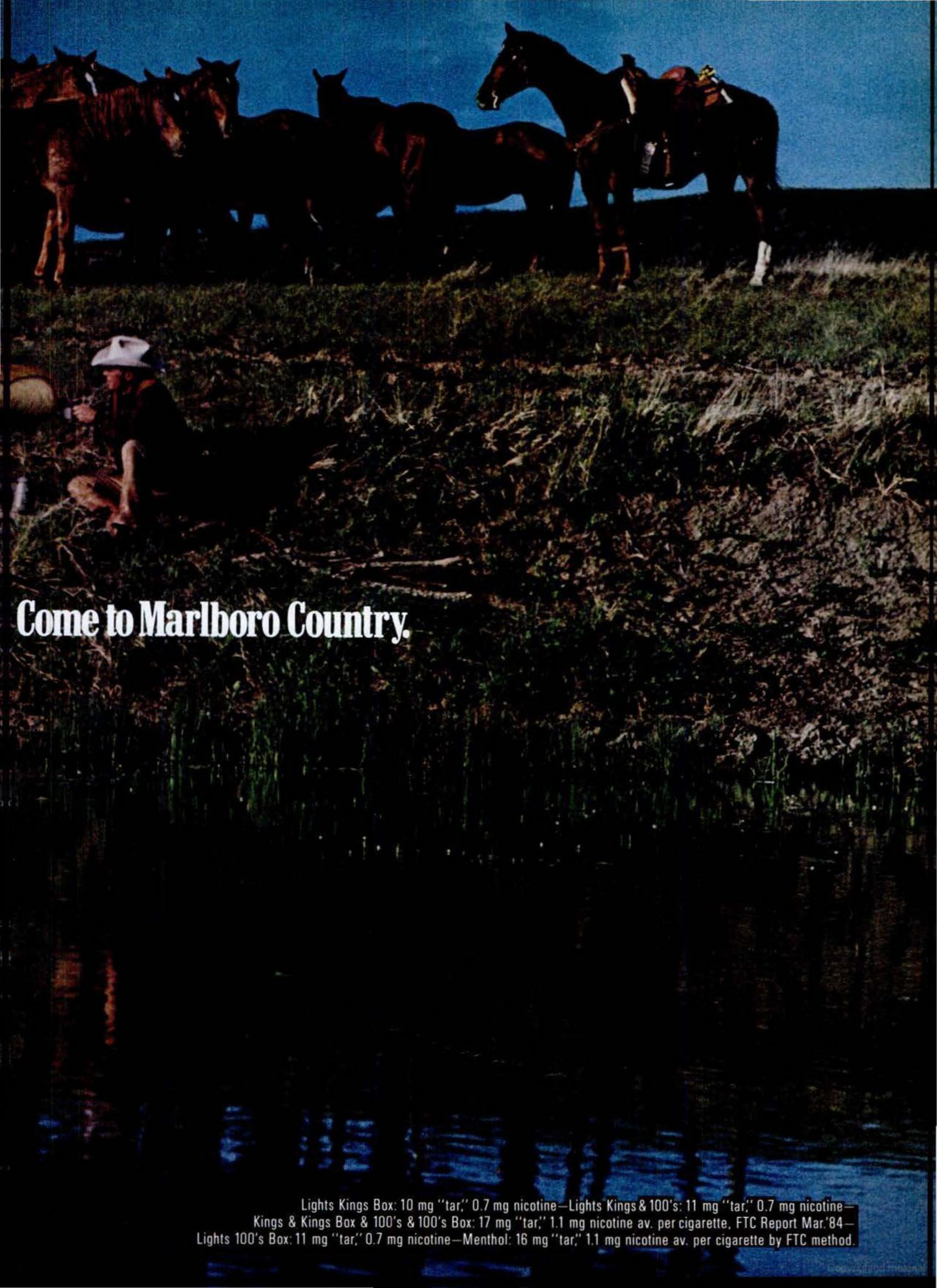
that last and last and last.

4801 WEST PETERSON AVENUE

CHICAGO IL 60646

EMERSON.





Pickup vour life.

A full-size pickup from GMC will pick up your life, and a whole lot more.

You'll feel uplifted by driving a vehicle so different from the dreary norm: a pickup from the people at GMC. When "trucks" is your last name, you have to do trucks very well. We do.

comfortably A full-size GMC has full-size hauling capabilities. So you can take your toys to fun places. Tents, motorcycles, bicycles — it can all be neatly tucked inside your GMC. And GMCs offer impressive pulling power, too. Properly equipped, a full-size GMC twowheel-drive pickup can tow up to 10,000 lbs. Making it the perfect companion for any adventure.

Option-wise, you can get your full-size GMC pickup with two-wheel or four-wheel drive, a six- or eight-foot cargo bed, in 1/2,

3/4 or 1-ton models. The new Vortec 4.3-liter V-6 engine is standard for 1985. It offers the highest horsepower and torque rating of any standard V-6 in the industry. Or you can pick up the pace with optional V-8s. There's even a hearty 6.2-liter diesel available.

> Best of all, a GMC pickup offers the options and comforts you're accustomed to in a nice car. Making it one nice truck, indeed.

Buckle up and pick up a full-size pickup at your GMC dealer. (He's in the Yellow Pages.) Give your life a

For a free copy of GMC's 28-page "How To Live Comfortably With A Truck," please write to: GMC Truck Merchandising

> Headquarters, Drawer 30093, Department D43 Lansing, MI 48909.



atruck.

SMC

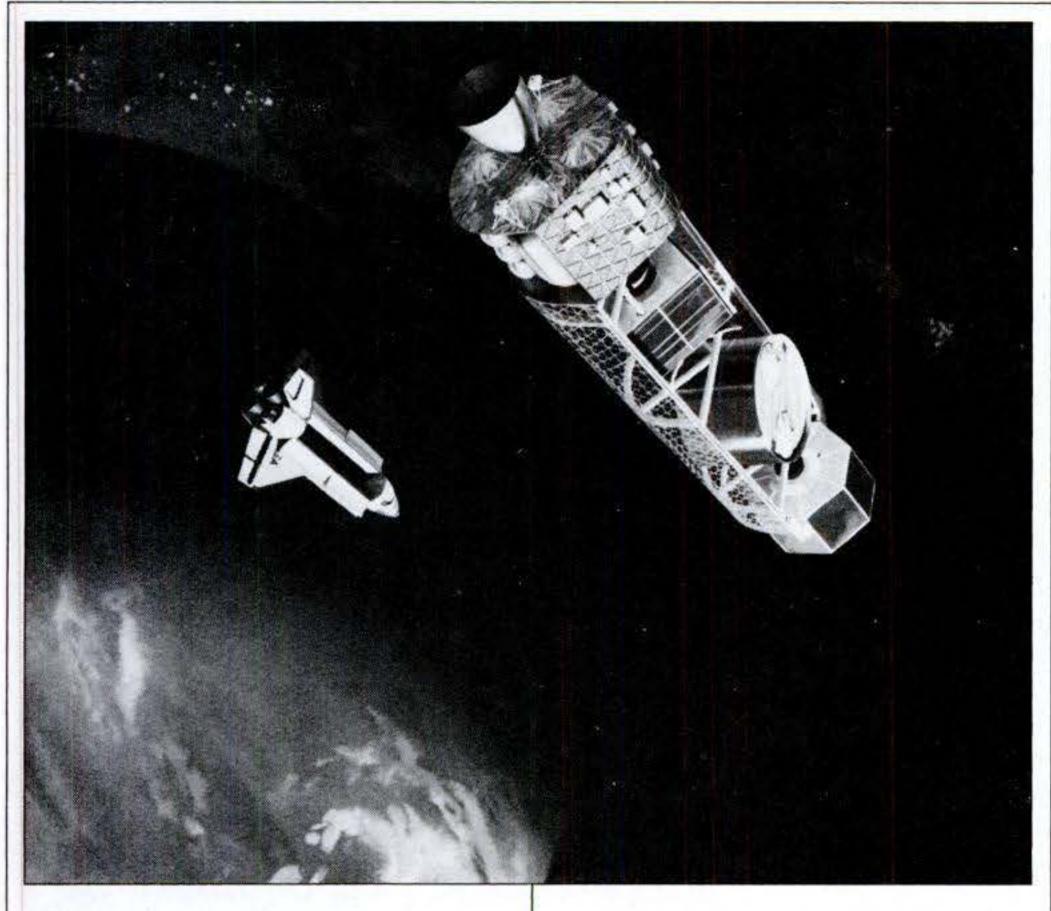
A truck you can live with.

GMC full-size half-ton pickup.



Science Newsfront

By ARTHUR FISHER

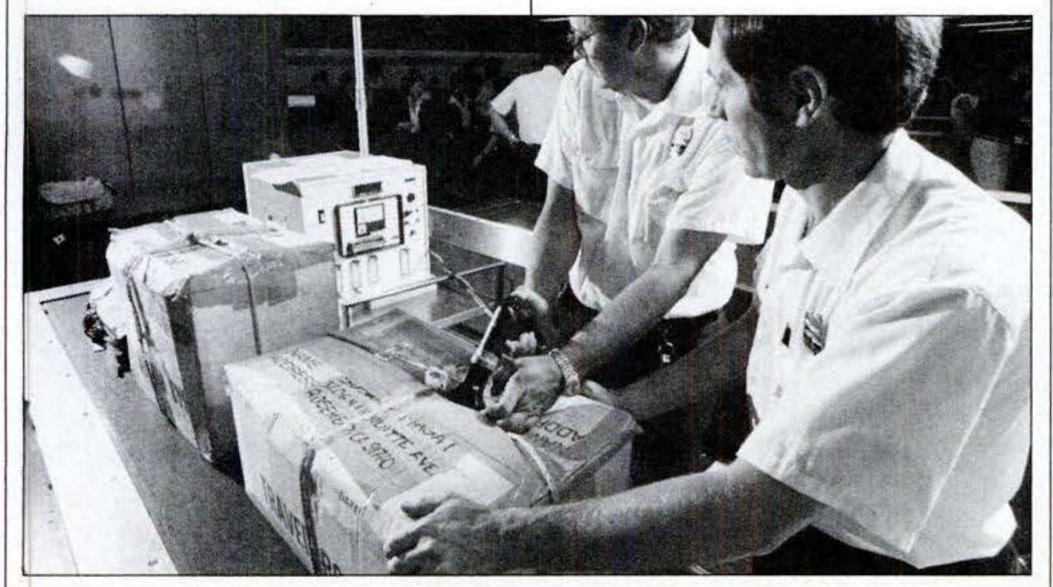


Super booster

A new upper-stage rocket destined to boost large payloads such as satellites from the space shuttle to higher orbits is being developed by McDonnell Douglas. Shown in the artist's concept above, the Delta Transfer Stage is an offspring of the second stage of the workhorse Delta launch vehicle, which has performed yeoman service for NASA for 24 years; over the last 10

years it has carried out 74 launches with a 100-percent record of success.

The Delta Transfer Stage will burn storable liquid fuels. It is being designed to boost payloads up to 9,000 pounds directly into 22,300-mile-high geosynchronous orbit. McDonnell Douglas executives say that because the new rocket will use off-the-shelf hardware, it will need a relatively brief development period and could fly on the shuttle in late 1986.



Two new sniffers

Trained pigs nose out truffles, dogs scent drugs and dynamite, and a variety of electronic devices have been developed to sniff—and warn of—everything from gasoline vapors to alcohol on the breath. Now there are two new additions to the lineup of high-tech sniffers.

Sniffer I, in the photo below left, was developed by U.S. Department of Agriculture scientists to signal the presence of high levels of carbon dioxide. Reason: Plant materials such as fruits and vegetables exude the gas once they have been picked, and the USDA is concerned about the illicit importation of plants into the U.S. because of the risk that they might carry dangerous diseases or pests such as the Mediterranean fruit fly. Thus the need for a portable CO₂ sniffer that could be used at airports on passengers' luggage. A prototype of the device, invented by Paul Magidman, Wolfgang Heiland, and colleagues at the USDA's Eastern Regional Research Center in Philadelphia, is shown being tested last summer at Los Angeles International Airport.

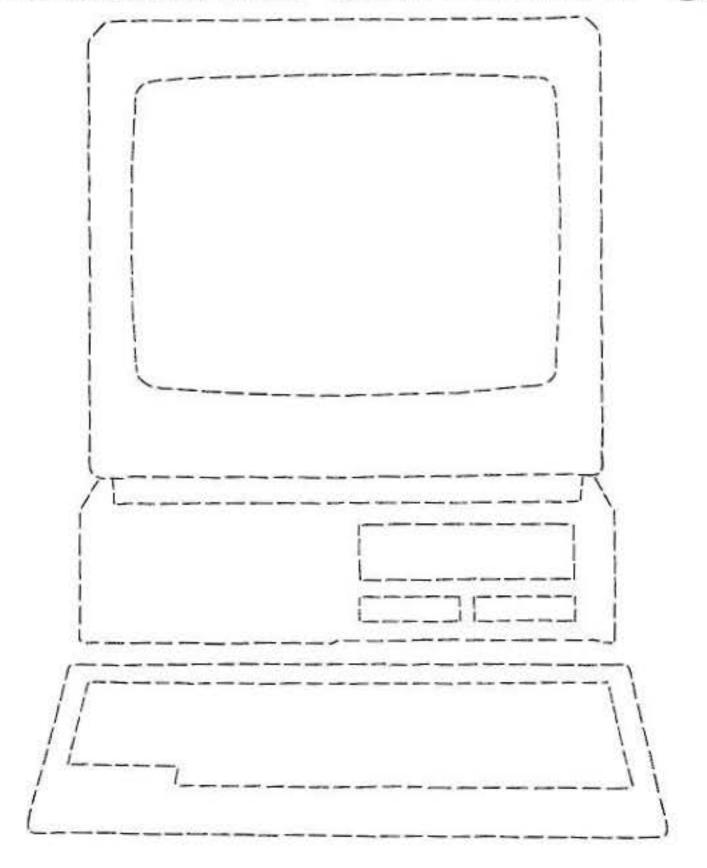
Sniffer II, in the photo below, detects more-deadly stuff. Called the Chemical Parameter Spectrometer, or CPS-100, it was designed to identify the nature and concentration of 12 hazardous gases instantly. The need was clear: According to the National Safety Council, some 1,400 persons each year are killed by toxic fumes, about 200 of those by gases from toxic chemicals (as opposed, say, to fumes in sewers or cesspools). The fatalities include workers succumbing to fumes in empty chemical tanks and in the holds of ships carrying industrial chemicals.

It was to test such workplaces that the device was developed at Argonne

Continued



Picture a computer under \$1000 that runs over 1000 of the best programs written for the IBM PC.



Now picture this.

There's a lot that's new about PCjr and it's all good news for you.

PCjr now has a lower price. A new typewriter-style keyboard.

A new option that can give

Right now, PCjrcan run

the powerful Lotus 1-2-3™

PCjr Installation Kit and

additional memory). The

memory, will be available

Managing Your Money™

on cartridge for PCjr, is a

comprehensive personal

financial advisor and

Turn your screen into

a canvas. The new

cartridge program.

create with the added

dimension of color.

PCjr ColorPaint, lets you

manager.

by Andrew Tobias, new

new cartridge version, requiring no additional

this fall.

user memory a dramatic boost.

And new business and personal programs to add to its fast-growing library of up-toon diskette (with Lotus 1-2-3 date programs.

All of which can make PCjr the most useful computer a little money

can buy. It comes standard with 128KB of user memory—twice the memory of its most popular competitor. An

advanced 16-bit processor. And a double-sided diskette drive that can store over twice as much information as most single-sided drives.

With all these all the way to a hefty 512KB. features, PCjr can run over a thousand of the most popular programs written for the IBM PC. And with the new optional 128KB Memory Expansion Attachment,

it can run over a

PCjr also runs a growing number of powerful cartridge



The new PCjr Memory Expansion

quick lift to 256KB. Or, along with

a PCjr Power Expansion Attachment.

Attachment can give memory a

diskettes, and don't take up a bit of user memory. The three newest examples being Lotus 1-2-3,[™] the fascinating PCjr ColorPaint and Managing Your Money™ by financial expert Andrew Tobias.

As its library of software keeps growing, PCjr keeps growing, too. By leaps and bounds. Because IBM designed it with 13 ports for add-on options. And a modular construction that will accept new capabilities down the road. Even those that haven't been invented yet.

All this in a computer that weighs a mere 10 pounds.*

Takes up just a bit over a square foot of desk space. And costs less

than \$1,000[†],

without monitor. Picture yourself with a PCjr. Try one out and see what's new at an authorized IBM PCjr

dealer or IBM Product Center.

For the name of the store nearest you, call

warranty

More computer for your money. See how PCjr compares with other

computers at its price. Memory Software

User Memory (RAM): Runs over 1.000 128KB (expandable to 512KB) Permanent Memory (ROM): 64KB

Diskette Drive Double-sided. double density Capacity: 360KB

Processor 16-bit 8088

Keyboard Typewriter-style Detached; cordless

Warranty 1-year limited

programs written for the IBM PC Runs both diskette and cartridge programs

Display 40- and 80-column Resolution: 4-color: 640h x 200v 16-color:

320h x 200v Expandability Open architecture Optional 128KB Memory Expansion Attachment(s) 13 ports for add-ons, including built-in serial interface

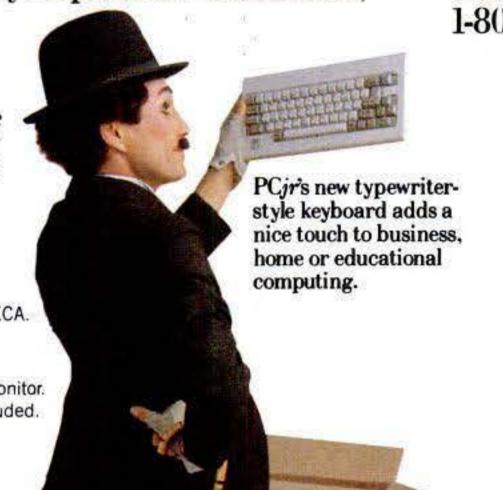
1-800-IBM-PČJR. In Alaska and Hawaii, call 1-800-447-0890.

thousand more.

programs. They work faster than

Managing Your Money is a trademark of MECA. 1-2-3 and Lotus are trademarks of Lotus Development Corporation.

*Weight does not include power pack and monitor. †IBM Product Center price, monitor not included.



IBN PCjr Growing by leaps and bounds.

Science Newsfront

National Laboratory's Energy and Environmental Systems Division. The CPS-100 weighs only 15 pounds and is battery operated, making it completely portable. The photo shows it being used by a Coast Guardsman in a ship's hold. The U.S. Coast Guard's Office of Research and Development requested development of the system to aid its emergency response teams in gauging hazards at the sites of chemical spills.

Sandy solar receiver

Solid particles of material the size of grains of sand may be a better heattransfer medium for high-temperature solar central receiver plants than the fluids now used, according to research at Sandia National Laboratories at Livermore, Calif.

The new concept envisioned by Sandia scientists and engineers is strikingly different from "conventional" solar technology. As in other central receiver plants, sun-tracking mirrors called heliostats would focus and concentrate sunlight on a central tower. But at existing plants, such as Solar One at Barstow, Calif., the solar energy is absorbed by a working fluidwater/steam—that flows through tubes in the receiver. The steam is heated to about 500 degrees C (932 F) and then drives a turbogenerator to produce electricity. By contrast, in the Sandia scheme, sunlight would heat sand-sized ceramic particles as they fell through the receiver. A groundlevel heat exchanger would extract thermal energy from the particles, which would then cycle back to the top of the receiver. Such solid particles, according to Sandia thinking, have major advantages for high-temperature receivers: They have high heat capacity; they absorb solar energy directly; and they can transfer energy by direct exchange.

To test their concept, Sandia researchers conducted an experiment recently at the Radiant Heat Facility in Albuquerque, N.M. The test apparatus consisted of a chute 10 meters (33 feet) long through which fell a stream of silicon carbide particles—each about a millimeter (0.04 inch) or less in size —past a bank of high-intensity infrared lamps. The lamps emitted the equivalent of 500 suns—500 times the average amount of solar energy incident on a given site on the earth's surface. The particles were collected in a catch bin at the bottom of the chute. Temperatures of the particles in the bin ranged between 500 and 1,000 degrees C (932 and 1,832 F).



Laser probes determined that most of the particles had been exposed to the simulated sunlight for an average of just two seconds.

"When the project started," says Rex Steele of Sandia Livermore's Solar Components Division, "we were not sure whether the falling particles would get hot when exposed to the simulated sunlight.... We consider the results of the experiment to be a major step in high-temperature solar central receiver technology."

Applications for such high-temperature plants-higher than those now in use for electrical generation—include petroleum and chemical processing.

Copper-plated circuits

General Electric scientists Robert J. Wojnarowski (left) and Charles W. Eichelberger triumphantly demonstrate their new process in the photo above by dipping a printed circuit board into a solution that plates it with pure copper. The process depends



on the development of special metallic "inks" consisting of a liquid polymer carrying a mixture of finely powdered nickel and iron. The polymer ink is transferred to the circuit board by a stenciling-like method called screen printing. Heating for just one minute in an infrared oven hardens and cures the inked circuit pattern. Then the circuit is made electrically conductive by dipping it into a copper sulfate bath. An electrolytic reaction occurs, and pure copper replaces some of the circuit's iron and nickel powder.

Feeble forces figured

What is that glass of bubbly doing in the picture below of a laboratory instrument? It's to emphasize the claim of the people at Cambridge Technology, Inc., that their new force transducer is the first commercially available device capable of measuring very fast, ultra-low force phenomena, such as the bursting of bubbles in a glass of champagne. This unit can measure forces as feeble as one milligram with a frequency response of 10 kHz. Another unit can measure forces of one microgram, and so, according to the manufacturer, "can easily measure the landing force of a minute snowflake or the footstep of a mosquito. It can measure much smaller forces, such as those generated by single insect muscle cells."

Leaping lizards!

Biologists at the Smithsonian Tropical Research Institute in Panama have for the first time succeeded in artificially incubating and hatching the eggs of the green iguana, the large leaf-eating lizard prized as a food source in Latin America for millennia (tastes something like chicken). The goal is to create iguana farms so that the reptile, whose numbers have been dwindling in the wild, could be raised as a high-quality-protein staple.

Galactic prominence

The National Science Foundation reports that astronomers at UCLA and Columbia University have discovered an enormous arc of hot gas, billions of times larger than the sun, jutting from our galaxy. Observations made at the Very Large Array network of radio telescopes in New Mexico show the arc to be 150 light-years long. The entity is unlike any previously seen. Astronomers speculate that the hot, ionized gas is controlled by magnetic fields, and could have resulted from a kind of "galactic dynamo." PS

If you can imagine a VHS videocassette recorder that can bring movie theatre sound quality into your home, then you're ready for the latest product of our imagination.

OUT OF OUR MINDS, INTO YOUR HANDS.



Detroit Report

By JIM DUNNE

Four-door N-cars

Four-door versions of the recently introduced personal coupes—Oldsmobile Calais, Pontiac Grand Am, and Buick Somerset Regal (see below)—are already rolling around General Motor's proving ground. Major dimensions will remain the same or close to those of the coupes. Code-named the N-car, the sedans will continue GM's thrust against sporty Japanese imports.

Omni/Horizon replacement

Chrysler's P-car is undergoing prototype testing in preparation for a 1987— '88 introduction. One test mule spotted recently (bottom left) used a Reliant body to test the new P-car nose and drive train. Fender outline and hood shape indicate an aerodynamic shape similar to Ford's Tempo/Topaz. Power will come from either a new 1.8-liter (110-cu.-in.) Chrysler four or the current 2.2-liter (134-cu.-in.) four-cylinder.

Feistier Fiero

Caught on the corner of the test track is Pontiac's more muscular V6 Fiero (below). Note the air scoop in front of the rear wheel well and slipperier front end from the Indianapolis 500 pace-car version of the plastic Pontiac. A high-output version of the 2.8-liter (171-cu.-in.) V6 currently powering the 6000 STE will provide the hotter performance the sleek body begs.

A new Olds

A revamped Oldsmobile 88 model (also below) will make its appearance next fall. V6 gasoline and diesel engines will replace the V8s; wheelbase will shrink by a half foot to 110 inches; and overall length will be cut by more than two feet. Curb weight will drop to about 2,950 pounds from the present 3,550. Look for improvements in fuel economy because of the lighter weight and smaller engines. Performance will be better because of subtle changes in gearing.

Shrinking Toronado

One of the first modern American front-drives, the Oldsmobile Toronado (bottom right), will undergo a major change in 1986. The front drive stays. But weight will drop about 600 pounds, and overall length will be chopped by more than two feet. A fuel-mileage improvement of at least two or three mpg is expected. The new Toronado will use the same power train as the new Olds 98.

1986 PONTIAC GRAND AM



1986 BUICK SOMERSET REGAL



1988 CHRYSLER P-CAR



1985 PONTIAC V6 FIERO



1986 OLDSMOBILE 88



1986 OLDSMOBILE TORONADO







Dodge

Announcing a major challenge to Ford and Chevy.

A truck warranty just as tough, just as long-lasting as the one you'll find on every passenger car Chrysler builds.

Five long years or 50,000 grueling miles, whichever comes first. At no extra cost.

Nobody, you'd figure, would have

the courage to put that kind of guarantee behind a vehicle that takes a the kind of beating a truck does.

Nobody except Dodge. America's fastest growing truck manufacturer.
Our light truck sales have increase

Our light truck sales have increase a remarkable 127%, comparing the first 9 months of the '84 model year to the comparable period in the '81 model year.

We're leading the industry. In 1985, we're backing every truck we build

Copyrighted materia



with the same 5/50 Protection Plan.
Every new 1985 full-sized Dodge oickup and Ramcharger, two- and our-wheel drive. Every new 1985 Dodge wagon. Every new 1985 Dodge wan, even our revolutionary Dodge Mini Ram Vans and Caravans. No exceptions. Right up to our dual rear wheel 10,100 lb. GVW Ram 350.

We're giving America engine and owertrain coverage that's more than wice as long as our competition. And

long-term outer body rust-through protection they can't even come close to:

So Dodge issues the ultimate challenge.

All truck companies talk tough. Ford. Chevy. The imports.

But here's the difference.

At Dodge, we're not afraid to put our money where our mouth is.

'Limited warranty, excludes imports, fleets & leases, deductible applies.

Ask for details. Comparison based on competitive warranty information available at time of printing.

BUCKLE UP FOR SAFETY.



America's best backed trucks. Guaranteed.



DODE SE

Total cars tested to date: 687

2 + 2 Japanese-style

-sporty cars for the budget-conscious

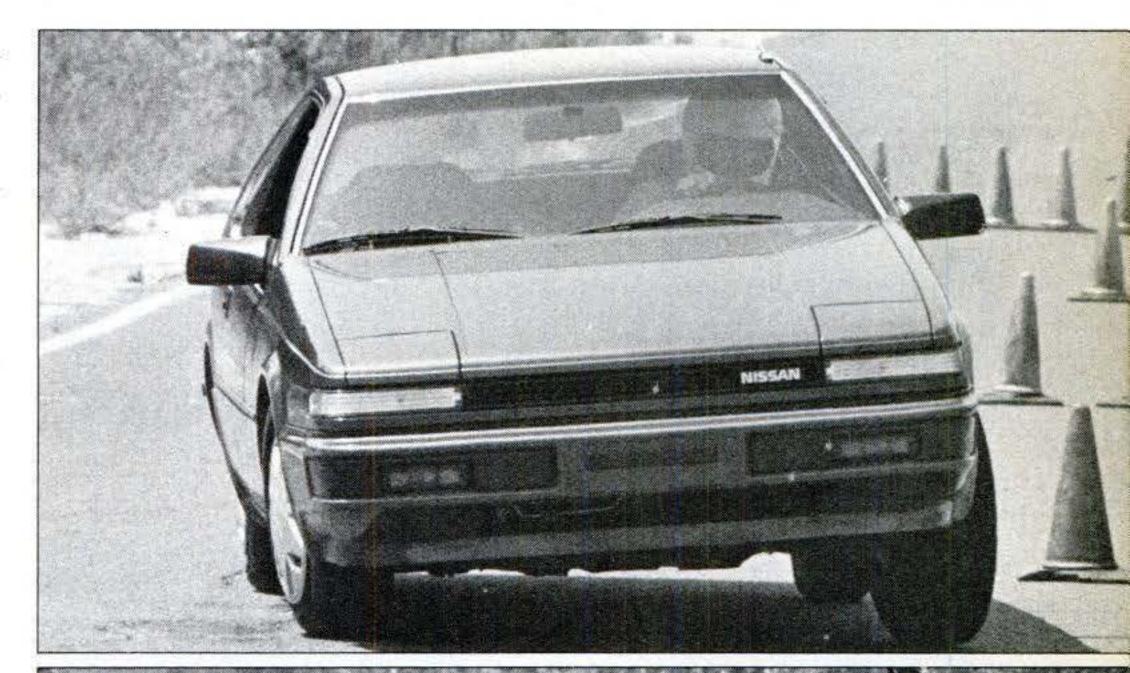
At the core of a vast selection of practical sporty hatchbacks are the Mitsubishi Cordia L, Nissan 200SX, and Toyota Celica SR5 GT. PS auto editors put these comfortable, fuel-efficient, and affordable benchmark cars through their paces in acceleration, braking, handling, and maneuverability tests.

By JIM DUNNE and JACK KEEBLER Photos by Greg Sharko

multitude of Japanese imports are three affordable coupes that fill the bill for many shoppers for sporty cars. Ranged tightly around the \$10,000 mark are the Nissan 200SX, Mitsubishi Cordia L, and Toyota Celica SR5 GT. These competitive 2+2 hatchbacks offer a sporting flair with the practical features of fuel economy, comfortable ride, and rear-seat room that all-out sports cars can't match.

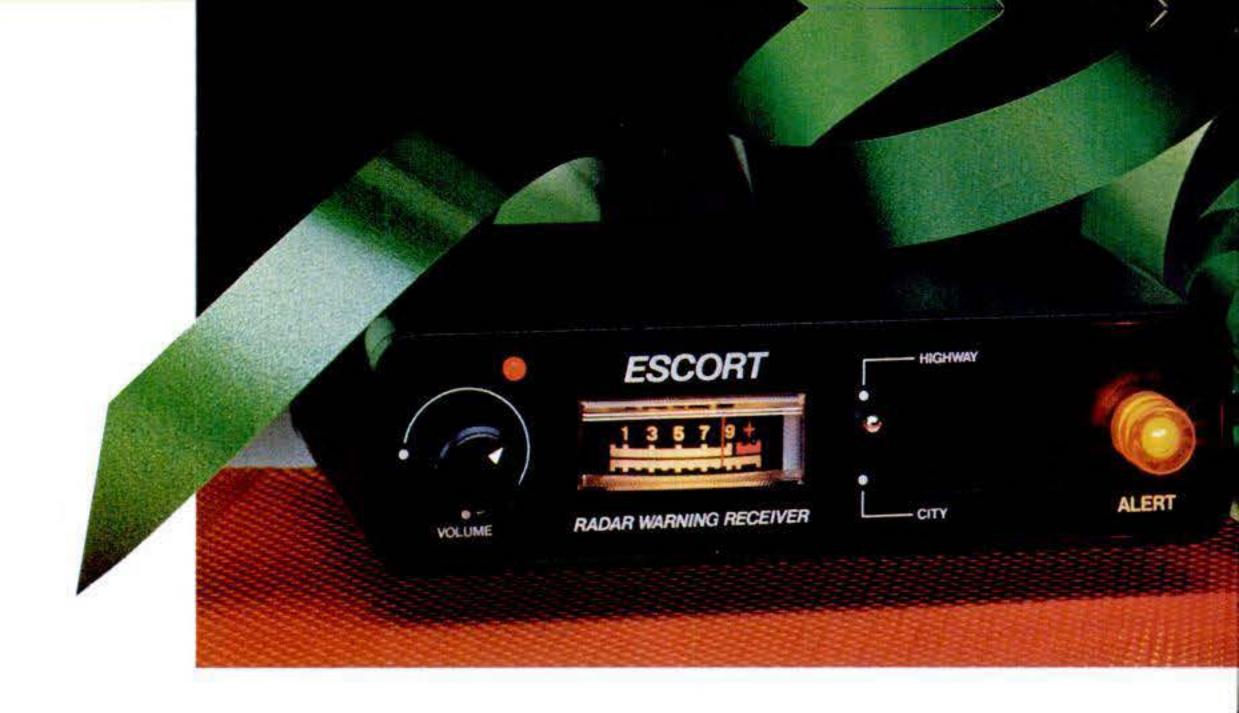
The Popular Science test team brought the three vehicles to Bridgehampton Race Circuit for a detailed comparison. We found that the vehicles deliver the features promised, but no more. They are civilized, reasonably fast, versatile when asked to carry cargo or passengers, and fuel efficient. They are not, however, tastefully appointed, all-out performers, or roomy. In past years Japanese car makers have been praised for their innovations, especially in driver and front-seat-passenger convenience and comfort. But today those features are old hat, at least to those who have Continued

Nissan 200SX, Toyota Celica SR5 GT, and Mitsubishi Cordia L (top to bottom) negotiate the high-speed-handling, braking, and maneuverability tests.









Overwhelm Your Favorite Driver

With new pocket-size PASSPORT, or the classic ESCORT

The perfect gift is more than a surprise; it hits the mark. If there's a driver on your list, you can give ESCORT or new PASSPORT with absolute confidence. Here's why.

Credentials

Car and Driver magazine rated ESCORT number one in its most recent test, calling it "...clearly the leader in value, customer service and performance..."

In the six years since its introduction, ESCORT has become the classic instrument of radar detection. Our policy of continuous refinement has maintained its leading-edge performance. In fact, when it comes to finding radar, nothing can replace ESCORT. So we're not replacing it, just adding something: smallness.

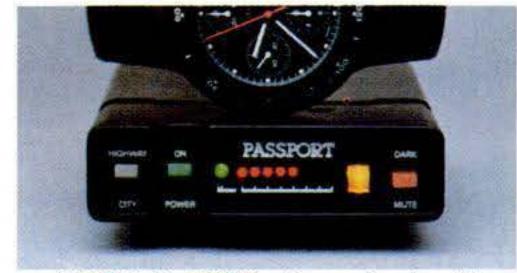
Frequent Flyers

The person on the move, switching between cars or using rentals in distant cities, needs the smallest detector possible. Ideally it would be pocketable for convenient carrying from one vehicle to another, or on a business trip. But it would have to perform small size is no advantage if performance must be sacrificed.

Could we put ESCORT performance in a detector one fourth its size? It seemed impossible, but we turned our best technical minds loose on the subject in 1982.

The Result

Now we're introducing PASSPORT: Radar Protection That Fits In Your Pocket. It's incredibly compact, just ¾" high and 2¾" wide, about the size of an audio cassette box. PASSPORT offers ESCORT performance and features in a miniaturized package. The remarkable technology that made this possible is a story in itself. (See "Techno-Talk".)



PASSPORT offers ESCORT performance in an incredibly compact size.

All The Right Moves

Feature for feature, PASSPORT and ESCORT are unmatched. Both incorporate our unique three element warning system. Upon radar contact, the amber alert lamp lights and the meter shows radar signal strength (ESCORT uses an analog meter, while PASSPORT has a bar graph display with eight Hewlett-Packard LEDs). At the same time, you will hear an audio warning—pulsing slowly when the radar is weak, quicker as it

strengthens, then constant as you approach the radar unit. Both units have separate warning tones for each radar band: "beep" for X band, a more urgent "brap" for K band because you have less time to act.

PASSPORT adds a Mute/Dark switch to the system. In the Dark mode, the alert lamp and the bar graph meter are defeated only the audio warning will be activated.

The Mute function is a momentary position on the switch. When you activate the mute, it defeats the audio alert for the duration of that radar encounter. After that radar signal ceases, the system automatically resets and the audio will alert you to the next radar signal.

Breakfast Of Champions

When it comes to performance, both ESCORT and PASSPORT are thoroughbreds. Both use our varactor-tuned Gunn oscillator patented signal processor, and our STatistical

TECHNO-TALK TECHNO-TALK TECHNO-TALK

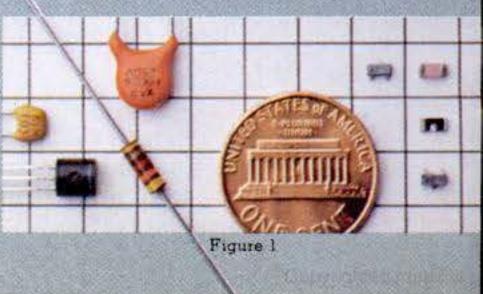
The compact size of the PASSPORT system was made possible only through the use of a remarkable technology:

SMD: Surface Mounted Device

Originally used exclusively in the hybrid integrated circuit industry, SMD technology is just now being incorporated in high end consumer electronics. PASSPORT is the first large-scale application of this technology to a radar detector.

The Basics

Surface Mounted Devices are micro-size transistors, capacitors, resistors, and diodes. These remarkable components are only a fraction of the size of conventional electronic parts PASSPORT was made even more compact by mounting the SMDs on the underside of the circuit board, leaving the top surface for custom integrated circuits, microwave diodes, and other parts too complex to be reduced to SMD proportions.





Tune in "Talkback with Jerry Galvin." America's new weekly call-in comedy talk show. Sunday evenings on public radio stations. Check local listings.

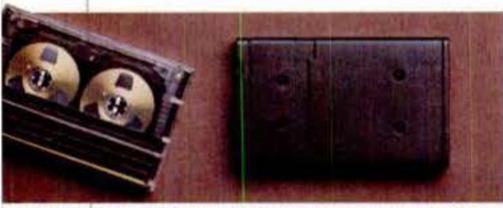
© 1984 Cincinnati Microwave, Inc.

Operation Processor (ST/O/P™), which eliminates alarms caused by other radar detectors.

And either PASSPORT or ESCORT will complement any car's interior. Both are constructed of sturdy aluminum and polycarbonate. ESCORT is finished in a glare-resistant polyurethane, PASSPORT is charcoal Nextel, a rich, non-glare finish that's as durable is it is elegant.

Apart From The Crowd

We've always felt that users of precision electronics are entitled to deal with experts. That's why we sell direct from our factory. There are no middlemen. When it comes to customer satisfaction, we take full responsibility.



PASSPORT is only ¾" tall and 2¾" wide, about the size of an audio cassette box.

And while our system of factory-direct sales was not designed specifically for gift givers, it does offer some rather special benefits. For example, you needn't worry about buying a discontinued model still in

a store's stock. Your gift will never be seen marked down in the discount chains. More importantly, giving either ESCORT or PASS-PORT shows you are concerned enough about quality to track down the only source. And there's one more advantage.



ESCORT and PASSPORT come complete with accessories.

Easy Shopping

ESCORT and PASSPORT let you do your Christmas shopping by phone and avoid the retail hassle. No searching for parking. No standing in lines. We're only a toll-free call and a parcel delivery away.

Most important of all, ESCORT and PASS-PORT are guaranteed to please. Holidays or anytime, take the first thirty days as a trial. If you're not absolutely satisfied, return your purchase and we'll promptly refund your money and your mailing costs. We also back ESCORT and PASSPORT with a full oneyear limited warranty. Now you have a choice. ESCORT, the classic instrument of radar warning, or PASSPORT, pocket-size radar protection.

Order Today

By Phone: Call us toll free. A member of our sales staff will be glad to answer any questions and take your order, (Please have your Visa or MasterCard at hand when you call).

CALL TOLL FREE . . . 800-543-1608 IN OHIO CALL 800-582-2696 (Phone M-F 8-8, Sat 9-5:30 EST)

By Mail: We'll need your name and street address, daytime phone number, and how many PASSPORTs and ESCORTs you want. Please enclose a check, money order, or the card number and expiration date from your Visa or MasterCard. (Personal or company checks require 18 days processing.)







PASSPORT \$295 (\$16.23 tax in OH) (Available November 1, 1984) Pocket-Size Radar Protection



ESCORT \$245 (\$13.48 tax in OH)
The Classic of Radar Warning

Cincinnati Microwave
Department 100-1116
One Microwave Plaza
Cincinnati, Ohio 45296-0100

Seeing Is Believing

Figure I shows the amazing size difference between conventional components and their SMD counterparts. In fact, the SMDs are so small, prototype PASSPORTs had to be constructed with a steady hand and a tiny pair of tweezers. Hardly an efficient production technique.

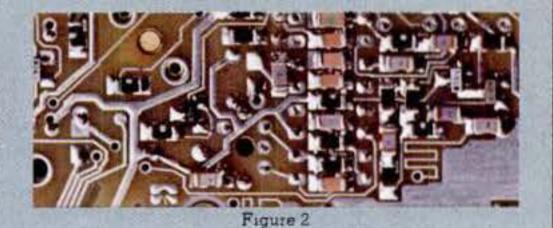
A Serious Commitment

Although a sophisticated numerical control machine that can accurately mount SMD parts costs several hundred thousand dollars, Cincinnati Microwave is firmly committed to SMD technology. By the end of the year we will have three such machines in operation.

The machine places over one hundred SMD components on PASSPORT's epoxy circuit board, affixing them with a special adhesive. The circuit board then passes through an ultraviolet curing chamber, securing the parts for what lies ahead.

A 500° Bath

The circuit board is then passed through a flowing bath of molten solder. The SMDs are on the bottom as the board passes through this 500° bath of liquid tin/lead alloy. A small area of the finished board is shown in figure 2.



To Be Continued...

The revolutionary SMD components are only one part of the story that made PASSPORT possible. We'll reveal some of the other technology in future sections like this one.



Nissan 200SX has the smoothest shape of the hatchbacks tested. An overly

soft suspension handicapped this stylish sports coupe in high-speed tests.



Toyota Celica SR5 GT proved to be the best handler of the trio. A taut suspen-

sion and grippy tires gave it the stick necessary for big-league maneuvers.



Mitsubishi Cordia L's asymmetrical wheel wells are an unusual styling fea-

ture. The maker claims the flat arch enhances the car's aerodynamics.

closely watched the progress of the "made in Japan" products. Here's how the sportsters stacked up:

Acceleration

Not one of the models was able to plunge through the 10-second bogey that separates serious sporting automobiles from sporty pretenders. The cars fell more comfortably into the 12-to 13-second range when attacking the zero-to-60-mph challenge. The Cordia was the fastest with a 12.4-second average. (All PS acceleration times are determined with a driver and passenger and 30 pounds of test equipment aboard.) The Nissan 200SX was less than a tick slower at 12.5. The Celica GT took 13.1 seconds.

Fuel economy

Fuel mileage is an area in which these cars really shine. Economy approaches that of the better subcompacts and easily outdistances that of the all-out performance machines. We found that city fuel economy in the high 20s is normal. On the highway, mileage shoots into the middle 30s. (Note PS steady-state fuel-economy tests.) Five-speed transmissions are the key here. Tall overdrive fifth gears keep engine revs and noise low and fuel economy high.

Braking

Each vehicle was equipped with disc brakes up front and drums in the rear. The cars were only so-so in braking. We noted serious fade in the Toyota Celica GT. But even with its superheated brakes the Celica stopped shorter than the 200SX and far shorter than the Cordia. Stability during stops was good for all three cars. All remained straight and true in the braking lane.

High-speed handling

Strong differences showed up here. The Toyota was the quickest and most stable in our high-speed lane-change maneuver. In fact, it was substantially faster through this grid than either the 200SX or Cordia. Tires probably played a major part here. The Toyota rode on Michelins. The Mitsubishi carried B. F. Goodrich rubber, and the 200SX was shod with Bridgestones. The Goodriches and Bridgestones seemed to lack the sticking power of the Michelins. High-speed passes by the 200SX and Cordia were marked by lots of drift, or side-slip, as the cars ran the high-speed gauntlet.

Quietness

For small hatchback coupes, the interiors were remarkably quiet. In past Continued



Video Skulduggery

We've made a strange arrangement to bring you this new Emerson \$699 front loading VHS video recorder with remote control and 14 day, 3 event programmable recording. It's yours for just \$378, but the fur is going to fly. to record a show you are watching withrecord and pause. You can even use for-

We didn't sell our soul. And, we didn't do anything wrong. But, we have an incredible price on a feature laden VHS video cassette deck that will give you years of automated video enjoyment.

Here's the scam. Emerson's Western Regional Sales Manager, Gary, knows that DAK sells over two-thirds of our products outside his territory.

So, we can sell thousands of decks without really affecting his other western sales. On the other hand, we do affect total sales in the midwest and east, and they get no credit for the DAK account.

Now Gary, who says he isn't competitive with his counterparts in the midwest and east, offered us an incredible price on his new super automated VHS deck. But he threw in two catches.

We had to run it nationally, and print his name in our catalog. Well, for Gary's price, we offered to print his name on every box we shipped east of the Rockies, but he said he didn't want to start a war.

So, look how we all win. Gary gets his name in the catalog (plus a lot of recorders sold outside his territory).

DAK wins because we get to offer this incredible recorder to you at a price that is sure to make us your electronics hero.

And you win, because you get everything from electronic tuning, to two week programming, to remote control, to one touch timed recording & more, for \$378.

Here's our part of the bargain. 'Gary Stines is a wonderful and knowledgeable person'. Now, on to the recorder.

HERE'S WHAT YOU GET

From the moment you put a video cassette into the front loading slot and see it automatically drawn into the recorder, you'll appreciate the quality of this machine. And, look at all the convenience features that it has.

THREE SPEEDS. You can record and play back, not in just 2, but in all 3 speeds for 2, 4, and 6 hour recordings (8 hours with the new thin tape).

ONE BUTTON TIMED RECORD. Just

touch the 'OTR' button once, and the recorder will record for 30 minutes with a countdown timer showing the action.

Touch it twice for an hour, and so on for up to two hours. This is really neat if you are leaving the house and you want

out having the tape run for 6 hours.



3 EVENT/14 DAY PROGRAM CAPA-BILITY. You can select any 3 programs over a two week period to record.

So, if you're going on vacation, you can keep up with weekly series while you're gone, even on different channels.

The timer is extremely easy to use. All that you have to think about is whether you want to record this week or next.



And, as one of the programmable functions, you can set it to record at the same time, the same channel, every day. You'll record shows you miss when you're out, shows that you want your children to see at a more appropriate time, and important events that you'll want to keep.

Plus, with this recorder, just push a button and you can watch one show on your TV while you record another.

ELECTRONIC TUNING THE WAY YOU WANT IT. This recorder's synthesized tuner can tune in VHF channels 2-13 and UHF 14-83. But, what's really special is that you can put any 16 of them in any order you like at any time.

ASSORTED EXTRAS. There's stillframe that automatically releases after 5 minutes to protect your tape, and both forward and reverse high speed search. When the display isn't showing the 24 hour time of day or future programmed recording instructions, it becomes an electronic digital counter.



10 FUNCTION WIRED REMOTE CONTROL. The remote lets you change channels, start and stop the recorder,



The recorder will set you free. You'll watch TV when you want, not when the networks put shows on. The recorder is backed by Emerson's limited warranty.

1 Emerson

ENJOY VIDEO FREEDOM RISK FREE

Hook your antenna to this recorder, and this recorder to your TV. It takes less than 5 minutes. But, you'll enjoy total control of your TV viewing from now on.

If you're not 100% satisfied with the incredible picture quality or the automated functions, simply return it in its original box within 30 days for a refund.

To order your Emerson Programmable Remote Control VHS Video Cassette Recorder, risk free with your credit card, call toll free or send your check, not for Emerson's suggested \$699 price, but for just \$378 plus \$9 for postage and handling. Order No. 4162. CA res add tax.

Now you can watch last night's midnight show at dinner, or tonight's dinner show at midnight. And, thanks to eastwest rivalry, it's yours for just \$378.



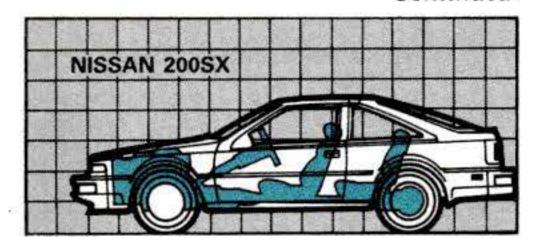
11213

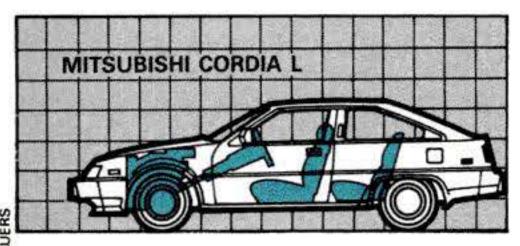
TOLL-FREE ORDER LINE For credit card orders call 24 hours a day 7 days a week CALL TOLL-FREE. . . 1-800-325-0800 8200 Remmet Ave., Canoga Park, CA 91304

Copyrighted material

2+2 Japanese-style

experiences with this body style we've noted excessive road noise, especially from the rear axle and tires. But that wasn't the case here. Both the Nissan and Mitsubishi sound levels were about equal to that of a small sedan. At highway speed, the Toyota was on par with a conventional sedan. But at lower speeds (about 30 mph), the Toyota was definitely noisier, a couple of decibels louder than the competitors. (Two decibels are easily Continued







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

easy; 5, very easy.	Mitsubishi Cordia L	Nissan 2005X	Toyota Celica SR5 GT
Checking fluid levels			
Battery	5	5	5
Master cylinder	5	5 5 5 5	5
Windshield washer	5 5 5	5	5
Engine oil	5	5	5
Coolant	5	5	5 5 5 5
Checking the engine			
Spark plugs	5	5	5
Distributor	4	5	5 3 F.I. 3 5
Carb adjustment	e====	F.1.	F.I.
Oil filter	2 5	4 5	3
Oil fill	5	5	5
Replacing hoses			
Upper radiator hose	5	5	5
Lower radiator hose	4	5 3 4	5 4 4
Heater hoses	4	4	4
Changing bulbs			
Headlights	3	3	3
Taillights	5	3 5 3	3 4 5
Front running lights	3	3	5
Front parking lights	3		3
Front directionals	3	3	3
Rear directionals	5	3 5 3	4
Rear running lights	3	3	3 4 4
Checking fuses	4	3	4
Spare-tire accessibility	4	4	4
Changing belts	3	3	4

Test results, dimensions, and specs

	Mitsubishi Cordia L	Nissan 200SX	Toyota Celica SR5 GT
EST RESULTS			Street and the street and
Acceleration (sec.)	Actes (1996)	de Line	raction to
0–60 mph	12.4	12.5	13.1
Brake test (cool) 60–0 mph			
Stopping distance (ft.)	186	177	173
Pedal pressure (lbs.)	95	60	120
Brake test (hot) 60-0 mph			
Stopping distance (ft.)	190	172	177
Pedal pressure (lbs.)	100	140	180
nterior noise @ 60 mph (dBA)	71	70	71
landling test (mph)	58.0	56.1	62.4
Maneuverability test (mph)	27.7	27.7	27.9
PA FUEL MILEAGE (mpg)			
Highway	42	40	37
City	29	28	26
Calif. city	28	29	26
S FUEL-MILEAGE TESTS			
steady-state mpg)			
35 mph	-	47.6	39.0
55 mph		37.9	27.8

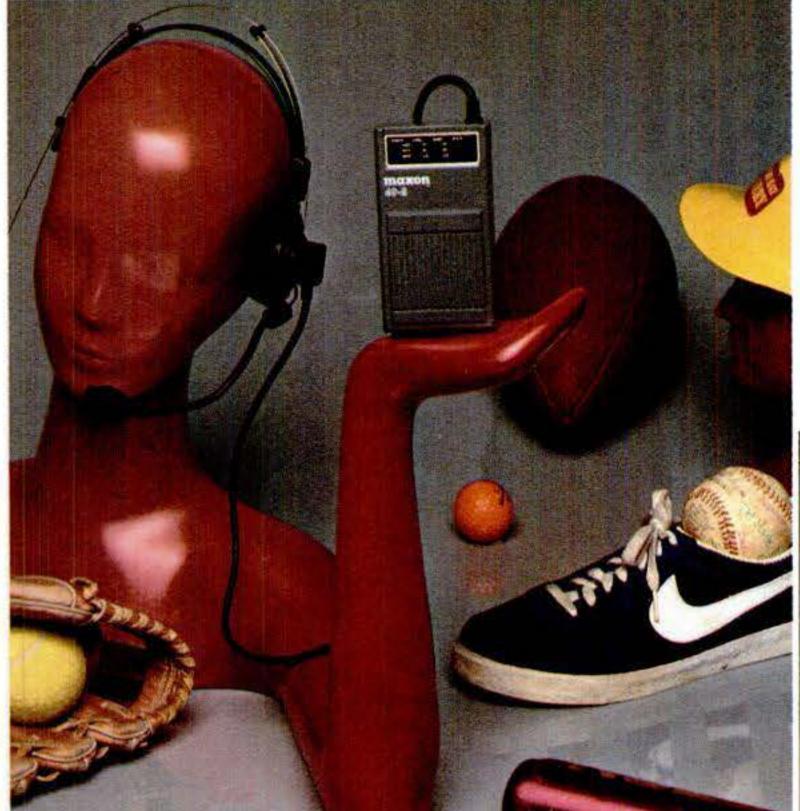
NOTE: POPULAR SCIENCE fuel-economy results are derived by driving the test vehicle over a flat, measured mile at sea level. Fuel consumption is measured using Pierburg PLU-116 liquid flowmeters with an accuracy of plus or minus 1.0 percent of actual flow rate. To eliminate the effects of wind, we average consumption after two north and two south runs.

TEST CONDITIONS Ambient temperature, 80° F; relative humidity, 78 percent; barometric pressure, 29.9 inches Hg

Wheelbase	96.3	95.5	98.4
Overall length		174.4	176.0
Overall height		52.4	52.0
Overall width		65.4	65.6
		54.3/53.5	54.9/53.7
Track, F/R			
Ground clearance		6.1	6.0
Front head room	35.5	35.5	35.0
Front hip room		42	40
Front leg room	43.5	45.5	42.5
Rear head room	31	32	33
Rear hip room	34	45	42
Rear leg room (min.)	30	32	29
Reaf knee room (min.)		-1.0	1.5
Couple distance	28.0	23.0	26.5
SPECIFICATIONS			
Engine type	In-line 4	In-line 4	In-line 4
Displacement (cu. in./cc)	122/1,997	120/1,809	144.4/2.366
Compression ratio		8.0:1	9.0:1
Carburetion		F.1.	F.I.
Net hp @ rpm		102 @ 5,200	105 @ 4,800
Net torque (ftlbs.) @ rpm		116 @ 3.200	137 @ 2,800
Fransmission	'	5-speed manual	5-speed manual
Axle ratio		3.70:1	3.77:1
fire make		Bridgestone	Michelin
fire type		RD 113 steel wide 70	Radial X
Fire size	.	185/70SR14	185/70R14
Steering		Power, rack and	Power, rack and
Accing	pinion	pinion	0.000 110
Querall steering ratio	#FEC 96007 (D)	16.4:1	pinion
Overall steering ratio		500000	Variable
Turns, lock to lock		2.9	3.1
Turn diameter (ft.)	32.0	32.2	32.8
Front suspension		Independent, Mac-	Independent, Mac
	Pherson struts,	Pherson struts,	Pherson struts,
왕	coil springs	coil springs	coil springs
Rear suspension	Independent, trailing	Independent, coil	Live axle, 4-link,
	arms, coil springs	springs	coil springs
Front stabilizer-bar			
diameter (in.)	0.87	0.95	0.86
Rear stabilizer-bar		59.	
diameter (in.)	=	0.95	0.59
Brakes		Disc-drum	Disc-drum
Brake swept area (sq. in.)		Section Constitution Constitution	300
Fuel tank (gal.)		14.5	16.1
Trunk space (cu. ft.)	10.075 (1.075	18.7*	25.7*
Liftover height (in.)		36.5	34.0
Curb weight (lbs.)	· 15000000000	2,469	2,566
F/R weight distribution (%)			
		54.0/46.0	52.3/47.7
Basic price		\$10.249	\$9,499
Price as tested	\$9,019 ¹	\$11,119	\$12,649 ³

power pack \$450, audio upgrade \$480, sun roof \$500, air conditioning \$675

*With rear seat folded



PRICE SLASHED

DAK has sold over 20,000 of these incredible communication devices for \$49.95.

NOW JUST \$29.95

Use Order Number 9810 (\$3 P&H). See Below.

PWR	VOL	MIC	PTT	
VOX	HI	HI		
PTT	M	M		
OFF	LO	LO	4	



Think Speak Plus

On the job, on the field or on the road. Now you can talk and listen 'hands free' at a new breakthrough price. Plus, there are now special units for motorcycle helmets with an intercom and FM radio reception.

SWAT Teams use them. So do quarterbacks and firemen. Now you too can talk and listen to people near and far, totally hands free, while you are jogging, sailing, skiing, hiking or riding a motorcycle.

Both at work and at home, this unique communications system, with a range up to 1/2 mile, will let you keep in touch.

NOT A WALKIE TALKIE

This is no toy. The Think Speak is totally automated. When you speak, a special voice activated circuit (VOX) automatically engages the transmitter so that you are broadcasting. When you stop speaking, it will automatically return to 'stand-by' to await a reply.

It is virtually noise free because it uses a quartz crystal locked dual conversion superheterodyne communication circuit that operates on 49mhz with FM.

So, your communication won't sound like a CB or an AM radio. You'll speak and hear with the full power and clarity you'd expect from an FM radio station.

HERE'S WHAT IT IS

You wear the Think Speak just like a personal stereo. There's an adjustable headphone that you wear on either your right or left ear. The other ear is clear to hear the outside world for safety.

In the helmet versions, the headband comes off and the earphone attaches inside. The mike and antenna attach to the outside with quick release velcro.

A flexible boom microphone lets you speak normally while you transmit. The entire shaft of the boom mike is adjustable and will retain any position you set.

The voice activation circuit has a 3 level sensitivity switch. If you're riding a motorcycle or breathing hard while you jog, you can set the sensitivity to low so that you won't transmit in error.

If you are hunting or fishing and you can't talk much over a whisper, you can

set the sensitivity to high. Plus, the headphone has a 3 level volume control too.

In addition to the VOX voice operated circuit, you'll have 'PTT' which means Push to Talk. When you want to talk, you just push the PTT button.

This is a really great feature when you want to whisper very quietly below the threshold of even the high sensitivity setting of the Voice Operated Circuit.

You may be into surveillance or photographing wildlife. When you can only whisper, you'll especially appreciate the super quiet FM reception of this system.

The motorcycle version adds a plugin 2nd headset for your rider (included), and an intercom/internal switch which lets you talk to and listen to your rider. You'll still be in contact with the outside world and will receive communications.

SOME SPECIFICS

You can expect long battery life from a standard 9V battery (not included). The antenna is conveniently clipped to the headband for normal use. For full range use, the antenna pops up.

The system operates on the 49 mhz band using FM, so you shouldn't be bothered by any other radio transmissions as you are with CBs and Walkie Talkies.

The transmission output is a full RF of 10,000uV/m @ 3 meters max. No FCC licence is required. And, the FM hum and noise is almost good enough for a high fidelity system at 40db min. The case clips to your belt, and is 4-9/16" X 2¼" X 15/16" for the standard unit and 4%" X 3" X 1½" for the motorcycle unit.

PERSONAL OR GROUP

You can talk to 1 or even 10 people with Think Speaks. The Think Speak is great if you're skiing with friends, using two boats, or sailing at sea. And, if you go hiking in the mountains, it's a must.

The two new versions designed for

motorcycle, dune buggy, ultralight aircraft and snowmobiling where you wear a helmet and may have a passenger, expand the Think Speak's range of use.

All three systems are electrically identical. So, if you're a pitcher, you can talk to your catcher or the coach. If you're on a loading dock, you can talk to the man in the truck or on the forklift.

It's made and backed by Maxon Electronics, the two-way specialists.

TRY THINK SPEAK RISK FREE

Walk around the block. Take a bike ride and really test the range of this communications breakthrough. If you aren't 100% satisfied, return it in its original box within 30 days for a refund.

To order your Think Speak risk free with your credit card, call toll free or send only \$49.95 (\$3 P&H) for each standard unit. Order No. 9810.

If you'd like a unit that you can either wear or attach to your helmet with velcro, complete with a second plug-in headset and an internal intercom, send just \$59 (\$3 P&H) Order No. 9811. And if you'd like the helmet unit with a built-in FM tuner too, it's just \$79 (\$3 P&H) Order No. 9812. CA res add Sales Tax.

All three units are totally interchangeable, sound identical and will both transmit to and receive from each other. A minimum of two Think Speaks are required for communication.

When you think out loud, people will listen. Try a Think Speak risk free today.

DAK 11221
INDUSTRIES INCORPORATED

TOLL-FREE ORDER LINE For credit card orders call 24 hours a day 7 days a week CALL TOLL-FREE. . . 1-800-325-0800 8200 Remmet Ave., Canoga Park, CA 91304

Copyrighted material

2+2 Japanese-style

detectable by the human ear and are usually considered a significant difference.) Still, the Toyota was not in the same noise class as some sports models that punish eardrums at all speeds with loud exhaust notes.

Moans and damp clouds

An eight-spark-plug ignition system on the Nissan 200SX four-cylinder engine ensures smooth, steady power and good fuel economy. That's because, says Nissan, the extra plug in each combustion chamber helps to burn the intake charge more completely.

Two strange quirks in the 200SX made us wonder whether the car wasn't haunted, however. On days with high humidity, the air-conditioning ducts spewed damp gray clouds of vapor into the passenger compartment. And at highway speeds, one of the rubber gaskets on the top of the passenger's door resonated with a moaning sound. Cracking open the windows seemed to liberate both spooks.

The Nissan 200SX interior layout is a sporty type with gauges for most of the important functions. Stalks mounted just below the steering wheel are easy to reach while the driver's hands remain on the wheel. One poorly executed interior detail is the position

of the radio. The operator has to lean uncomfortably far forward to reach its controls.

A five-speed transmission, electrically adjusted mirrors, multiple-adjustment front buckets, and split-back rear seats are some of the standard features in this Japanese sports coupe. All add immensely to the comfort and convenience of the vehicle, but they do little to hide only adequate engine power and a just barely adequate suspension and chassis. During our standard high-speed handling tests the body rolled excessively, and the tires offered little grip. This provided heartracing amounts of drift as the car traced sweeping arcs through the cones.

Front-wheel drive

You'd never guess that the Mitsubishi Cordia L was a front-drive. There are some design aspects that contribute to this impression. The center console takes up about the same amount of space as a transmission and drive-shaft tunnel. Also, the suspension tuning provides a neutral feel, not unlike that of the two rear-drive cars in the test. In our handling tests, the Cordia performed slightly better than the rear-drive Nissan but not as well as the rear-drive Toyota.

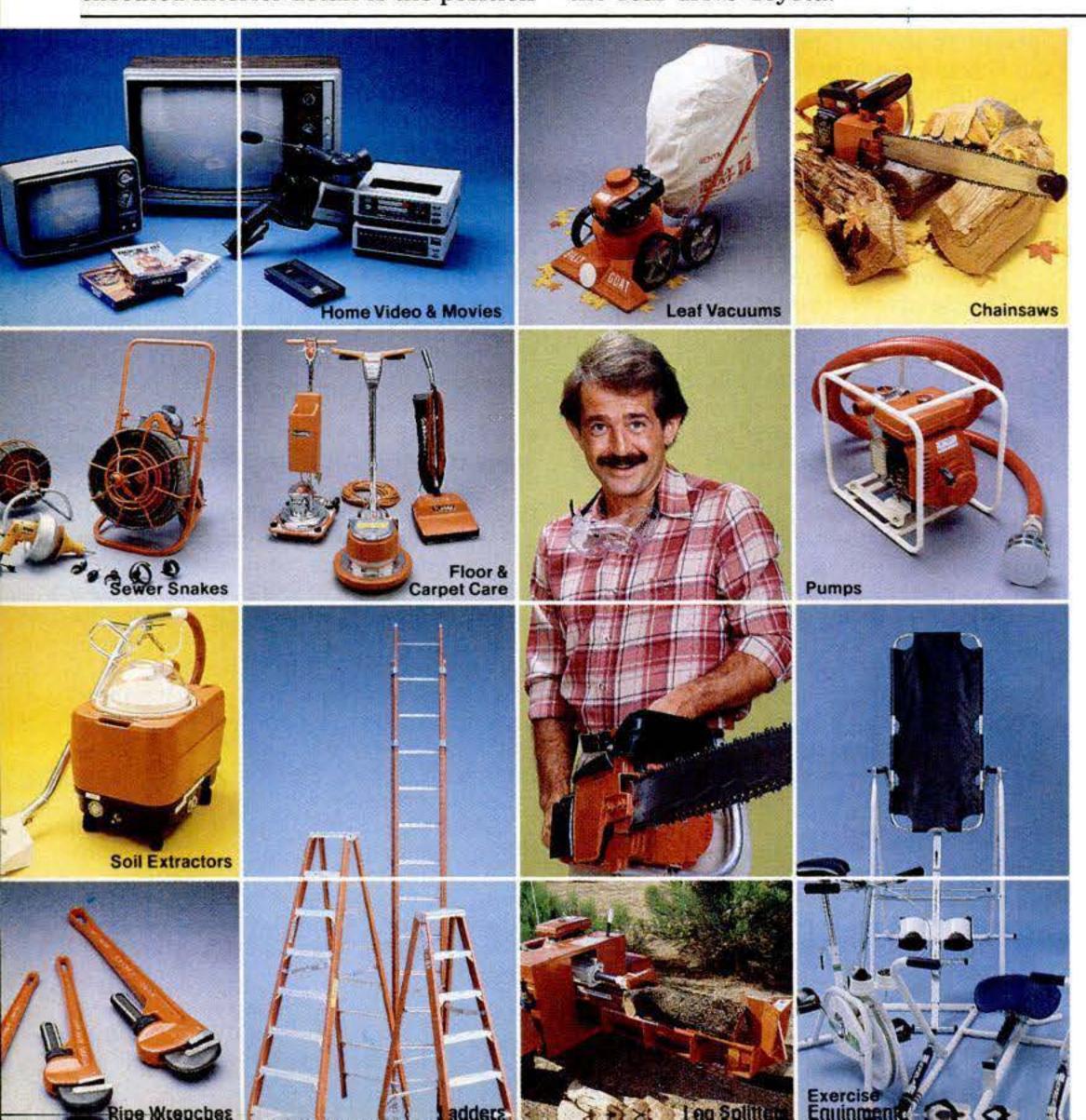
PS ratings test report in a nutshell

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.

	Mitsubishi Cordia L	Nissan 200SX	Toyota Celica SR5 G1
Acceleration	5	5	5
Braking	2	2	2
Handling	2	2	4
Maneuverability	5	5	5
Quietness	1	2	1
Roominess	2	2	2
Vision	4	5	5
Entry/exit ease	3	3	2
EPA economy	5	5	4
Ride comfort*	2	2	2
*Authors' opinion			

For easier access to the rear seats of the two-door, the passenger's bucket slides forward when the backrest is pushed forward. This opens up a wide corridor for back-seat riders. Once the passenger is aboard, pushing the backrest to its normal position returns the seat to its original track setting. The added space amounts to about five inches. That's significant compared

Continued



WHY BUY? NOW RENT IT AND SAVE AT YOUR U-HAUL CENTER

Now you don't have to buy an expensive tool that you may use only once a year

only once a year.

Rent it at U-Haul for a fraction of the cost. Your U-Haul Center rents everything you need for the wood-burning season and home fix-up.

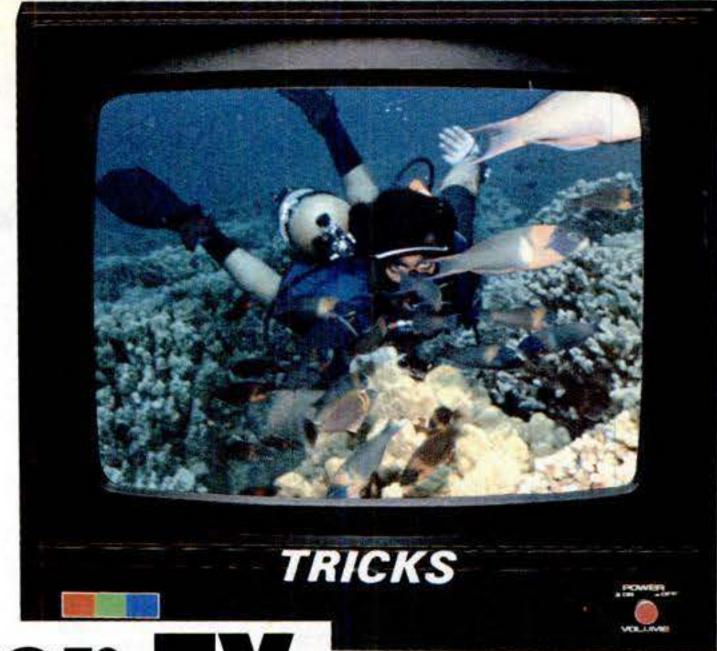
Plus you'll find other moneysaving rentals—everything for home, garden and play.

Stop by your neighborhood U-Haul Center and pick up a free Rental Catalog (free glove offer inside) today. For the location nearest you, look in the white pages.

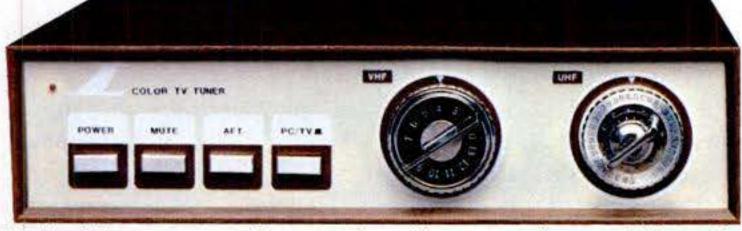
Rent it all at U-Haul







Computer TY





Wait till you experience the vibrant color and fine detail you'll see when you watch TV on your own computer's color monitor. These new TV tuners let you use your computer's monitor when you're not computing.

It's hiding. You've probably got the EASY INSTALLATION the picture above to suit your taste. Then

It's hiding. You've probably got the best color TV you've ever seen sitting right behind your computer.

If you've ever tried to look at computer graphics or text on a conventional TV, you know how hazy and muddy the picture can be. You just don't get the clarity and detail you see on a monitor.

The picture is sharper on your computer monitor because it is designed to have more lines of resolution than a conventional TV in order to display the fine detail required by the computer.

SO, WHAT IS RESOLUTION

The easiest way to visualize what an increase in resolution can do for your TV picture, is to compare the pictures in your newspaper to the pictures in a magazine.

The pictures in a newspaper are composed of lines of 65 dots per inch of resolution. A magazine's pictures contain 120 dots per inch. The difference in picture quality is like day and night.

While computer monitors vary in their exact resolution, they have significantly more lines of resolution than standard TVs and therefore you'll see an incredibly more detailed vibrant color picture.

GREAT IDEA

If you have a color monitor on your desk or in your den, why have a TV too? With these inexpensive tuners, you can have an incredibly sharp TV by simply making use of the **expensive** super high resolution monitor you already own.

My son added one of these tuners to the computer in his bedroom and threw out his old B/W TV. So, this tuner saved me from buying him the \$300 color TV he had wanted for his birthday.

I've added a tuner to one of the 5 computers at my desk (yes, as president of DAK it really does take 5 full size computers to do my job), and now I have entertainment and news, in color, without having another screen at my desk. Just look at the back or front of your monitor. If there's a single RCA jack that says video, you're ready to go.



Now for the sound. Most monitors have an identical looking jack that says 'Audio'. If yours does, you're all set. If it doesn't, just plug the audio into any 'aux' input on your stereo, or even into a clock radio.

There's a convenient switch that lets you switch from TV to computer without ever touching a cable again. There are both VHF and UHF inputs to the tuner. The world of TV will be at your command.

The tuner operates on standard 110V AC. Your computer may be on or off when you watch TV. You can be assured of the quality, because the tuners are made by Link, the computer specialists. They're backed by a limited warranty.

ENJOY SUPER-SHARP TV RISK FREE

Just imagine sitting back and enjoying brilliant TV images floating across your computer's screen. You'll be amazed at the detail that emerges from the screen.

Just plug your computer's output into the tuner and the tuner into your monitor. Add your antenna, and away you go.

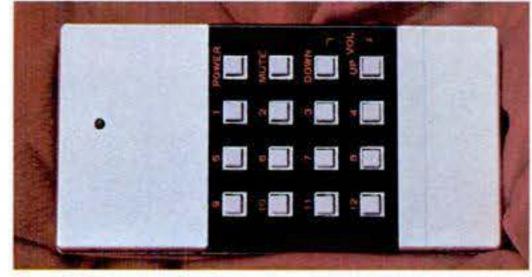
The rotary tuner is great for watching TV from the same seat from which you operate your computer.

Just set it on top of your monitor and flip its front panel swtich from PC to TV. Then, turn to the channel you want and enjoy a startlingly vibrant TV picture. It receives VHF 2-13 and UHF 14-83.

The all electronic remote control tuner is really special. The remote sits on the front panel for normal use, but lifts off for total control up to 20 feet away.

The electronic tuner can be set to receive any 12 channels you desire. Just adjust the tuning elements exposed in

the picture above to suit your taste. Then you'll have complete freedom of movement and an incredible picture. It receives VHF 2-13 and UHF 14-83.



But look at this. It's not in its specs, but I can tune it to midband cable channels 14-24. So, while we aren't offering it as cable ready, it tunes in my cable channels, and if they're not scrambled, it should tune in yours too.

Try one of the tuners risk free. If you don't see the sharpest, clearest most vibrant picture you've ever seen, simply return the tuner in its original box within 30 days for a courteous refund.

To order a Computer Monitor Tuner risk free with your credit card, call toll free or send your check for DAK's incredible breakthrough price of just \$88 (\$4.50 P&H) Order No. 4141 for the Rotary Tuner. Or, send just \$119 (\$4.50 P&H) Order No. 4142 for the Electronic Remote Control Tuner.

Enjoy breathtaking color TV by using the expensive, super-sharp color monitor you already own. Save the expense of a new TV that can't compare with the 'TV' that you practically already own.

DAK 11239
INDUSTRIES INCORPORATED

TOLL-FREE ORDER LINE For credit card orders call 24 hours a day 7 days a week CALL TOLL-FREE. . . 1-800-325-0800 8200 Remmet Ave., Canoga Park, CA 91304

Performance comparison with selected models

	Mpg (city driving)	Accelera- tion 0-60 mph (sec.)	Brakes 60-0 mph (hot) (ft.)	Handling (mph)	Maneuver- ability (mph)	Noise @ 60 mph (dBA)
1984 Chrysler Laser Turbo in-line 4	22	11.7	189	65.3	29.0	72
1984 Mazda RX-7 rotary	19	8.6	148	60.7	29.2	72
1984 Nissan 300ZX V6 Turbo	20	8.9	170	65.0	29.6	74
1984 Pontiac Fiero in-line 4	26	14.8	152	65.4	29.1	73
1983 Honda Prelude in-line 4	26	12.1	157	67.5	31.0	70

with the inch or so left when the seat is at its rearmost position. (Nissan and Toyota also have this clever seating arrangement.)

To make rear-seat passengers comfortable after they've taken their seats, air vents in the B-pillar can be pushed out into the airstream to scoop fresh air from outside.

Smooth-running four-cylinder engines are a well-developed science at Mitsubishi. The company reinvented the engine-balancing shaft that cancels out virtually all of the vibration that is so noticeable in larger-displacement fours. The result is a four-cylinder engine that's nearly as smooth-running as a V6.

How good is the system? The rumors are that Chrysler and Ford will be adopting this engine-balancing method for their engines soon. And

Porsche already uses the system in its 944 model.

Lesser Supra

The Toyota Celica SR5 GT is the basic car the Supra is built on. But the differences are substantial. Three important ones are a smaller engine, solid rear axle, and about a \$5,000 lower price.

Interior appointments are typical of Japanese sportsters. Gauges are backed up by warning lights, and there are more than enough storage pockets. The seats, like the others in this test, have multiple adjustments and are comfortable. Pull releases below the seat cushion open the fuel cap and rear hatch. The sun roof and outside mirrors are motorized.

Rear-seat room in the Celica is nothing to brag about: There's little of it.

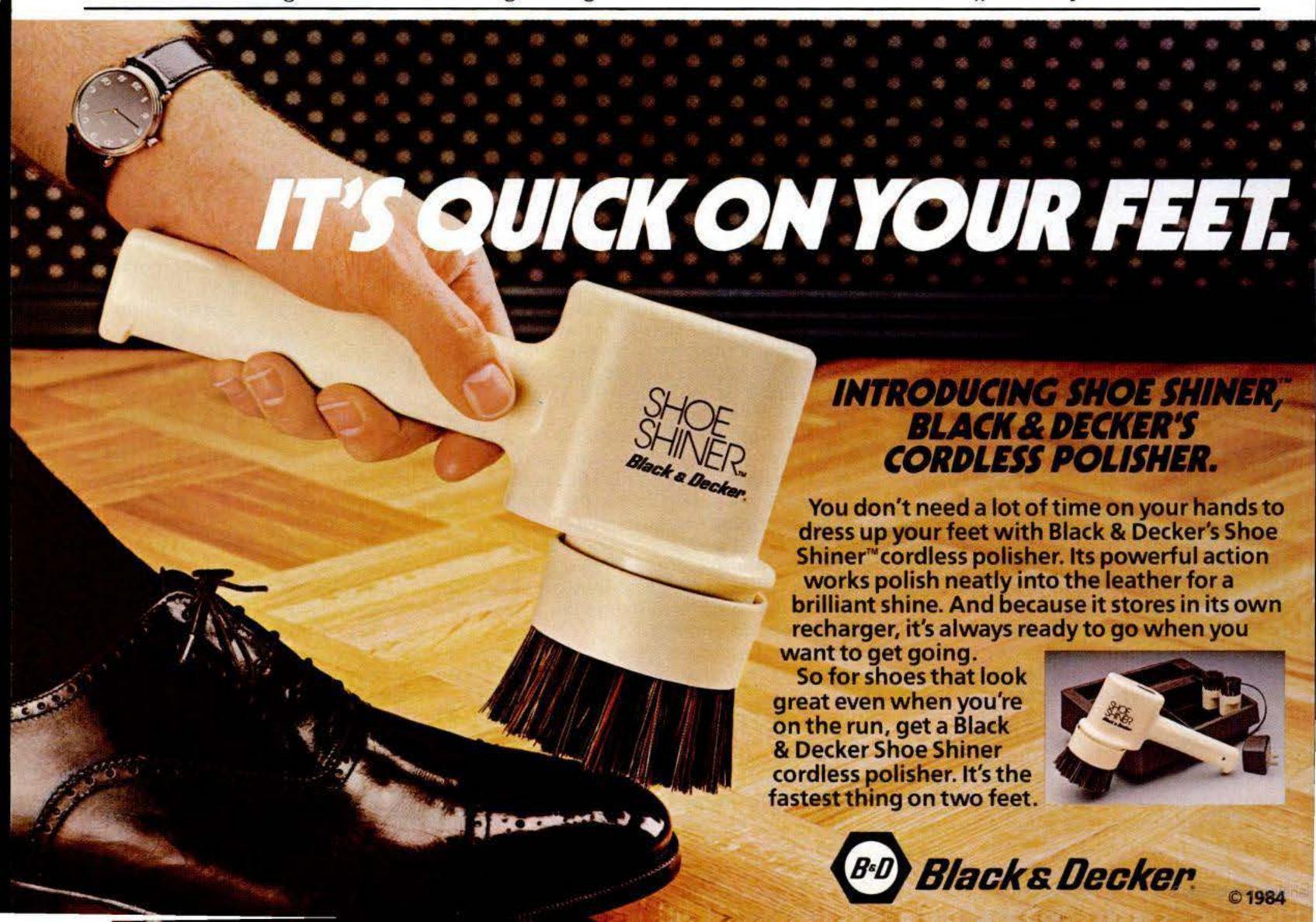
Preteens, let alone full-size adults, will find the back seat snug. Knee room is minimal, head room is cramped, and the rear cushion is thinly padded. Finally, the rear wheel wells intrude into the cushion, making it difficult to stay comfortable on a long trip.

The front seats are a different story. There's plenty of head and leg room. Even good-size adults will find the seating adequate. Drivers can get comfortable in a well-formed bucket with three positions, including an adjustable lumbar support. One point that drivers may not appreciate is the low (16-inch) seat height from the ground, a position that makes entering and exiting difficult. (Grab handles above the doors offer some help.)

Our pick:

Despite its slower zero-to-60 time, the Toyota has more of the sports-car feel and performance than the competition. But off-the-line performance isn't outstanding in any of these models. My decision is based on handling and the feel of the drive train. I think Toyota does the best job of making driving fun. And that's what a sporty car is all about.—J. D.

I agree. The Toyota offers an attractive exterior, better-than-average handling, and an affordable price.—J. K.



Cable Controller Plus

Get all the cable channels on any TV or video recorder with this all new wireless infrared remote control cable tuning system. And at just \$88, we're sure to break the cable market wide open.

If you've got cable, we've got it all. Now you can tune in up to 60 cable channels from your easy chair.

The Universal Cable Controller receives all VHF Low Band channels 2-13 and VHF Midband 14(A)-22(I).

Plus it tunes the Super Band VHF channels 23(J)-36(W) and Hyper Band channels from 37-58. It even captures the A1 and A2 Sub Band.

MOVIE CHANNELS

If there are movie channels on your cable and they're not scrambled, the Controller is all you need. If they're scrambled, you'll need the cable company's box.

Note: Check with your cable company before viewing anything at all, to see if they require you to pay a fee. SPORTS PLUS

There are lots of 'Super Channels' broadcast on cable. On the all sports channel you'll watch 'World Class Sports' whenever you wish. All Movie Channels give you entertainment at all hours.

And 'Super Stations' from New York and Atlanta give you major city TV for cities other than your own. Plus, there's Cable News Network for a world wide perspective on the news and much more. Why not see what's on your cable?

ONLY FOR CABLE

If you don't have cable, the Cable Controller isn't for you. It only finds you extra channels when you are connected to a cable. And, it doesn't tune in UHF.

But, if you're on cable, your cable company is rebroadcasting UHF over unused VHF channels. So with the Cable Controller tuner, you'll get it all.

TOTAL RANDOM ACCESS TUNING

The wireless infrared remote hand controller does it all. It switches both the TV and the Controller on and off and selects your channels. And, look at this. You can select your favorite channels (up to 6) and store them in a special section.

Then just touch the special 'RCL' Recall Button and you'll be able to sequence through only your favorite channels. This is especially convenient if you like to flip through movie channels during commer-

cials on regular TV.

For the other channels, you'll enjoy total random access tuning. You can go directly from channel 2 to 28. Or you can step tune one channel at a time.

Once you've set your own TV to channel 3, you can just forget it. Any fine tuning is handled from the wireless infrared remote handset. And you'll have crystal controlled frequency phase lock loop synthesizer tuning for the finest picture.

You'll see the number of the station that you have selected displayed on the command base. And, you can tune channels either from the remote or the base.

Color tints, volume, brightness and contrast are all controlled by whatever method you now use.

INSTALLATION

Nothing to it. All cable systems use 75 ohm round cable. Simply unscrew the end from your TV and screw it into the Controller base input.



Then screw in an identical cable (included) between the Cable Controller and your TV. Finally, plug your TV's AC plug into the Controller and the Controller's AC plug into the wall.

WHAT IT IS

The Cable Controller is actually a very sophisticated, all electronic VHF TV tuner/receiver. It's really like a TV set without a picture tube.

Since it's all electronic, you won't be getting snow from dirty tuning contacts and loss of fine tuning as the set ages.

The Controller tunes all the possible stations that your cable can broadcast, something that would be very expensive to build into standard TVs, because not all TVs are going to be used on cable.

UNIVERSAL V-1000 FIV SFT RCL

GREAT FOR VIDEO RECORDERS

Now you can record off cable. With the Cable Controller hooked to your video recorder you can open the world of cable to your video recorder too.

Cable ready video recorders that don't even tune in 60 channels can cost hundreds of dollars extra. You can feed both your TV and video recorder. Or, you can separate them so that you can easily watch one thing and record another.

WHAT IT ISN'T

It isn't one of the infamous 'black boxes' you might have read about that illegally decode various 'Pay TV' channels. On cable, most of the programming isn't scrambled, it's just found outside the tuning range of the average TV.

So, if there is a Pay TV channel that is scrambled, or is only unscrambled on one TV in your house, the Controller is not made and should not be used to tune

it in without paying.

Actually 'Cable Ready' TVs and video recorders do basically the same thing as the Cable Controller, but cable tuning is usually an added on feature that often doesn't cover as many channels.

The Cable Controller is made and backed by a standard limited warranty from Universal Security Instruments Inc.

TRY THE WORLD OF CABLE **RISK FREE**

Relax up to 20 feet away. Change channels, adjust the fine tuning or turn your set on or off. Explore the vast number of cable channels available to you.

Try it risk free. If you aren't 100% satisfied, simply return it in its original box within 30 days for a refund.

To order your Universal 60 Channel Cable Controller with Wireless Infrared Remote Control, risk free with your credit card, call toll free or send your check for DAK's market breaking price of just \$88 plus \$5 for postage and handling. Order Number 4147. CA res add tax.

There's a whole new world of entertainment waiting for you just off your normal TV tuning range. With the Cable Controller, you can sit back in your favorite easy chair and tune in the world.

> 11247 INDUSTRIES INCORPORATED

TOLL-FREE ORDER LINE For credit card orders call 24 hours a day 7 days a week CALL TOLL-FREE. . . 1-800-325-0800 8200 Remmet Ave., Canoga Park, CA 91304

Copyrighted material

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 University of Colorado.

Solar-water-heater plans

Where can I get plans for a home solar water heater I can build? I live 10 degrees north of the equator and have

sunshine 90 percent of the year. No one here builds any solar-powered equipment.

J. A. Stampfli San Fernando, Trinidad and Tobago

One book that will help you is Build Your Own Solar Water Heater, by the Solar Conservation Foundation (935) Orange Ave., Winter Park, Fla. 32789; \$4). I also wrote a book in 1977 on water-heating design for the West Indies; you can acquire a copy for the cost of printing (\$7.50) by writing to me, care of POPULAR SCIENCE.

What's a cord?

Just how much is a cord of firewood? I bought two cords-cut, split, and delivered. The first pile measured 40.5 cubic feet; the other was 90 cubic feet. James L. Colson, Ashfield, Mass.

A cord is a rectangular volume of 128 cubic feet, measuring four feet by four feet by eight feet. Your two "cords" totaled only one cord as defined above. The measurements used by your supplier might have been a face cord, which is a pile four feet high and eight feet long but of any depth. The face cord is obviously not a useful volume measure. If Massachusetts requires sale by the cord, you appear to have legal recourse to be supplied a total of 256 cubic feet of wood.

Water-jacket fireplace

I helped a friend install a water-jacket fireplace in his ski chalet two years ago. I am now building my own house, and I would like to install a hydro unit like his. Do you know of any companies that might manufacture fireplace units surrounded by an exterior water jacket?

L. Swope, Willoughby, Ohio

I am not aware of suppliers of waterjacket fireplaces. A few units installed in the last five years have had serious corrosion problems in the severe environment of a wood fire. In addition to the usual internal corrosion problems, external corrosion of both galvanized steel and copper has occurred. This can be very serious when the water jacket is under city water pressure; when a leak develops, steam production can be unsafe and can damage your home. Leaks are also difficult to repair. The only safe material for the piping is costly stainless steel. One firm manufacturing a stainless-steel grate (not firebox) is Movick Engineering, 4600 Macky Way, Boulder, Colo. 80303.

Drop-ceiling insulation

My house has a nine-foot-high ceiling. During remodeling I plan to install a one-foot-lower dropped ceiling. Should Continued



Copyrighted material

Split Personality

This is just about the best \$79 speakerphone you'll find. And, with its 512 programmable security codes and 1000' range, it's a fabulous cordless phone too.

If you're perplexed, join the rest of us. With all sorts of cheap cordless phones hitting the market, it's hard to separate

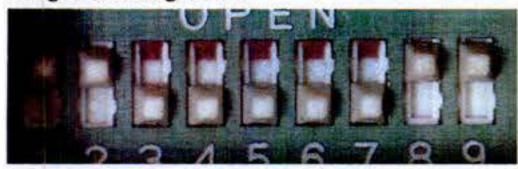
the good from the bad.

Here's Unitech's top of the line 1000' range cordless with 512 programmable digital security codes. It even has a second keypad and an absolutely fabulous sounding speakerphone that stands head and shoulders above the crowd.

If you live in a wealthy neighborhood, where everyone already has cordless phones, you know how annoying false

phone rings can be.

Well, with Unitech's top of the line phone, you'll switch any of 9 switches to select one of the 512 personal security codes and forget the annoyance of false rings ever again.



BUT, IT'S THE SOUND

This phone is loaded. You can originate or answer calls at either the base or the handset. And, you can transfer the call from one to the other. Plus, this phone makes a wonderful 1000' intercom.

You don't even need another phone. Just use the speakerphone and handset

to make your intercom.

You have total control. The base can call the handset and the handset can call the base for maximum convenience.

The intercom is great for everything, from setting up a TV antenna on the roof to calling your mate home when you need help.

Of course, the person with the cordless phone can call home for help or information with the simple push of a button. You'll never be out of touch with this phone by your side.

TOP OF THE LINE

It's Unitech's top of the line phone. And, just wait till you hear the sound.

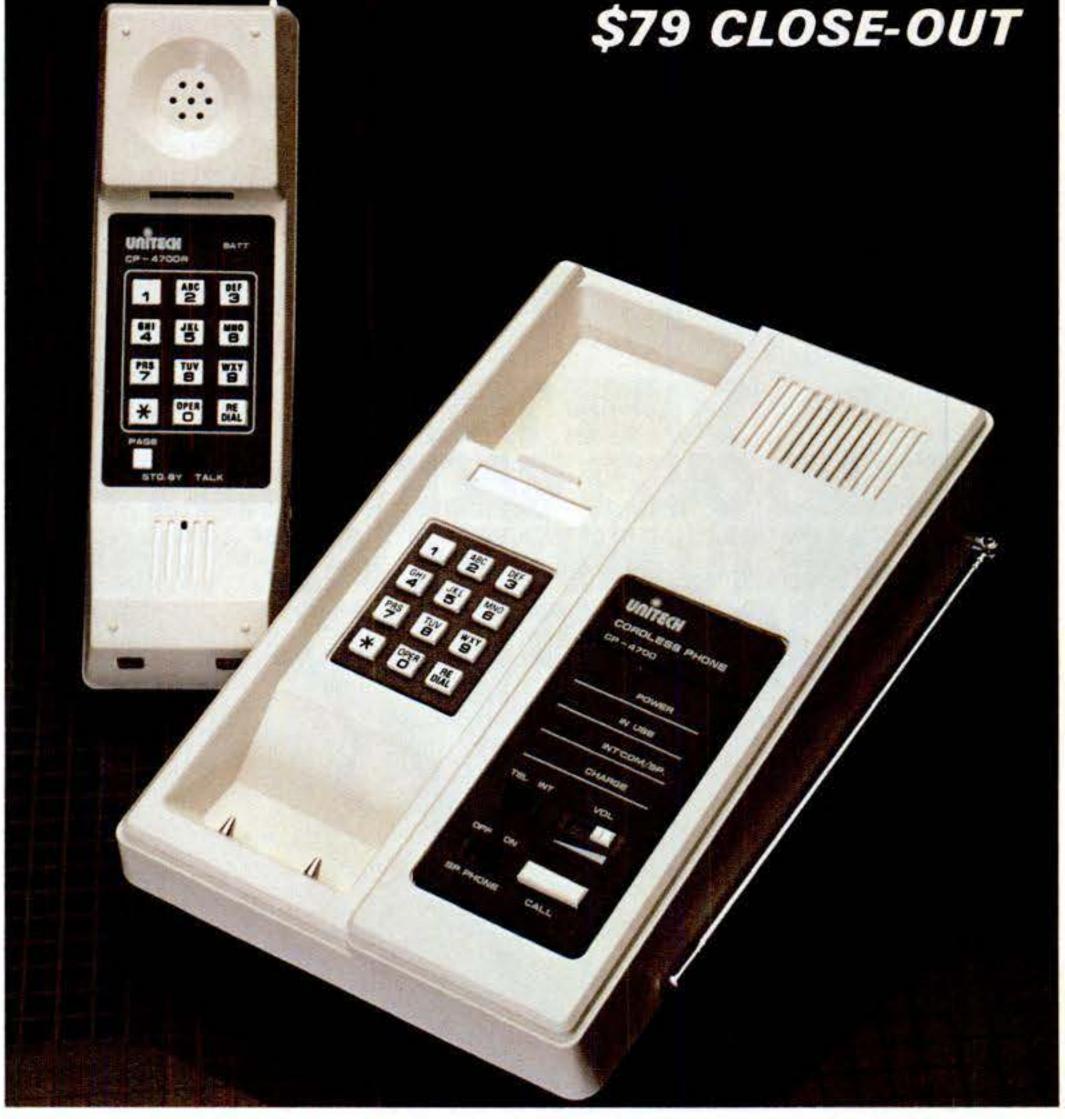
First, the speakerphone. You'll hear the person you're talking to with incredible volume and clarity. And, they'll hear you better than with any other speakerphone we've tested.

There's no hollow sound, no loss of volume. Unitech has designed a light-ning-fast, simplex speakerphone that sounds great. There are no push to talk buttons. Just talk and listen normally. You simply won't believe the clarity.

But, don't forget the cordless handset. With its 1000' range, you can roam around your home or around the block with total freedom. The sound is clean, clear and bright. The digital coding and super sensitive circuits really bring in superbly clean, clear sound.

SUPER CONVENIENCE

Imagine walking your dog while you talk on the phone. Think of the convenience for your wife of being able to



talk on the phone while keeping track of the kids in the yard or down the street.

Consider the security of being only seconds away from the police or fire department. You can instantly call a doctor or anyone, anywhere, anytime. It's a superb personal security device. You'll never be alone again.

And, look at this. You'll never run for the phone again. If the phone rings while you are working in the garden, the garage or lounging on the patio, now you can answer it without having to stop what you're doing.

Just consider the convenience of never having to wait by the phone again. You can visit a neighbor, work in the garden or get the mail without ever worrying about missing an important call.

When your phone arrives, why not make a call from your living room or garden. It's a great combination of posh luxury and life-saving utility.

NO INSTALLATION

If you can plug in a lamp, you can install your new cordless phone. Just plug it into an AC plug and modular phone jack.

It uses universal pulse dialing, so it works anywhere. It's backed by Unitech's standard limited warranty.

TRY THE SPLIT PERSONALITY RISK FREE

Try its speakerphone. Then take the handset for a walk test. The sound quality is sure to amaze you.

Call a friend. Use the speakerphone and then the cordless handset. See if your friend is aware of the difference. If you're not amazed, simply return it to DAK in its original box within 30 days for a courteous refund.

To order your Unitech Top Of The Line 1000' Cordless Phone, Super Speaker-Phone And Two-Way Intercom, risk free with your credit card, call toll free, or send your check for just \$79 (\$5 P&H). Order Number 9829.

It's a sensational speakerphone and a cordless phone with a 1000' range. And, you are likely to use the base speakerphone even more than you'll use its incredible cordless handset. Wow!

B DAK 11254
INDUSTRIES INCORPORATED

TOLL-FREE ORDER LINE
For credit card orders call 24 hours a day 7 days a week
CALL TOLL-FREE. . . 1-800-325-0800
8200 Remmet Ave., Canoga Park, CA 91304

Alternate-Energy Answers

I lay the fiberglass insulation between the new and old ceiling, or should I put the equivalent R-value insulation in the attic? I know ceiling panels exist with a fiberglass backing, but I already have uninsulated ceiling panels.

M. Cornaccia, Elizabeth, N.J.

These are your trade-offs: It is easier to insulate the attic, and a better job will result because no openings for light fixtures, with resulting air leaks, need be provided. The integrity of the vapor barrier will be more easily maintained. The main advantage of the other approach is the additional insulation value of the air gap between the original ceiling and the top of the insulation. The gap will have an R-value of about 2.5 with foil-faced insulation. My preference is to insulate the attic.

Hard-start capacitor

Recently, while my heat pump was undergoing its annual servicing, the re-

pairman told me I could benefit from the installation of something called a "hard-start" capacitor. Because of the hot, muggy weather we have here in the Tampa area, he said it would make the unit last longer (it's two years old), run more efficiently, and cost less to operate (supposedly 20 percent less per annum). He also said it would cost \$75 for parts and labor. I'd appreciate your opinion on the subject.

Mark Gipson, Palm Harbor, Fla.

A hard-start kit is designed to assist compressors on start-up. Start-up difficulties may arise because of hot weather or compressor wear. The capacitor is discharged on start-up to assist the electric motor in overcoming the startup load on the first revolution or two. A standard hard-start capacitor can extend compressor-motor life somewhat but will have almost no effect on electric power consumption. The cost quoted is on the high side of average.

Heat exchange

I would like to dump the waste heat from my air conditioner into my swimming pool to heat the pool. Who makes a heat exchanger for refrigerant-towater heat transfer?

Fred W. Hand, Torrance, Calif.

Contact the Trane or Carrier representative in your area.

Sun worshippers

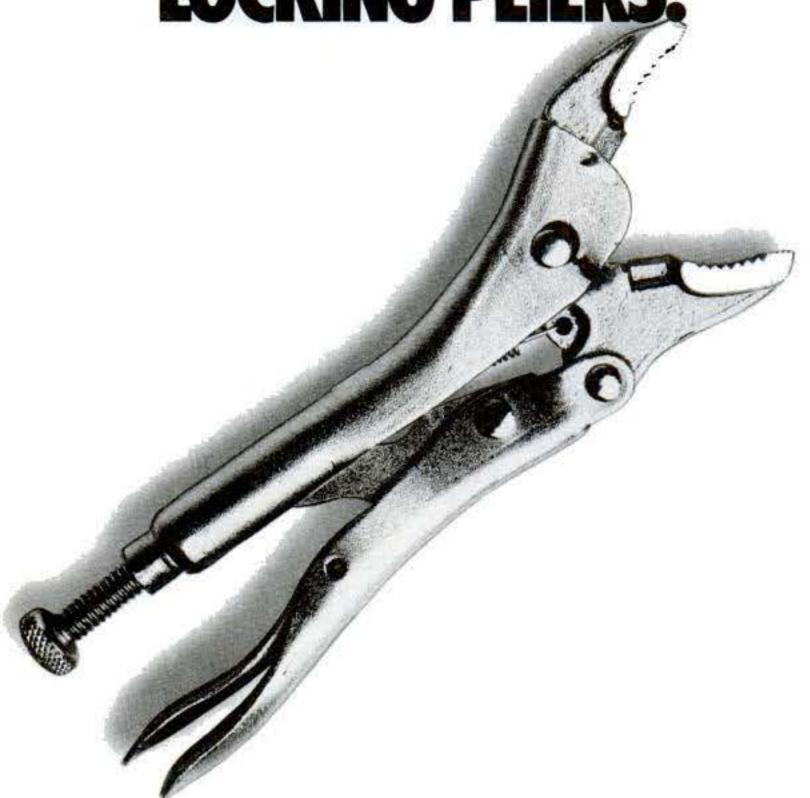
The members of St. Peter's Episcopal Church in Clearfield, Utah, have decided to do something about our outrageous winter natural-gas bills by building a solar collector. For a 550square-foot collector, what size fan should we use? Also, how should we bring the air back into the collector?

Bob Roberts, Layton, Utah

The recommended flow rate is about 1,500 cubic feet per minute at your altitude. Air should be distributed as usual and returned to the collector from the return air ducts already in place. A filter should be installed upstream of the collector inlet. If someone in the congregation is an engineer or heating contractor, ask that person to calculate the pressure drop in the solar air circuit so that the proper fan size can be determined.

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. Queries can't be answered by mail.





There are a number of locking pliers on the market that look like ours. But when you try to make them work like ours they get all bent out of shape. Because they're simply not built to withstand the years of use you take for granted with genuine VISE-GRIP locking pliers.

Don't take a chance on a look-a-like. Look for the VISE-GRIP trademark on the package. It's your assurance you're getting a tool that will stand up, not bend over.

© 1984 Petersen Mfg. Co., Inc. DeWitt, Nebraska 68341

The \$2 Commodore 64 Energizer

Just \$2 will buy you a powerful word processing program and a sophisticated data base management program. Or, \$2 gets you two top rated games, Slinky and Forbidden Forest. Or, you can get the infamous Monster Trivia Game with two thousand, almost impossible trivia questions. Buy one or all three groups for only \$2 per group. But, there's a catch.

By Drew Kaplan

Fire up your Computer. We've just gotten our hands on a software bonanza.

For work, for play and for mental stimulation, you'll have it all. Just \$2 can buy you hours of freedom, from writing letters and keeping track of everything from phone numbers to your stamp collection.

\$2 can give you hours of thrilling action fun with two award winning, Hi-Res, arcade quality action games.

And/or \$2 can give you the ultimate challenge of Monster Trivia. It's an earth-shaking software bonanza. But, don't forget there's a catch.

THE FIRST \$2

Imagine a word processing program that's so easy to use that you'll be writing, editing and printing out letters in just about 10 minutes.

You can write or edit text. And, you'll never have to retype a letter, memo or report again. A change or a correction is just a push of a button away.

You can delete or correct a single letter, a word or a whole line. You can save the text, and you can print it out.

But the best part is how easy it is to use. There are no complicated codes to learn. Just look at the menus shown above and you'll see just how easy this system is to use. Plus, it's incredibly fast.

Then add a data base management program. A data base is like a filing system. It lets you electronically 'file' all the information you have about a subject.

Then through the power of the computer, you can access and compare the information in many different ways with all the other files you have.

This data base program will let you create, organize and search up to 200 files, each with 8 individual sections. Everything is menu driven. There's absolutely no programming required.

And you can create as many different data bases as you wish, each with up to 200 files. In the example above, I've created a Telephone/Address book.

You can keep the information in your computer or print it out. The data base program can arrange it for you numerically or alphabetically. Or, use 'Greater Than' or 'Less Than' commands.

For example, if you had your stocks listed and one of the 8 fields was the value of each stock, you could simply tell the computer to list everything greater than or less than a certain dollar value.

And, you can locate information from any field in 'Global Search'. In the example above, you could locate me by my phone number, my first or last name, zip code, my interests, or even my street name or number.

Think what you could do with stamps, coins, recipes, little league teams or baseball cards. Wow, what power.

THE SECOND \$2

If you'd like some fun, try Slinky or Forbidden Forest. You guide Slinky as he jumps from square to square, changing each square's color as he goes.

But, watch out for the 'Evil Meanies'





lines free 358



who are out to get him. As you clear each level, you'll see a cartoon featurette celebrating your success.

But, beware. After the first level it gets hard because if you land on the same square twice, the square turns back to its original color. In the May '84 issue of Commodore User Magazine, they said "It's the best game we've seen so far this year!"

Forbidden Forest was chosen as one of the top 50 games of all time. You have to use three-dimentional skills to shoot arrows at everything from bloated bees and winged dragons to killer skeletons and more, as you run through an ever changing scenic arena.

THE THIRD \$2

Finally, it's time to stretch your brain. If you have a nagging desire to remember things that are less than monumental, Monster Trivia is for you.

You'll need a high frustration tolerance to play this game. You'll be asked questions about Science, History, Sports, Grab-Bag, The Arts, and Show-Bizz.

One to four players can compete. But, if you lose, a man-eating monster will break through the door and take you away.

THE CATCH

The catch is really very simple. You may not currently need a 'Commodore-ready' data cassette recorder. But, at DAK's \$49 Blow-Out price, think again.



The data recorder simply plugs into your Commodore 64. Nothing else is required. Then you can load our cassette programs, or anyone else's. Plus, you can save your own programs on cassettes very cheaply and securely.

The heavy duty data recorder is built to

give you years of reliable service. It has a massive flywheel drive for true data stability. If you have a disk now, you'll find the cassette a useful addition. It's an especially useful tool for exchanging programs with friends. It's backed by a standard manufacturer's limited warranty.

\$2 SOFTWARE BREAKTHROUGHS RISK FREE

Wait till you experience the full power of computer word processing. Wait till you fill in your own data bases.

You and Slinky will jump together and you'll shudder as you enter The Forbidden Forest. And finally, you'll have your brain challenged by Monster Trivia.

If you aren't 100% satisfied, simply return the recorder and all programs you purchased in their original boxes within 30 days for a courteous refund. Note: you may not return the recorder without all the programs you purchased.

To order your Fortronics Data Recorder for your Commodore 64 and any of the programs you desire, risk free with your credit card, call toll free, or send your check for the incredible price of just \$49 plus \$4 for postage and handling for the recorder. Order No. 4143.

You may order one copy each of any or all of the cassette programs. The Word Processing and Data Base cassette is just \$2 (\$0.50 P&H) Order No. 4144. The Slinky and Forbidden Forest Cassette is just \$2 (\$0.50 P&H) Order No. 4145. And, the Monster Trivia Cassette is just \$2 (\$0.50 P&H) Order No. 4146.

Fire up your computer with these exciting top of the line programs to aid your work and exercise your brain.

Commodore and Commodore 64 are regestered trademarks of Commodore Electronics Ltd.

DAK INDUSTRIES INCORPORATED

TOLL-FREE ORDER LINE For credit card orders call 24 hours a day 7 days a week CALL TOLL-FREE. . . .1-800-325-0800 8200 Remmet Ave., Canoga Park, CA 91304

Copyrighted material

Enter A Whole New World of TV Entertainment

the whole line of Regency Regency invites you to enter the exciting world of home satellite products, see your satellite television. Imagine Regency dealer or write us at the address below. being able to choose from over 100 channels, including movies, sports, news, and educational programs, all at the touch of a button. Regency offers a complete selection of satellite system components including the new SR5000 remote controlled satellite receiver pictured here. For more information on

Regency Electronics Inc. • 7707 Records Street • Indianapolis, IN 46226

READY AIR mounts on most truck engines and gives you 150 psi.

- For air pressure anywhere your vehicle goes
- Quickly inflates tires
- Operates pneumatic tools
- Uses no passenger or load space – mounts under hood, tank under body
- Compatible with all factory accessories, including air conditioning
- Mounts easily on most
 2 WD and 4WD trucks,
 no vehicle modification
- Low cost complete kits \$595
- 12-month warranty



Wherever you need fast, high pressure air – for whatever purpose. On the highway . . . at construction and field sites . . . in warehouses. For commercial uses. Industrial uses. Mechanical repairs.

It's READY AIR.

Our careful engineering gives you a lightweight (less than 70 lbs.), high quality and highly durable full-time source of power . . . made specifically to fit your truck and engine model. And easily removable when you sell or trade in your vehicle. Dealer Inquiries Invited

READY AIR

Call - (619) 356-1060 We'll Ship Today

Cal. residents add 6% sales tax

es,	I'm interested!	
	Please send me more information	

Please send me a READY AIR kit at \$595.

NAME _____ADDRESS _____CITY ___

Mail to: Therold Industries

TRUCK MODEL & YEAR _____
ENGINE TYPE & DISPLACEMENT ____

MASTERCARD # ______
VISA # ____

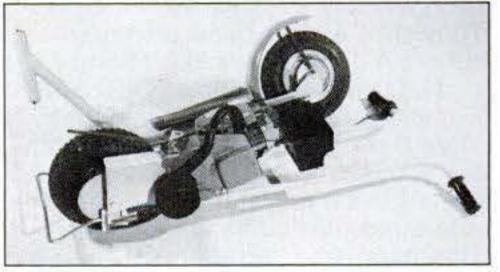
Exp. Date

Exp. Date

500 E. 7th Street Holtville, California 92250 SIGNATURE

Take-along folding scooter





This tough little 50-pound runabout has a husky steel frame, ball bearings in all the right places for easy steering and free rolling, and a 50-cc (three-cu.-in.) two-stroke Tecumseh engine for speeds of up to 20 mph at an impressive 125 mpg.

But I was even more impressed when I switched off the Skoot Cub: For transport or stowing you unscrew and pull a kingpin to separate the engine and handlebar from the rear wheel and rider platform. The two halves fit in a trunk as take-along gear on an outing. (Its maker recommends it for use in factories, airports, and farms, or by police.)

In use, I found it easy to start on its kickstand. The centrifugal clutch lets the engine idle with no forward motion until you twist its one and only control: a grip throttle. To stop, you just ease your weight back on the foot platform, and a rear-wheel band brake does the rest.

Skoot Cub is \$395 plus shipping from Summit Productions, Box 2555, Lincoln, Neb. 68502.—E. F. Lindsley

STATE ____ ZIP

Two Lines For Everyone

Now you can forget expensive, but dumb, two-line phones from the Phone Company at home or at the office. DAK has slashed the \$129 price tag on this installation-free two-line, 10 memory, Tone/Pulse decorator styled

telephone down to just \$49.

You're at the office. You have just 5 minutes before your next meeting. And,

you want to call home.

You dial your home number. You want to tell your wife to meet you for an early 5 o'clock dinner at a new restaurant near the office. It sounds great.

But, the line is busy. Your meeting starts. So, tonight it looks like you're going to eat dinner at home.

NOT JUST THE RICH

For those of us who already have two lines, we can send back our expensive, dumb phones. If you don't already have two lines, you might be surprised to know that having the extra line will cost you only about 30 cents a day.

And, installing this phone consists of simply plugging in a jack(s) just like on a single line phone. It's easy and it's fast.

We even have optional \$1 cords to let you plug this phone into two standard, single line jacks or one 2 line jack.

If you don't already have jacks, you can put them in yourself. Or, you can have the phone company do it for you. SO, WHAT DOES A \$129 PHONE DO?

For \$129 it does a lot. For DAK's \$49 close-out price, it's a smash, even if you use it as a single line phone. (Yes, you can use only one line if you wish.)

Tone/Pulse Switchable. Just switch it to fit your area. Or, dial in pulse to access your Sprint or MCI number, then switch to tone for dialing.

10 Memory Dialing. You'll have 10 16 digit memory locations including last number redial to make your dialing easy.

You can store frequently dialed numbers, or your complicated Sprint or MCI codes. I store my Telephone Credit Card.

First, I dial a long distance number. Then, the phone automatically dials my 14 digit credit card number. No more mistakes and no more hassles. Wow!

And, look at this. The memory is protected for over a year by two built-in, replaceable calculator-type batteries.

A Real Hold Button. You can put one or both lines on hold. If you answer a call in the bedroom, and you need to look up something in the kitchen, just put the call on hold. Red LEDs show which line(s) are on hold.

Any phone, of any type, in your home can take over the call with this professional hold feature. It's up to you.

Mute Switch. Using the mute switch is like electronically putting your hand over the mouthpiece for privacy.

Full Conference Capability. While you are talking on one line, you might want to add a third person from the other line to your conversation.

You can put whichever line you are using on hold, and use the other line to call out. Then just push both the line 1 and line 2 buttons, and both calls will be joined. It's easy. It's fast. And, group conversations can be really productive for work and fun with friends and family.

Two Bells, Two On/Off Controls. There are actually two separate, real mechanical bells built into this phone (one for



each line). The ring(s) will sound just like a Phone Company Phone ring.

Plus, LEDs show which phone line is ringing. There are even separate on/off switches for each bell. So, you can turn one phone on and one off. This is really neat. You can give one phone number to only your most important friends or family.

A, B, C, and D Buttons. These special buttons generate special tones for future services, such as bank transfers.

YOU'LL LOVE THE CONVENIENCE

Now you can have the luxury of two phone lines. If you have kids at home, you'll still be able to make or receive calls even when they are talking.

And, don't ever worry about getting a busy signal again when you call home. Plus, you're going to have an extremely comfortable, great sounding phone with traditional 'Phone Company' fit and feel. WHY SO CHEAP?

Toryo is primarily an engineering company. They subscribe to the design a better mouse trap and the world will beat a path to your door theory.

We at DAK saw this phone selling for \$129.95 in another catalog. But unfortunately for Toryo, they didn't know how to get these phones in enough stores or catalogs to make it profitable.

So, DAK offered a ridiculous all cash price to Toryo and Toryo's factory to clear out all 37,000 of these phones.

So, you can buy this phone from another

large company (we have a copy of their summer catalog in our factory outlet store) for \$129.95, or you can buy it from us for just \$49.

This handsome addition to any room may be desk or wall mounted. And, it's backed by a DAK 1 year limited warranty.

TWO LINES FOR YOU RISK FREE

Call your friends. Feel and hear the quality of this phone for yourself.

If you're not 100% satisfied, simply return the phone to DAK within 30 days in its original box for a refund.

To order your Toryo Two-Line Phone with Tone/Pulse Dialing, 10 Number Memory, Hold, Conference and Future Banking Service Buttons, call toll free, or send your check, not for the \$129.95 price we've seen, but for just \$49 plus \$4 for postage and handling. Order No. 4129.

If you want to plug it into 2 jacks, we have a pair of modular cables for \$1 (\$0.50 P&H). Or. No. 4130. If you have a single 2 line modular jack, we have a cable for \$1 (\$0.50 P&H). Order No. 4131.

If you have two lines as I do, this phone will end fumbling with receivers forever. If you only have one line, think of the convenience and luxury this phone and a second line can add to your life.

T DAK INCORPORATED

TOLL-FREE ORDER LINE For credit card orders call 24 hours a day 7 days a week CALL TOLL-FREE. . . 1-800-325-0800 8200 Remmet Ave., Canoga Park, CA 91304

Copyrighted material

Put yourself in Halley's path!



Mason & Sullivan YOUR BEST **CLOCKBUILDING** SOURCE • Great projects for

- any skill level. · Plans, hardware, flat
- lumber. W. German move-
- ments with 36-month quarantee. Widest selection of
 - competitively priced quality quartz movements.
 - Solid brass dials.
 - Tools, books.
 - Customer service to help your project go smoothly.

No matter what your clockbuilding needs. come to Mason & Sullivan first. We want you to be a great clockbuilder too.

NAME		
ADDRESS		
CITY	_STATE	ZIP
cMo	son &. S	Sullivan

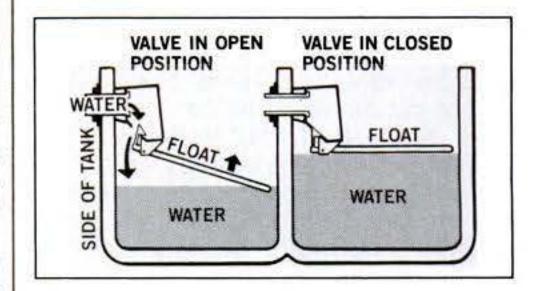
Send \$2.00 to receive a one year subscription to our 56-page color clockbuilding supply catalogue. Includes clock kits, dials, movements, weather instruments, hardware, tools, books, and accessories Address "Fine Clockmakers Since 1947" Q PRODUCTS P.O. Box 2069 Kansas City, KS 66105 Dept. 1337, W. Yarmouth, Cape Cod, MA 02673

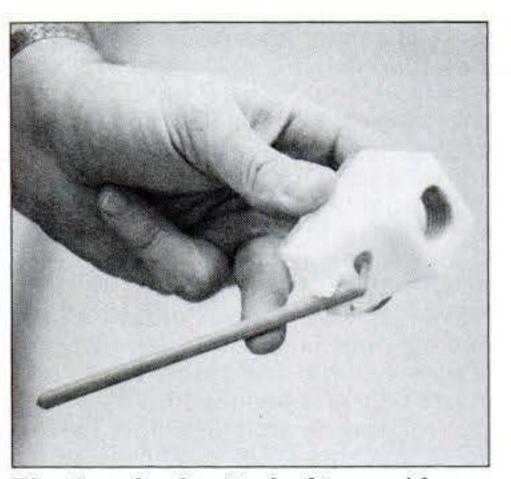


Phone ___

State ___ Zip __

Plastic float valve





Plastic valve is attached to semi-buoyant arm that seats cone when tank refills (right in diagram). Flexible body absorbs the shock of fast closure.

Fed up with noisy, erratic float valves for toilet water tanks or storage cisterns? A British firm says it has a solution with the Ve Cone Valve, an allplastic, fast-acting float valve with one moving part. The Ve Cone Valve is quiet, leak-proof, maintenance-free, and washerless.

Also, says Roberts & Associates (London House, 271 King St., Hammersmith, London W6 9LT, England), the Ve Cone costs a fraction of the price of conventional brass valves. The new valve is a flexible hollow cone molded to a float arm. The arm pivots on the valve body and seats against the tapered water inlet. When the water level drops, the cone lifts off its seat and admits water at twice the rate of normal ball-cock valves. As the tank fills again, the float rises to close the valve.

However, unlike an ordinary hollow ball, this float is water-filled and just barely buoyant: Because water pressure from the inlet firmly seats the valve cone and not the float, the float must be weighted to overcome inlet pressure until the last moment. -David Scott



Now, just the sound of your voice is all you'll need to remotely retrieve phone messages with the all new Voice-Print Plus Answering Machine. And, at DAK's \$79 price, the answering machine market will never be the same.

Forget beepers. Your own voice is your remote beeper with this incredible new breakthrough in sophisticated telephone answering computers.

And, the VoicePrint breakthrough is just the beginning. You can forget both the regular 20 second fixed announcement and 30 second fixed incoming mes-

sage recording length that's standard with most answering machines.

Plus, you can forget listening to your own announcement between your incoming messages But, best of all you can forget forgotten beepers forever.

FIRST THE SIMPLE THINGS

The new VoicePrint's computer brain lets you record any announcement up to 40 seconds in length. So, with Voice-Print, you don't have to worry about your message being too short or too long.

comes in, you can monitor the caller's message (it's called call screening) and then decide if you wish to pick up.

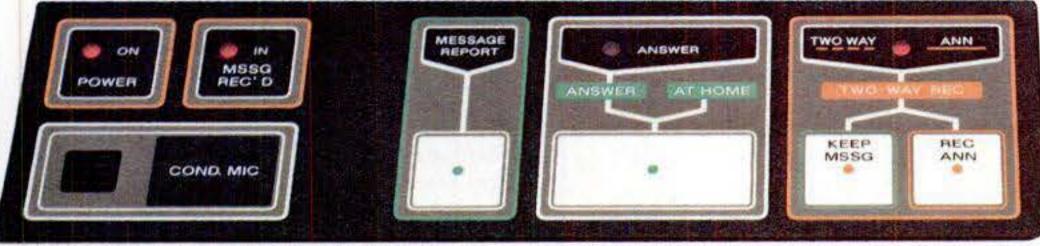
This machine does everything. If you're on the phone and you want to record both sides of the conversation, just touch the 2-way record button and you'll have a permanent record of the conversation.

IT SAVES YOU MONEY

When you call in to get your messages, VoicePrint's toll saver takes over. The machine tells you by not answering on the second ring that you have no messages. So, you can hang up before the connection is made.

When you're home, you can set the machine to answer on the 2nd, 4th or 6th ring to give you plenty of time to get to the phone if you desire.

If there are messages when you call



Taking messages is automatic too. Many cheap answering machines must record a preset 30 second incoming message. The more expensive units let callers talk as long as they want.

The VoicePrint combines the best of both. The computer will stop recording as soon as the caller stops talking.

But, calls are limited by the computer to no more than 1 minute. And, if someone hangs up without leaving a message, the machine ignores the call.

LOADED

Everything is automated. Just touch one of the full logic controlled touch pads and the computer answers with a confirming beep and jumps into action.

To play back messages at home, just touch the Message Report Button. Of course, you can elect to save them or let the machine record over them.

A message light tells you at a glance if you've received any messages while you were out. If you're home when a call in, just give the computer your personalized VoicePrint and you'll get all your messages. Plus, we've got an optional beeper for you to use if you don't want to use the 'Voice Function'.

Here's a nice extra. If your machine has taken a lot of messages and filled up its tape, a second message that you've recorded will come on and inform callers that no more messages can be taken.

NEW ELECTRONIC TECHNOLOGY

You can forget costly endless loop cassettes and long empty spaces. This machine is so intelligent it knows exactly where each message is on the tape.

This machine is fascinating to watch in action. First, it plays your outgoing message. Then, it sounds a tone as it zips to the end of the last message it took.

It then beeps and starts taking the new message. Finally, it rewinds back to your outgoing announcement to start the cycle again. It's one smart computer.

OPTIONAL SMART TELEPHONE

For an extra \$20, you'll have a model with a Tone/Pulse phone that gives you the convenience of on hook dialing.

On hook dialing lets you dial a number without picking up the receiver. Through the speaker in the answering machine you'll hear whether you get a busy signal, a ring or if someone answers. Then, just pick up the phone and talk.

EASY INSTALLATION

Just plug in the modular phone jack and the included AC adaptor. Then, just record your message(s) using the builtin condenser mike. The VoicePrint Plus is made by Unitech. It's backed by their standard limited warranty.

TRY THE VOICEPRINT PLUS RISK FREE

It's new. And, it will set you free. Wait till you see how easy it is to use. And, wait till you and your callers hear just how good it sounds.

Try this heavy duty industrial quality answering computer in your own home or office. If you aren't 100% satisfied, simply return it within 30 days in its original box for courteous refund.

To order your Unitech VoicePrint Remote Control Microprocessor Controlled Answering Computer, risk free with your credit card, call toll free or send your check for DAK's market breaking price of just \$79 plus \$6 for postage and handling. Order No. 4148.

If you'd like the VoicePrint Plus with a Tone/Pulse On Hook Dialing Phone, it's just \$99 plus \$7 for postage and handling. Order No. 4149. And finally, if you don't want to talk to your machine, we have a special remote beeper that works with either machine for just \$12 (\$1 P&H) Order No. 4160. CA res add 6% tax.

At home, at the office or on the road, you'll be in full control with the latest in user-friendly telephone technology.

DAK INDUSTRIES INCORPORATED

TOLL-FREE ORDER LINE For credit card orders call 24 hours a day 7 days a week CALL TOLL-FREE. . .1-800-325-0800 8200 Remmet Ave., Canoga Park, CA 91304

Copyrighted material

11296

MUSTLIQUIDATE AT BELOW DEALER COST! Nimslo 35mm 3-D CAMERA

FACTORY NEW! FIRST QUALITY!

We were very fortunate to obtain an inventory of these amazing cameras from a trading company. Because of the favorable terms of the transaction, we can now offer you this camera at an extremely low price!

Compact

7" long.

Size.

Just

PUBLIC NOTICE!

It's unique! Fascinating! The impressive realism of 3-dimensional color print photography!

Even if you own a Nikon, Olympus AND Pentax, NONE of those can do what THIS one does!

FOUR separate lenses take FOUR separate shots of a scene, simultaneously! Special processing produces a SINGLE 31/2" x 41/2" glossy color print with the

amazing realism of THREE-DIMENSIONAL photography! (Two pre-paid processing mailers are included.)

You actually see the DEPTH, from foreground to middleground to background . . . without use of special "glasses." You'll be thrilled and fascinated with your beautiful 3-D photos!

This camera uses regular 35mm color print film (ASA 100 or 400). You get 18 finished 3-D color prints from a 36 exposure roll. The camera provides AUTOMATIC electronic control of speeds (1/30 to 1/500 sec.) and aperture for best photo results.

We have sold tens of thousands of fine cameras! But THIS one is by far the most unusual one we have ever seen! Even highly experienced camera enthusiasts can't help but marvel at the remarkable three-dimensional color prints from this camera.

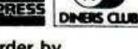
Add this exciting camera to your Christmas gift list for those individuals who "have everything." They'll be delighted! And don't forget to order one for YOURSELF. You deserve it!









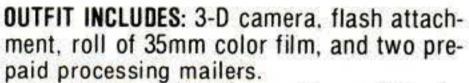


Credit card members can order by phone, 24 hours a day, 7 days a week.

Toll-Free: 1-800-328-0609 In Minnesota, call:

Toll-Free: 1-800-742-5685

Authorized Liquidator MINNEAPOLIS, MINNESOTA 55441-3357



QUADRA LENS SYSTEM. Four 30mm f/5.6 airspaced triplets with coated high index optical glass elements. Pre-focused, 6-ft. to infinity. **DEDICATED HOT SHOE.** Contact for cordless connection to electronic flash unit (included). DOUBLE EXPOSURE PREVENTION. Avoids wasted film.

SIGNAL LIGHTS. LED indicators for low light warning, bat-tery OK and sufficient light.

Warranty!

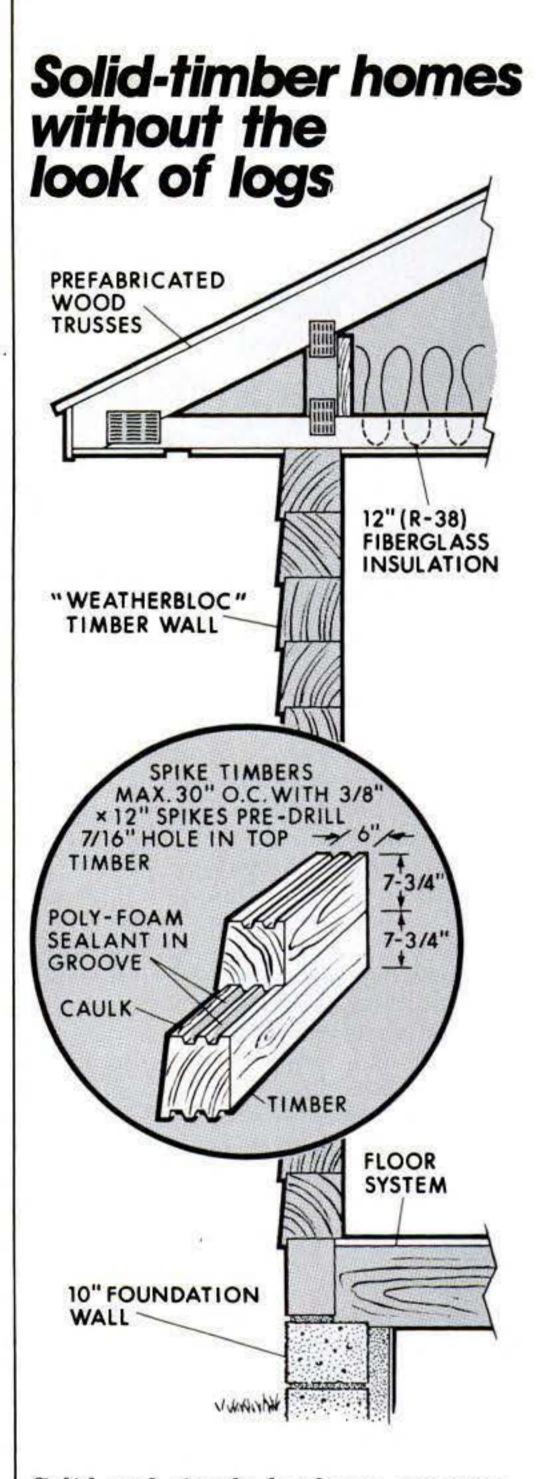
One Year Limited **Factory**

Manufacturer's Suggested Retail

OUT THEY GO AT ONLY:

Price subject to change after 60 days. Offer void outside the 50 United States.

!	C.O.M.B. CO. Item F-685-62815-6	07
	14615 28th Ave. N., Minneapolis, MN 55441-	3357
111	Send 3-D Camera(s) at \$68 each plus \$4.25 each shipping and handling. (Minnesota residents add 6% tax. Allow 2-3 weeks for delivery. Add 2-3 weeks paid by check. Sorry, no C.O.D. orders.)	6 sales
1	☐ My check or money order is enclosed.	
i	Charge: □ MasterCard * □ VISA □ Am. Ex. □ Diner	s Club
i	Acct. No Exp	- 13
!	PLEASE PRINT CLEARLY	
1	Name	
I	Address	
I	City	- 17.
ì	State ZIP	
i	Phone	
1	Sign here	/



Solid and simple log-home construction—without the log-cabin look—is available as an energy-efficient alternative to wood-frame houses. The WeatherBloc System uses squared-off timber construction, with walls that resemble New England clapboard (see drawing).

The building technique uses the timber's thermal mass to provide significant savings on heating and cooling costs when compared with wood-frame houses insulated to the same R-factor, claims the maker, Lincoln Logs, Ltd. (Waterside Rd., Chestertown, N.Y. 12817).

Prospective homeowners can either design their own custom homes or select from a range of existing designs. To save on costs, three workers with average construction skills can build a basic home from a WeatherBloc kit in about 30 days, according to the manufacturer.—Stuart Brown

Firefighting helibucket

Fabric buckets have taken over from oil drums as helicopter-borne water buckets for fighting forest fires. This latest entry from Vancouver, Canada, combines new fabric technology and ingenious structural design.

By TIMOTHY O. BAKKE

ention the name "Bambi," and most people envision a tranquil forest scene inhabited by an endearing fawn, a rabbit named Thumper, and a coterie of cuddly creatures. Mention it to a forester in California or Alberta, Canada, and you'll probably get a discourse on the merits of the water bucket shown here.

The so-called Bambi Bucket, from the Canadian firm SEI Industries Ltd. of Vancouver, B.C., is something new in the world of forest firefighting. It uses strong nylon scrim fabric and a unique structural design to update an old idea: dumping water from above onto a fire.

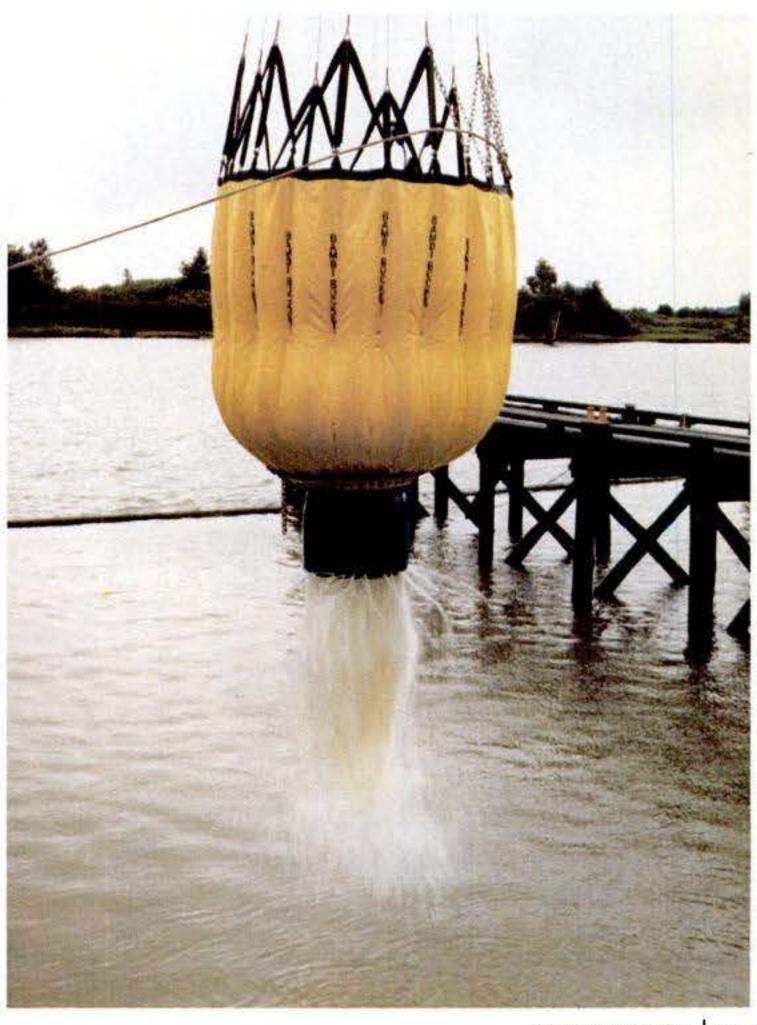
Since their inception more than 15 years ago, when they were nothing more than modified oil drums, helicopter water buckets have been important firefighting tools. Over the years "helibuckets" have been refined to increase portability and improve performance. This newest incarnation achieves both purposes like none before it, says SEI, and the company boasts a long list of clients, including the Forest Protection Branch of the Province of Alberta and the California State Forestry Service.

What makes the Bambi Bucket different from other fabric water buckets? The standout feature is its novel structural design, which SEI calls a "frusto-conical shape." Instead of a rigid frame, a fiberglass hoop and 16 fiberglass sidewall battens comprise the skeleton. When empty, the bucket has straight sidewalls for stability in flight; when it's dropped in water, it immediately tips and sinks in two to four seconds. But here is where the ingenuity comes in: As the bucket is lifted, water pressure bends the skeleton outward, increasing the bucket's volume. The greater the pressure, the more volume the bucket holds. Thus the copter pilot can vary the bucket's capacity by how fast he pulls it out of the water.

Now that the bucket is filled, how do you empty it? Other buckets have drop gates that open upward, fighting gravity and often producing wasteful spray. The Bambi's dump valve, made of Du Pont's Enduro nylon, opens downward, producing a concentrated column of water; the 350-gallon version empties in three seconds. The Bambi Bucket comes in 10 sizes, from 96 to 900 gallons in capacity.

Fiberglass-batten skeleton of Bambi Bucket supports most of the load, reducing fabric stress. Round bottom and downward-opening gate allow quick water dumping.





Announcing VORTEC V6.

MOST POWERFUL STANDARD ENGINE YOU CAN GET IN A 1/2-TON PICKUP.

Team a swirling, tornado-like vortex action with advanced engine technology and what do you get?

VORTEC. New V6 power, standard in tough full-size ½- and ¾-ton 2WD Chevy Pickups, ½-ton 4WD Chevy Pickups and Chevy Vans and Sportvans* for 1985.

VORTEC's swirl-port induction literally storms ahead of conventional engine design to mix fuel and air together more completely.

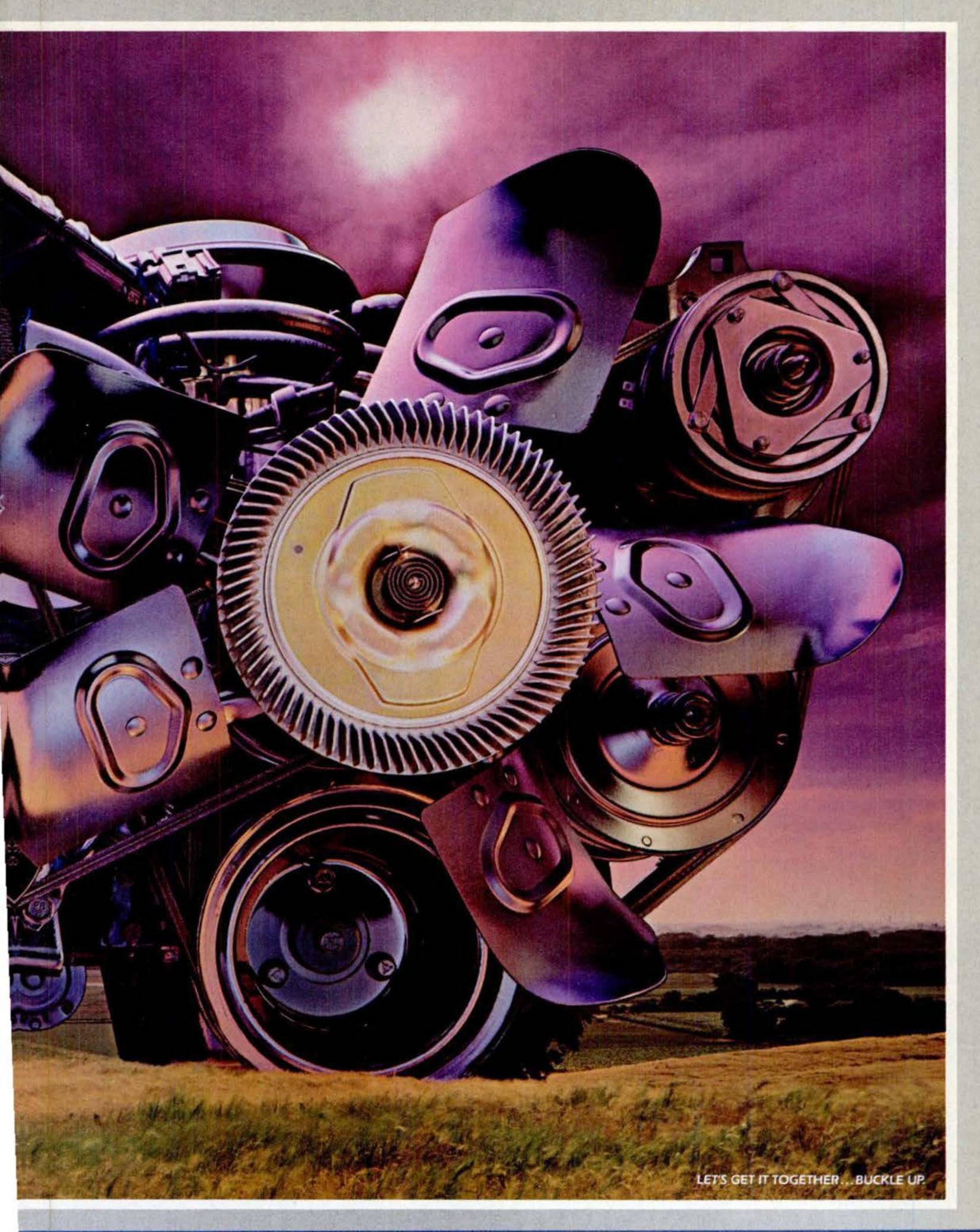
For you, this means truly impressive performance. Impressive towing power, too.

VORTEC's statistics? 155 SAE net horses bred for truck use and fed by four-barrel carburetion. There's even the surefire kick of electronic spark control. VORTEC V6. The new standard of six-cylinder power in tough Chevy trucks.

*Excludes G30/3500 Series. Chevrolet trucks are equipped with engines produced at facilities operated by GM car and truck groups, subsidiaries or affiliated companies worldwide.

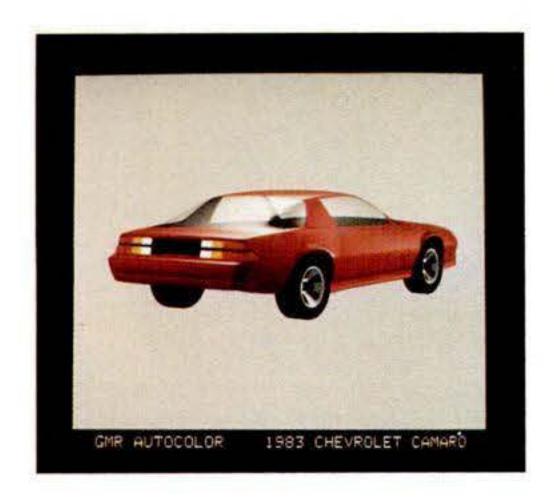


NOTHING WORKS LIKE



A CHEWY TRUCK





Computer images add dazzle to car design

A new GM graphics system helps designers study body surfaces before a scale model of the car is built. A computer simulates the lighting in a photographer's studio, speeding evaluation of colors, materials, and components.

By JOHN FREE

sleek Chevrolet Camaro image glows on a computer-graphics display. As an automobile designer taps a keyboard, the picture rotates slightly, giving him a better view of the headlights. Another keyboard entry slides an arrow along a list of options on the CRT screen.

Then, as though a spotlight in a photography studio had been switched on, a narrow cone of light floods the Camero's hood. Another beam appears to wash over the rear of the car.

General Motors designers now use a clever new computer program, GMR Autocolor, which "illuminates" synthetic images to produce such special lighting effects. Autocolor helps designers evaluate automobile-body surfaces even before a scale model is built.

Earlier computer-graphics programs relied on simulating a single-point source of light—analogous to a single 100-watt light bulb. But point-source lighting experiments with a computer are tedious. Shifting a light requires recomputing the entire image, which takes one to five minutes. "With Autocolor, we've moved far beyond the traditional point-light source used in computer graphics," says David Warn

of General Motors' research labs.

Autocolor simulates lighting controls available in a photographer's studio, plus some tricks, such as different sizes of "light cones," that are impossible with studio light. Autocolor produces floodlights or spotlights and even simulates the large flaps, called barn doors, used to restrict lights.

The new technique is faster because Autocolor's "lights" are easier to adjust for a desired effect. Lights "behave in a more 'natural' way," Warn notes. Tables of data stored in computer memory draw small, meshed polygons on the screen, representing metal, glass, and other surfaces. Dazzling highlight colors are crucial in depicting various materials. Autocolor, says Warn, "thus can display glass in windows, the shiny reflectance from a metal fender, and the duller flatness of, say, a plastic taillight lens."



Synthetic images of new designs are "illuminated" by research scientist David Warn at GM computer science department.

Learn robotics and industrial control as you build this

New NRI home training prepares you for a rewarding career in America's newest high-technology field.

The wave of the future is here. Already, advanced robotic systems are producing everything from precision electronic circuits to automobiles and giant locomotives. By 1990, over 100,000 "smart" robots will be in use.

Over 25,000 New Jobs

Keeping this robot army running calls for well-trained technicians . . . people who understand advanced systems and controls. By the end of the decade, conservative estimates call for more than 25,000 new technical jobs. These are the kind of careers that pay \$25,000 to \$35,000 a year right now. And as demand continues to grow, salaries have no place to go but up!

Build Your Own Robot As You Train at Home

Now, you can train for an exciting, rewarding career in robotics and industrial control right at home in your spare time. NRI, with 70 years of experience in technology training, offers a new world of opportunity in one of the most fascinating growth fields since the computer.

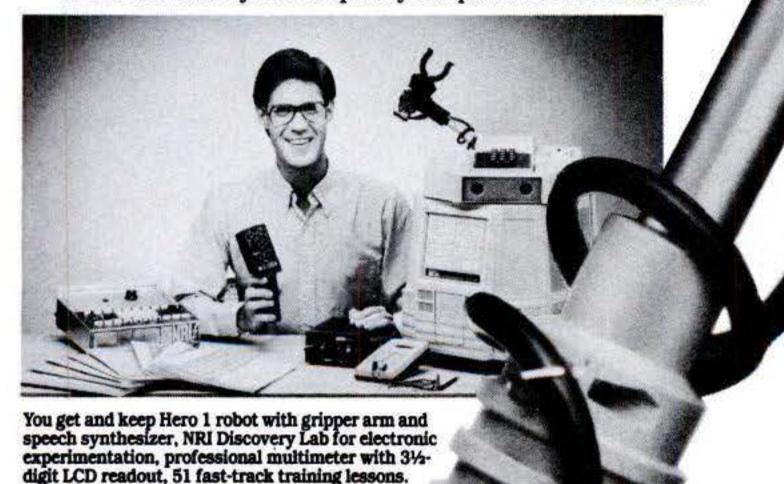
You need no experience, no special education. NRI starts you at the beginning, takes you in easy-to-follow, bite-size lessons from basic electronics right on through key subjects like instrumentation, digital and computer controls, servomotors and feedback systems, fluidics, lasers, and optoelectronics. And it's all reinforced with practical, hands-on experience to give you a priceless confidence as you build a programmable, mobile robot.

Program Arm and Body Movement, Even Speech

Designed expecially for training, your robot duplicates all the key elements of industrial robotics. You learn to operate, program, service, and troubleshoot using the same techniques you'll use in the field. It's on-thejob training at home!

Building this exciting robot will take you beyond the state of the art into the next generation of industrial robotics.

You'll learn how your completely self-powered robot interacts



with its environment to sense light, sound, and motion. You program it to travel over a set course, avoid obstacles using its sonar ranging capability. Program in complex arm and body movements using its special teaching pendant. Build a wireless remote control device demonstrating independent robot control in hazardous environments. You'll even learn to synthesize speech using the top-mounted hexadecimal keyboard.

Training to Build a Career On

Sopyrighted material

NRI training uniquely incorporates hands-on building experience to reinforce your learning on a real-world basis. You get professional instruments, including a digital multimeter you'll use in experiments and demonstrations, use later in your work. And you get the exclusive NRI Discovery Lab®, where you examine and prove out theory from basic electrical concepts to the most advanced solid-state digital electronics and microprocessor technology. Devised by an experienced team of engineers and educators, your experiments, demonstrations, and equipment are carefully integrated with 51 clear and concise lessons to give you complete confidence as you progress. Step-by-step, NRI takes you from the beginning, through today, and into an amazing tomorrow.

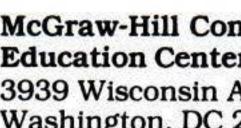
Send for Free Catalog Now

Send for NRI's big free catalog describing Robotics and Industrial Control plus over a dozen other high-technology courses. You'll see all the equipment you get in detail, get complete descriptions of every lesson, find out more about career opportunities for trained technicians. There's no cost or obligation, so send today. Your action today could mean your future tomorrow.

NRI SCHOOLS

McGraw-Hill Continuing **Education Center** 3939 Wisconsin Ave. Washington, DC 20016

WE'LL GIVE YOU TOMORROW.





CAMEL TASTE

Today's Camel Lights, unexpectedly mild.

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

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

Announcing: Ninth annual PS/APA panel-project contest

Last year's competition was opened to all structural panels bearing an APA grade stamp—not just plywood. This year, waferboard and particleboard are again welcomed to eligibility—and the total cash awards are raised to \$5,250, including \$1,250 grand prizes in the three categories described in the rules. Entry deadline is March 4, 1985.

By AL LEES

ave you spotted this poster (photo, right) at a local lumberyard or home center? It alerts workshoppers to the latest edition of the project contest Popular Science has co-sponsored for nearly a decade with the American Plywood Assn. (APA).

All the information you need to enter your project is included in the box at the end of this announcement: You'll find complete rules plus the entry coupon. You only have to decide two things: 1) which category you wish to enter, based on the amount of panel material required for your project (a half panel, a single four-by-eight-foot panel, or multiple—up to six—panels); and 2) which panel type and thickness is best for your project.

With last year's contest, PS and APA admitted to competition any properly identified structural panel. For the first seven years of competition, only projects built of APA-stamped softwood plywood could qualify. But within the last couple of years other panels have challenged plywood's singular popularity, and many home workshoppers now cut and assemble project parts from waferboard and particleboard—or even more exotic panels such as oriented-strand board (OSB) and com-ply. All such panels now qualify equally with plywood for the contest, and you can use two or more different types, where appropriate, within the same project.

Just be sure to identify each panel type and thickness on your entry —and copy its APA stamp in the space

Continued



provided on the coupon or on a separate sheet. Remember, APA doesn't stamp any hardwood ply, and we haven't qualified non-structural panels such as hardboard for this competition. A structural panel is one, like plywood, that generally needs no supportive framework: You can join two pieces of it without having to mount them on a lumber frame.

Both waferboard and its costlier cousin, OSB, are rated for structural characteristics by the same grading standards used for plywood, so they can be substituted for plywood in most applications. But unlike plywood, which is stamped either "interior" or "exterior" depending on its grading, waferboard and OSB are made in only one type and can be used indoors or out. Particleboard, on the other hand, can be used only for interior projects, and you'll want to seal it thoroughly to prevent any formaldehyde outgassing (a source of indoor pollution).

One other requirement of the competition has been liberalized this year:

For the first eight years of the contest PS/APA required that a full-size prototype be built of each submission because a photograph of the finished project was an essential part of the entry. This requirement is now relaxed: You can, if you prefer, construct an accurate scale model and submit a photo of the model (but, please, don't ship the model itself). I'm sure most entrants will still prefer to build fullscale versions of their projects so they'll have them for personal use, but as long as your design is sound, you no longer need access to a workshop to qualify.

Bear in mind that APA builds every entry full-size in order to test the project's practicality, to photograph it for the August portfolio of winners in PS, and to check the accuracy of the project plans APA produces for sale. So if any scale-model entry chosen as a potential winner proves impractical to construct, it will be disqualified, and another entry will be awarded that prize in its place.

Incidentally, if your lumberyard or home center isn't displaying the announcement poster but would like to, don't tell the owners to contact Popular Science. They can obtain a copy by writing on their letterhead to the address shown in the coupon below.

We've had entrants in past years praise the timing of this contest because it let them create a project as a Christmas gift. So look again at last August's winners, and start scaling out your entry on graph paper.

Good luck to all entrants. I'm already looking forward to seeing the designs you come up with to qualify for the big money in this ninth edition of America's longest-running and most prestigious annual project contest. And you'll be glad to hear that the long-promised project book, collecting all prizewinning entries from the first eight years of the contest—76 of them—is now on the presses. I'll be able to tell you how to get a copy when these rules are reprinted in the February 1985 issue.

- PRIZES: A \$1,250 check will go to the top entrant in each of three major categories. There will be a secondary award of \$500 in each category for a total of \$1,500 additional. An honorable-mention entry in each category will receive a generous selection of how-to books from the Popular Science Book Division.
- HOW TO QUALIFY: Your project must be constructed from a stated amount of an APA-trademarked panel appropriate for the intended use. Projects should be designed for efficient layout of the panel or panels you select; parts should be scaled, arranged, and nested to minimize waste. You may enter your project in any of the three categories, specifying which thickness you choose for your half (four-by-four- or two-by-eight-foot) or full (four-by-eight-foot) panels. Should you choose to enter the multiple-panel category, you may use two or more different thicknesses, if that makes sense structurally.

In all categories, aim for minimal waste and minimal use of additional materials; non-panel purchases must not exceed \$100, and the structural panel you choose should remain the dominant material. Functional, structurally sound designs are sought in this contest, but decorative or ingenious projects will also qualify if they represent an efficient use of the panel or panels you specify and if they can be built with homeworkshop tools.

 HOW TO ENTER: Fill out our entry coupon, or list all information the coupon calls for on a separate sheet of paper —including a rough sketch of the APA grade trademark(s) stamped on the back face or edge of each panel you choose. Mail this with at least one clear photograph (black-and-white or color print preferred,

but color slide is acceptable) plus a dimensioned diagram of how the project parts were laid out on the panel or panels. A crude pencil sketch will suffice if it's thoroughly and accurately labeled with critical dimensions. Please don't submit scale models, full-size cutting patterns, or plans sheets larger than 18 by 24 inches. Also needed is a list of all materials used: grade and thickness of your panel(s) plus any lumber, hardware, and finishing materials (paint, stain, plastic laminate). Also jot down special construction tips you'd like to pass on to anyone attempting to duplicate your project. If no publishable photo exists, Popular Science and APA reserve the right to arrange photography at your convenience (and their expense). Entries must be delivered to the Tacoma post office box by March 4, 1985; upon delivery, publication rights belong exclusively to APA and POPULAR SCIENCE unless neither exercises the option within six months of receipt.

Print the category you're entering (½ PANEL, SINGLE PANEL, 1½ TO 6 PANELS) in the lower left corner of your envelope (one entry per envelope, please). No entries can be acknowledged, and none will be returned, unless accompanied by a written request and a self-addressed envelope with proper postage (no checks or money orders).

• JUDGING (by PS Reader Activities Editor Al Lees and representatives of APA) will be for the most efficient and appropriate use of the panel or panels you choose. PS may publish dimensioned plans of those prizewinning projects it feels its readers might want to make. Plans for all nine winning projects will be available from APA after Sept. 1, 1985. Prizewinners will be notified by April 15; winning entries will be shown in the August 1985 issue.

Mail entry to: POPULAR SCIENCI Box 11700, Tacoma		To qualify, entry must reach Tacoma by March 4, 1985	
YOUR NAME (prin	t or type)		
ADDRESS		Daytime Phone No	
CITY	STATE	ZI	P
Copy the panel's grade stamp here	Description of project Which category? PANEL What panel and in what thickness? My signature certifies that this project is of	my own design.	☐ 1½ to 6 PANELS



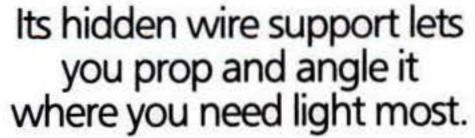
Black & Decker's SPOTLITER™ Rechargeable Light splits the dark with a powerful beam. It's always ready on a moment's notice to light your way.

@Spotliter

SPOTLITER™ has batteries that can be charged and charged again without losing power or corroding.

Its beam isn't the only thing that's strong. Its casing is built strong enough to survive a 6-foot drop to concrete.

SPOTLITER™ mounts in its own recharging base. So it's always charged and ready. 11





Car-care quiz

The master mechanic challenges you to solve these autosystem riddles. Even with the clues, the puzzles require sharp thinking. If all else fails, turn to the answers.

By STEVE MERCALDO

Drawings by Russell von Sauers

Problems

Engine tap

The odometer is approaching the 90,000 mark when you decide to put the "For Sale" sign in the window. You haven't even gotten back to the porch when a neighbor walks over to the car, gives it the once-over, and expresses interest. It seems she needs a second car for the daily four-mile trip to the train station. You assure her that the car should be fine for short trips. After examining the interior, she asks to take the car for a drive.

The road test goes well until the car is brought to a stop at a red light. There's a peculiar tapping sound. Your neighbor gives you a skeptical look.

You explain that the tapping only started recently, but to your knowledge it doesn't affect the car's operation. Except for the tap, the car performs perfectly during the road test, but you can feel an air of mistrust.

At the end of her road test, you suggest that she take the car to a mechanic for a complete inspection. Four hours later, she returns. The mechanic found no major problems, but he was concerned about the tapping noise. He said the noise was coming from the engine, that it could be a bad hydraulic lifter, and that it could cost more than \$200 to correct the problem.

Your neighbor says she wants the car and will pay the asking price, but only if the noise is eliminated. So you go to work.

First you pull the dipstick to make sure the sump is full and the oil is reasonably clean. The stick shows clean oil at the correct level. You start the engine and attempt to locate the

sound with a mechanic's stethoscope. The strongest source of sound is the front of the engine near the valve cover. Was the mechanic right about the lifter? You remove the valve cover. Careful study reveals no problem parts. You move the stethoscope toward the mechanical fuel pump. The noise gets louder. What's causing the tap?

2. Hot-weather stalling

The forecaster was right ... "high in the 90s... with no relief in sight." Taking the kids for ice-cream cones seems like a great way to beat the heat. Everything is fine until you start back home. About a block from the house, the engine stalls and refuses to restart. It cranks normally but won't fire up.

You raise the hood and look around. Coil wire, plug wires, and vacuum hoses are all in place. And there are no visible fuel leaks. Too much to take on in the street, you call for a tow.

At home in your garage, you check for spark by pulling a high-tension wire from the spark plug and holding it about 1/4 inch from the engine block. A strong blue spark snaps across the air gap when the engine cranks.

It's been about 15,000 miles since the last plug change. Have the plugs fouled? You remove a plug and inspect the electrode. It isn't fouled, and the gap is right on the 0.035-inch recommended spec. If it's not ignition, maybe it's a fuel problem.

You remove the air cleaner and peer into the carburetor air horn. You move the throttle linkage. Strangely, no fuel squirts from the discharge nozzle in the carburetor throat. The engine won't start because the carburetor's dry. But why is it dry?

Perhaps the fuel filter is plugged. You remove the filter and fit a piece of vacuum hose on the filter's inlet. When you blow on the end of the hose, air passes freely through the filter.

Could the mechanical fuel pump be

defective? To check the pump you disconnect the inlet line to the carburetor. Next you attach one end of a long neoprene fuel line to the disconnected fuel line. You place the other end in a onequart container. No fuel comes out of the hose when the engine cranks. To be safe, you check the fuel tank and tank filter for blockage. Both check out.

Now you feel you're getting somewhere. The fuel pump must be replaced. You install a new fuel pump and flexible fuel line (short hose at the pump inlet). With the new parts installed, the engine cranks for several seconds and then comes to life. You feel a sense of elation as you close the hood.

That lasts for three days. Then it happens again. The engine stalls after a short stop and refuses to restart. Again you make a quick check for spark. It's blue and strong. The fuel filter is clear, and the fuel-tank gauge reads three-quarters full. You check the fuel pump—it fails to deliver fuel. You're back to square one.

You pull off the pump and bring it back to the parts store. To your relief, the counterman gladly replaces the "faulty" pump.

Two days later you stop for a quick lunch at a diner. On your way back to work, the engine quits again. A quick check reveals a dry carb. You hitch a ride to work.

That night when you return for some serious trouble-shooting, you get a surprise. The car starts after several cranks. What's causing the stalling?

3. Lights out

You're cruising along at night on one of the brightly lit boulevards when suddenly your tranquility is shattered by a surging red police light and a loudspeaker command to "pull over." What law had you broken? You remem-

Continued

FOR OUR HIGHEST EFFICIENCY GAS HEATING.

FOR YOUR HIGHEST MONTHLY GAS BILL.

It's the hottest sale in heating history. Because right now, when you buy and install a Bryant Formula or Plus 90 gas furnace by January 31, 1985, we'll pay you back for any month's gas bill

from date of installation until June 30, 1985.

And that's not all you'll save. The Bryant Formula makes natural gas—always your most economical way to heat—an even better value by including in this sale the newest, most efficient furnace they've ever made: the Plus 90.

Call 800-HOT SALE for the name of your participating Bryant dealer. He's got complete details and the Formula for super savings—for today, tomorrow and years to come. Call now. Offer expires January 31, 1985.

800-HOT SALE

Gas gives you more for your money.

bryant

New super-efficient gas appliances make America's best energy value even better.

Look for Holiday Gift Ideas in the December Issue from these and other fine companies.



First Alert® READY-LITE

POWERFUL RECHARGEABLE LIGHT





Discover stamp collecting.



We bring good things to life.

GENERAL DE ELECTRIC



Car-care quiz

ber coming to a full stop at the last stop sign, and your speedometer has been reading five mph below the speed limit.

"Your headlights are out," the police officer explains. Sure enough, although all other lights are on, the headlights are out. "You can't continue driving with the lights out," he warns.

Before abandoning the car, you push the light switch in and out. No luck. But when you tap the dimmer switch to the high-beam position, the lights come alive. Only the low beams are out. You use the high beams to get home.

You study a diagram of the wiring circuit of your car (see illustration). The next morning you begin by checking the electrical connector at each headlamp. There's no sign of corrosion, and each connector fits snugly on its headlamp terminal.

Could a poor headlamp ground be the cause of the problem? You remove both grounds and clean and tighten them. The lights still refuse to work.

You know a sealed-beam headlamp has either one or two filaments. Because your car has only two headlights, each lamp has both a high- and lowbeam filament.

Perhaps the low-beam filament in both lamps is burned out. You decide to install new lamps. After you struggle with some corroded parts, you're disgusted to find that the low beams still refuse to light.

To check for power at the headlights you remove the right lamp's blue connector and insert a 12-V test light. With the switch on, the test light refuses to light. You perform the same test on the left lamp with the same result.

Finally, you check for power at the dimmer-switch terminals. With the headlight switch on and the dimmer switch in the low position, you probe the "L," or low-beam, terminal with a test light. No power. With the dimmer switch in the high-beam position you touch the "H," or high-beam, terminal, and the test light glows. Why don't the low-beam lights work?

4. Engine miss

Your engine lacks power when you attempt to accelerate from a stop or to pass on the highway. It misfires. Hot or cold, the problem remains.

You open the hood and inspect the engine for obvious problems. All of the vacuum hoses are in good shape and are properly routed according to the emissions-system decal. All of the ignition-system high-tension wires are secure, and their insulation is OK.

Visually, the carburetor checks out.

There's no sign of fuel leakage on or near the carburetor. The choke plate moves freely. When warm, it's wide open. All the carburetor screws and mounting bolts are tight. Maybe the accelerator pump isn't working. You remove the air cleaner. With the engine off you peer into the carburetor air horn and move the accelerator linkage. A strong jet of fuel squirts out of the discharge nozzle.

According to your repair records, the engine is long overdue for a complete tuneup. You begin by checking the battery with a hydrometer. Specific gravity for all the cells reads between 1.250 and 1.265. You check the compression in each cylinder. All are within the 120- to 140-psi manufacturer's spec.

The other half of the tuneup includes replacing the plugs, fuel filters, PCV valve, charcoal canister filter, breather filter, air filter, distributor cap, rotor, and high-tension wires.

The distributor pickup-coil wires of the electronic ignition are secure at their connections. When you test the pickup coil with an ohmmeter, the resistance is 400 ohms. The specification calls for 150 to 900 ohms.

All the emissions-control systems are serviced and tested according to the manufacturer's recommendations. All are in proper working order.

Next you check the ignition dwell. Your dwell meter indicates 20 degrees at idle speed. The manual specifies 43 degrees. When you check the air gap between the reluctor and pickup coil with a brass feeler gauge, it measures 0.014 inch. The spec in the manual calls for 0.008 inch. You reset the gap to 0.008.

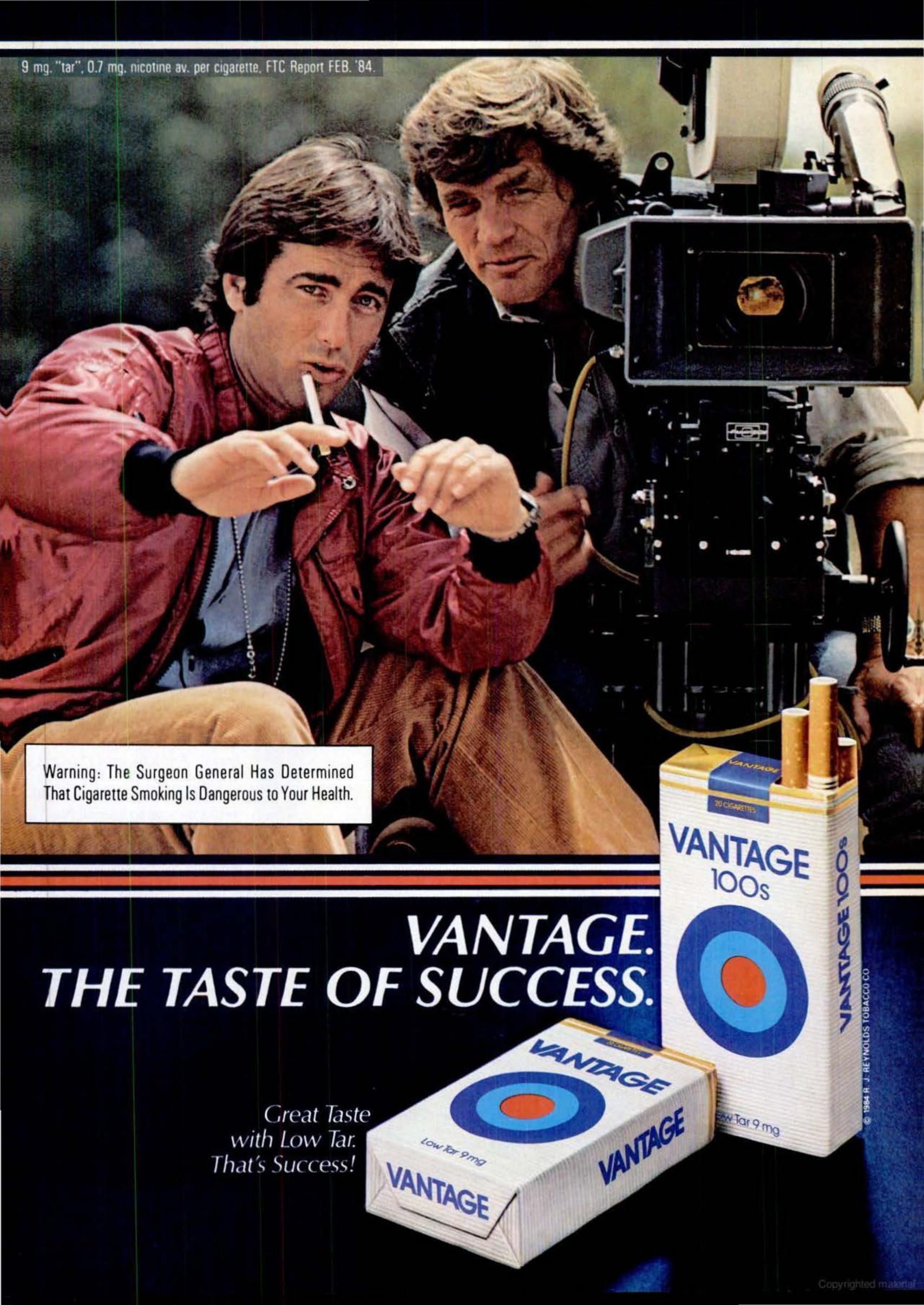
To test the ignition timing, you remove the vacuum-advance hose from the advance unit and plug it. Then, using a tachometer and screwdriver, you adjust the engine to the correct speed. When you aim your timing light at the timing marks, it indicates that the initial timing is off by several degrees. You reset the timing to spec.

You adjust the carburetor to the curb idle speed specified on the underhood decal. Finally, you check the engine vacuum. The gauge's needle holds rock steady at 20 inches.

Confident that the tuneup has eliminated the misfire, you road-test the car. But as soon as you attempt to accelerate, the stubborn misfire occurs.

Maybe the ignition system isn't producing a strong spark. You don't have an oscilloscope or coil tester, so you drive to a local repair shop and ask a mechanic to check the ignition system. On the oscilloscope the mechanic dis-

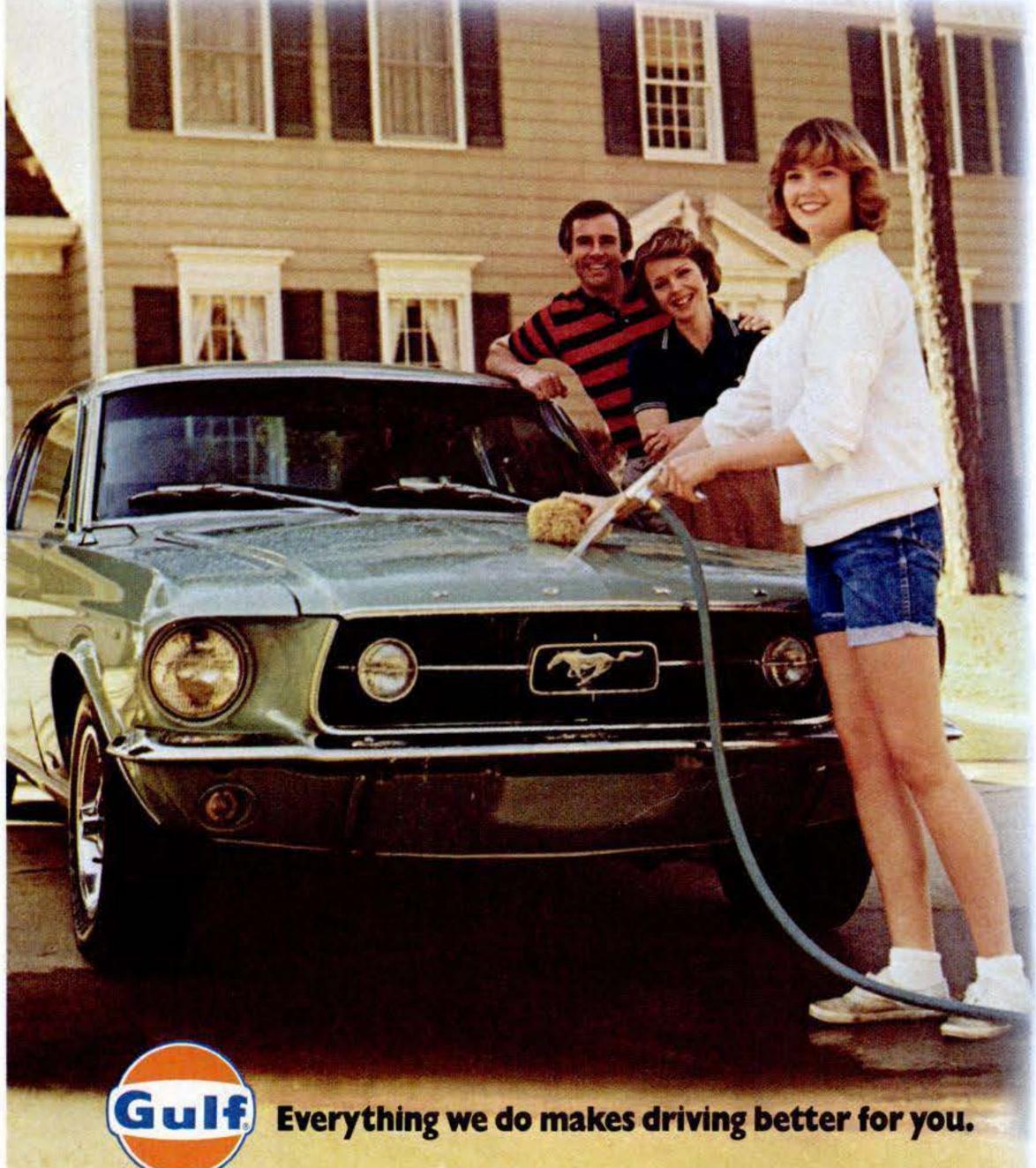
Continued



My daughter was practically born in this car.
Now she wants the keys to it.

the keys to it.

Do you think I'd use just any motor oil?



A '67 Mustang, raised on Gulfpride."

I was 18 and just married when I bought it. I was 19 and over in the next county when my wife called to say she was in labor.

You never saw anyone drive o fast.

I dropped her off at the emergency room, and by the time I'd parked the car, I was a daddy.

Now I've got a teenage daughter with a new driver's license. And a teenage Mustang with a new driver.

Should I trust a car that old with someone so special? No problem. I've always taken good care of it. Frequent tune-ups. And frequent oil changes, always with Gulfpride. Maybe that's why it's always taken good care of me.

So I know I can trust the car

with my daughter.
The question is
whether I can
trust my daughter with the car.



WHEN IT'S A MATTER OF PRIDE.

Get a \$2.00 rebate when you buy 5 quarts of any grade of Gulfpride oil. For details, look for Gulfpride displays at participating retailers.

Car-care quiz

covers that the ignition high-tension spark is weak. You know that the spark is produced by the coil. But it checked out. Could it be the cause of the weak spark? With a new coil, will the car still misfire? What's causing the weak spark?

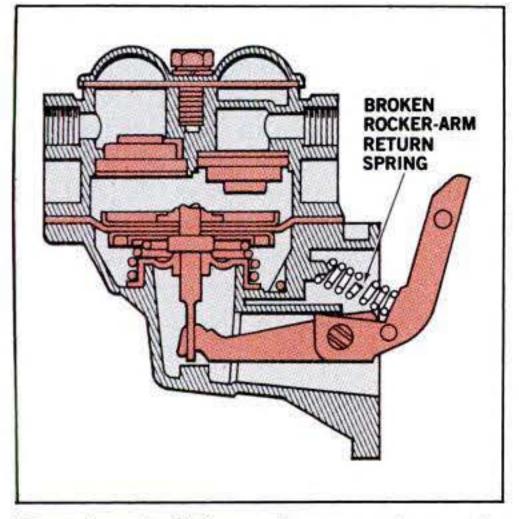
Solutions

The fuel-pump-rocker-arm return spring is broken. Changing the fuel pump will eliminate the noise. The return spring is designed to keep the pump rocker arm in constant contact with the camshaft eccentric or push rod. When the return spring breaks, the rocker arm bounces against the eccentric or push rod and causes a tapping sound.

Tapping caused by a defective fuel pump can vary according to the operating mode of the pump. The loudest tap will occur at idle speeds, when the pump is supplying little or no fuel to

the carburetor.

Diagnosing a tapping sound in an engine can be a tricky job. It's easy to confuse a fuel-pump noise with a valve-train noise. The best approach is to listen with a stethoscope or similar tool at various parts of the engine.



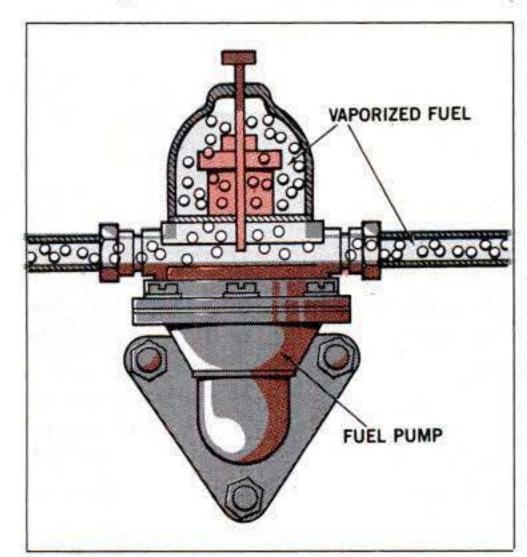
Keep in mind that noise can telegraph: What you hear in one component may actually be coming from another.

2. The gasoline in the fuel pump and lines is vapor locked. Vapor lock means that the gasoline has been exposed to excessive heat and has changed from a liquid to a vapor. The fuel pump can't pull this vapor, so flow is stopped or reduced.

Here are some things to look for if you have a vapor-lock problem: Look for a fuel pump or fuel line running too close to a hot exhaust manifold. To correct the problem, try rerouting the lines or wrapping the pump with heat-shielding material. Correct any cooling-system condition that causes the engine to reach higher-than-normal temperatures. A clogged radiator core, defective thermostat, or malfunctioning radiator cap will raise temperatures above normal.

Bugs and road dirt in the radiator fins can cause a serious restriction of airflow and a sharp increase in the temperature of the coolant. Use a garden hose and a scrub brush to loosen and remove the accumulation.

If possible, shorten a fuel line that's too long. One that bends all around



the engine before it reaches the injection system or carburetor may be picking up additional heat. (NOTE: Be aware that lines may be routed in a certain way to protect them against damage during a collision.)

In addition, some types of gasoline are more prone to vapor lock than others. Try a tankful of another brand if you're in doubt.

Finally, there's a temporary cure for an engine that's vapor locked. Simply pour cool water on the pump. This should cool the fuel, and the vapor should change to a liquid.

3. The dimmer switch is defective and must be replaced. The clue came when, with the dimmer switched to low beam, the 12-V test lamp did not light when it was connected to its "L" terminal. The fact that the test lamp lit when the dimmer was in the high position indicated that electricity was available to the dimmer. However, the switch was not sending electricity to the low-beam terminal.

When the headlight switch is turned on, electricity flows from the headlight switch to the dimmer-switch "B" terminal. With electricity available at the dimmer, it can send power to either the low- or high-beam circuits.

If you switch the dimmer to lowbeam, an internal connection is made between the "B" and "L" terminals.

Continued

GUT FUEL BILLS \$100 to \$300*...

Pays for itself in one year.

Robertshaw gives you a family of thermostats that you can easily program to cut down costly heating and cooling. Choose the model that matches your lifestyle and delivers:

 Automatic savings when you want it, comfort when you need it.

· Fast payback, years of savings.

15% Energy Tax Credit, state and local credits.

Strong 3-Year Warranty

Armchair programming—exclusive

New ENERGY MANAGER™ Deluxe Electronic Setback



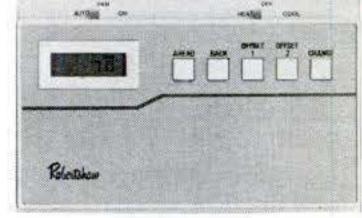
T60 Models

· Multiple daily programs

7-day weekly schedule

Exclusive — armchair programming

Standard Electronic Setback

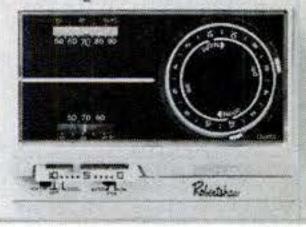


T50 Models

· One or two daily programs

Repeats programs until changed
 Battery backup retains programs

Popular Quartz Thermostat



T33 Models

· One or two daily programs

Automatic setback with quartz accuracy

Robertshaw Quality. Millions of Robertshaw thermostats are used in commercial and residential buildings—worldwide. Your assurance of reliability ... Robertshaw has been a leading manufacturer

of controls since 1899.

Guaranteed Savings. If properly used, this thermostat will pay for itself in one year. Or simply return it to the store where you bought it and your purchase price will be fully refunded. Fair enough?

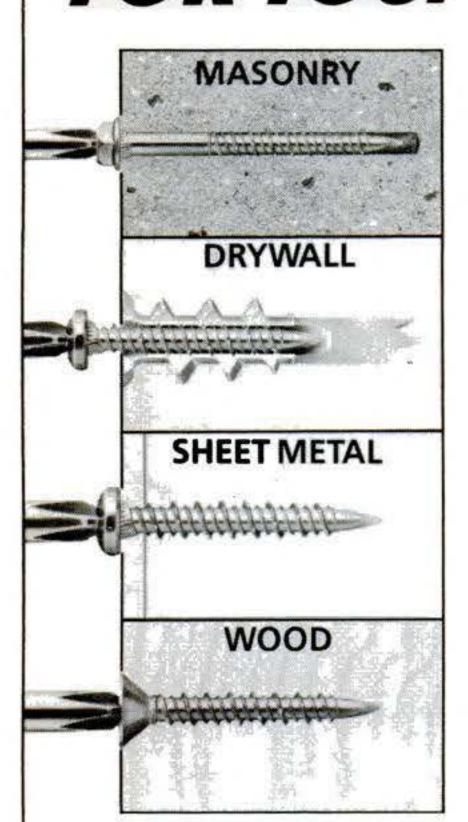
Sold nationally by home centers, hardware stores, and mass retail outlets.



Consumer Products Marketing Group
100 W. Victoria Street, Long Beach, CA 90805
The Energy Control Company

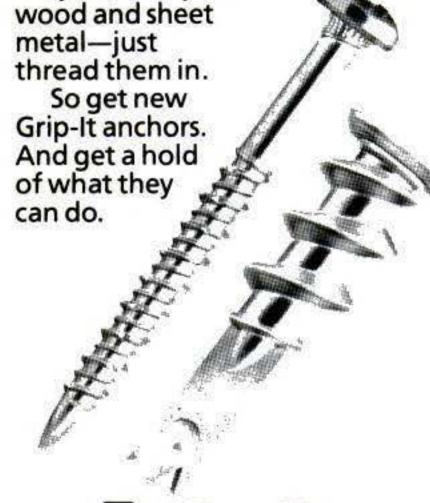
*Based on \$1,000 in heating bills. ASHRAE Journal Study shows savings up to 30% with a 10° setback for two 8-hour periods.

WE'LL HOLD ANYTHING FOR YOU.



Introducing Grip-It, the allin-one anchor system that holds almost anything.

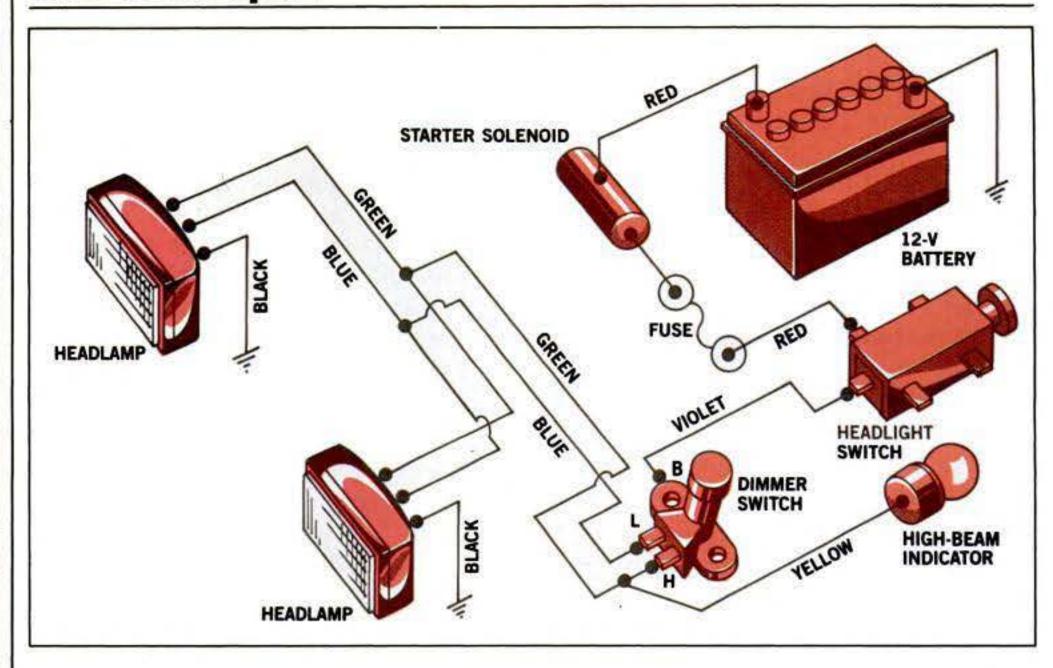
Grip-It screws fasten to masonry fast and sure. With a revolutionary design that taps its own thread in a pre-drilled hole. And for drywall, there's a Grip-It anchor that threads right in with no drilling. So it takes just a screwdriver, and it's incredibly fast. And Grip-It screws are just as easy for wood and sheet metal—just



Grip-It.



Car-care quiz



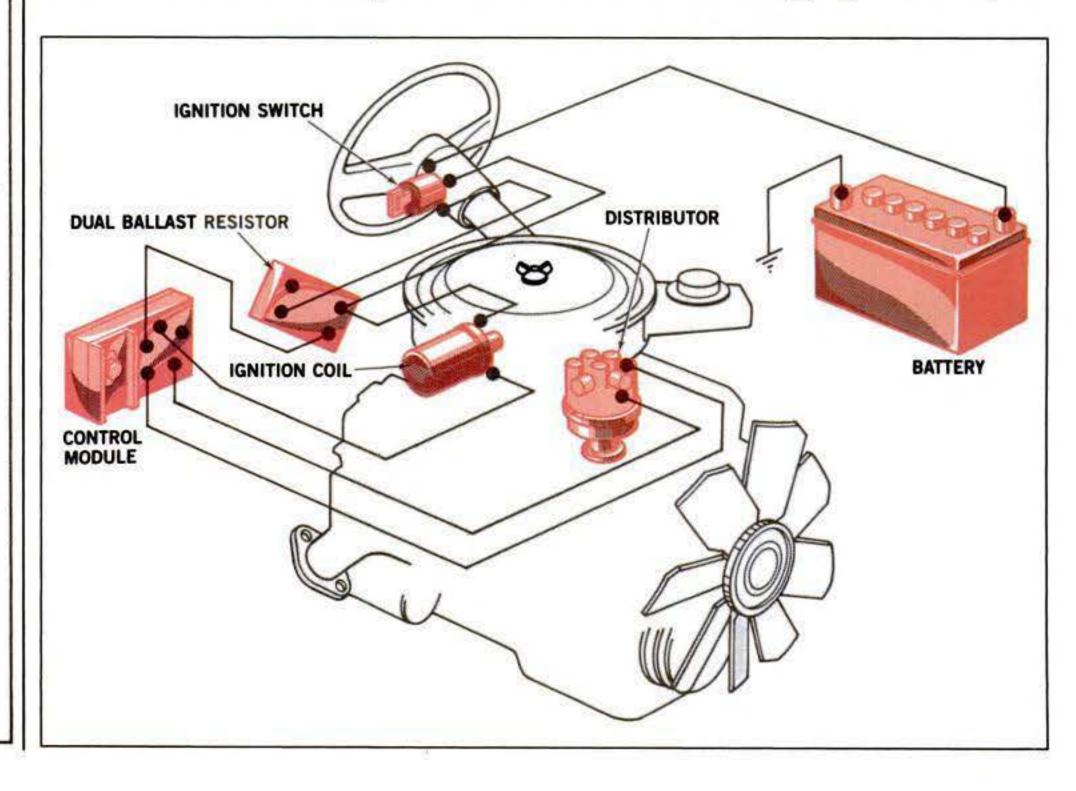
Electricity now flows from the "L" terminal of the dimmer, through the connecting wires (blue on this car) and onto the low-filament terminal.

If the dimmer switch is defective, the internal connection is broken, and no electricity flows to the "L" terminal for low-beam operation. (NOTE: It's a good practice to check connections, grounds, and bulbs before testing switch operation.)

The ECM (electronic control module) is defective and must be replaced. The dwell reading of 20 degrees should have been the tip-off. Dwell in an ECM is the number of degrees of distributor-shaft rotation during which the control transistor is turned on. When the control transistor is on, current flows through the primary (low-voltage) windings of the coil. This creates a magnetic field

around the primary windings. When the transistor is shut off, the field collapses, and a high-voltage spark is produced by the ignition coil.

If the dwell angle is too low (20 degrees), the coil doesn't have enough time to build up power, and it won't produce a strong spark. The longer the current can flow through the coil, the greater the amount of energy that will be stored. Dwell in an electronic ignition system is controlled by the module, not at the distributor. You mistakenly thought that changing the pickup-coil-to-reluctor air gap would change the dwell angle. If the dwell angle is incorrect in an ECM ignition system, changing the module will bring it back to spec. (NOTE: Replacing the ignition-control module can be quite expensive, and these units rarely fail. Make sure that you have exhausted all of the diagnostic procedures before swapping an ECM.) PS



INTRODUCING THE TRUCK DESIGNED TO CARRY A TUNE.

A tune you can shape with the Equalizer V.

Now the Delco Electronics Equalizer V option makes the sound of great music part of the driving enjoyment of selected '85 model Chevy and GMC trucks. With this graphic equalizer you can separate and blend the bass, midrange and treble responses in your favorite tunes, while the system-designed speakers deliver fidelity unexpected in a truck.

That's because, unlike some other truck radios, the Delco music system wasn't an afterthought. When these trucks were on the drawing board, so was Delco Electronics, determining the precise location for the system's speakers

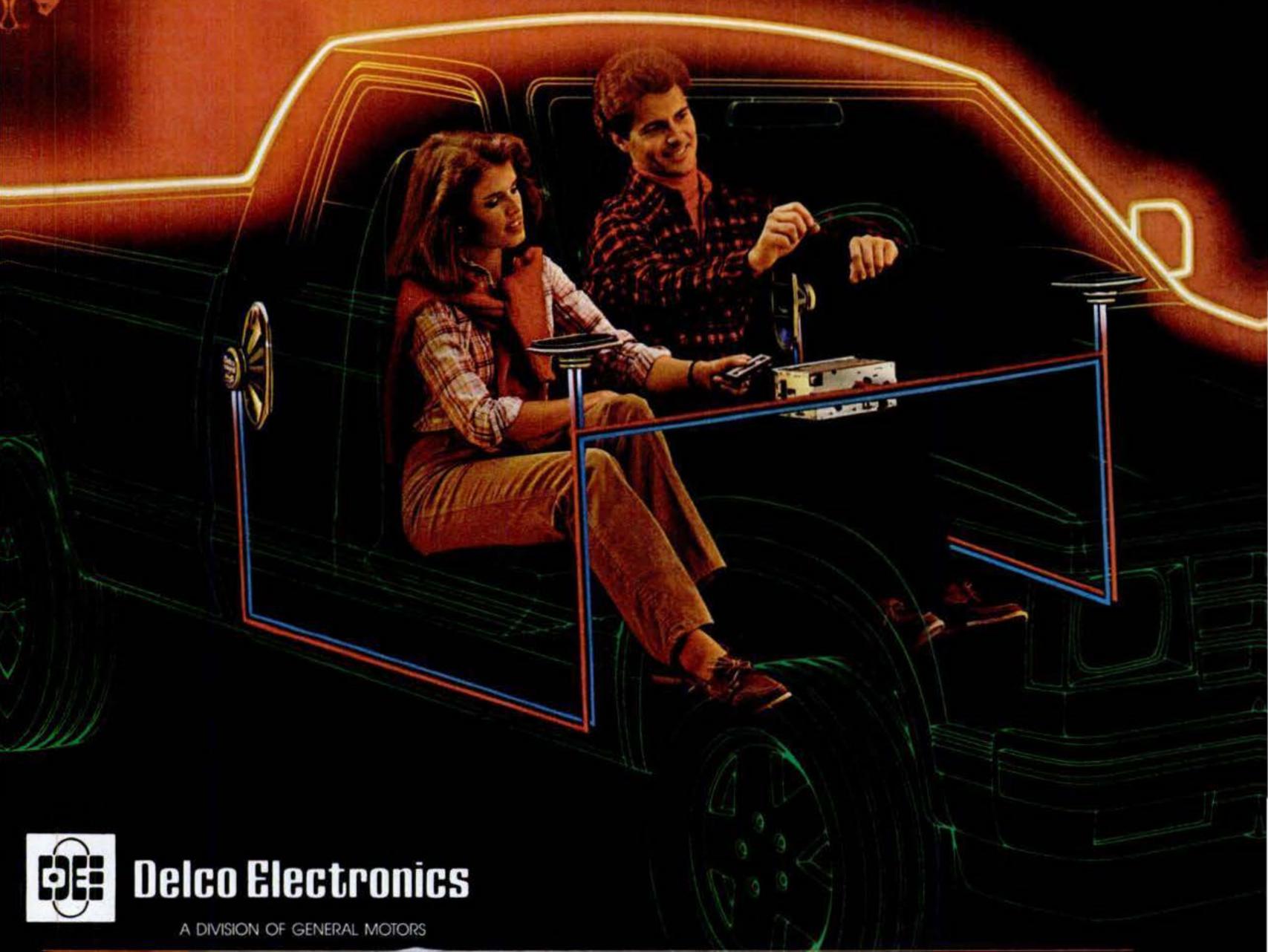
for optimum audio performance.

The result is a music system that's designed into the truck as carefully as the suspension. Visit

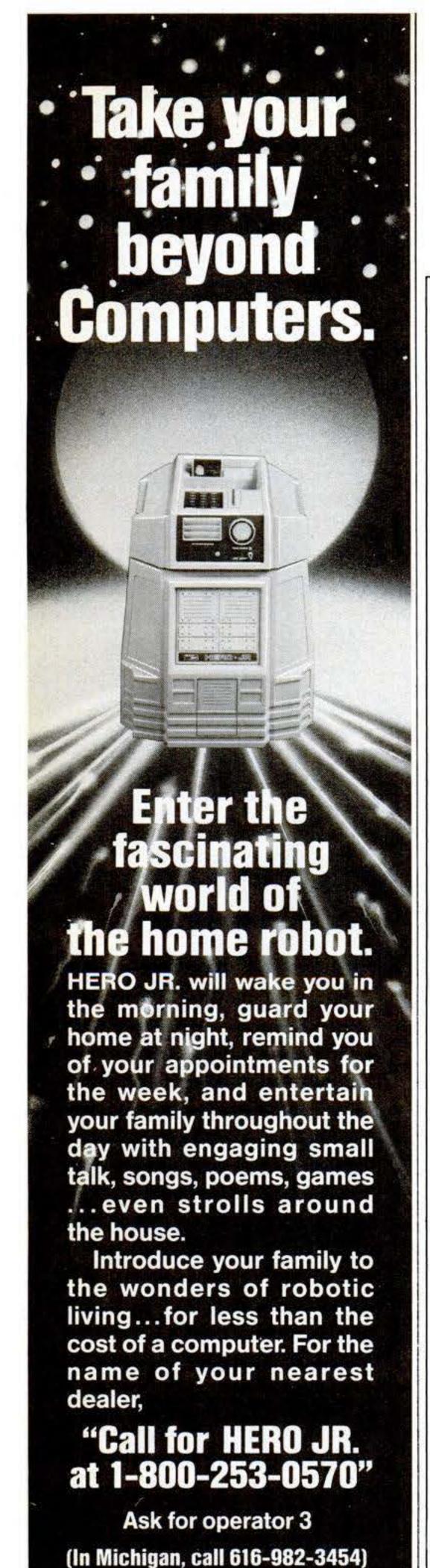


your nearest GM dealer for a test-listen of the Equalizer V.

And look for the Delco-GM name on music systems in all Chevrolet and GMC trucks. Wherever the music goes, there's Delco Electronics bringing you the art of music through the science of sound.

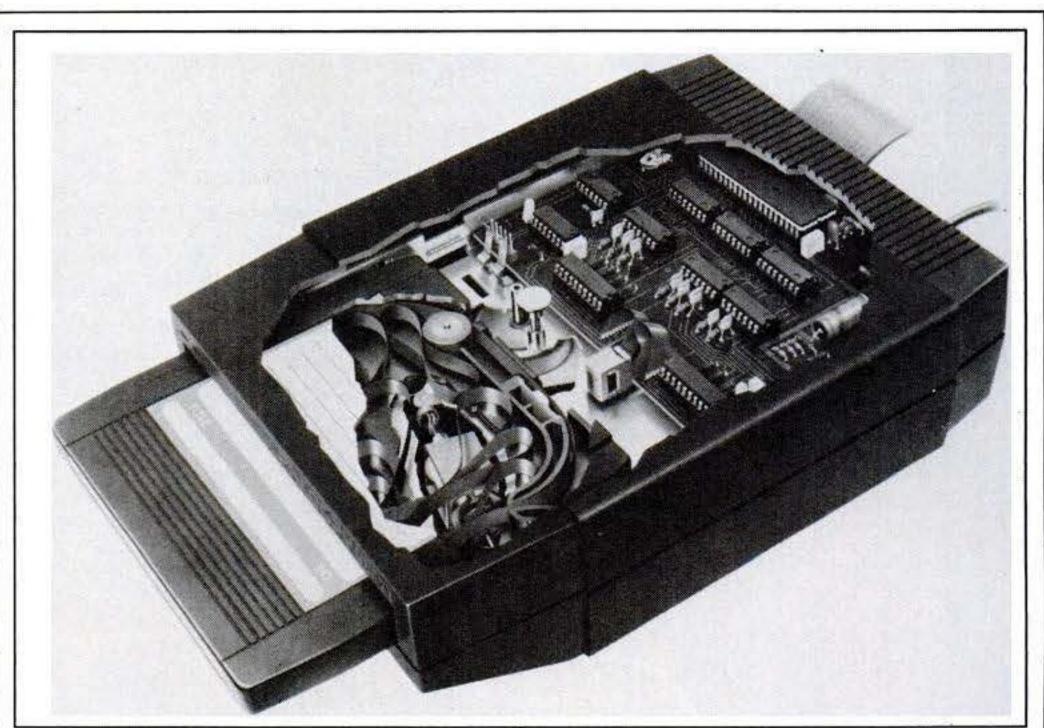


BRINGING YOU THE ART OF MUSIC THROUGH THE SCIENCE OF SOUND.



Bits & Bytes

By WILLIAM J. HAWKINS



Phloopy vs. floppy

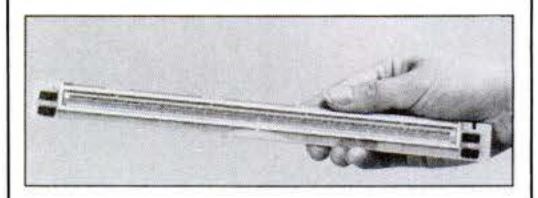
It looks something like an eight-track cartridge player made for music. But the British Phloopy (above) records data at quantities and speeds comparable to a disk drive's. And at \$150 it's less than half the price.

The Phloopy uses a 12-foot-long endless loop of ¼-inch videotape housed in a removable cartridge that costs \$5.80. When the cartridge is inserted in the drive, its tape passes over a read-write head. Each of eight tracks on the head holds a single bit of data, allowing an entire eight-bit byte to be recorded or retrieved at one time.

The result is speed. Typical access time to any spot on the tape is three to four seconds, and the data transfer rate is 10 kilobytes (K) per second. A built-in microprocessor checks the data being read and automatically attempts to correct errors.

Each cartridge can hold up to 100K in as many as 63 separate files. Files are handled like files on a disk: They can be titled, locked, unlocked, renamed, or deleted. Utility programs supplied with the Phloopy system also allow you to recover files that were accidentally erased or to copy files onto a conventional audio cassette.

At present, Phloopy only works with the Acorn computer [PS, June] via a 34-wire ribbon cable. But it's now being adapted for other computers



by maker Phi Mag Systems, Ltd. (Box 21, Falmouth, Cornwall TR11 3TD, England).

Out of the lab

The long tube pictured above uses eight bipolar LSI chips for high-speed, high-resolution image sensing. The Matsushita sensor can scan any kind of letter-sized document in one second. The contents can then be transfered to a computer. The graphic resolution is 16 dots per millimeter (0.04 inch).

Upgrades for PCjr

"People couldn't use the PCjr at home to run programs created on their office PC," admitted an IBM spokesman. "Now they can." How? The PCjr has some new features available:

• High-quality typewriter-style keyboard. It's a big improvement over the original button-type keyboard. I tried it and found that its tactile response is excellent, comparable to the feel of the keyboard used on the PC. The keyboard may be connected directly to the computer or, like its predecessor, use

Continued

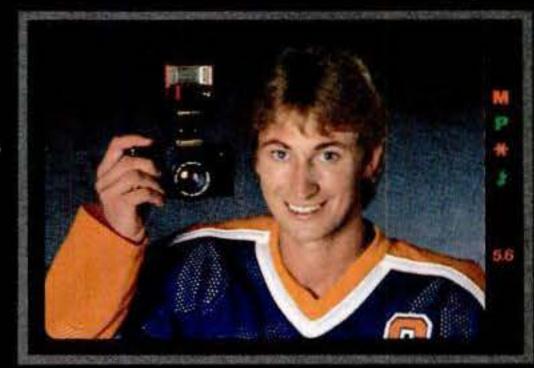
Heath/Zenith

The new Hanon Trumakes the great shots simple.

When N.H.L. superstar Wayne Gretzky shoots a goal, he does it so well he makes it look simple.

When Gretzky shoots pictures, he uses the superstar SLR—the incredible new Canon T70, with automatic features so advanced it makes the great shots simple.

The new T70 actually loads itself! A built-in power winder advances the film and rewinds, too. Electronic touch-buttons control all functions and a bright LCD display provides a full information readout.



You just focus-and-shoot with three programmed modes: standard program for most subjects, TELE for action and telephoto shots, WIDE for scenics and wideangle shots. Shutter-priority mode lets you set speeds for total control over action, and the optional Canon Speedlite 277T provides fully automatic flash. So you can make really great shots without giving up automatic convenience.

The optional Command Back 70 adds even more incredible capabilities, and the entire line of over fifty Canon FD lenses can be used.

Get the superstar SLR. It makes the great shots simple.

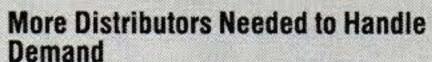


Big Profits In Steel Frame Homes.

Here's an exciting opportunity for builders, developers, investors, do-ityourselfers, entrepreneurs and others who'd like to cash in on the multi-billion dollar housing industry. Our steel frame homes are sweeping the nation with features today's homebuyers want, but aren't finding in contemporary wood frame housing:

- Low cost per square foot
- Higher strength, lower maintenance
- Energy efficiency (up to 60%) savings - R30)
- Variety of clearspan designs & custom options

Affordability, high resale value



Tri-Steel sales are booming, and we're looking for distributors to market our proven line of steel frame homes. We give you the tools and training to start your own successful business from the ground up!

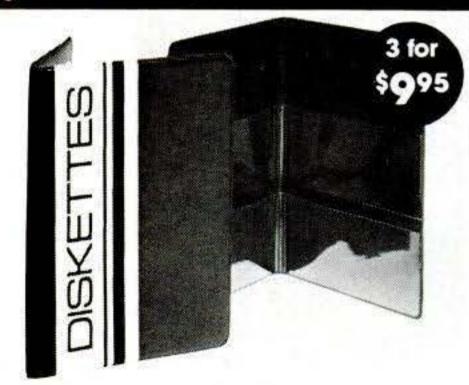
- Proven sales concept
- Low initial investment
- No inventory requirement
- Dealer training/support
- National advertising leads, plus

local co-op advertising

Select territories now available with \$3950 refundable investment required. Call for color brochure or send \$25 for Home Buyers Guide (\$85 with videotape. Specify VHS or Beta).



Order our 51/4" Diskette Holders Today!



- SPECIAL ANTI-STATIC VINYL
- HOLDS ONE TO FOUR DISKETTES
- AN INEXPENSIVE WAY TO INSURE THAT YOUR DATA IS NOT LOST OR STOLEN

NAME		
ADDRESS		
CITY	STATE	ZIP
CHECK M		EXP.
☐ ENCLOSED ☐ VI	A #	DATE
QTY TOT	AL PRICE	
SHI	PPING	14.50
SAI	ES TAX (5%)	
	A. ONLY)	
send to: TO		

MULRYAN COMPUTER

155 Wedgewood Rd. Worcester, MA 01602

Train at home for one of these 26 career opportunities

Free facts about Diplomas and 2-year Degrees

Now at home in your spare time, without any previous experience, you can train for a money-making career...even get an associate degree. Send for free career facts about the exciting career program that interests you most. You will



receive color brochure and information on employment opportunities in the field you choose. Mail coupon today and see how easy it is to train at home for a great new career or advancement on your present job.

SEND FOR FREE FACTS!

	-		
International	Correspond	ence	Schools
Dept. PCSA4			

SINCE 1891 Please send me free facts, color brochure and full information how I can study at home for the career I have chosen. I understand I am under no obligation

and no salesman will call.	CHECK ONE BOX ONLY!
2-YEAR BUSINESS DEGREE PROGRAMS Business Management	CAREER DIPLOMA PROGRAMS ☐ Surveying & Mapping ☐ Drafting
☐ Marketing ☐ Finance	 ☐ Electronics ☐ Wildlife/Forestry Conservation
☐ Accounting 2-YEAR TECHNICAL	 ☐ Computer Programming ☐ Diesel Mechanics
DEGREE PROGRAMS Civil Engineering Technology Mechanical Engineering Technology	 Electrician Small Business Mgmt.
- looimology	 ☐ Microcomputer Repair ☐ Gun Repair
☐ Electrical Engineering Technology	 ☐ Motorcycle Repair ☐ General Law Enforcement
CAREER DIPLOMA PROGRAMS	 ☐ Catering/Gourmet Cooking ☐ Bookkeeping
☐ High School ☐ Auto Mechanics	☐ Art ☐ Small Engine Repair
These courses are offered by ICS a Schools.	and North American Correspondent

ADDRESS.

CITY/STATE/ZIP

Bits & Bytes

infrared light for wireless operation. Now standard on all PCjrs, the keyboard will be given free to present owners.

 Memory expansion up to 512K. Plug-in 128K memory boards can be added for \$325 each. A special program is included that lets the additional memory simulate the operations of a second disk drive.

 Speech synthesizer (\$300). This gives the PCjr a voice. Also, with a microphone, the system allows you to record your voice on disk for playback later.

All these new features make PCjr comparable in power and functions to the PC, and at a lower cost. Won't that hurt sales of the more-expensive machine? Don't worry: It's rumored that IBM will shortly announce enhancements for the PC to keep junior from upstaging senior.

Let there be light

Adding a room to your home? Before swinging the hammer, try the CADlight I program on your IBM PC. The \$595 program analyzes your plans, including windows, overhangs, skylights, ground surfaces, landscaping, and neighboring structures. The result is a graphics display of how welllighted the room will be by sunlight. (A future CADlight II program will analyze artificial lighting.) More information is available from Wiley Professional Software, John Wiley & Sons, 605 Third Ave., New York, N.Y. 10158.

On line

 An international telex service compatible with 28 microcomputer brands promises five-minute delivery and substantially lower prices than traditional telex methods. International Record Carrier, Inc. (211 E. 43rd St., New York, N.Y. 10017), says customers receive free software on a floppy disk for its Supertelex service. IRC customers are linked to the parent firm's London computer center.

• The Omni Online Database Directory, edited by Mike Edelhart and Owen Davies (Macmillan Publishing Co., New York, 304 pp., \$19.95 cloth, \$10.95 paper), tells you how to patch your personal computer into information data bases over telephone lines. Each of 1,000 data-base services in 50 fields (patents, science and technology, energy, etc.) is summarized. Costs for each service, which are often high, aren't given, but a chapter describes how your bill is calculated. PS

ONLY FROM BAYLINER

FI COMPLETE BOFT, MOTOR FIND TRAILER OUTFIT FOR ONLY \$4,495*

hat's right. Until December 15, you can give your family a whole new world of relaxation and enjoyment for only \$4495*.

Imagine. For less than you'd pay for a two week vacation, you can drive in to your nearest Bayliner dealer ... and drive out with a deluxe, fully-equipped Bayliner 1400 Capri Bowrider, ready for season after season of boating fun. It's complete with richly upholstered seating, fully-carpeted interior ... and the kind of styling that'll turn heads, on or off the water.

Plus, there's a quick, dependable 50 hp Force™ outboard

engine with plenty of power for skiing, and economical performance for all-day outings.

This sporty package comes to you on a custom-fitted Escort™ trailer that's fully galvanized for long life. And, for all its deluxe features, it's small enough for effortless towing, even behind small cars.

> VALUE PACKAGE

If all this sounds exciting to you, the editors of Motor Boating & Sailing magazine share your enthusiasm: "From the way it tows a skier to the way it's towed by a car, the 1400 has been planned in advance... the only thing Bayliner hasn't designed is the car."

You'll find the same kind of unbeatable value throughout the exciting 1985 Bayliner fleet, from

14 to 45 feet.

See your Bayliner dealer today; look him up in the yellow pages or mail the coupon below for the name of the Bayliner dealer nearest you, or call toll-free 1-800-477-4700.

But see him before December Because a price this low can't last forever.

YES, I'd like to know more about Bayliner for 1985; please rush me the name of my nearest Bayliner dealer.

NAME

ADDRESS

CITY

STATE/ZIP

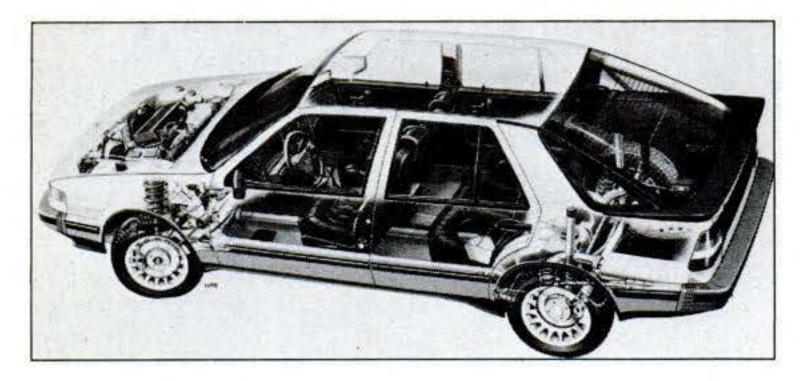
Bayliner Marine Corporation, Dept. 114A PO Box 24467, Seattle, WA 98124

Bayliner 1400 Capri Bowrider

POWERED BY **FORCE™ OUTBOARDS**

*Manufacturer's suggested special introductory price in effect on deliveries through December 15, 1984 at participating dealers. Actual prices set by dealer. Taxes, license, freight, options and dealer delivery charges extra. Prices may change without notice.

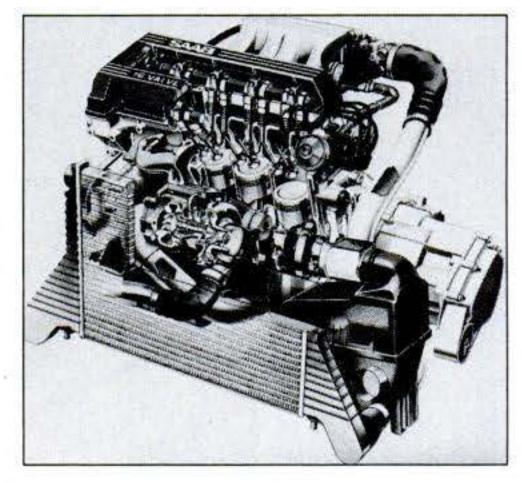
Saab 9000 luxury hatchback



years, the Saab 9000 is packed with state-of-the-art automotive technology and luxury features. The engine is Saab's latest turbo with 16 valves (four per cylinder) and an intercooler. The two-liter (122-cu.-in.) engine develops 175 horsepower and accelerates the 9000, says Saab, from zero to 62 mph in 8.3 seconds. The suspension is MacPherson strut in front, rigid axle in the rear, with gas-filled shocks front and rear. Brakes are disc, front and rear, and an anti-lock braking system is being developed. The body is highly aerodynamic with a 0.34 drag coefficient. Driver and passenger seats are leather covered, multi-adjustable, and electrically heated. The car's climate-control system is computerized and automatic. In Saab tradition, instrumentation and driver controls are well located and easy to read and operate. Priced at more than \$20,000, the Saab 9000 will compete in the luxury import sedan class when it reaches the U.S. in the fall of 1985.—Richard L. Stepler

The first all-new car from the Swedish auto maker in 17





Front-wheel-drive Saab 9000 has luxurious seating for five (cutaway). Turbocharged engine has double overhead camshafts and 16 valves. The spark plug is located in the center of a dome-shaped combustion chamber for more efficient combustion.

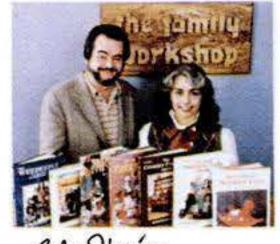
COSCO STEP DECK**...

"STANDARD EQUIPMENT
FOR DO-IT-YOURSELF
PROJECTS"

Step Deck™, the versatile step stool/work platform, is two products in one!

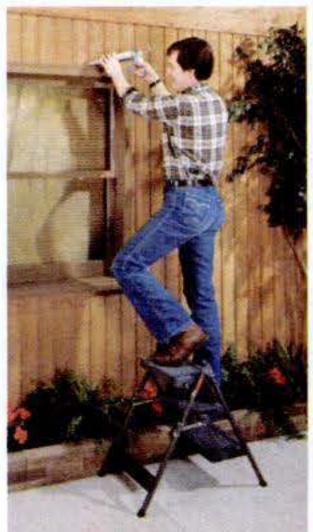
In the 3-step position, Step Deck gives extra height for jobs normally out of reach. In the platform position, Cosco's Step Deck becomes a wide stable work base for painting or wallpapering.

"Cosco's Step Deck is standard equipment for DO-IT-YOURSELF projects," say Ed and Stevie Baldwin of the Family Workshop. Make your next project easier with Step Deck



Ed & Stevie Baldwin Family Workshop

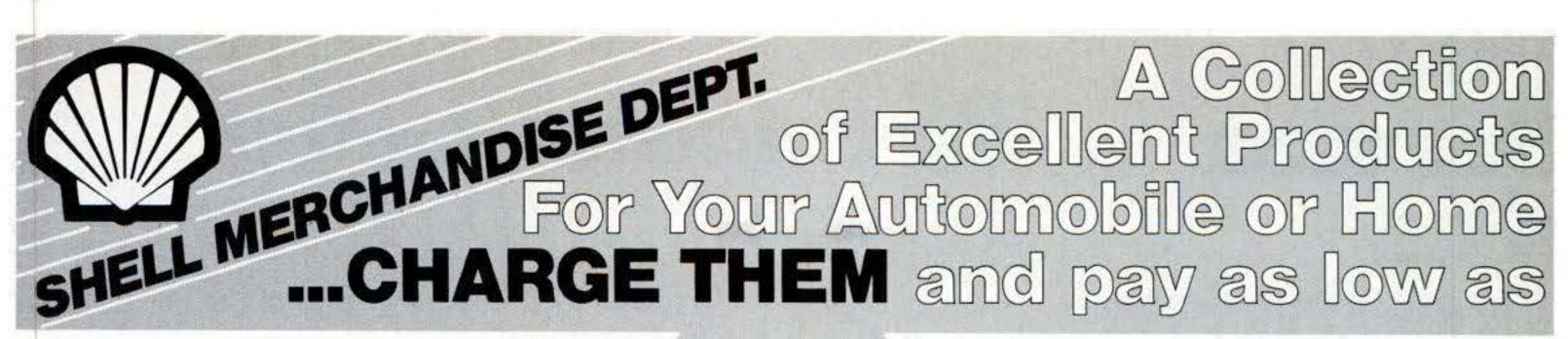






COSCO INC.

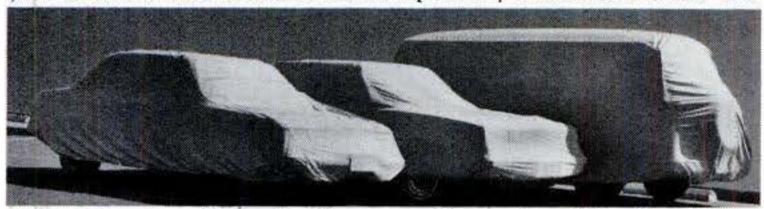
COSCO
Housewares Group
2525 State Street
Columbus, IN 47201
812-372-0141



on your

SHELTER YOUR CAR-CUSTOM CUT FROM OVER 8,000 PATTERNS

Complete exterior and interior protection-Shell account. Starshine Auto Shelter's™ improved fabric totally shields your vehicle from nature's single most damaging element...the sun. Direct exposure will oxidize your paint, bake dirt into the finish and fade the color. Plus, ultraviolet rays magnified by the windshield glass will cause your car's dashboard and other interior upholstery to crack and fade as well.



A Starshine Auto Shelter™ will prevent these value-robbing losses from occurring. If used regularly, your Auto Shelter will help keep your car looking new, inside and out, for years. Each cover is individually tailored to fit your make of car as opposed to lesser quality, bulky "universal" type cover-alls.

Specify Make, Model, Year, 2 or 4 Door when placing order. List length for Vans & Pickups. Allow 4-6 weeks for delivery.

Try the AUTO SHELTER (#7422), one price covers all cars. SHELL card holders pay as little as

\$95* a month for 9 months plus FINANCE CHARGE, or a single payment of \$89.55* on your SHELL account. (See schedule of Credit Terms below). Or you may use: MasterCard, VISA, American Express, Diners Club under their normal payment terms. *Plus applicable taxes and \$6.95 shipping and handling.

THE BACK CHAIR

Introducing the Back Chair, the chair with one goal a month in mind; the care of your back, spine and health. It has been long recognized that many back and neck problems are the result of improper posture when sitting. Sitting on the Back Chair relieves your back from supporting the total weight of your body by distributing the weight between your lower back and legs. Made of multiple layers of hardwood with a top layer of oak. Seat and knee rest in camel velour. Assembles in 15 minutes with a screwdriver.

Try the BACK CHAIR (#7421). SHELL card holders pay as little as \$95* a month for 4 months plus FINANCE CHARGE, or a single payment of \$39.80* on your SHELL account. (See schedule of Credit Terms below). Or you may use: MasterCard, VISA, American Express, Diners Club under their normal payment terms.) *Plus applicable taxes and \$9.95 shipping and handling.



AIR BEDS

Flexible, air-cushioned comfort provides a better night's sleep as opposed to lying on a conventional mattress of rigid metal springs and stuffing. Controlled Air Chambers support you when lying, sitting or just lounging. The perfect portable spare bed for unexpected guests, camping or traveling. Inflates with a vacuum or hair dryer. Velveteen camel finish. In five bed sizes.

Try the AIR BEDS. Shell card holders pay monthly terms of \$9.95* a month as listed in table at right, plus FINANCE CHARGE, or single payments as



stated in table, on your SHELL account.

Air Bed Sizes	Pay \$9.95* per month for	Single Payment
Single	4 months	\$39.80*
Twin	5 months	\$49.75*
Full	6 months	\$59.70*
Queen	7 months	\$69.65*
King	8 months	\$79.60*

Or you may use: MasterCard, VISA, American Express, Diners Club under their normal payment terms. *Plus applicable taxes and \$6.95 shipping and handling.

SHOP FASTER BY PHONE Call Collect 1-805-966-7187

SHELL MERCHANDISE DEPT. 816B State Street Dept. SL184, Santa Barbara, CA 93101



☐ Check here if you would like to receive a SHELL OIL CO. credit card application.









**\$9.95 payment terms available only to SHELL OIL CO. Card Holders, on their SHELL account. Or you may use MasterCard. VISA, American Express or Diners Club under their normal payment terms.

Please send the items specified below:

Quan.	Item Description		
	AUTO SHELTERS #7422, Make Model 2, 4 Door, Year Length (Vans, Pickups)		
	BACK CHAIR # 7421		
	AIR BEDS: Single (29x72) #7423, Twin (39x75) #7424, Full (54x75) #7425, Queen (60x80) #7426, King (76x80) #7427		

☐ Check ☐ Money Order, enclosed. Am	ount
CHARGE MY: SHELL Credit Card (First 9 L VISA (All Digits), American Express (All Digits)	

Acct. # LIIIIIIIIExp. Date

Acct. # LIIII			Exp. Date _
SIGNATURE X		be signed to be vali	d)
Name			
Address			
City		State	Zip _
This offer expires April	30, 1985 Offer go	ood in continenta	U.S. only.

You will be billed for your merchandise purchases on your monthly billing statement. Within 25 days from the "Closing Date" shown on your statement, you may either (1) avoid any FINANCE CHARGE by paying the total amount of the merchandise purchases, which will be included in the "New Balance" on your statement or (2) budget your purchases by paying the monthly installment shown on your statement, which will be included in the "Minimum Due" on your statement in which event a FINANCE CHARGE will be assessed on an average daily balance at the periodic rate allowable by law in the state of your residence as follows.

Computed FINANCE CHARGES of less than \$.50 will be adjusted to \$.50 except in AR, CT, HI, MD, NE, NH, NC, ND, WI and DC.

1.77	Balance on which FINANCE CHARGE is computed	Periodic Rate(s)	ANNUAL PERCENTAGE RATE
AR	ALL	5/6 of 1%	10%
CT, MN, PA	ALL	1.25%	15%
IA, TX, WI	0-\$500 Over \$500	1.5% 1%	18% 12%
AK, KS, MD, WV	0-\$700 Over \$700	1.5% 1%	18% 12%
CA	0-\$1000 Over \$1000	1.6% 1%	19.2% 12%
AL, NE, SC	0-\$500 Over \$500	1.75% 1.5%	21% 18%
CO, GA, IN, MS, OK, RI, TN, VT, WY	ALL	1.75%	21%
az, DC, DE, ID, IL, KY, NJ, NM, NV, NY, OR, SD, UT, VA	ALL	1.8%	21.6%
Mi	ALL	1.7%	20.4%
ALL STATES NOT LISTED ABOVE	ALL	1.5%	18%

Orders are subject to routine credit approval. Upon default, the entire unpaid amount becomes due. The budget purchase option is not available to commercial or aviation accounts.

Power Service Gas Treatment

GAS TREATMENT Specially Formulates for Fundamental Telegram 12 Oz. - 0.354 LITER DANGER-HARMFUL OR FATAL IF SWALLOWED, VAPOR HARMFUL FLAMMABLE READ BACK PANEL.

- Boosts octane in today's low-octane gasoline
- Increases the power and performance of your car's engine
- Improves fuel economy
- Reduces engine knock
- Disperses the water in gasoline
- Prevents gas-line freeze even in sub-zero temperature
- Safe for catalytic converters
- 12-ounce container treats 15 to 25 gallons of leaded or unleaded gas
- Use regularly for year-around benefits.

When you want the job done right...



Heavy Duty/Automotive Products

1410 N. Bowie Drive Weatherford, Texas 76086-1089 817-599-9486

Recreation Roundup

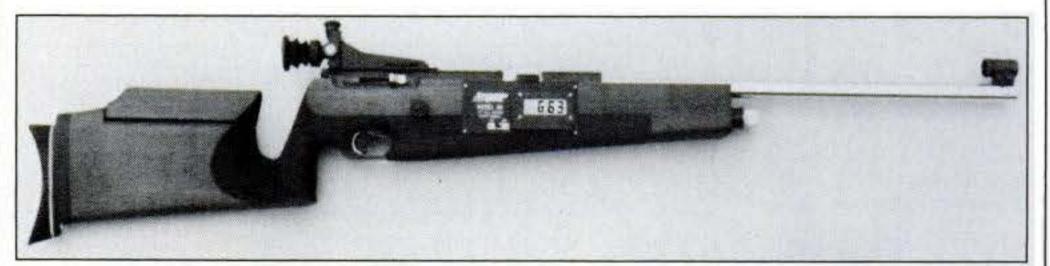
By HERBERT SHULDINER



High-output lanterns

The old reliable gas lanterns from Coleman (250 N. St. Francis, Wichita, Kan. 67201) have undergone their first major redesign in 50 years, the company claims. Two models are the CL2 (left) and CLX, \$34 and \$40, respectively. The CL2 is 30 percent more compact in size than existing lanterns but provides the same amount of light. That's attributed to a new venturi system designed to make the flame burn

right on the surface of the mantle instead of inside or outside the mantle. The CLX provides 36 percent more light than the model 220 doublemantle lantern it replaces. The CLX also has a new venturi system, which is said to do a better job of mixing fuel and air to obtain increased brightness. But it consumes about 30 percent more fuel. Both lanterns have a built-in system that automatically cleans the generator tip. The plastic case (left) is optional.

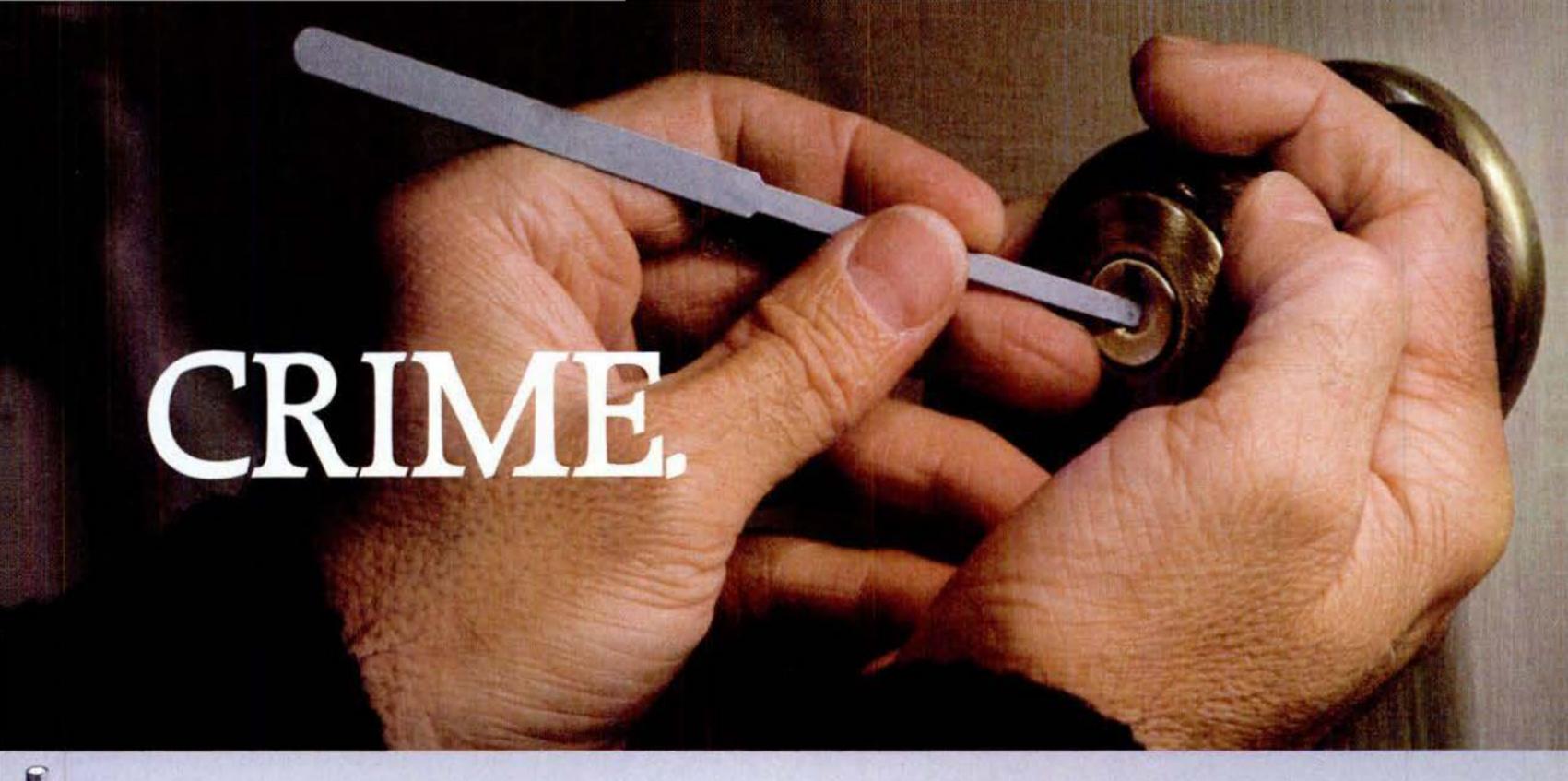


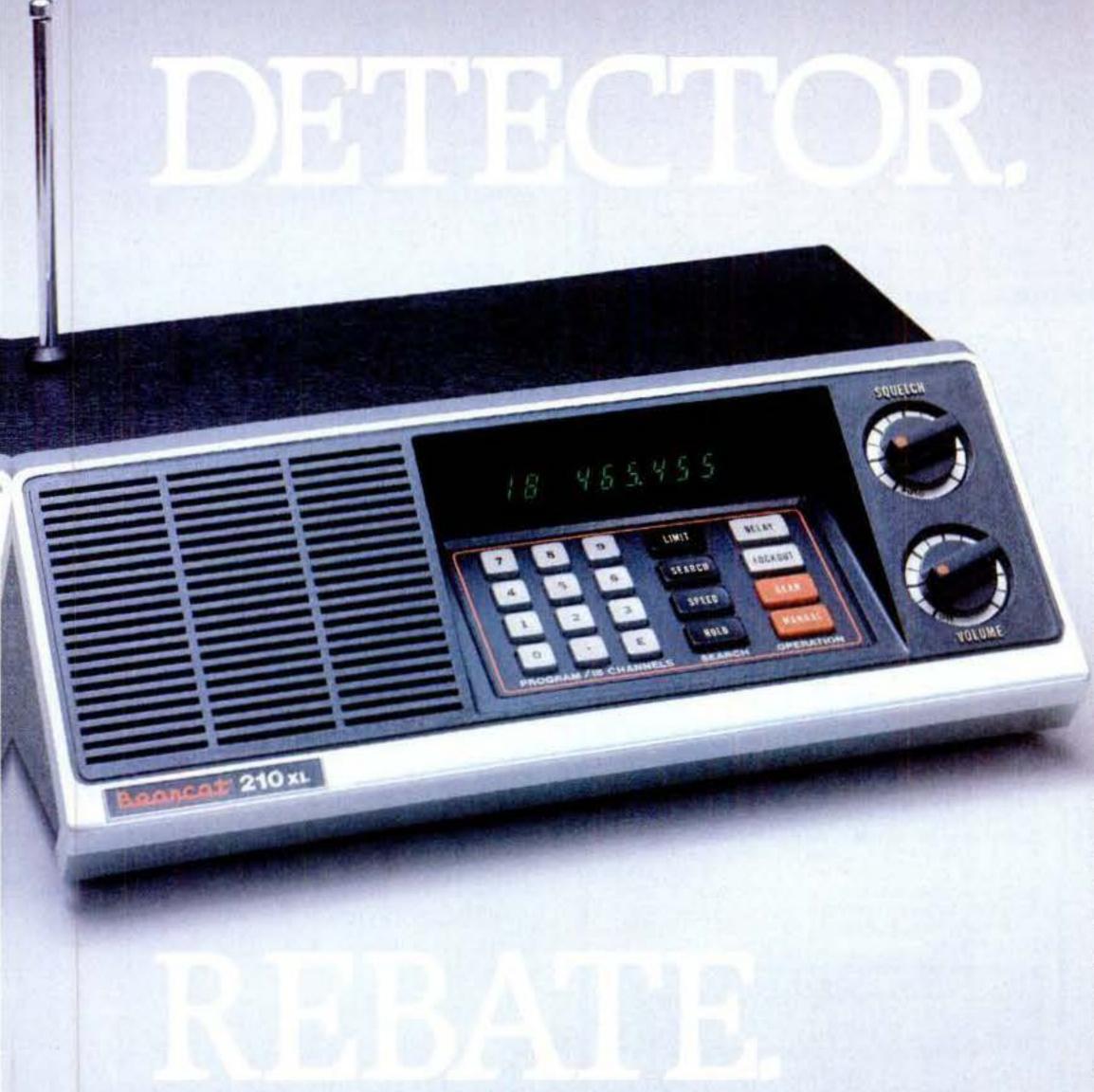
LCD air rifle

Crossman's new model 84 competition air rifle is the first ever to show pressure settings on a liquid-crystal display. It is powered by carbon dioxide, but unlike other such rifles, the model 84 is pressure regulated instead of volume regulated. Crossman (a Coleman

company) claims this produces a repeatable uniform and consistent shot. The CO₂ cylinders can be refilled from a bulk tank, and each cylinder provides enough power for 100 shots. Velocity is adjustable from zero to 720 feet per second. The adjustable velocity allows a user to match pellets to the barrel for optimal performance

Continued





Like a smoke detector protects you from fire, a Uniden*
Bearcat* Scanner Radio is a simple way to help protect you from neighborhood crime.
Because if a crime wave hits, you'll be the first to know about it with up-to-the-minute police reports. And you'll be ready to take precautions against the kind of people who do their shopping at night.

Get up to \$50 back on Uniden® Bearcat® Scanners. To get the rebate on the Uniden® Bearcat® Scanner you've purchased, send: (1) original dated sales slip (non-returnable), (2) purchase confirmation cut from carton flap, and (3) this completed request to: Crime Detector Rebate, P.O. Box 50208, Indianapolis, Indiana 46256.

Please circle the scanner purchased:

(1) BC-300/\$50 Rebate

(2) BC-210XL/\$25 Rebate

(3) BC-100/\$25 Rebate (4) BC-20/20/\$20 Rebate

(5) BC-250/\$20 Rebate

(6) BC-220/\$20 Rebate(7) BC-260/\$15 Rebate

(8) BC-201/\$15 Rebate

(9) BC-200/\$10 Rebate

(10) BC-180/\$5 Rebate

(11) BC-155/\$5 Rebate

(12) BC-151/\$5 Rebate (13) BC-5-6/\$5 Rebate

(14) BC-5/\$5 Rebate

(15) BC-15/\$5 Rebate

First Initial

Middle Initial

Last Name

Address

City

State

Zip

Requests must be postmarked by December 8, 1984.

Offer valid only on purchase made between October 1, 1984 and November 25, 1984. All requests must be postmarked by December 8, 1984. Limit of one Uniden. Bearcat. Scanner per household, and/or consumer, regardless of number of Uniden. Bearcat. Scanners purchased. This is a consumer rebate offer only. Resellers, companies and employees of Uniden, their advertising agencies, distributors and retailers are not eligible. This official coupon must accompany all requests, and may not be reproduced. This offer may not be used in conjunction with any other rebate offer from Uniden. Bearcat. Offer good only in U.S.A. Void where taxed or prohibited by law. Allow 6-8 weeks for delivery of check.

uniden[®]
Bearcat[®]



Uniden provides major financial support to the Neighborhood Crime Prevention Coordinating Committee.

★ ★ ★ ★ Northern Hydraulics ★ ★ ★ * * * Discount Parts & Equipment * * *

Heavy Duty Log Splitter Sale!

Horizontal and Vertical 12 thru 35 ton models at discount prices Also all the parts to build your

own 121/2 Ton #1128 \$729 151/2 Ton..... # 1132 \$869 241/2 Ton....#1142 \$1399 Will ship 121/2 Ton

48 states for \$60



We now have a new 8

Ton Electric Splitter.

Log Splitter Parts 2-Stage Cast Iron Gear Pumps

11 GPM @ 650 PSI until more pressure is needed Kicks down to low GPM & up to 2500 PSI Right hand rotation, can direct couple to 5 HP or larger engines 3600 max RPM 12Lbs

Item# 1011 \$111.00 13.6 GPM @ 650 PSI/ 3600 RPM max.

Item# 1013 \$128.00 16 GPM use with 8 HP+ Item# 1015 \$157.00

22 GPM use with 10 HP+ Item# 1017 \$248.00 Welded Cylinder

Item# 902424 2"shaft X 4"Bore X 24"Stroke \$119.00 Tie Rod type Cylinder #909324

3',"X 24"Stroke X 1'; "Rod with cleves Only \$92.00 4-Way Control Valves

Built-in relief valve. 4" in-out ports. 12" cylinder ports Item #2010 \$45.50

(Has pressure sensitive detent, hands-free on return stroke). Item # 2020 \$59.00

Sun-Spot Heater Radiates ingra-red rays at 11 000 BTU's/hr Use with disposable propane cylinders. Includes sturdy plastic stand

Price Sh Wt List Item# 55995 \$36.95 17261 61 bs

"Mr.Double Heat-Ir" Light one burner to conserve fuel (12 000 BTU/hr) or both for maximum heat (24,000 BTU/hr). Tank not included. Adjustable directional infra-red heat Price

1727 5167 00 141 bs

Gas Engines (Horizontal)

Horizontal 5 HP Tecumseh 4"shaft #6051, \$139.95 A 5 HP Briggs %"shaft #6053...\$146.95

8 HP Tecumseh cast iron sleeve #6081...\$192.95 10 HP Tecumseh cast iron sleeve

#60101 w/ electric start- \$278.95 *6010...**\$232.95**

Trailer Parts

480x8 4-hole wheel & tire #1211 \$24.00 570x8 wheel & tire #1212 \$33.00 16 5x6 5x8 wheel & tire #1214 \$32.00 480x12 wheel & tire # 1216 \$36.00 530x12 wheel & tire # 1217 \$37.00 Trailer Light Kit # 1270 \$16.00

2000 to capacity spring set # 1251 \$24.00/pr High speed 4-hole hubs & spindles set with \$37.50/set 2000 lb capacity

Heat-Magnet

17101

Clings to any magnetic iron or steel surface. Energy efficient, thermostatically controlled. Provides heat for pipes, pumps, engine oil pans and other uses. Ship Wt. List Price Our Price

1 Lb.



Zip

Chimney Cleaners (Ship 48 states \$2.50) Designed to provide the best and least expensive method for cleaning the inner walls of chimneys where soot and other deposits accumulate. Item# Type Fits these sizes Sh.Wt. Sale

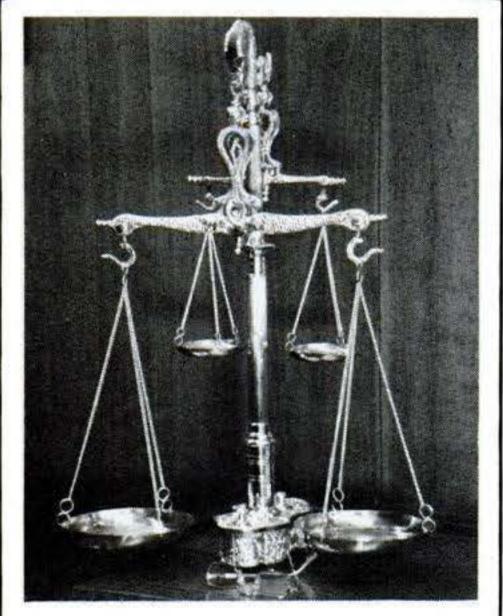
6Lbs \$19.95 1540 Round 6 to 11 1541 Square 6 to 11 6Lbs 19.95 1542 Rectangle 6x10 10x14 6Lbs (Orders Only!) Toll Free 1-800-533-5545 ext. 139114

& all in between

Send For FREE 104 pg. Discount Catalog Or send \$6 for splitter design/fact booklet & catalog Name Street

City State

Northern Hydraulics 801 E.Cliff Road, Box 1219, Dept. 139114 Burnsville, Minnesota 55337



solid brass

- Heirloom quality, generations of enjoyment
- Handcrafted by old world craftsman
- Functional complete with graduated brass weights self-contained in the base
- Ideal for home, office or den
- Height 25" Double Beam 14" and 8" Weight 9 1/2 lbs.

-SATISFACTION GUARANTEED-

129.00 + 5.25 postage & handling To order, send check or money order to: YORKSHIRE,

Box 2732, Idaho Falls, Idaho 83401 in Idaho call: 524-3111

Call Toll Free: 1-800-952-1800



Famous Junghans quartz mini-movement from West Germany at an unbelievable introductory price. Only 21/4" square x %" thick! Pick the shaft for your dial thickness . . . choose from 1/4", 1/4", or 1/4". Accurate performance guaranteed for THREE YEARS! Order as many as you wish at this amazing low introductory price. Major credit cards accepted. WRITE OR CALL TOLL-FREE.

FREE CRAFT CATALOGUE **CLOCK MOVEMENT** AND ACCESSORIES

WRITE: Clockwerkes, Dept. PS 11 2419 Foster Avenue Janesville, WI 53545

Wisconsin residents call (608) 755-1000 Out of state customers

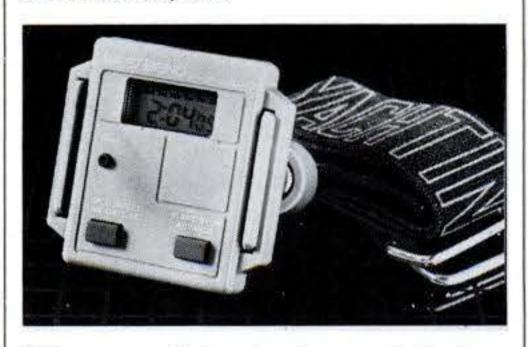
CALL TOLL-FREE 1-800-356-4011



Tempus Instrument Corporation 2419 Foster Avenue, Janesville, WI 53545

Recreation Roundup

and accuracy, the company says. Crossman claims the air rifle delivers "hole in hole" accuracy at 33 feet. The model 84 costs \$1,500.



Water-resistant stopwatch

The versatile Ski & Cycle stopwatch from West Bend (Box 278, West Bend, Wis. 53095) can be used for timing a variety of sporting activities. It comes with a stand that allows you to mount it on motorcycle or bicycle handlebars or even on a ski pole. It also comes with a wristband. The LCD display will time in hundredths of a second, seconds, and minutes up to 30 minutes. Thereafter, it times in seconds, minutes, and hours up to 24 hours. Price is \$24.95.



Free-standing tent

The Mobile Dome by Sierra West (6 E. Yanonali St., Santa Barbara, Calif. 93101) has a clever interior design in which maximum width and height are in the front of the tent-where it's most needed. The tent also has a sealed floor and rain-fly seams. In addition, the tent's fly canopy allows you to get in and out of the shelter without getting wet. The dome tent costs \$279.

RV publications

Interested in getting into recreational vehicles? The Recreational Vehicle Industry Assn. offers a free publications catalog covering a broad range of subjects of interest to potential RV users and buyers. Also available from the RVIA is a new brochure, "This Is the RV Life." Write to the association at Box 204, 14650 Lee Rd., Chantilly, Va. 22021.

Now there's a tough new anti-freeze for today's hotter running cars.

Today's fuel-efficient cars run hotter by design. And to keep their weight down, they use light ...but corrosion-prone ... metals like aluminum in their engines and cooling systems.

All this puts tremendous new demands on your anti-freeze/coolant. To protect your engine against costly heat damage, it has to cool with maximum efficiency...and fight against corrosion and sludge formation that can block your radiator.

That's why we developed STP® Anti-Freeze/ Coolant...a tough new anti-freeze product designed specifically for today's hotter running cars. It delivers extra protection because it's

formulated with ALUGARD® 340-2. And it's the only anti-freeze formulation approved by all 4 major U.S. car makers for effective use in all their cars. It's also recommended for use in imports. But we haven't stopped there...

New Easy Pour, "No Glug" Jug. Tired of spilling and wasting anti-freeze when

you pour it? Our unique new Easy Pour jug puts an end to anti-freeze mess. Its convenience is another good reason to switch to STP Anti-Freeze/Coolant.

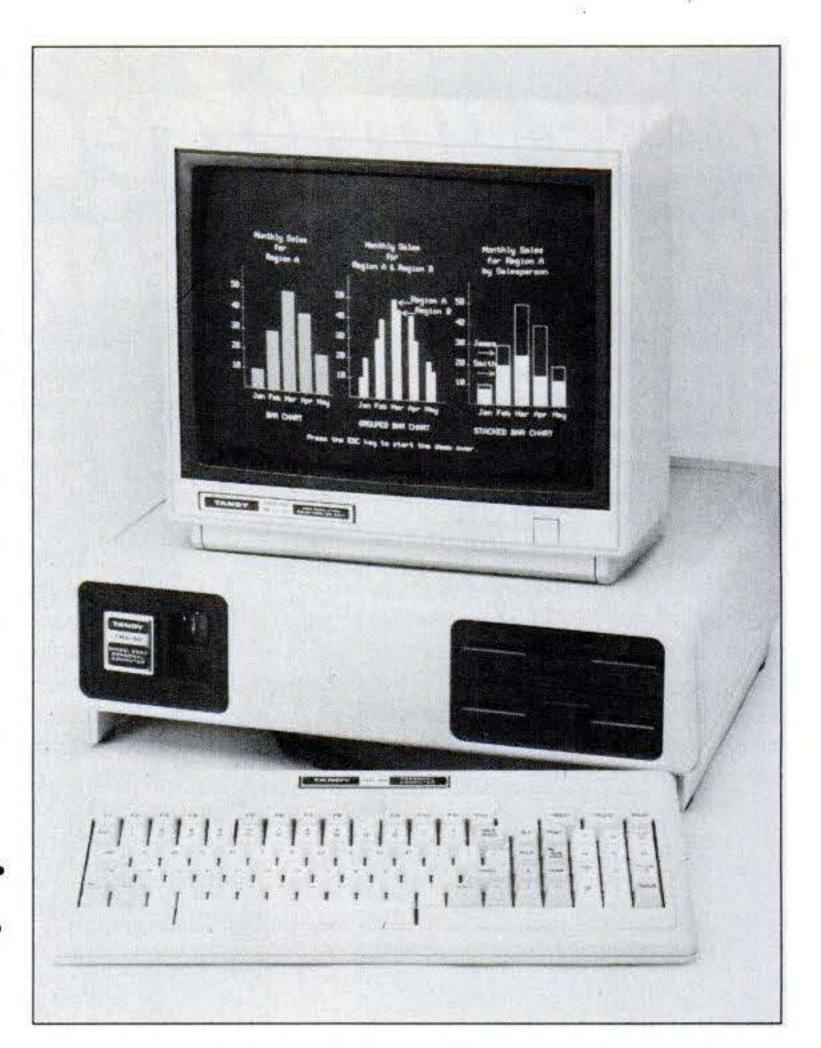


Depend on STP proven performance.

COMPUTER

Tandy's 2000 personal computer

—high power at a bargain price



If you please try

Box: Less than 0.5 mg. "tar", 0.05 mg. nicotine; Soft Pack, Menthol and 100's Box: 1 mg. "tar", 0.1 mg. nicotine; 100's Soft Pack and 100's Menthol: 5 mg. "tar", 0.4 mg. nicotine; 120's: 6 mg. "tar", 0.6 mg. nicotine; 120's Menthol: 6 mg. "tar", 0.5 mg. nicotine av. per cigarette, FTC Report Mar. '84. Slims: 6 mg. "tar", 0.6 mg. nicotine av. per cigarette by FTC method.

By JIM SCHEFTER

andy's new, versatile high-speed model 2000 microcomputer adds yet another look-alike to the scores of mid-priced machines that run software written for the IBM PC. But this is more than a look-alike. Adding a variety of enhancements, Tandy designers shed the Radio Shack name and their usual TRS-DOS disk-operating system to develop a true 16-bit micro with both power and performance that goes head to head with the PC. Standard features include:

128 kilobytes of RAM.

• Two built-in disk drives, each with 720K storage.

Intel's 80186 processor, with true 16-bit data path.

Four expansion slots.

Built-in parallel and serial ports.

The computer's operating system is MS-DOS, which is becoming virtually an industry standard. That means that hundreds of software packages written for the IBM PC will run directly on the Tandy 2000. But not all. Some must be modified by users. That's easy, says Tandy, but you must follow strict step-by-step instructions that the

company provides.

Tandy is careful to point out, however, that some popular programs, including Lotus 1-2-3 and Perfect Pearl, cannot be run. That's because such programs are written to skip over MS-DOS and directly access the PC's video controller board to take full advantage of its graphics capability. It may be only a matter of time, however, before these programs are modified to run on the 2000. (The PFS series, dBase II, Microsoft's Word and Multiplan, Videotex Plus for communications, and others are already available in the 2000 format.)

To make full use of the 2000's 720K disk storage, I copied programs one file at a time from PC disks to a formatted Tandy disk. In a month of testing, I ran IBM PC versions of such programs as WordStar and dBase II. The machine's disk drives read the disks without problems, but compatibility is only one-way with the 2000. Once a disk is formatted on the Tandy, it can't be read by the IBM PC disk drives. (It's formatted at 96 tracks, but the track density is different.) And when I simply duplicated entire disks, I was left with capacities ranging from 280K to 340K.

The 2000's expansion slots are easily reachable: New boards simply slide in at the rear of the main unit. As delivered, the 2000 runs standard monochrome graphics through a built-in video port. High-resolution monochrome graphics requires a \$449 board. And for color graphics Tandy sells a handful of chips for another \$199, along with instructions on how to plug them into that board. (It's a bit intimidating for novices.) Memory expansion to 256K involves still another handful of chips; these must be installed by a Tandy technician.

The 2000 comes with a 90-key keyboard that is usable but not flawless. For instance, I found it easy to miscue the 12 user-definable function keys, which stretch across the keyboard's top, and to trigger caps when all I wanted to do was hit shift.

Base price of the 2000 is \$2,750 with two floppy-disk drives, or \$4,250 with one floppy and an internal 10megabyte hard disk. But expect the dual-floppy version to become a \$4,300 machine with the almost mandatory memory expansion and a color monitor.

Other options include a mouse-clock expansion board, mouse, joy stick, and an external memory unit to bring the 2000 up to 512K of RAM. PS

ATTAMENTALE

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

Choose one:

□ Comfort and luxury.
□ The confidence of 4-wheel drive.
□ Both of the above (in the American Eagle).

By choosing "Both of the above" you've obviously made the right choice. A choice that most car makers, however, don't even give you!

Until the American Eagle. An automobile with the comfort and luxury of a fine road car, plus the capability to let you shift-on-the-fly to the confidence of 4-wheel drive. So simple. So incredibly logical.

After all, why should your family have to give up a roomy five-passenger interior, leather upholstering, plush carpeting, power windows, door locks and more for the privilege of having 4-wheel drive??

You shouldn't. And you don't have to. And that's why your choice is so clear: the one and only American Eagle. Available in wagon or 4-door sedan.



This gas turbine burns sawdust

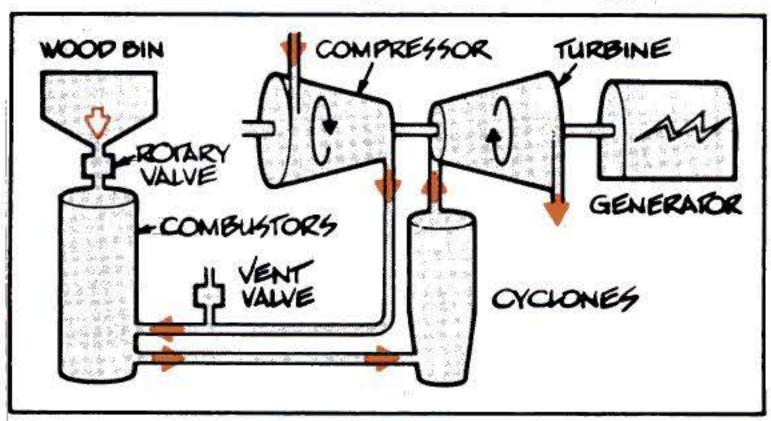
External burning and cyclonic separators prevent turbine-blade erosion and downtime in this system; the engineer who designed the turbine now sells electricity to the TVA.

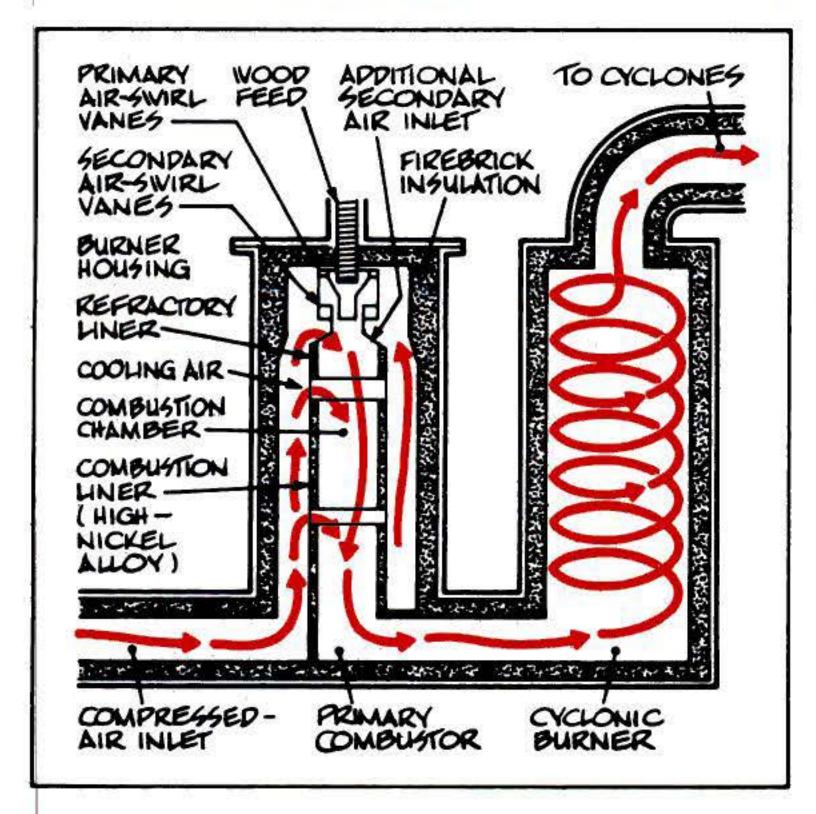
By RICHARD LAYNE

oseph Hamrick didn't set out to be a purveyor of electricity to the homes of America. "I sort of backed into selling electricity," admits Hamrick, who began tinkering with turbines at the National Advisory Committee on Aeronautics, the precursor to NASA. "When the energy crunch hit in 1978, I thought

that electricity could be supplied by a gas turbine using an untried fuel-sawdust."

With funds from the Department of Energy, Hamrick





built a 3,000-kW woodburning gas turbine that has so far practically eliminated downtime for repairs and cleaning. The turbine should be in full operation by the time you read this, generating electricity that Hamrick will sell to

the Tennessee Valley Authority.

The key to cutting downtime in a gas turbine, Hamrick realized, could be summed up in one word—space. "The British Coal Research Lab got cleaner exhausts than were previously possibly by using three large cyclones in series," he says. Cyclones are hollow tanks that swirl the gas from the combustor like a centrifuge to separate out fuel particles before they reach the turbine. "But the British still had problems with erosion of the cyclones and turbine blades," he points out. "They never gave themselves adequate space for burning and cleaning."

To ensure complete burning of particles within the combustors—a key to cutting erosion—Hamrick feeds pulverized wood chips into a 15-foot vertical primary combustor, where they are swirled down and then up through a second burning site, a 15-foot cyclonic burner, before entering the cyclonic separators. "A straight combustor, one without swirling, will leave charred wood in the cyclone, where the walls will then be heated to the point where they start to wear away," Hamrick explains. "But our two-stage combustion system ensures that the burn-

ing doesn't continue in the cyclones."

Although the 4½-inch-thick firebrick lining of the combustors can withstand temperatures of up to 3,200 degrees F, Hamrick found that temperatures above 1,800 degrees encouraged spalling of the lining of the cyclone walls and slag formation. To keep the temperature down, he uses the turbine exhaust to dry wood to 25-percent moisture—higher moisture content boosts combustion temperature—and feeds cooler air into the combustor from the compressor.

The two large cyclones in series, an idea borrowed from the British, have proved so effective at cleaning the gas that Hamrick decided there was no need to coat the turbine blade. "Battelle Labs tested the cyclones and found that 90 percent of the particles that reached the turbine scroll were less than 0.5 micron [0.00002 inch] in diameter. And wood particles were only 12 parts per million,"

Hamrick reports.

The cyclones' efficiency is aided by the fuel's inherent cleanliness. "Wood burns better—in my system—than coal or oil," Hamrick states. "Burning wood doesn't lead to large accumulations of ash, clinkers, and sulfur in the cyclones, which is what you get with coal. And unlike oil, wood doesn't contain significant amounts of carbon, a cause of turbine-blade erosion since it won't burn in the relatively low heat of a turbine combustor."

Some erosion may occur, Hamrick admits, after the turbine is installed in Red Boiling Springs, Tenn., and begins to generate the 12 to 14 megawatts of electricity a year the TVA has contracted for. But at least fuel will be plentiful: There are 35 lumber mills in the area, all eager to sell their sawdust to Hamrick at \$5 a ton.

Little fire breather: Corolla GT-S

On the surface, the 1985 Toyota Corolla GT-S looks barely different from last year's model. But under the skin, everything—engine, drive train, and suspension—is new or modified. Toyota replaced the standard 1.6-liter (98cu.-in.) 70-horsepower four-cylinder engine with a hot twincam 1.6-liter four with four valves per cylinder. Result: 112 horsepower with an engine redline of 7,500 rpm. That's a 60-percent increase in power.

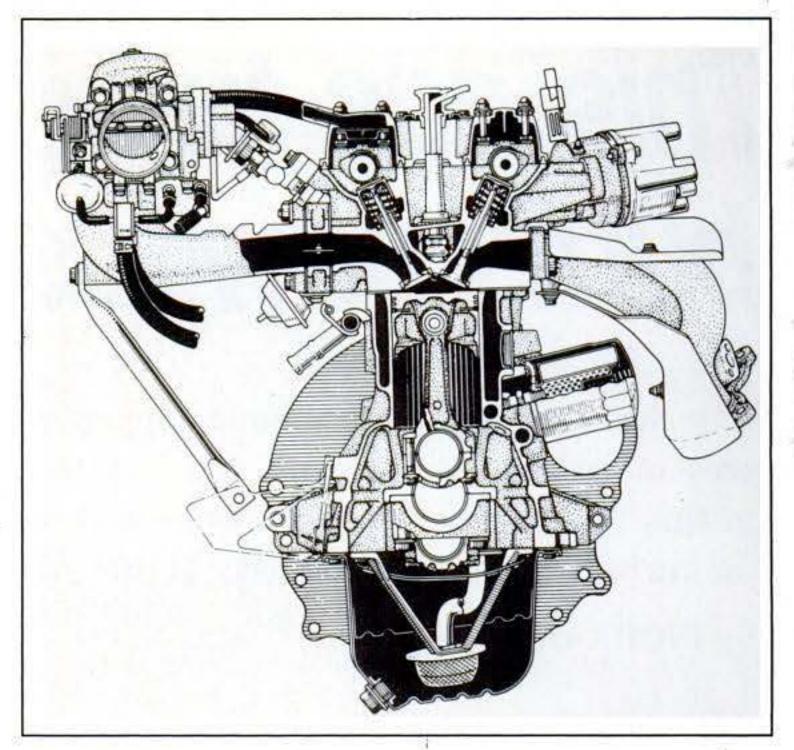
"One of the two intake valves is closed until 4,650 rpm," explains Eric Bondus, technical training manager for Toyota U.S.A. "That yields better fuel-air mixing, reduces blow-back at low rpm, and prevents over-rich mixtures at

high rpm."

To match the added power, Toyota modified the chassis with stiffer springs, improved shock damping, a limitedslip differential for the rear axle, a rear anti-sway bar, and four-wheel disc brakes. Front and rear spoilers were also added to improve airflow. That netted a 0.35 drag coefficient for the liftback version and a 0.37 for the coupe body style.

Despite the power and performance improvements, Toyota sacrificed little in economy. Preliminary GT-S fuelmileage figures are 37 mpg on the highway and 29 in the city. Of course, at the car's 115-mph top speed, mileage will be considerably less. The base price is about \$9,500.

—Jim Schefter



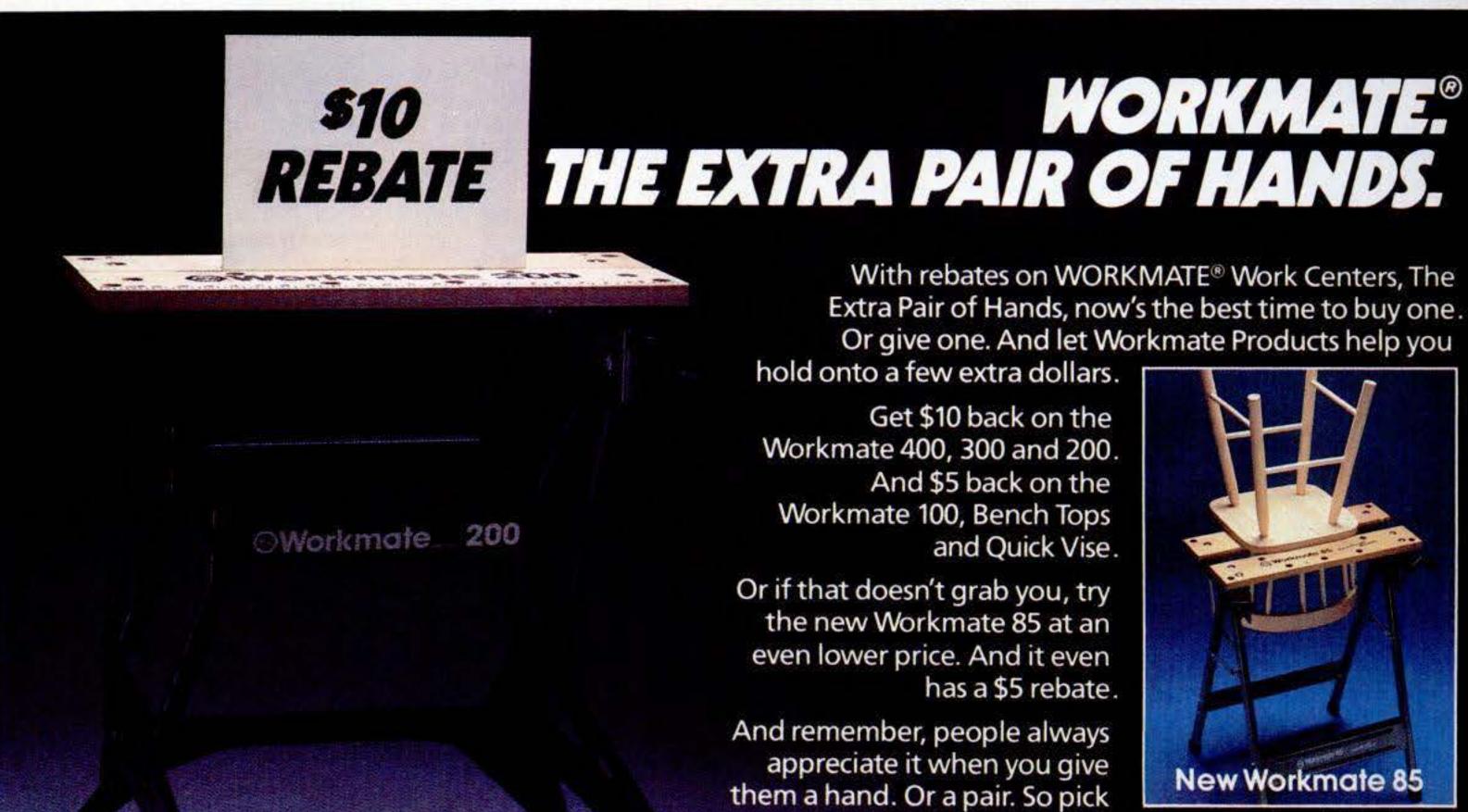


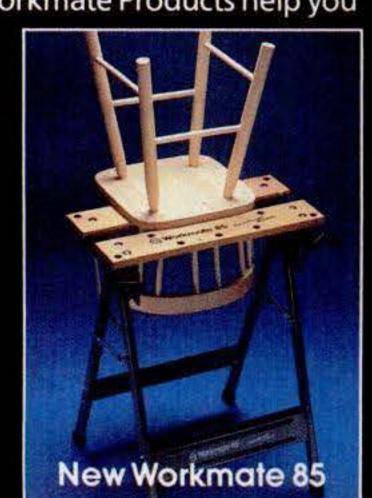
up The Extra Pair of Hands for someone else this holiday.

Or drop a hint for yourself. Because with rebates and

new low prices, there's no better time for the present.

Workmate* The extra pair of hands





lack & Decker

Copyrighted material



The Whistler® Spectrum™. It was chosen #1 by Motor Trend, "The Whistler Spectrum resides at the top of the list. A world class radar detector." Autoweek Magazine says, "The Spectrum is the most sensitive radar detector Autoweek has ever seen." Plus, nearly one out of two truckers who own radar detectors own Whistler. And there's only one reason.

Performance.

Spectrum conclusively detects all police radar. Stationary, moving, trigger -even pulsed radar. On the straightaway-from behind-over hills and around curves. If there's police radar in the area, Spectrum lets you knowlong before the radar can sense you.

Spectrum also comes in a remote version that can be concealed behind the grille of your car-no one will know you're using radar protection except you.

POLLUTION SOLUTION™

Several imported radar detectors generate a signal on the X Band and K Band frequencies that cause most radar detectors to "false." But thanks to the Whistler Pollution Solution, Spectrum can tell the difference between a polluter and police radar. The polluter signal is blocked out, while maintaining maximum range at all times.

EXCLUSIVE FILTER MODE™

Sensitive receivers also detect microwave intrusion alarms, which are particularly frequent and annoying in urban areas. Spectrum's exclusive Filter Mode allows you to operate at full sensitivity at all times, even in the

WHISTLER®

city. Because the Filter Mode simply changes the way the Spectrum alerts you when intrusion alarms are present.

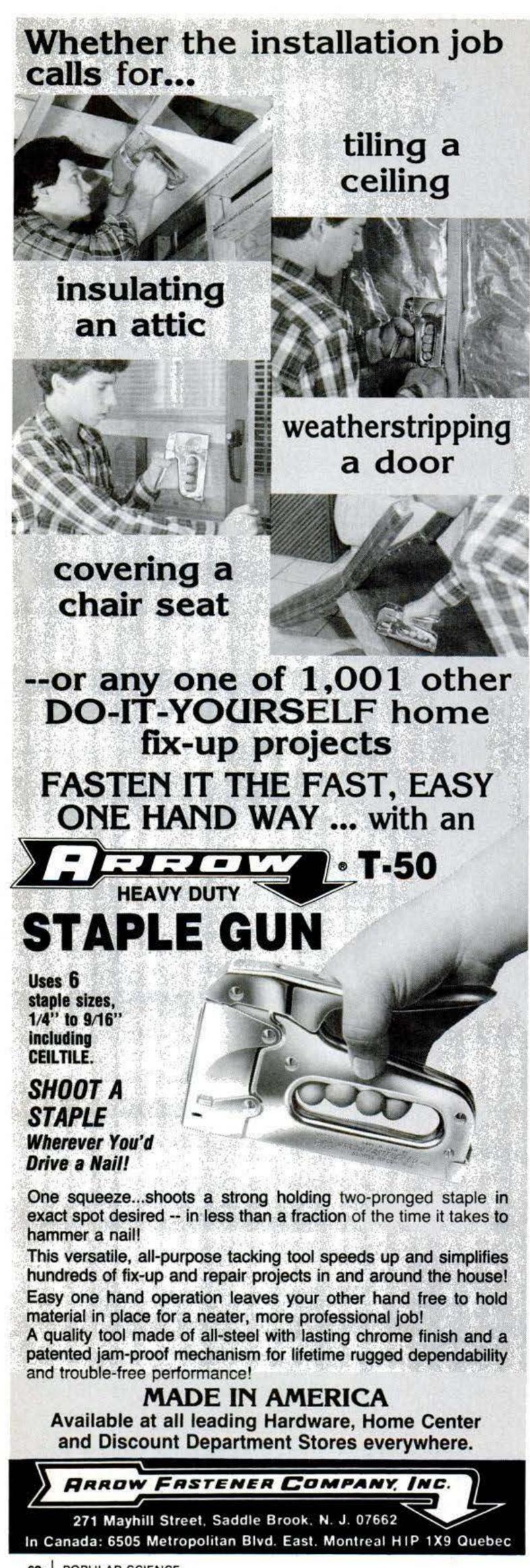
WHISTLER RELIABILITY

Every Whistler comes with a full parts and labor warranty. But chances are you'll never have to use it. Because Whistlers are made to last. They're the most reliable, top quality radar detectors on the road.

CALL US TOLL FREE

Our complete line of superheterodyne radar detectors with dash/visor or remote mounting options can be found at over 4,000 dealers across the U.S. So for the dealer nearest you call us toll free now at 1-800-531-0004. In Massachusetts call (617) 692-3000.

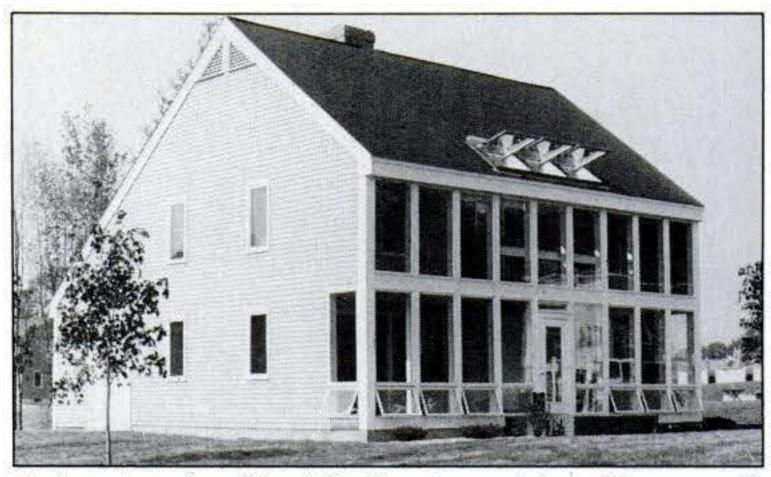
Because we know you only drive the best. That's why you should drive with Whistler.



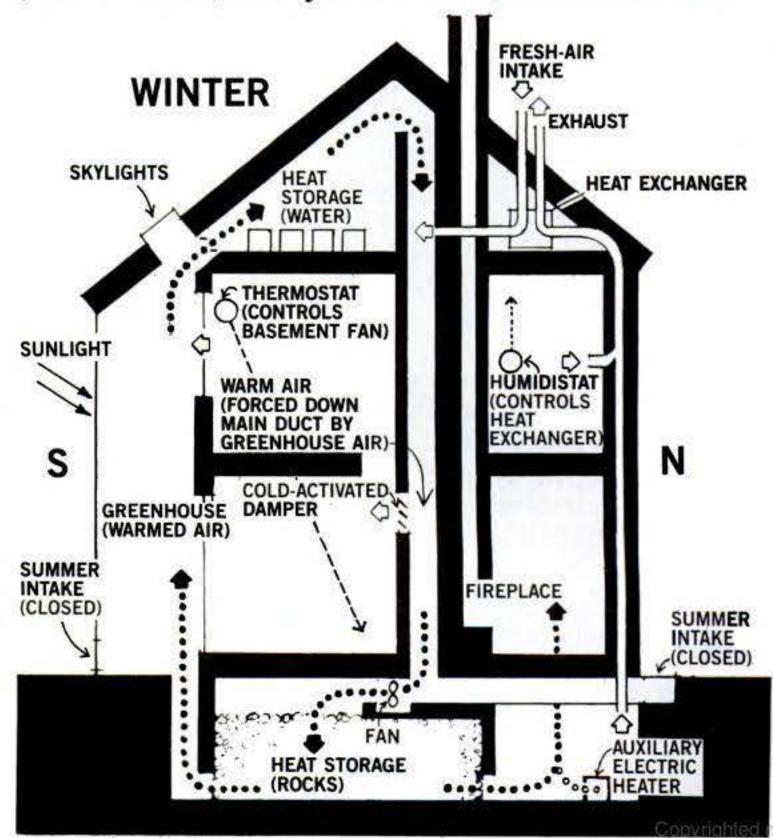
New England Sunbox is 100% solar

When New England Electric Systems sponsored a design competition for energy-efficient homes, Newton (Mass.) architect Paul Stevenson Oles responded with the New England Sunbox, which harks back to the colonial saltbox design. The utility has now built a Sunbox house—one of three prizewinners—and will monitor the three-bedroom Methuen, Mass., home's energy efficiency for two years.

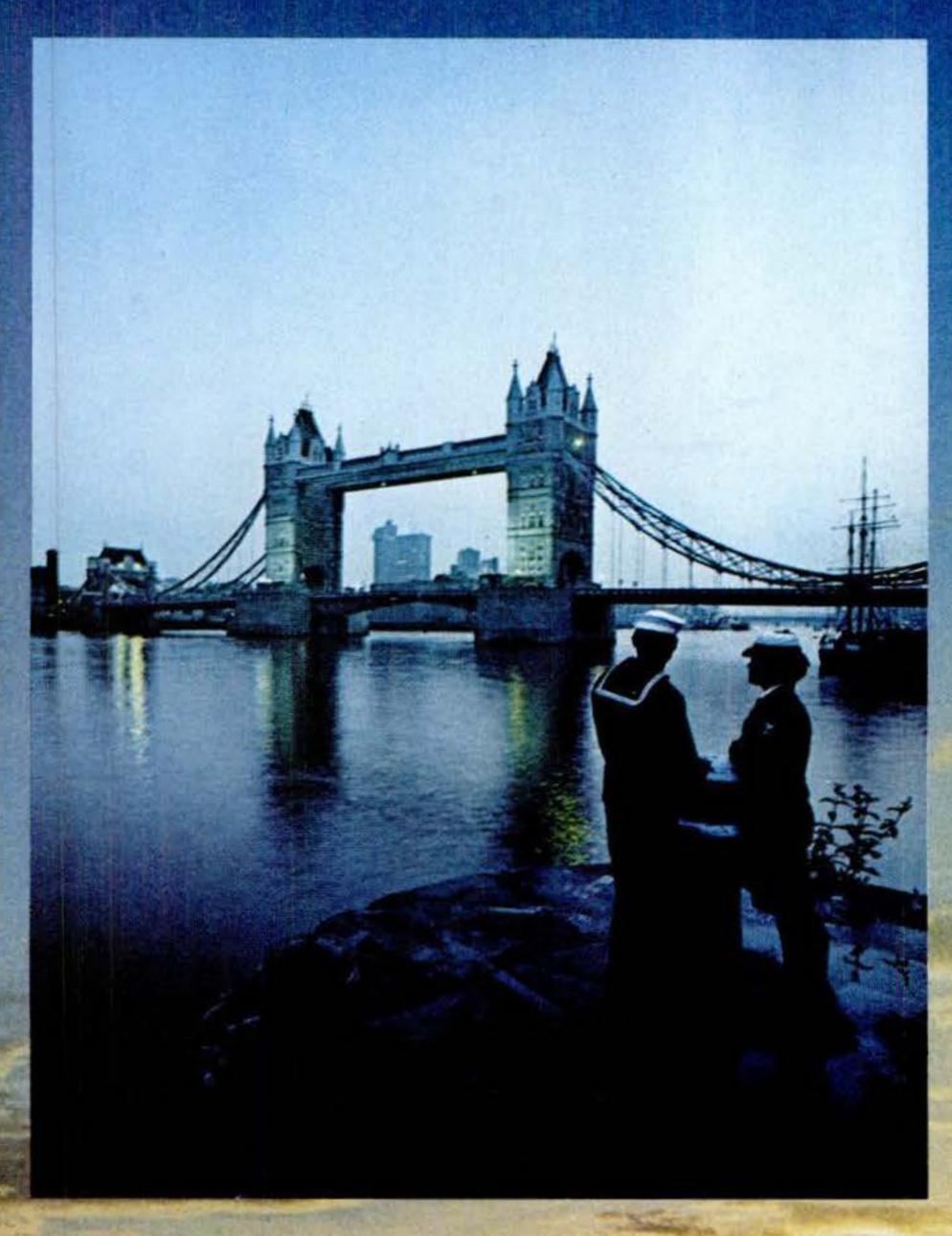
Incorporating designs developed by solar-energy consultant Norman B. Saunders, the \$89,000 house is "a highly insulated passive solar hybrid envelope," conceived to look like a traditional residence, Oles says. It uses basement and attic heat-storage areas connected by a central duct to retain and circulate warmth collected by its southwardfacing solar greenhouse. The house is designed to remain at a comfortable temperature for five or six consecutive cold, dark winter days, with an electric heater providing a backup for worst-case weather conditions. Plans are \$40 from Massachusetts Electric (Energy-Efficient Home Designs, 25 Research Dr., Westborough, Mass. 01581). —Stuart F. Brown



East and west walls of Sunbox house (above) have small, quadruple-glazed windows. Below: Solar heat from storage areas is distributed by convection and basement fan.



MOST JOBS PROMISE YOU THE WORLD. WE DELIVER.



Rio de Janeiro, Singapore, Hong Kong, Manila, and ports of call in between. Why wait a lifetime to see the world, when the Navy makes you a world traveler right from the start.

And while we're moving you around the world, we'll also be moving you up in the world. Top Navy training in a highly technical field of your choice can give you a headstart on a career you'll have the rest of your life.

A chance to see the world. And a world of experience. If you're looking for a job that can promise you a lot more than just a paycheck, see your local Navy recruiter or call toll-free 800-327-NAVY.

IT'S NOT JUST A JOB, IT'S AN ADVENTURE.



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

Kings: 12 mg "tar;" 1.0 mg nicotine—100's: 14 mg "tar;" 1.1 mg nicotine av. per cigarette, by FTC method.

The WHAT'S NEW magazine

What's News

They didn't roll out the Grumman X-29 at the roll-out ceremonies in Calverton, N.Y. Instead, in a huge darkened hangar before an audience of perhaps 1,000 persons (including Vice President George Bush, a large flock of Air Force and Navy brass, and this writer), a Grumman stage manager opened the curtains and turned on the spotlights in a niche in a corner of the hangar. And there it was: a gleaming white beauty with blue and red feature stripes and the same "wrong-way wings" that prompted us to assign Ben Kocivar to write an article about it in April 1980. We even put a painting of the craft—not yet built—on the cover of that issue.

I circled the craft, holding Kocivar's 4½-year-old article in my hand. It looks as if Grumman got everything right. They didn't put the blue and red stripes exactly where our cover artist did, but everything else is pretty accurate. First, of course, there are the forward-swept wings that are expected to make the craft more efficient—less drag, more lift, better maneuverability. There are the stubby canard wings at the middle, which, along with a flap near the end of the exhaust nozzle and a "camber device" that changes the curvature of the wing in flight, provide pitch control. And everything else also seems to be where Kocivar said it would.

Grumman will be testing the X-29 at Edwards Air Force Base toward the end of the year and then will turn the plane over to NASA for further tests. If all goes well, we should see some of the features of this experimental craft —its number indicates that it's the 29th of the series—on other planes, probably in the next decade.

Coming: composite drive shafts

Although the advantages of forwardswept wings were appreciated as far back as 1944 (by the German air force), it wasn't until the new technology of plastic composites came into being that the wings could be incorporated in a modern high-speed craft.



That same technology is finding hundreds of other uses, too, where high strength and light weight must come together. Among these is a drive shaft. Ford Motor Co. hopes to equip at least 50,000 of its 1986 pickup trucks with glass-graphite-fiber-reinforced plastic-composite shafts.

The one-piece shafts (steel shafts currently in use are two-piece) offer benefits not only of lightness but of stiffness, durability, and reduced vibration—just what Grumman foresees for its backward wings.

Skid control

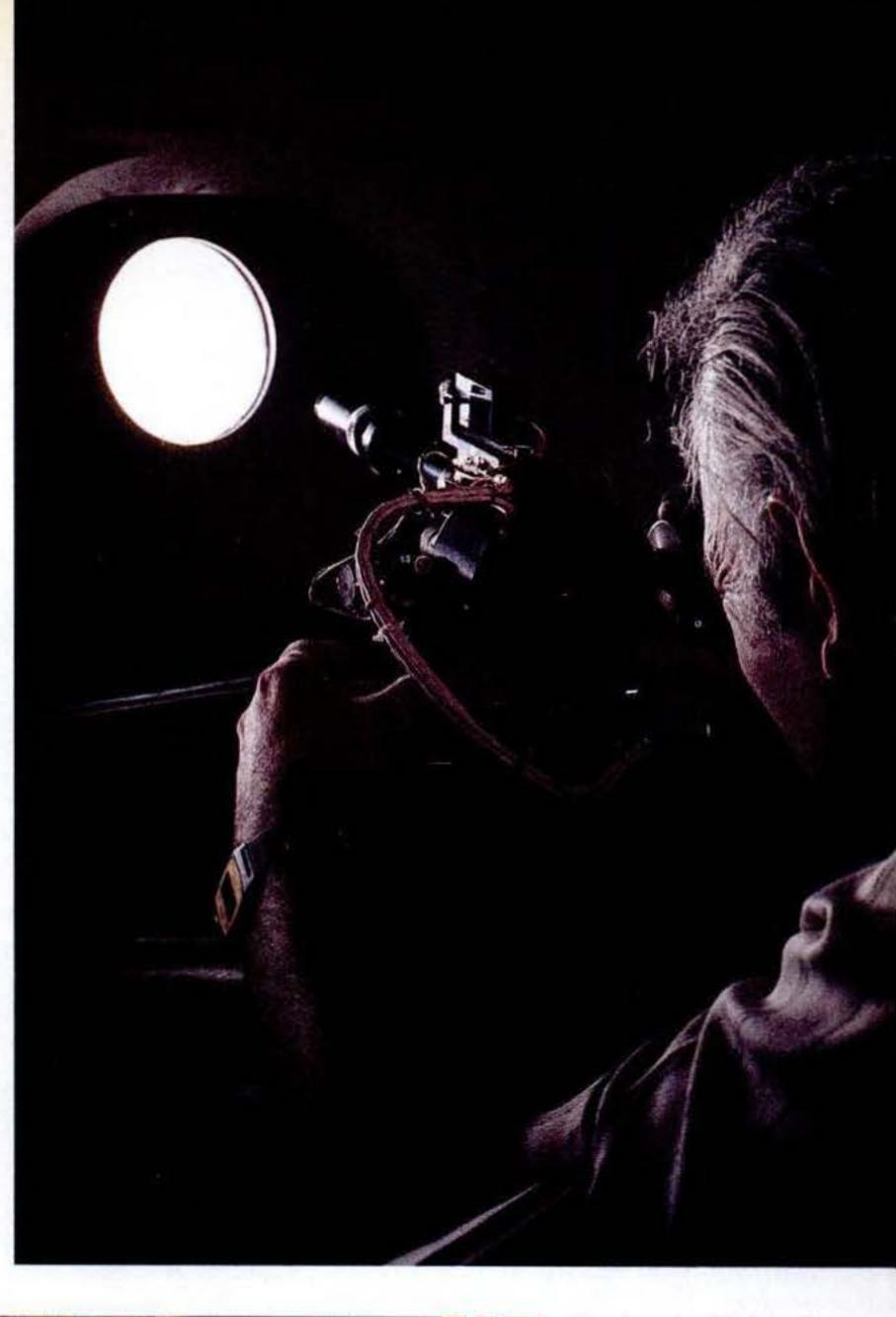
Anyone who has been through the heart-stopping experience of a wild skid on an icy road knows how deadly those skids can be. But recently Pop-ULAR SCIENCE editors have been undergoing that experience voluntarily —and happily. The reason: skid-control brakes that enable a driver to maintain control of his car under the iciest conditions. In Detroit, PS Senior Editor Jim Dunne slid—under perfect control—through a treacherous Ford proving-ground skid-test course with

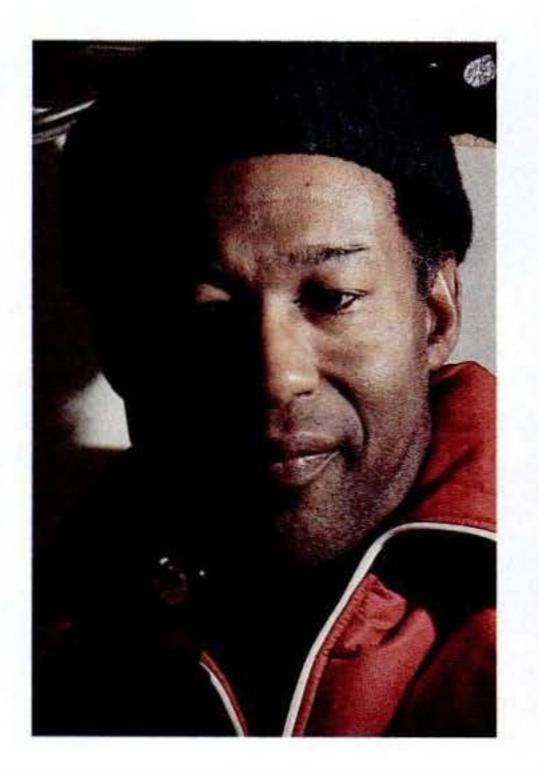
a new Lincoln Mark VII equipped with anti-lock brakes while PS photographer Greg Sharko recorded the event for our cover.

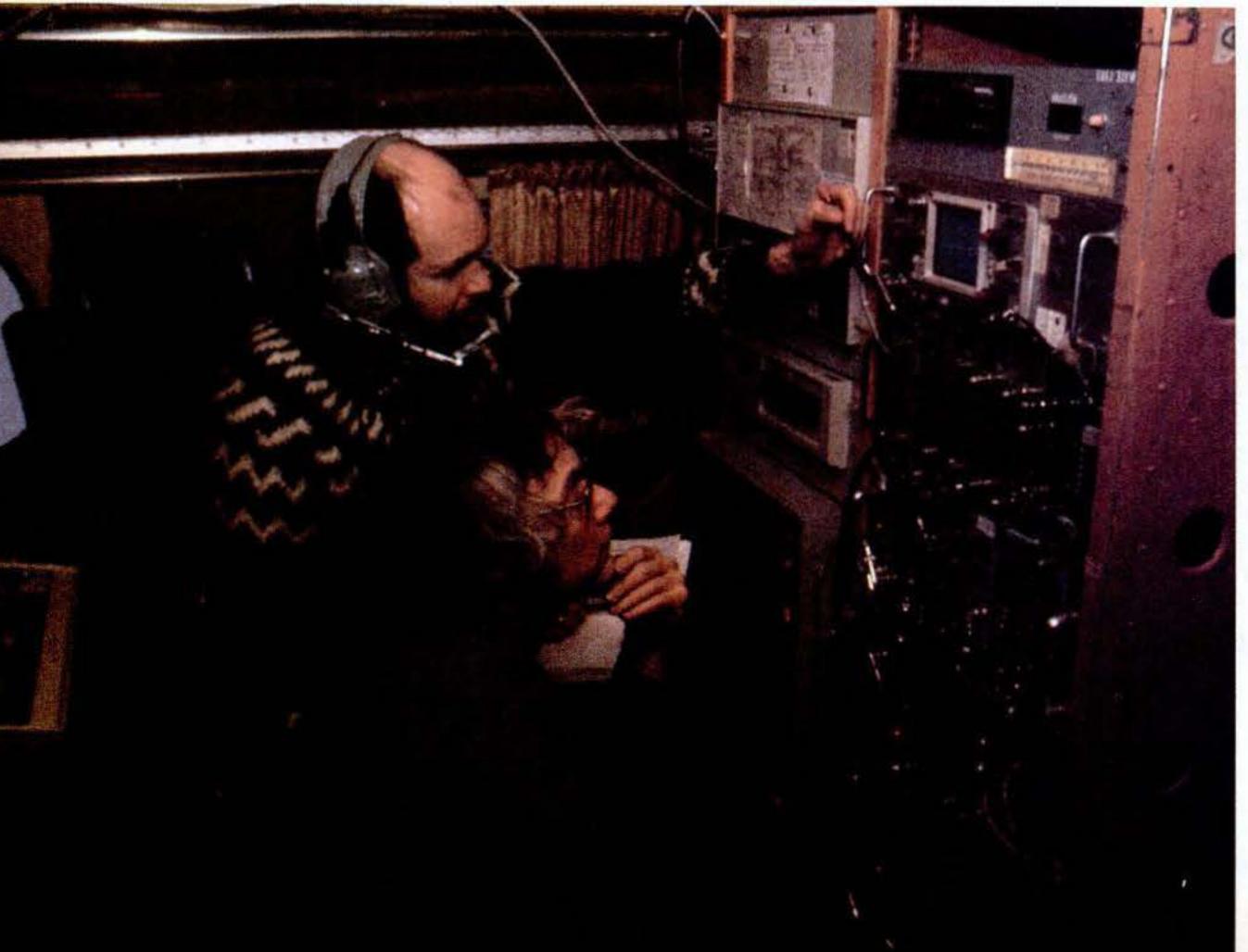
At the same time, at the Mercedes factory in Stuttgart, West Germany, PS Executive Editor Herb Shuldiner was investigating the Mercedes ABS system of anti-lock brakes—a system that Dr. Wolfgang Peter, head of passenger-car research and development, told Shuldiner he considered the "most important safety innovation in 15 years."

"I didn't need those words to convince me," Shuldiner says. "I had spent a good part of the day testing a car equipped with the new Mercedes anti-lock system at the Motordrom in Hockenheim. The difference in driving control with the ABS system is startling."

A full report on anti-lock braking systems is in this issue.







During in-flight observations of the polar stratosphere (left), author Gannon watches as engineer Hunt explains the display on the lidar scope. (Hunt is on assignment to NASA from Wyle Laboratories.) Physicist Woods (top left) examines the quartz-crystal microbalance he uses to collect particles. Sighting through a photom-eter (above), David Grolemund, a Bendix technician assigned to NASA, gets a bearing on the rising sun to check the accuracy of a similar instrument in orbit aboard Nimbus 7.

Probing the mysterious polar vortex

Tracking a volcano's exhaust, a NASA research team flies due north, deep into the arctic night, and finds some surprises in the atmosphere above the North Pole—including a giant cloud that no one has ever seen before. The findings may lead to better understanding of weather patterns.

By ROBERT GANNON

As a long-term observer of scientists in action, author Robert Gannon has hitched rides with a spectrum of research teams—ranging from deep-sea explorers to Alaskan environmentalists. Recently he joined scientists aboard a NASA plane crammed with equipment—the best-equipped research plane to fly over the North Pole. Here is his report.

he last of the morning twilight was left behind hours ago. Now the surface of Greenland, 19,000 feet below us, is as black as starless space.

We are heading north out of Thule, Greenland, in a commercial airliner converted by NASA. You can still see evidence of its tourist design: Florida-blue seats and yellow-flowered curtains and a little lounge in the back. Aboard, nestled among racks of equipment, are 17 men—nine scientists and technicians, seven crew members, and one writer. Our mission: to look at the arctic atmosphere in midwinter to see what kind of matter it holds.

The trip today began in typical Thule winter weather—dismal, dreary, depressing, and 40 degrees F below zero. Thule—where footfalls on packed snow sound like ripping cloth, where fingernails crack off because of the dryness, where you can pad yourself so you look like a snowman, but you can't stop the air from searing your nasal membranes or cracking your teeth.

Now we are warm, high above the glaciers, heading toward the arctic outpost Alert. There we'll shift directly north to ride up the 60-degree meridian and over the North Pole. All the way we'll be passing through the mysterious winter polar vortex, a huge area of sinking air spinning slowly counterclockwise, associated with the coldest temperatures in the Northern Hemisphere. The vortex has never been probed by modern instruments.

But the equipment we have along can peer and collect and analyze. Until now, no research team this heavily instrumented has ventured this far north. During this one brief flight the team will make three discoveries:

- The polar atmosphere is cleansing itself with remarkable speed.
- The Soviet-generated Siberian haze may extend farther than was suspected.
- A huge, rare cloud may blanket the North Pole during the months-long arctic night.

Together, these three findings will cast new light on atmospheric circulation and may lead to greater understanding of global weather patterns.

Pat McCormick, the atmospheric physicist who designed this mission, is absent. The 43-year-old chief of NASA's Aerosol Research Branch is back at Langley Research Center. "I'd love to go," he'd told me earlier, "but I felt I could coordinate things better back at home base, where I have access to weather information and satellite data."

The team McCormick sent to the Arctic includes Bill Hunt, a tall, bearded engineer, and Bill Fuller, on-plane director of the operation. Sitting in the plane's midsection, flanked by a pair of CRT screens, Hunt scribbles frantically in a three-ring notebook in his lap, swivels around to adjust contrast, twists this, punches that—and enjoys every second of it. He's been working all year to get his equipment in order, and now it's functioning perfectly. Fuller is listening to the flight engineer, talking with the pilot, watching Hunt's two scopes, and all the time jotting in his notebook.

Hunt is looking for a layer of aerosols—minute particles spewed into the atmosphere by El Chichon. Since the Mexican volcano exploded in 1982, McCormick's team has been tracking its airborne debris up and down the hemisphere (see box). Now cruising north at 292 knots (336 mph)—optimum speed to conserve fuel—we easily spot the El Chichon layer. Its signature sits in jagged green on Hunt's two screens, each tracing readings of the sky.

The screens are hooked to the main lidar (light-detection-Continued

"The extent of the polar cloud is

and-ranging) unit. With its laser and telescope receiver, the lidar works something like radar, except instead of detecting objects the size of planes, it looks for aerosol particles. Now the lidar beeps every three seconds. With each beep, the 8.4-kilovolt ruby laser fires for one-thirty-billionth of a second. Then up through a window in the roof shoots a streak of ruby-red light (6,942 angstroms) three inches in diameter and 30 feet long.

As the ruby shaft of light pierces the El Chichon cloud layers thousands of feet above us, most of it simply disappears. But a tiny part of it backscatters down to the telescope receiver, there to be converted to electrical signals, amplified, projected onto the CRT screens, and stored on tape for later review.

"What we're seeing here," says Hunt, pointing at one of the screens, "is a nice, distinct layering of El Chichon material. It's resting primarily between about 36,000 and

65,000 feet. That's well into the stratosphere.

"Now, the important thing about this," Hunt adds, "is that the layer is thinner and more transparent than we expected. We measured it south of Thule both this year and last, and it's not as dense now. That's probably the case up here, too. The total has likely dropped off by, oh, I'd guess, 30 percent. That's really, I think, important. It means that the stratosphere is cleansing itself."

How? Not with the normal atmospheric cleansing mechanism, rain. There isn't any in the stratosphere. But the vortex we are churning through might act as a huge sink, a mammoth maelstrom down which pollutants can drain.

Suddenly, far below, like a hole in a velvet curtain, Alert slides past—a brave, lonely little village with all its street-lights on at noon, pushing back a little of the oppressive polar night. We turn due north.

Wandering along the aisle to check on the other researchers, I stop to chat with Jack Bufton, whose main interest is carbon dioxide. He's monitoring the CO₂ drawn in via a probe poking out the plane's side. Every so often he opens an aluminum vacuum bottle the size of a rolling pin that, with a whoosh, sucks in a sample of whatever we're going through. Back home it will be analyzed. "Actually, we have so little gaseous data at these latitudes," he says, "that anything we find will be interesting."

Next, physicist Dave Woods, whose job is to collect particles, shows me his quartz-crystal microbalance unit. This "cascade impactor" has 10 thumbtack-size piezoelectric plates of quartz coated with a nickel electrode. As outside air is sucked in and directed through the unit, particles are deposited in eight bins by size—about eight microns (0.00032 in.) in diameter on the first slide to about 0.05 (0.000002) on the last. Back home he'll analyze the depositions with a scanning electron microscope.

I move on to Forrest Diehl, an electronics technician who, somewhat to his discomfort, finds himself acting the role of a scientist. "I'm happiest building equipment, not running it," he had told me earlier. But right now he is not bored. "The sonofabitch works!" he says. "You don't know how gratifying that is: to figure out a problem on paper, then apply it under these conditions—and it works." A half hour earlier, his equipment, a downward-looking lidar, was spewing nonsense. The laser wasn't responding properly to the computer. Diehl tore it apart in the cabin and resoldered the connections on the spot.

Suddenly, Diehl stops smiling. "Hey, Fuller, look at this spike!" he shouts. "Saturated at 27 microseconds!"

Ground-truthing SAM II

Before the NASA team could take off for the North Pole, they had a job to do: Verify the accuracy of stratospheric aerosol measurement II (SAM II). Since October 1978, this instrument on the Nimbus 7 environmental satellite has been circling Earth every hour and a half, looking for sunrises and sunsets. Its mission: to survey the amount of submicron-size particles and gases floating in Earth's polar aura.

When SAM II spots the sun, it opens its telescopic eye and locks on, scanning the disc until it moves out of sight. The eye concentrates on light of one-micron (0.00004-in.) wavelength, noting to what extent its intensity is being modified. The data, radioed to NASA, show the amount of sunlight blocked by atmospheric aerosols, mostly sulfuric acid droplets.

Once a year, NASA compares measurements taken within the atmosphere with those being supplied by the satellite to make sure SAM Il continues to transmit accurate data. The verification is called "ground truthing."

To corroborate SAM II's messages, atmospheric physicists use two pieces of equipment, a photometer and a lidar assembly. The photometer is a tiny telescope that locks on to the rising or setting sun, measuring its intensity in four wavelengths. The lidar (see text) fires a laser beam straight up, and the intensity of the backscatter shows the amount of aerosols present.

The trick is to so time things that the instruments on the plane and the telescope on SAM II are looking at the same spot in the sky at the same time. During last January's flight the team succeeded, confirming that SAM II was still working well.—R. G.

The unit is tracing an ugly gaudy-purple scratch on the screen—the backscattering result of 10 blasts per second of 1.06-micron (0.000042-in.), near-infrared energy—and it's registering a layer of something 8,500 feet below us.

Fuller leaps across the aisle, Hunt swivels around, and the three of them study the screen. Something is lying in a 2,500-foot-thick blanket some 7,500 feet above the icecap.

Arctic smog

They conclude that it probably is what's called Siberian arctic haze, a smog thought to migrate north in late winter from industry in the southern U.S.S.R. If analysis bears this out, it will be the first time the haze has been sighted by sensors north of Thule.

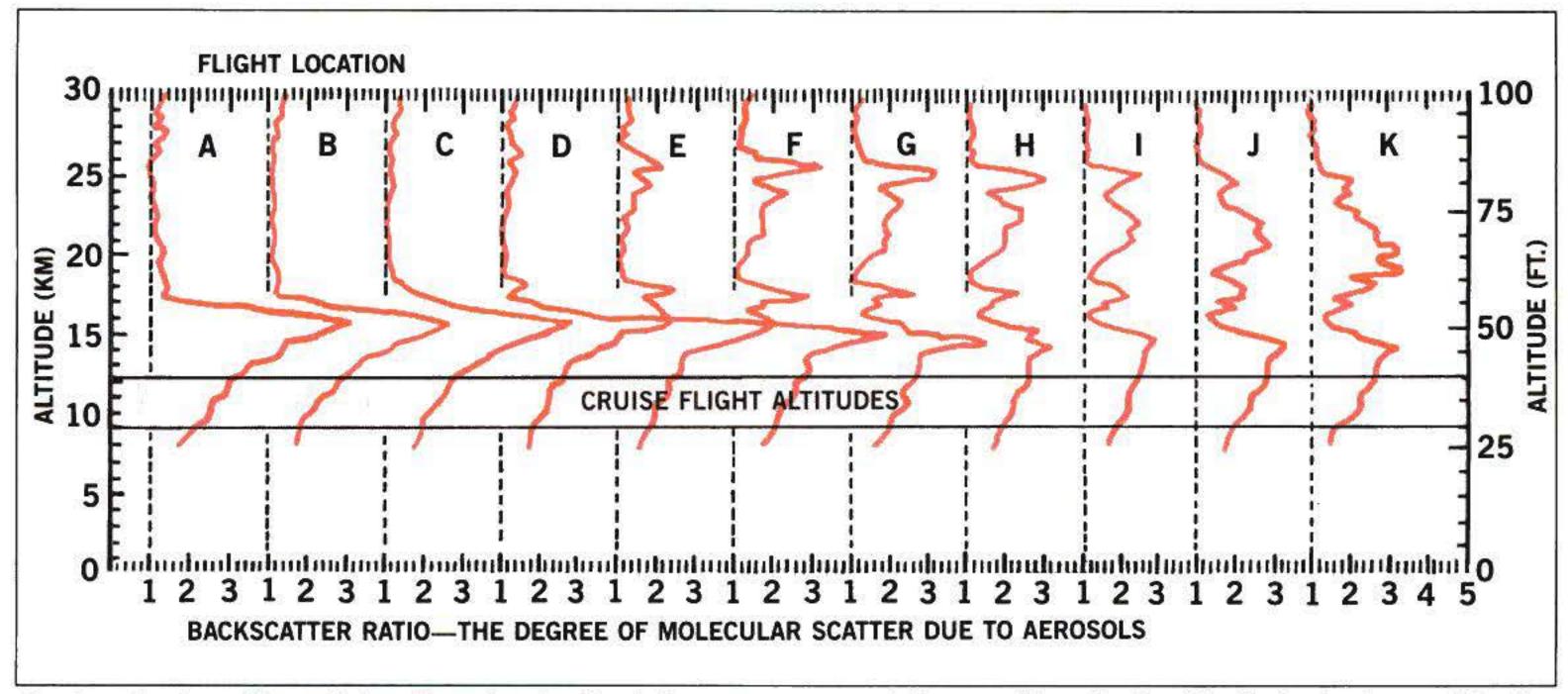
"We think arctic haze is composed of carbon particles from inefficient combustion," says Fuller. "It's very black, highly absorbent, and very interesting because it may affect the climate up here."

Now that the team knows that lidar can spot arctic haze (if that's what it is), it can be used to direct a chase craft through the clouds to scoop up samples.

Still we hurtle due north—toward yet another discovery. Hunt had noticed something earlier—at about 78 degrees N—blipping at the top of his lidar screen. It could be another layer of El Chichon, but it seemed to be in the wrong place; or it could simply be electrical noise. But now, 50 miles farther north, it's still there, lying between 62,000 and 79,000 feet from the surface, and the trace is getting stronger.

If the layer isn't El Chichon, there's only one other possibility: It's a mysterious and little-known entity McCormick calls a "polar stratospheric cloud" (PSC). Most clouds form in the troposphere, the layer of air next to the earth, at a maximum altitude of perhaps eight or nine miles. The orbiting SAM II (see box) occasionally sees, glinting in the midwinter sun, something different, some-

staggering—at least 350 miles long"



Backscattering of laser light off a volcanic cloud shows up as ragged lines on lidar display. Vertical axis shows altitude.

Tracking a volcano's debris

When El Chichon ("The Lump") erupted in southern Mexico in March 1982, it shot nearly 10 times as much material into the stratosphere as did Mount St. Helens.

Although both El Chichon and Mount St. Helens ejected about one cubic kilometer (35,315 cu. ft.) of matter, Mount St. Helens spewed predominantly sideways: El Chichon blew nearly straight up. Also, whereas Mount St. Helens ejected great amounts of ash that quickly fell out of the stratosphere, El Chichon hurled up huge volumes of sulfurous gases that converted into sulfuric acid droplets to

make up a persistent aerosol. (Aerosols are minute particles, not a gas like ozone.)

Since the eruption, NASA's Pat McCormick and his team have been monitoring the cloud —both in the tropics and in the lower Arctic. So far, they and others have discovered:

- The cloud's top rose to some 85,000 feet, well into the stratosphere. (Airliners fly no higher than about 40,000 feet.)
- The volcanic debris drifted from Mexico in two layers—one at 85,000 feet, the other at 59,000 feet. The lower volcanic layer drifted in a matter of weeks all across the earth. But the thicker, upper layer moved

slowly, taking nearly nine months to reach the polar regions.

- The cloud blocked some sunlight. The result: a 0.5-degree-C (1.8-F) temperature drop worldwide—the equivalent of elevating the earth's surface 500 feet, a significant difference for marginal agricultural land.
- There's also much private speculation (but no public claims yet) that the temperature drop was somehow tied in with the unexpected intensity of El Niño, that warm, equatorial Pacific pool that affects global weather. Says McCormick guardedly: "It's very suspicious."—R. G.

thing that forms only during the coldest weather, and only in the stratosphere of the far north or south.

Nobody has ever measured the layer, because it forms only in the arctic night. Even passenger jets flying the polar route never see it; they pass miles below it.

But now, if Fuller and Hunt are right and if the layer is not El Chichon residue, we, for the first time, are detecting a PSC from below.

To determine for sure whether it is a PSC, the researchers try polarization. The laser produces a polarized beam (the wave vibrations are confined to one plane) that, when reflected from spherical particles, returns virtually unchanged. El Chichon residue is made up of spherical droplets of sulfuric acid. But a true cloud at these low temperatures would be made up of ice crystals. Such irregular particles will depolarize the light so it vibrates in varied planes.

The trick to distinguishing between them: Insert a crosspolarizing crystal filter into the path of returning laser light. Then the chart tracing would show depolarized light —from the rare cloud—with strong, significant peaks.

Now Hunt slips in the crystal, sets the machine beeping, and studies the output. The sharp peaks of the PSC signature jab across the screen. For the first time, a cloud in the stratosphere is recorded by upward-looking lidar.

And that's not all. That the cloud was seen is exciting but not all that surprising. The *extent* of it, though, is staggering. We began recording it at 85 degrees N, and now we are nearing the North Pole. That means that the cloud is at least 350 miles long and is probably sitting atop Earth like a lopsided cap.

Suddenly, over the loudspeaker comes pilot John Riley's voice: "North Pole in 10 seconds... mark!" We all look out. It's black as a darkroom—no moon, no glimmer on the horizon—and the stars, brilliant as they are, light nothing below. If there's a pole there, we don't see it.

The plane banks into a turn, circles once, then heads south. Though everyone on board is excited about circling the Pole, the talk as we travel south is about the discovery of the cloud. "Imagine," says Fuller, "this huge thing sitting up here that nobody even knows about. It's one tremendous cloud, but satellites don't see it because it's out of their range. Pilots don't see it because they can't. Nobody's ever seen it.

"For all we know it could be sitting up here every winter. What causes it? What effect has it on the atmospheric movement? On the radiation balance? What could account for all that moisture? When meteorologists get hold of this, it could change their whole way of thinking about polar circulation."

mpossible Squirm drive

—first real advance in gears in a century

A low-friction, zero-backlash gear system can provide pinpoint accuracy in laser-aiming devices, may be durable enough at high rpm for use in helicopter engines, and can produce two gear ratios simultaneously—a feat that seems to defy the laws of engineering.

By E. F. LINDSLEY

Photos by Greg Sharko

ake this rubber band," Tom Murphy said, "and insert it between those two V-belt pulleys. I'll crank up the motor, and we'll see how long the band lasts

attached to squirm gears."

The pulleys—one hooked to the shaft of a one-horsepower motor, the other to the input shaft of a cast-iron gearbox large enough to drive a golf cart—would usually require a 1/2-inch V-belt. Though I expected the band to snap immediately, I knew there had to be a catch: I hadn't been invited to Oradell, N.J., home of Murphy's company, MAXAXAM Corp., to watch a rubber band being chewed up.

Murphy started the motor, the gearbox hummed, and the rubber band—to my surprise—showed no sign of distress. The inherent friction of any other gears would have ripped the rubber band. But squirm drive, which resembles worm gear (see box), is more than just a lowfriction gear system. This unique form of motion transfer can also aim a laser with pinpoint accuracy and drive a dual-motion robot's wrist. "It's natural to compare squirm with worm gear," Murphy said, "but squirm drive has capabilities that no other gear system in the world can match."

Murphy ticked them off for me:

 The ability to yield two gear ratios at once—giving a multispeed output from a single-speed input—which traditional mechanical engineering says is impossible.

 The ability to change gear ratios by replacing only one gear—not two as other gear systems require.

 A reverse, or speed-up, drive that turns the input —the worm—into an output and can step up a slowerspeed motor to a high-speed motor.

 Zero-backlash drive, which gives the pinpoint accuracy and precision needed in such high-tech fields as ro-

botics and aerospace.

These unmatched features stem from a unique design that is the first real advance on the worm gear in more than 100 years. It makes squirm drive versatile enough, Murphy believes, to be used not only as an alternative to

worm gear but also in places where worm gear's inherent limitations render it impractical.

Squirm drive's unique design, according to its inventor, George Brackett, a Portland, Maine, tool-and-die maker, is based on: 1) the substitution of bullet-shape rollers for worm-gear teeth, and 2) the shape of the worm itself.

Each roller sits on a complement of thrust and roller bearings and springs, which force the roller out and into firm contact with the worm's grooves. Bearings allow the

roller to rotate during contact.

These agile rollers engage the worm tangentially, not head-on as do the teeth in worm gear. To accommodate this unique orientation, Brackett redesigned the worm. In worm gear the worm is straight, like a regular screw, with spiral grooves, looking much like the coarse screw threads on a wine press or a bench vise. In squirm gear, however, the shape of the worm follows a double parabolic curve so that its profile resembles a thick-waisted hourglass.

Starting from scratch

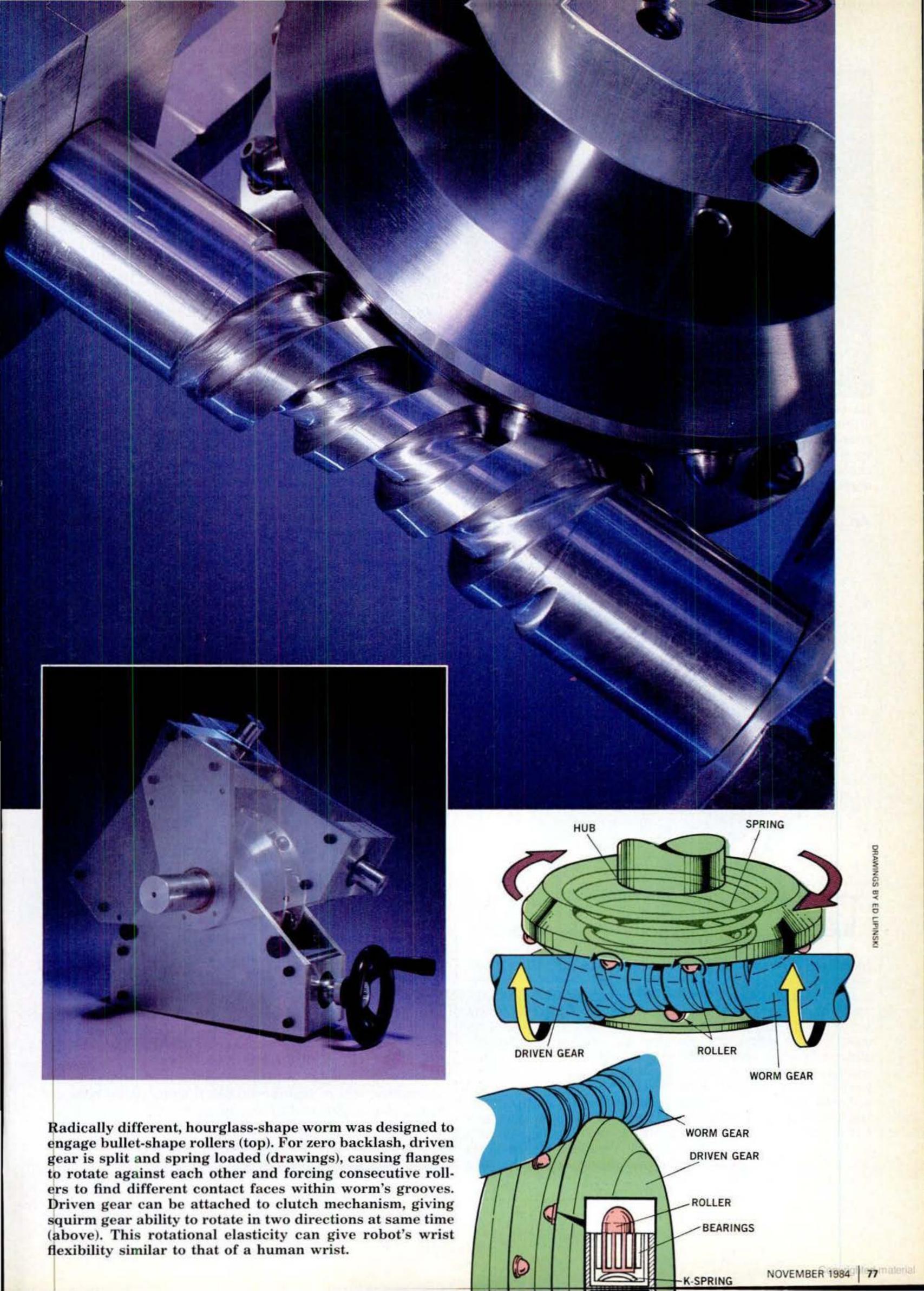
Cutting threads to such contours just wasn't being done when Brackett began work on squirm drive. "It took me four or five years," he said, "to build the cutting machine from scratch."

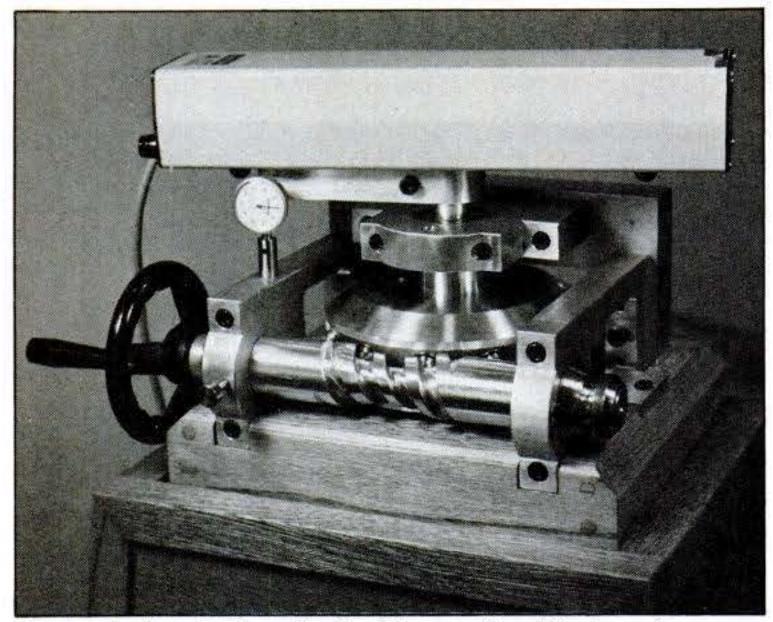
Now, however, fabricating the novel worm is no problem. At MAXAXAM's plant in South Portland, Maine, computeraided design takes over the job of designing just the right curves and tooth shapes. The output from the computer is programmed into a computer-assisted five-axis cutting machine that can swing and tilt freely to follow complex curves, so the worms can be turned out according to various specifications with great precision.

To achieve zero-backlash drive, the driven gear is split so that the rollers sit in a shallow V-shape indentation along the outer circumference of the gear. Rollers line both sides of the V and are staggered so that one roller at a time engages the worm (see drawings, opposite page).

Murphy believes that squirm gear's zero-backlash drive will fill a need in high-tech fields in which precision is paramount. To demonstrate this unique property, he used a table-top gear assembly with a small laser mounted on

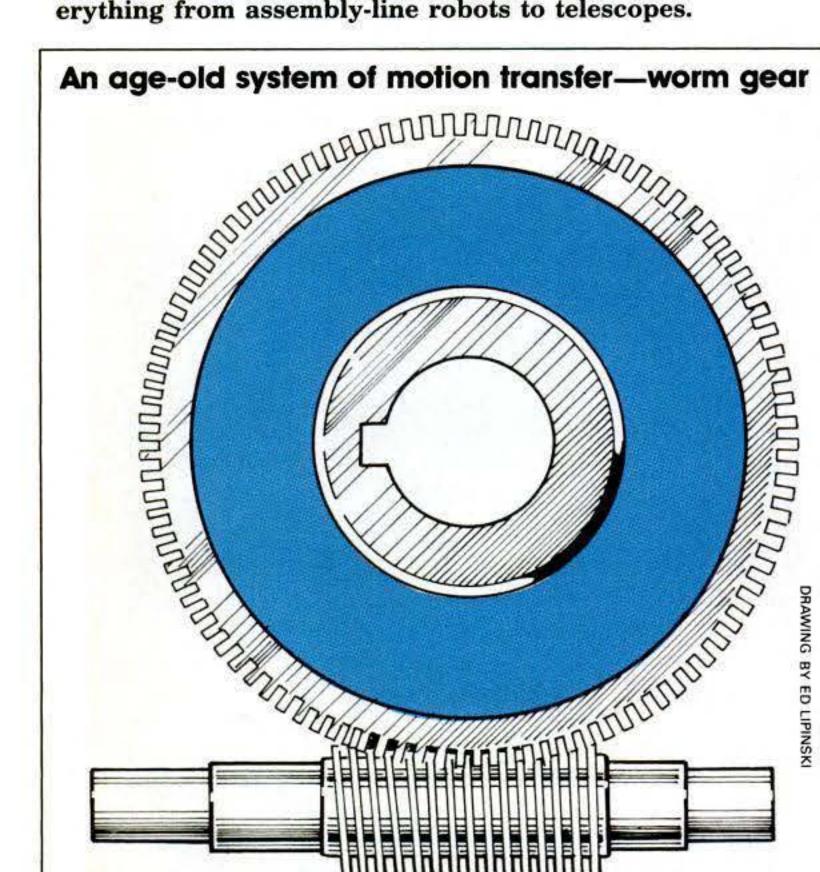
Continued





Laser-aiming device attached to zero-backlash squirm gear attains a precision impossible with other gear drives. Squirm gear's unique zero-backlash capability could fill a need in such high-tech fields as robotics and aerospace, in which extraordinarily precise mechanical drive is sought in everything from assembly-line robots to telescopes.

An age-old system of motion transfer—worm gear



To appreciate just how revolutionary squirm drive is, compare it with worm gear, a mechanical drive almost as old as the wheel itself. Worm gear consists of a worm, a screw-like helical gear, and a second, driven, gear with teeth. These gears do not mesh together closely, and the small space between them—backlash—is both necessary and the source of the gear's imprecision and inherent wear. Backlash allows for gears to engage and disengage with some degree of ease, lubricating oil to slide in, expansion due to heat, and minor manufacturing variations. Because of the backlash, however, the gears scrape and shear each other, affecting the life of the gear system and restricting the speeds at which it can operate. Nevertheless, worm gear has many applications, from race cars to hand mixers; it is used where gears are designed to be at right angles to each other and where a high-speed motor's output must be reduced before being transferred to a mechanical drive.

it. By cranking the drive, he could aim the laser. "Look up there," he said, pointing to a tiny dot on a wall about 60 feet away. He used the squirm drive to point the laser so its red beam fell exactly on the dot target. Then he set a gauge on the squirm drive to read zero. Next he moved the laser beam randomly, well off the mark.

"Now watch," Murphy said. "Without even looking at the dot, I'm going to return the laser beam dead on target simply by cranking the gears back to where the gauge reads zero." Standing with his back to the wall, he tweaked the drive until the gauge returned to zero. He turned around and pointed triumphantly to the wall. "With the backlash typical of conventional gear drives," he explained, "you'd never be able to do that."

Zero-backlash drive is handy if you're designing a robot arm for an assembly line to spray paint in exactly the same locations every time-gears with backlash may or may not hit the bull's-eye every time. And precision is of the utmost importance if you plan to send a telescope into space that will be mechanically aimed and re-aimed at exact coordinates.

In a demonstration of another of squirm drive's surprising abilities, Murphy picked up one of the hourglass-shape worms and placed it on his desk between two differentsize driven gears. According to orthodox engineering practice, he said, a worm cannot simultaneously drive two gears with different mesh pitches—the space between meshing teeth—and different gear ratios (the number of teeth on a driven gear compared with the same on a driving gear). "But squirm drive can—it's the only gear system that can deliver a multispeed output from a single-speed input," he pointed out. Squirm drive can do so because the worm is able to mesh with a range of roller spacings. From this ability follows another unique trait of squirm drive: You can change a gear ratio by changing only one gear—not two gears as you would in other gear systems.

High-speed applications

Squirm drive's durability and efficiency could allow this gear to be used both in place of worm gear and where that old standby simply can't perform. According to Murphy, squirm gear's low-friction drive makes it suitable for use in high-speed drives that would overheat and wear out worm gear. Murphy has tested one set of squirm gears, which will be used in a golf cart, up to 13,000 rpm. "Of course you don't need that speed for a golf cart," he admitted, "but there are other drives, such as those in helicopters, where I can foresee squirm drive performing at 30,000 to 50,000 rpm."

As for efficiency, worm gear is capable of transferring 50 percent of the rotary power fed into it, but that percentage jumps to 98 with squirm drive, according to Murphy. This degree of mechanical efficiency could be of great use in electric vehicles, for example, where there is little energy to waste.

In some reference books you'll find worm gear under the heading of "speed reducers." Worm gear is designed to run forward, linking a high-speed motor with a slower drive. But squirm drive can run in reverse as a speed increaser. Murphy is working on using it in wind-powered generators, where turbine blades turning at 40 rpm are linked to a 1,200- to 1,800-rpm generator.

Adding to squirm drive's versatility is the fact that Murphy can scale the gear size up or down. "The smallest gears we've designed so far have been for aerospace. The entire mechanism is one inch thick, 5½ inches long, and 3½ inches wide," he said. Murphy also estimates that the manufacturing cost of squirm drive will be five to 10 percent more than that of worm gear, although the price may fall in high-volume production. PS



Brakes applied, anti-lock-equipped Mercedes (right) steers around obstacle. Other car, without ABS brakes, is uncontrolled.

Now: skid-control brakes

—steerable stopping in rain or snow

Four-wheel anti-lock braking systems might be the most important auto-safety development of the decade, but their application has been limited. Now sophisticated electronics makes them practical and affordable. You'll find them in some 1985 U.S. cars.

By JACK KEEBLER

Drawings by Russell von Sauers

he lipstick-red Corvette bounces tautly out onto the blacktop. My driver, Corvette development engineer Dave Wickman, slaps the shifter quickly through the gate, and my shoulders push back against the bucket seat. In a blink we are speeding along at 80 mph. "Here we go," he says, and nails the brake pedal to the floor with both feet.

Even with his warning, I am unprepared for the crush of the seat belt against my chest. Amazingly, there is neither tire smoke nor the high-pitched squeal of tires fighting for traction. The sensation is more like that of a jet fighter slamming into an aircraft carrier's arresting cable than the smoky tail-wagging stops I am used to monitoring at Bridgehampton Race Circuit. "How do you like that anti-

lock braking system?" Wickman asks. "It'll be standard on the '86 Corvette."

Anti-lock braking systems are an engineering solution to a major driving problem. Hard braking in a variety of adverse conditions—including rain and snow or ice—can result in a catastrophic loss of stopping ability and steering control. The reason: Wheels lock, and excessive slippage between the tire and road surface takes place. A tire then loses both traction and the ability to absorb side forces. That, in turn, leads to a loss of steering control, and even uncontrollable spin outs.

But electronic four-wheel anti-lock braking systems automatically modulate the braking effect when the pedal is pushed hard. Without wheel lockup, tires can take full advantage of whatever traction is available from the road surface. As a result, the car can be steered even during a

Continued

"With four wheels under control you

panic stop; there is no tendency to spin; and stopping distances are reduced.

I rode with and spoke to brake-system experts at Bosch, Lucas Girling, General Motors Corp., Ford Motor Co., Chrysler Corp., Mercedes-Benz of North America, BMW of North America, Porsche, Audi/VW, and others. I found out who's testing the systems and when we'll see them on production automobiles. I learned of the engineering advances that made the new generation of skid-control brakes possible, and I asked the experts some pertinent questions, including this one: Can an average driver stop a car with four-wheel anti-lock brakes in a shorter distance than an expert driver in a car equipped with standard brakes?

Two manufacturers have already introduced 1985 models with four-wheel anti-lock braking systems: Ford and Mercedes-Benz. I had a chance to drive an anti-lockequipped Mark VII at Ford's proving ground. (For a driving report on the Mercedes-Benz, see the box.) The results are dramatic. I accelerated to 60 mph before hitting a skid-pad area that had been sprayed with jets of water. The skid-control system was switched off. As I shot into the skid area, I mashed on the brakes and locked them up. The Mark did a slow 360-degree spin. I spun the steering wheel to correct the spin. Useless-it was numb, and I crunched to a stop over a row of cones.

Now the cones were reset and, with the system switched on, I made a second pass. At the same speed as before, I hit the brake pedal. I could feel the pedal and the steering wheel pulse as the hydraulic system cycled the brakes

on and off. Not only did the car stop as if it were bolted to rails, but it responded perfectly to the slightest twist of the wheel.

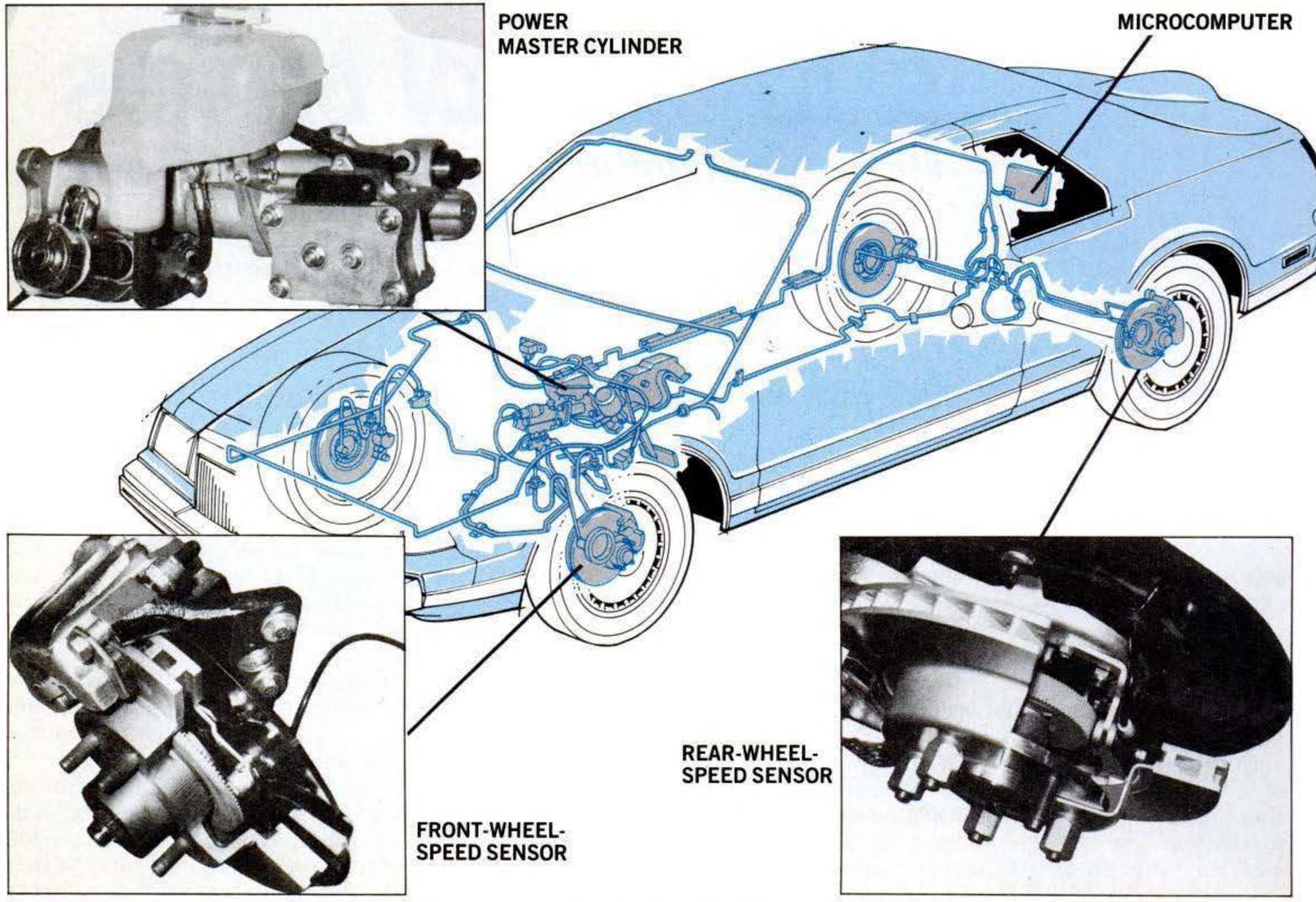
Who's got it

Anti-lock braking is another example of the technology spinoffs from the aerospace industry. According to sources at Boeing Co., the first application of an anti-lock braking system was on the Boeing B-47 swept-wing bomber, introduced in 1947.

Today, basically three anti-lock systems are being used by automobile manufacturers. One is the Bosch ABS (Antilock Brake System). The second is built by Alfred Teves (ATE) of Frankfurt, West Germany. The third system is a cheaper all-mechanical system made by Lucas Girling in England [PS, Jan.]. Several other systems control the rear wheels only, but chassis engineers agree that they are not nearly as effective as a four-wheel system.

Although most of the domestic car manufacturers are experimenting with four-wheel anti-lock brake systems, the only U.S. company to offer one in 1985 cars is Ford. GM divisions have received explicit instructions not to discuss their plans for anti-lock brake systems. In fact, the Corvette group was the only section of GM talking, and Corvette's Dave Wickman told me that he had received conflicting instructions about talking to the press.

About 15 to 20 percent of the total Mark VII and Continental production in 1985 will have skid-control brakes, and they'll be distributed in a strange pattern. All De-



Ford-ATE system features wheel-speed sensors on all wheels with information relayed to the electronic control unit.

can steer your way out of trouble"

signer Series Mark VIIs and Continentals, all LSC Mark VIIs, and those Mark VII and Continental models sold in California, Washington, Oregon, Alaska, and Hawaii will have the system. According to Ford officials, the system will not be offered as an option.

"We offered an anti-lock system on the Mark III back in 1968," said Bill Kath, Ford's executive engineer for brakes, wheels, and tires. "But that was a two-wheel vacuum-actuated design with a much slower cycling time. It was really only for straight-line braking stability. It didn't allow you steering control because it didn't operate on the front wheels. In addition, it cycled so slowly that you had longer stopping distances on dry pavement with the anti-lock operating. But with our new electronics, the cycling time is as high as 12 times per second."

Is this the most responsive system available? "I don't know," Kath said. "But against the principal competing system in a head-to-head face-off over in Germany, we felt that our vehicle was more controllable on transitional surfaces and where one side of the car is on a slick surface and one side on dry." Who was the competitor? "Well, it's got a star on the hood, and there are fewer than four points to it," Kath hinted.

In 1985 Mercedes-Benz of North America will introduce a four-wheel anti-lock braking system on six of its models. The systems will be standard on the 300SD, 380SE, 380SL, 500SEL, and 500SEC models. The only car to carry the system as an option is the 190. According to Dr. Wolfgang Peter, head of passenger-car research, "Mercedes has been

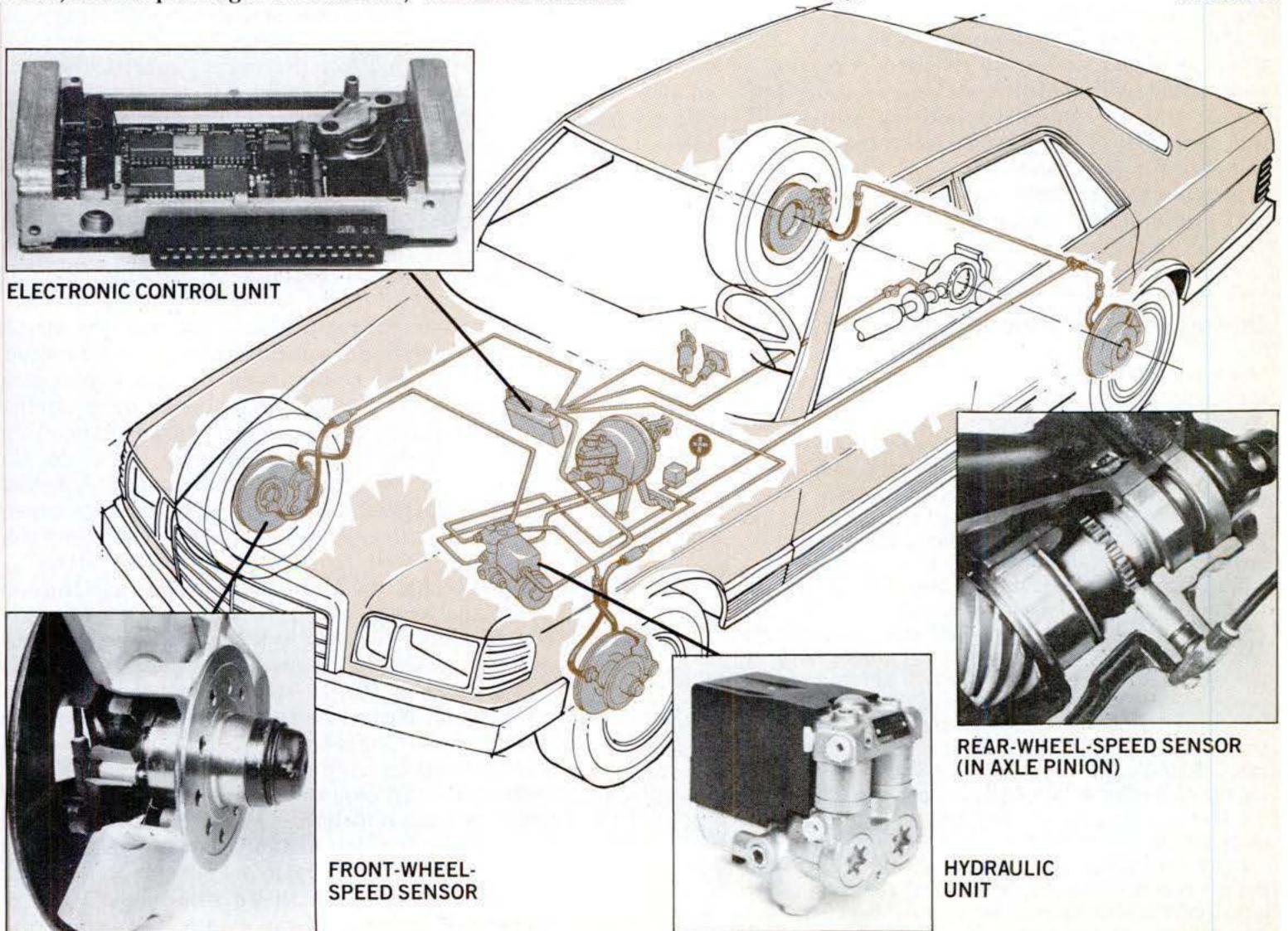
selling cars in Europe with Bosch ABS since October 1978. Today, more than 250,000 M-B cars have been delivered with the system, and this equates to about five million miles of driving experience."

BMW is also selling automobiles in Europe with the advanced ABS system. It's standard on BMW's 635CSi, M635CSi, and 745i models, and optional on other models. A company insider, reluctant to talk about the specifics of the 1985 U.S. models, would merely say that "it's only logical, after all of our research and development on the ABS system, that it should come stateside quite soon."

Wolfgang Lincke, head of passenger-car development for Volkswagen in Germany, says that electronic anti-lock systems will probably be standard on most German cars in 10 years. The system is already standard equipment on the European Audi 200 (Audi 5000 turbo to U.S. customers), he notes. "But they're still too expensive for less-expensive models," Lincke added.

Dr. Gerhard Blendstrup, Porsche's director for corporate planning, says that the ABS system is standard on the 1984 European 928S. Why isn't the system available in the U.S. market? Blendstrup explained: "First, our sportscar requirements are much more complicated than those for a passenger sedan. Second, it depends a great deal on Bosch being able to supply the diagnostic equipment for the U.S. market.

"Finally, we'll be watching what happens [legal actions] to the others that come first. As you know, there are much Continued



Mercedes-Bosch system senses front-wheel rotational speeds individually and detects rear-wheel speed at the differential.

greater product-liability problems in the United States than in Europe."

Ford doesn't seem overly concerned about productliability suits, according to Kath: "There's been a lot of talk generated by the European manufacturers. But our information says that for some odd reason all of those earlier concerns have been swept away. And we understand that Mercedes, BMW, and Audi will have their systems available on certain of their 1985 U.S. models now that we're going to have it."

How it works

To understand the operation of the system, imagine this situation. You're on an icy road, going round a curve. Suddenly a dog trots out onto the road ahead of you. You slam down on the brake pedal. Too hard. One of the wheels slows much too quickly and then abruptly locks—stops rotating.

Without anti-lock the results would be predictably unpredictable. But you have an anti-lock system with sensors (in all four wheel hubs of the Lincoln, in the front wheel hubs and the rear-axle pinion of the Mercedes) that immediately start relaying information about the rotational deceleration rates of each wheel to the computer. Each sensor, consisting of a magnetic core and a coil, transmits voltage that is proportional to the rotational speed of the wheel. The computer compares the rotational deceleration with the speed of the vehicle and what Mercedes calls a "boundary deceleration rate." In your case, the computer immediately determines that the boundary deceleration rate has been exceeded and orders a solenoid valve at the master cylinder to open. Hydraulic pressure decreases to the wheel cylinder, and the wheel starts rotating again and picks up speed.

But your foot is still on the brake pedal. So again the wheel is locked, and again released. A pulsing action has begun that will continue as long as your foot is on the pedal. And, of course, that pulsing action will continue independently for each wheel, with the computer masterminding the operation.

Suppose that a wheel is locked up on ice, then suddenly gets a bite on dry asphalt and starts to turn. Its sensors will tell the computer that its rotational speed is increas-

Driving with the Mercedes anti-lock brake system

HOCKENHEIM, WEST GERMANY

The temperature was a sizzling 95 degrees F at the Motordrom in Hockenheim when I was scheduled to test the Mercedes-Bosch ABS on an icy road. No, there weren't any refrigerated pipes under the road to create the ice. The slick solution by Mercedes engineers was plastic sheeting covered by a bath of soapy water and laid over the road. The result was a surface as slick as glare ice.

I first tried the course without activating the ABS system in the test 280SE. In my initial run I entered the course at 65 km/h (40 mph) and then nailed the brakes. The car started skidding, and I had difficulty controlling it, knocking down a row of pylons that marked the course. Then I tried another run in which I slammed on the brakes at 70 km/h (44 mph). I really lost control of the vehicle at that speed. It spun out, doing a vicious 540-degree loop.

With that baseline under my belt, I switched on the ABS for a couple of runs. In my first test with ABS, I entered the "icy" lane at 82 km/h (51 mph) and really hit the brake pedal. To my surprise, there wasn't the slightest difficulty steering in a straight line. I never came close to any of the pylons, and was able to stop the car easily. I'm not sure whether the stopping distance was lengthened by ABS, but even if it were, I'd willingly trade a slightly longer stopping distance for the stability and maneuverability of ABS.

I then moved to a dry curve for further tests. Without the ABS on, the car plowed to the outside of the curve when I braked. With the system on, the car traveled an arc alongside the curve's inside shoulder, even with the brakes applied.—Herbert Shuldiner

ing, brake pressure will be increased, and wheel acceleration will be reduced.

With all four wheels under control you can steer your way out of trouble, and that dog—a truly lucky one—is alive and unhurt.

What happens if either the Mercedes-Bosch or the Ford-ATE system fails? If the failure is electronic, the microprocessors switch off the system and activate a warning light on the dash. Both systems will then operate like normal braking systems. If the failure is hydraulic, another light comes on. Because both systems have split hydraulic reservoirs (required by U.S. law) the undamaged hydraulic circuit or circuits still have pressure available for stopping.

A novice can generate unbelievable stopping power. Even a trained monkey with the system could stop shorter than an expert driver without it

Can an expert driver stop in a shorter distance than the new four-wheel anti-lock braking systems? Most experts say no. Said Corvette's Wickman: "A novice can generate stopping power as high as 0.996 G." By contrast, he told me, the maximum stopping power of the Corvette on a dry road with the wheels locked was only about 0.75 G. "The system can stop in a shorter distance with far greater consistency than even the best driver," Wickman continued. "In fact, a trained monkey driving a car with the anti-lock system could stop in a shorter distance than an expert driver without it."

Mercedes engineers agree with Wickman about the system's superior dry-stopping ability over even an expert driver. Their tests show that the amount of grip in the computer's control range is easily greater than that with locked wheels and consistently greater than the adhesion even an expert driver can generate by carefully modulating the brakes.

Said Ford's Kath, "Our anti-lock system can stop shorter than even that one-in-a-thousand expert driver by about 10 percent. Of course," he reminded me, "the expert drivers achieve their best stopping distances under controlled conditions with plenty of practice. When we changed the stopping situation by creating a curve in the cones, the expert's ability to stop quickly and in control vanished. And for an unpracticed driver, it is unrealistic to expect him to approach an unexpected stopping situation and stop anywhere near as well as with the anti-lock system."

Wickman, Lincke, and Mercedes engineers can think of only a few situations in which the expert driver might be more adaptive than the anti-lock system. (Lincke's standards for the expert driver are high. He describes this individual as "one in 10,000.") They agree that on a road with fresh, loosely packed snow or loose gravel (depending on the exact surface conditions beneath), a wedge of the loose material can build in front of a locked tire, providing an effective additional increase in braking force that the rapidly pulsing anti-lock system would not provide. In this situation, stopping distances for standard brakes might be as much as 10 to 15 percent shorter. But even so, all the engineers agree that they'd gladly accept a marginal amount of stopping distance to get the panic-stop steering capability the anti-lock systems provide.

Costly caulks —when do you need them?

Picking the right caulk from the plethora available is tricky. Sometimes a 99-cent special will do. Sometimes you'd be wiser to spend \$8. Understanding the properties of various caulks is necessary. Understanding the differences among cracks is equally important.

By MARK BITTMAN

eople now realize just how much money can be saved by filling a crack," said an expert from a major caulking company recently. "And homeowners are now doing their own caulking instead of leaving it to professionals."

But most of us are novices, and knowing which caulk to use for each job is a problem—especially since there are so many caulks on the shelves at prices ranging from cheap to costly.

Your goal when caulking is to cut down on drafts, making your house more energy efficient and comfortable. You also want to seal out water and insects. You want to spend as little time—and money—as possible on the job. And you want to apply the caulk and forget about it. Doing the job only once is at least as important as quick payback.

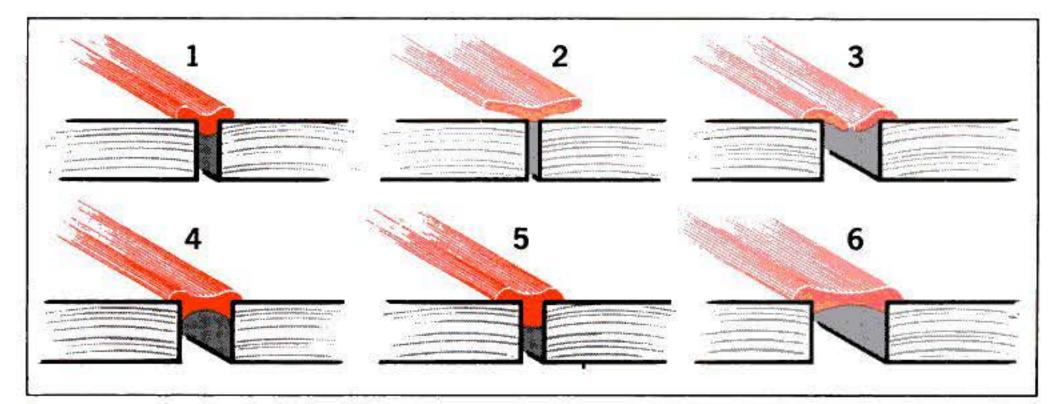
You can't always get these results with the least expensive sealant (a term once reserved for high-end elastomeric caulks but now used interchangeably with caulk.) But knowing the types will help you match the caulk to the job. And learning a few application tricks will help you get the best performance from whichever caulk you use.

The categories

Many of today's caulks are more versatile—and easier to use—than products available just a few years ago. The pro's caulking gun has been joined by the aerosol can and the foam dispenser.

Caulks are generally rated on how long they last—their "range." Highly rated caulks adhere well and withstand weathering, including ultraviolet radiation (UV).

All caulked joints move somewhat, expanding and contracting in response to temperature. Joints between dissimilar materials—such as wood posts



To make sure sealant stays in joint, widen crack with pointed tool before laying bead of caulk. A bead of caulk terials by ¼ in. allower a butt joint (1; shown in cross section) may get squeezed right out when joint contracts (2). When joint expands, weakened ally break (3). Separately break (3). Separately break (3) in allower ally break (3). Separately break (3) in allower ally break (3). Separately break (3) in allower ally break (3). Separately break (3) in allower ally break (3). Separately break (3) in allower ally break (3) in allower all break (3) in allower allower allower al

expands, weakened caulk may eventually break (3). Separating butting materials by ¼ in. allows caulk to adhere firmly to sides of crack (4). Contraction won't force bead out (5), and expansion won't break it (6).

on a concrete porch—move more than joints between the same materials. Cracks around objects that move or settle—doors, storm windows, bathtubs—have the most movement. The longest-lived caulks are those that are the most flexible and can withstand a lot of movement.

Low-range caulks, the 99-cent specials we tend to buy before we know better, are often oil-based. These are usually worth considering only for jobs in which neither longevity nor appearance is a concern. Oil-based rope caulks, for example, still do a decent one-season-only job on double-hung windows.

"If you're caulking around an inside window casing where there's virtually no expansion or contraction, the cheapest thing will probably work—if you know what you're doing," said the caulking expert. "But a latex-type sealant is the best one to recommend to a do-it-yourselfer," he added. "It guns easily, cleans up with water, and is very forgiving."

Latexes are categorized as mediumrange caulks along with acrylics and butyls. Butyls, though they have some limitations, are fine for jobs not exposed to sunlight. An exception: Pressin-Place Caulk ["What's New in Home Improvement," Oct.], a new butyl blend from 3M. It looks like a streamlined version of familiar oil-based rope caulks, but this unique ribbon caulk can be used anywhere and has a number of advanced features including unlimited shelf life (see table).

Acrylic latexes are the most popular of the medium-range caulks. For extra-easy application there are now aerosol acrylics. These "gunless" caulks use a non-fluorocarbon propellant.

"Only caulk comes out of the can no propellant escapes," said Mark Raines of Convenience Products, makers of Touch 'n Caulk. "The propellant expands and pushes a piston that forces the caulk out of the tube. You can use this caulk anywhere you'd use an acrylic in a cartridge—but it has a longer shelf life."

Acrylic-latex caulks with silicone added ("siliconized" caulks) are at the high end of the medium-priced caulks. "Siliconized caulks have small amounts of a silicone agent in them," explained Carl Weber, a chemist at H. B. Fuller. "This promotes adhesion, especially to glass and tile surfaces, which normally present problems to acrylic-latex caulks. It also improves the cohesion of the caulk so it comes out of the gun in a smooth, flexible bead."

Continued

Along with silicones, the high-range caulks available to consumers include copolymers and polyurethanes. The relatively new copolymers such as Geocel's Sempra (see table) cost less than silicone, adhere to more substrates, and cure with a tougher surface. But the copolymers' resistance to UV, water damage, and temperature extremes doesn't approach that of silicone. Polyurethanes, though they match up well against silicone in many applications, can be difficult to find and require extra care in use.

Silicone may be the closest thing to an all-purpose caulk, though it has some limitations. It produces irritating fumes during curing. It won't adhere to unprimed wood, and until recently no paint would stick to it. But most major manufacturers now offer "paintable" silicones as well as some colored versions.

"Silicones are overused for most inside applications. You usually don't need that high a quality for static, non-moving interior joints," said the caulking expert. "But if you never want to worry about caulking a joint again, use silicone."

Urethane foams are the latest addi-

tion to the caulking family. Despite their very real limitations—no flexibility, and no resistance to UV or punctures—they fill large holes and joints that other caulks can't.

Choosing a caulk

The first step in choosing a caulk is to define the job you want done. Are you caulking inside or outside the house? Will the caulked joint be subject to a lot of movement? How accessible is the crack—is it something you have to climb on a ladder to seal? Are you sealing your whole house for the first time, or are you fixing new cracks? Spending eight bucks for a high-quality caulk may not hurt if you need only one tube—but a whole-house supply could be costly.

If you're tackling every crack in your home, you need several types of sealant. I'd suggest the following: a can of foam for large holes and a tube of regular silicone for sunny outside spots. For shaded, protected exterior applications, butyl is fine.

For inside joints that are subject to a great deal of movement, use a silicone or copolymer. These same types, with a fungicide added ("tub-and-tile" and "kitchen-and-bathroom"), are best for wet areas subject to mildew. And acrylic latex is the best value for nonmoving, protected interior joints.

If there are any joints, inside or out, that take a lot of physical abuse, such as cracks around doors that get slammed shut, it's worth looking for a tube of polyurethane.

How do you know you're buying a quality caulk? A caulk that meets Federal quality specifications bears one of the following TTS codes: 00230C, 001543A, or 001657. But you still need to know its type. Some products substitute hyperbole for category, claiming to be the "low-cost alternative to silicone" or "better than silicone."

My advice: If you can't categorize a caulk, steer clear. Using the accompanying table, you should be able to find a type that meets your needs.

Caulking mini-course

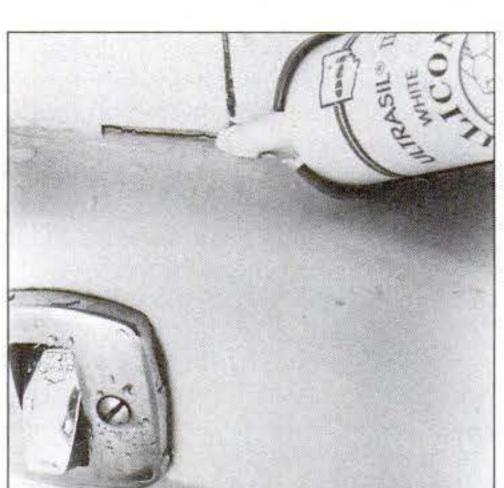
Though caulking is an easily acquired skill, to get a good, long-lasting bead you must pay attention to technique and surface preparation. Before caulking, get surfaces clean and free of all foreign matter. "Nothing will adhere well to dirt or water," said Diane



Multipurpose silicone permanently mounts ceramics onto bathroom tile (above left). Concrete-and-masonry ver-



sion of same sealant (above right) comes in gray for sealing and concealing cracks between foundation and siding.



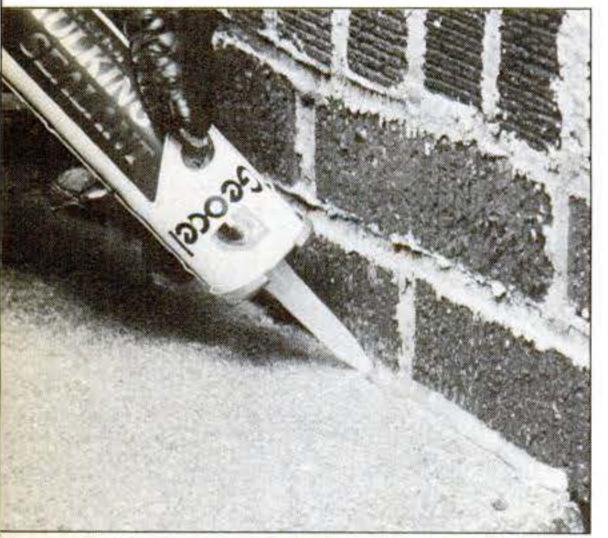
Filling bathtub before caulking minimizes cracks caused by settling of filled tub. An acrylic latex containing silicone and fungicide seals the joint.

Pushing bead in front of tube is best way to ensure adhesion when using gun. Inexpensive latex acrylic seals this crack between window and wall.

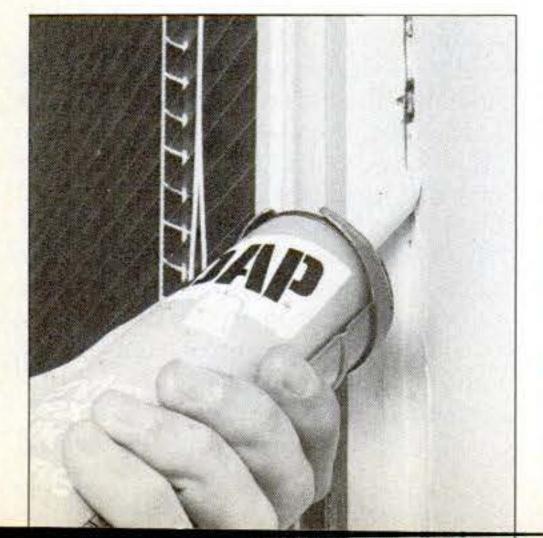


Aerosol cans dispense caulk without a gun. Pressing nozzle down (top) dis-

Aerosol cans dispense caulk without a gun. Pressing nozzle down (top) dispenses smooth bead of Red Devil silicone. A tube feeds foam into gap between house and foundation (above).



Sealing crack between materials with different rates of expansion requires flexible caulk that will withstand stress caused by temperature changes. Though cheaper than silicone, copolymer caulk should remain flexible for years.



Kelly, a lab technician at Dow Corning. "And look out for deterioration of the substrate—loose paint or rotting wood will cause trouble." Scrape clean, and repair if needed.

The next step is to open the joint (see diagram). "You always want a joint to be as open as you can get it," said Henry Spies of the Building Research Council of the University of Illinois. "Regardless of the caulk, it's easier to compress than elongate." The percentage of elongation the bead will undergo is far less if the original bead is larger. For a 1/4-inch bead to expand to 5/16 inch it needs only to grow by 25 percent, but a 1/16-inch bead has to double in size to reach 1/8 inch.

But don't widen a crack too much. Limit bead width to % inch except when you're using urethane foam. The bead's depth should be somewhat less than its width. And avoid contact between the caulk and the back of the joint—it weakens the bead. To prevent such three-sided adhesion in highly critical cracks, force a strip of wood into the joint before caulking.

Many depictions of caulk application show the user pulling the gun along behind the bead. "If you push the bead, you can use the nozzle both to smooth it—an initial tooling—and push it into the joint," noted Spies.

The new aerosol caulks are the exception to this rule—they flow out easily as you pull the tube down or across a crack. But aerosols still need to be tooled. This is the process of smoothing the bead out, pushing it into the joint, and forming the concave surface that works and looks best. The universal tool is a wet finger; it smooths well and picks up only a little caulk. (Of course, don't use your finger on toxic caulks such as silicone and oil-based caulks; read the label). A plastic spoon also works well.

If you're worried about keeping the caulk off the adjoining surfaces, tape the crack edges as a guide. But remove the tape immediately after application—and clean your hands and any spills. If you act fast, you can clean up acrylic and latex with a damp sponge; even silicone wipes off your hands if it hasn't cured.

Working with urethane foams is much different than working with other sealants. You have to be very cautious; overfilling can bow out a wall or crack a piece of siding. The foams expand very rapidly—most triple in size within minutes—so manufacturers usually recommend that you fill holes only about 40 percent, allowing the foam's swelling to finish the job. I'd suggest even greater caution—filling holes only a quarter or a third full, applying the material in layers.

Because the nozzles of foam containers tend to become clogged, plan a sweep of your entire home when you buy a can, returning to each hole periodically until it's full.

In fact, caulking is a great weekend project—you can become a caulking expert after an hour on the job, do your entire house in a day, and have the next day to relax.

SELECTED MANUFACTURERS' ADDRESSES

Convenience Products, Inc., 4205 Forest Park Blvd., St. Louis MO 63108; Dap, Inc., Box 277, Tipp City OH 45371; Dow Corning Corp., Midland MI 48640; Fomo Products, Inc., 1090 Jacoby Rd., Akron OH 44321; Geocel Corp., Box 398, Elkhart IN 46515; Gloucester Co., Box 428, Franklin MA 02038; H. B. Fuller Co., 3530 Lexington Ave. N., St. Paul MN 55112; Insta-Foam Products, Inc., 1500 Cedarwood Dr., Joliet IL 60435; Ohio Sealants, 7251 Commerce Dr., Mentor OH 44060; Sears, Roebuck and Co., Sears Tower, Dept. 703, Chicago IL 60684; Sonneborn-Contech, 7711 Computer Ave., Minneapolis MN 55435; 3M Co., 3M Center, Bldg. 223-4S, St. Paul MN 55144; Tremco, 10701 Shaker Blvd., Cleveland OH 44104; United Gilsonite Laboratories (UGL), Box 70, Scranton PA 18501

PS caulk comparison

Туре	Typical brand names	Initial cost(\$)	Optimum life (yrs.)	Relative cost	Application/appearance	Ability to withstand movement and stress	Water/weather/ UV resistance	Recommended uses; comments Noxious odor makes it generally unsuitable for interior use: many exterior uses	
Acrylic (solvent- based)	H. B. Fuller Maxseal, Tremco Mono, UGL AC-88	• 2-4	20	Low	Usually requires ambient temperature of at least 60 deg. F for application; cures very slowly (up to a week); paintable only after cure; cleanup may be difficult; several colors	Can accommodate moderate movement, will reseal if punctured	Good		
Acrylic latex (water-based acrylic)	Dap Acrylic Latex, H.B. Fuller Caulk-in-Colors, OSI Ultra/ Seal, Red Devil Extra-Quality Acrylic Latex, Sears Acrylic with Silicone, Tremco Acrylic Latex, UGL Acrylic	1.5-4	10 (15–20 if "siliconized")	Moderate to low	Very easy to use: fast cure (skins in minutes); cleans up with water; easy to paint; metal substrate requires priming; many colors	Can accommodate minimal movement; easily punctured	Fair: not for use in damp areas	Excellent caulk for interior use; wide range of colors and easy cleanup are advantages	
Acrylic latex (water-based acrylic) aerosol	Convenience Products Touch 'n Caulk, Dap Ready to Caulk, Insta-Foam Caulking Stuff, Scott-Page Easy Caulker	5-7	20	Low	Same qualities as non-aerosol acrylic latex but no caulking gun needed: Aerosol in bottom of can propels inter- nal plunger to dispense caulk	Same as for non-aerosol Same as for non- acrylic latex aerosol acrylic latex		Same as for non-aerosol acrylic latex	
Butyl	Dap Butyl-Flex, H. B. Fuller Butyl Rubber, Red Devil Butyl, Tremco Butyl, UGL Butyl	1.5–3	15	Low	May be stringy when applied but easy to clean up; slow cure; has a tendency to pick up dirt during cure; may not take paint well; some colors	Can accommodate minimal movement	Good weather but very low UV resistance	Good general sealant as long as it is kept out of sunlight	
Butyl blend	3M Press-in-Place	4-5	20	Low	Flexible strip doesn't get stringy, even when stretched; stays pliable but accepts paint immediately	Withstands maximum movement	Excellent	Use indoors or out on any surface: wide temperature tolerance; don't use in areas that are continually exposed to petroleum distillates	
Copolymers	Geocel Caulking Sealant, Geocel Sempra	3-4	20	Low	Easy to apply: available with fungicide; slow cure but paintable; primer needed for some materials; cannot be used on certain plastics; some colors	Very flexible; can be used in wide bead if necessary; will reseal if punctured	Good to fair	Good silicone substitute, espe- cially when kept out of bright sunlight; may be applied at low temperatures	
Oil-based	Dap Architectural Grade, Red Devil Speed Demon, Sonne- born-Contech Easy Caulk, UGL ThermaKing	0.75-2	5	High	Some may be messy to apply, may shrink, stain, and crack; wood must be primed; few colors	Almost none	Poor	Limited to easily reached static joints; only short-term uses recommended	
Polyurethane	Sears Polyurethane-Based Caulk, Sonneborn-Contech Sonolastic NP 1, Tremco Dymonic	25	30	Low	Easy to apply, even at low temperatures; proper ventilation and gloves required; primer usually needed; slow cure but paintable; some colors	Can accommodate move- ment, though not as much as copolymers or silicones; extremely tough; difficult to puncture or tear	Good; limited but generally accept- able UV resistance	Good general sealant, especially for decks, garages, and heavy- traffic areas; will not adhere to certain plastics; sometimes hard to find	
Silicone	Dap Silicone, Dow Corning Silicone, GE Silicone II, OSI Silicone, Red Devil Lifetime II Silicone (also in aerosol)	3-8	50	Low	Can be applied at any temperature; cures quickly; joints must be clean; may not adhere well to unpainted wood; many cannot be painted; few colors	Most can withstand maxi- mum movement; can be used resistance; in wide bead if necessary; essentially not puncture or tear resistant waterproof		As close to an all-purpose caulk as you can get, but less-expensive substitutes do well in many jobs	
Jrethane loams	Convenience Products Touch 'n Foam, Fomo Fomofill, Insta- Foam Great Stuff Sealant	5-10	20	Moderate to low	For use in hidden, protected places; ease of application varies greatly; proper ventilation and gloves required	Almost none	Fair to poor	The only caulk that can fill large holes; has a significant R-value (typically R-5 per in.)	
Vinyl latex	Darworth Polyseamseal, H.B. Fuller Latex, Sonneborn- Contech Latex, UGL Duracaulk	1-2	5	High	Very easy application; fast cure; cleans up with water; paints well; available in white only	Almost none	Poor	For interior use only	

North-south—but no east-west: two-faced house

Abundant windows in the south wall of this house, designed by a Philadelphia-area architect, admit solar energy and provide light and views for every room. The superinsulated north wall is curved to deflect winter winds. East and west walls? There aren't any.

By V. ELAINE SMAY Photos by Greg Sharko

WEST CHESTER, PA. s you drive along the road east of the house, you catch glimpses of it through the trees. It's a strange sight indeed: The curving white north face is abruptly halted by the straight cedar-clad south face. "From that side it looks as if half the house was cut off," volunteered Beverly Chu. It is an accurate, if irreverent, description. Chu and her husband, Wilson, are the owners of this unique house, where they live with their small daughter, Jessica. While owners of innovative houses tend to speak of them in almost sacred terms, Mrs. Chu often talks of theirs with refreshing humor and objectivity. But she ticks off its salient features with relish:

• The north face is superinsulated and curved to deflect winter winds. Its few small windows are strategically located for daylighting and effective cross ventilation.

• The south face has abundant windows to admit solar energy in winter. A roof overhang protects the windows from the high summer sun.

 The house is elongated on the east-west axis so that every room has daylight, a view, and, in winter, solar gain.

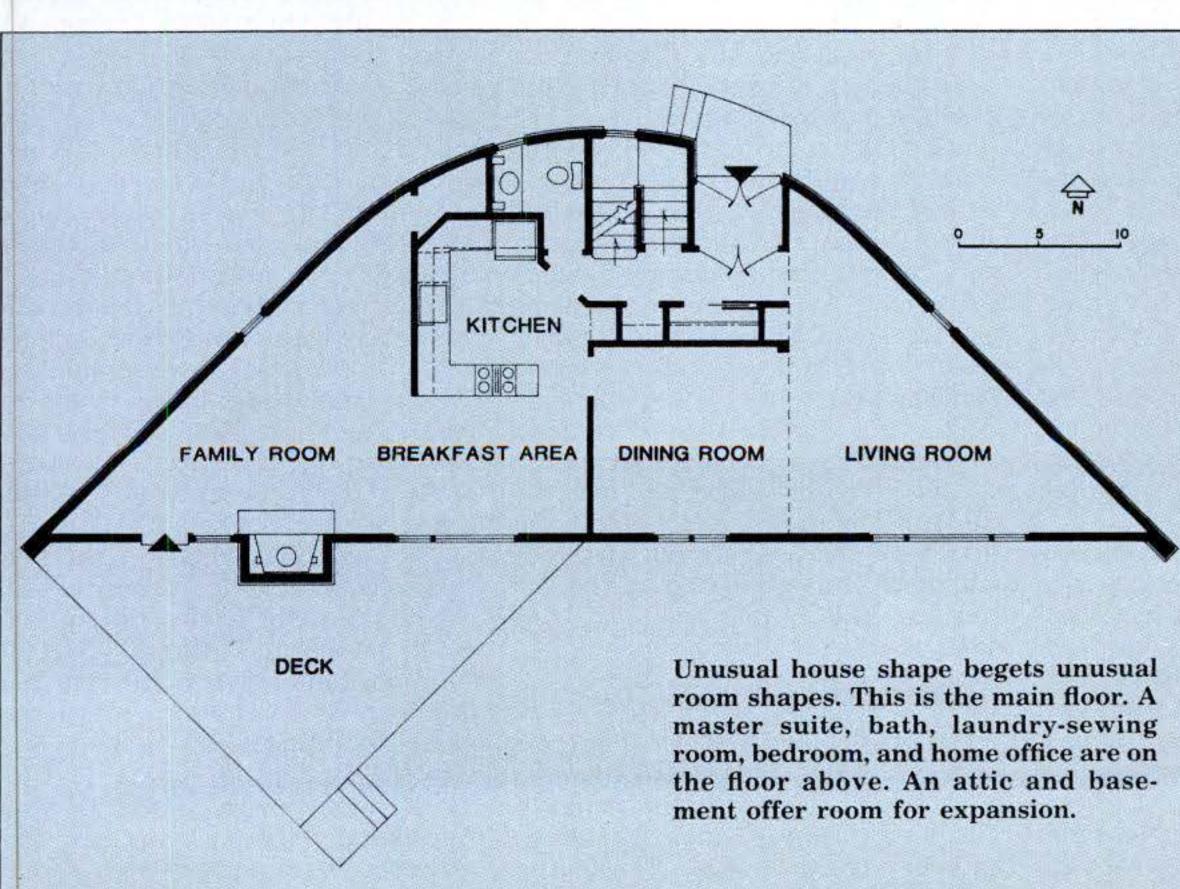
 There are no east or west sides, nor east- or west-facing windows they are difficult to shade in summer.

The house is the creation of Robert Bennett, an architect who practices in nearby Bala-Cynwyd, Pa. In 1980 the Chus were ready to build on a lot they had bought two years before, and with rising energy costs, Wilson wanted a solar house. "Other architects we talked to had some ideas for energy efficiency, but Bob was really a solar









The front of the Solar Biangle (facing page, top), is vaguely castlelike with its curving face and slender, recessed windows. Living room (facing page, bottom) has black slate floor to absorb solar heat. Most windows are on the south side (above); insulated drapes reduce heat loss on winter nights. An awning over the window in the breakfast area keeps out summer sun; others are shaded by the roof overhang. The deck, on which architect Bennett and the author talk while Jessica Chu plays, was expanded.

purist," said Mrs. Chu, "and we were impressed with his credentials."

Bennett has degrees in mechanical engineering and space physics as well as architecture, and is the author of a solar reference book, Sun Angles for Design. Tall, blond, and a native of Texas, he was the national coordinator for the American Solar Energy Society in 1977 and '78. In that capacity he spent six months touring the country, meeting the key people involved in the then-nascent field of passivesolar design. He returned to the Philadelphia area (where he had worked as an engineer and got his architectural degree) to establish a practice, specializing in passive-solar residential and commercial design.

Solar hybrid

The Chus' house—Bennett calls it the Solar Biangle—is Bennett's first venture into hybrid design, combining passive-solar features and superinsulation. "Originally I was considering a direct-gain solar house for them," he said, "but economics made me turn to superinsulation. A direct-gain house requires a lot of glass, and once you have that much glass, you need a lot of thermal mass to keep the house from overheating and to store the heat for use at night."

Most passive-solar houses are built of masonry, which also acts as thermal mass, or they contain drums of water or have rock beds beneath. "But when you put in more glass and more mass, you start to push up the construction costs," Bennett noted. Instead, he put in more insulation, so the Chu house loses very little heat. That means it doesn't need to gain or store as much heat as does a purely passive-solar house. Consequently, he could reduce the glass and mass—and cost.

But why the unusual shape? "One of my rules of thumb is that if a house is the same on each face, it's probably not very energy efficient," Bennett replied. "The northern exposure is so different from the southern. And east and west are different from either north or south. The fact that it is an unusual form means it's responding to those considerations.

"Typically, passive-solar houses are elongated along the east-west axis to get the maximum southern exposure. But then you also get a long northern exposure in a conventional rectangular house" (something Bennett admits he has never designed). The Solar Biangle evolved from a triangular house he designed for an Atlantic City, N.J., client. For the Chu house he reduced the triangle's three faces to two—with the igloo as his inspiration. "It's one of my

favorite examples of environmentally designed buildings," said Bennett. "It responds to cold winds by having the minimum surface area for maximum volume inside, and the curved shape helps to deflect the wind."

After the startling appearance of the house when you see it from the east side, when you approach it from the front, the north side, it looks surprisingly conventional. It sits at the end of a cul-de-sac in an area of large lots and large houses. The white stucco of its facade echoes other houses in the neighborhood. The front door opens into an air-lock entry, which leads to a narrow entry hall.

Inside, the sense of conventionality disappears once more. To the left is the living room, a triangle, or more accurately a trapezoid: The apex of the triangle is sliced off to form a wall about 18 inches wide. Three other major rooms (the family room at the west end of the main floor and the master bedroom and Mrs. Chu's office on the second floor) are similar trapezoids. In fact, the only square room

When studs for the north wall went up, the neighbors thought we were building a circus tent

in the house is Jessica's bedroom. "We didn't want her to grow up with strange complexes," Mrs. Chu quipped.

All rooms but a small powder room near the entrance have a view to the south across a lawn and an adjacent farm. The south glass equals nine percent of the house's 2,100 square feet of floor space. Had the house been a pure direct-gain solar design, Bennett would have had to increase the south glass to equal 25 percent of the floor space to enable it to achieve the same performance.

The long, narrow slits of windows on the north are strategically placed so the house has effective cross ventilation. And they're recessed into the thick wall. That screens the northeast and northwest windows from the low morning and evening sun. All windows are double glazed.

Building it

Despite the unconventional appearance of the house, its construction was fairly standard, according to Bennett. The walls have six-inch fiberglass batts between 2×6 studs. ("When the studs for the north wall went up, the

neighbors thought we were building a circus tent," said Mrs. Chu.) A polyethylene vapor barrier isolates the insulation from the wallboard on the inside, and two-inch-thick rigid insulation board was tacked to the outside of the studs. Finally, the north wall was finished with stucco and the south with cedar siding. The insulation value of the walls and attic is R-30; that's less than in some superinsulated houses but far more than the R-11 or R-12 walls of standard houses with 2×4 framing. Basement walls have two-inch-thick insulation board (Thermax) on the outside.

The only thermal mass Bennett added in the house is the black Pennsylvania slate floor tile in the living room and dining room; it is laid over a oneinch-thick concrete slab. The largest windows are in that area, and the winter sun shines in, warming the masonry.

Though the house has more southfacing glass than most, the total window area is about standard. Despite its extra insulation and energy-saving features, the cost of the house—\$55 a square foot—was also standard for large, custom houses in the area.

Performance

The Chus' house has not been independently monitored for energy use, but they did keep track of their energy bills for the first 11/2 years. The first winter (1982) they spent \$275, at seven cents a kilowatt-hour, to operate their electric air-to-air heat pump and a kerosene heater. Their average cost for air conditioning during each of two summers was \$85. Superinsulation contributes to the low cooling as well as heating cost. And on summer nights the Chus open the windows and turn on their whole-house fan to cool the house. "We don't usually turn on the air conditioner until it's in the 90s," Mrs. Chu told me.

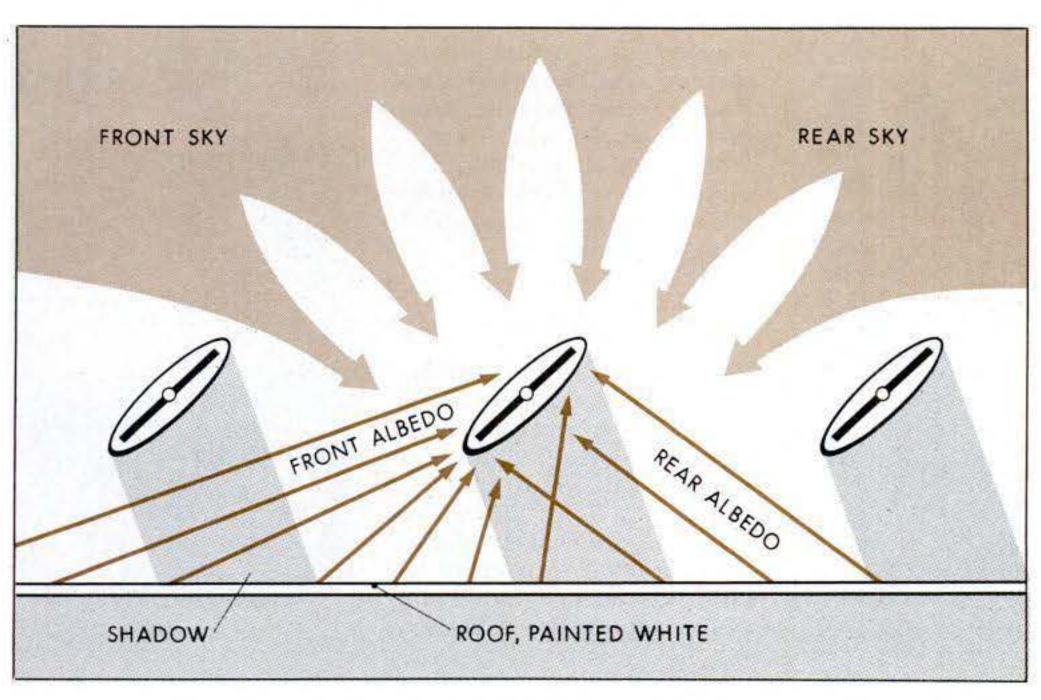
Total cost of heating and cooling while they kept records came to \$360 annually. According to the local utility, a conventional new house in the region should cost \$1,050 to heat and cool with a heat pump. "That comes out to a 66-percent saving for the Solar Biangle," Bennett noted.

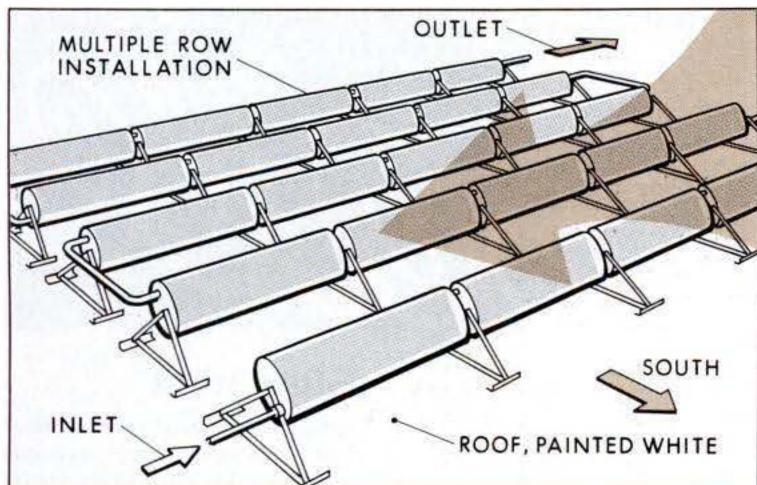
The Chus further reduced their energy bills by installing a passive-solar, batch-type water heater. But they do not know how much it contributes. In addition, Bennett's careful attention to providing daylight for every room reduces lighting costs.

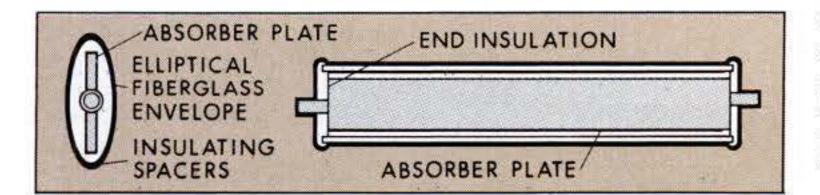
"It's a comfortable house, laid out for the way we live," said Mrs. Chu. And energy bills 66 percent below par make the two-faced house very appealing—any way you look at it.

Reflector collector

Housed in an elliptical fiberglass envelope, the No-Box collector's absorber plate collects both direct and reflected solar heat. Claimed advantages over conventional flat-plate collectors: higher efficiency and lower cost. It needs a flat, reflective roof, however.







No-Box collectors are mounted on legs above a flat reflective surface; rows are spaced to minimize shading and permit reflected solar radiation to strike back of absorber (above). Flow resistance is low, so collectors are connected in series (left). There are four major components: fiberglass envelope, 1.3-by-6.6-ft. steel absorber plate, and two end caps. Each collector weighs less than 27 lbs. and costs about \$250.



By RICHARD STEPLER

ong and thin and suspended on spindly legs, the No-Box solar collector looks like no other you've seen. Invented by Israeli solar pioneer Prof. Harry Tabor, the No-Box is ingeniously simple: Sandwiched inside an elliptical fiberglass envelope is a selectively coated steel plate that absorbs solar radiation, including reflected radiation, on both of its faces. (Because the No-Box absorbs a large fraction of reflected solar radiation [albedo], it is also called the albedo collector.) Unlike conventional flat-plate collectors, there is no box or metal pan to hold insulation, absorber plate, and glazing. The advantages of the No-Box collector, according to its Israeli manufacturer, Miromit, are its higher efficiency and lower cost.

The selective coating is Miromit's patented Miroblack, a coating applied by an electroplating process that results in a surface that absorbs 93 percent of solar radiation but emits only 12 percent. (An ordinary black surface absorbs 90 percent and emits 80, so is less efficient.)

As for cost, the collector itself costs the same per square foot as a flat-plate unit. "But the system price is much less," Don Booth of American Heliothermal Corp. (the U.S. importer) told me. "That's because the lightweight collectors are easy to handle and install," explained Booth. "In fact, where a flat-plate system has an installed cost of \$30 a square foot, we expect the No-Box to go out for \$15." (Prices are for the collector array only; storage, piping, and controls for both systems cost the same.)

The higher efficiency of the No-Box also means that it takes fewer collectors to obtain the same amount of solar heat, claims Booth. "We figure a No-Box system will need only 70 to 80 percent of the collector area of a flatplate system."

American Heliothermal (4986 Olive St., Commerce City, Colo. 80022) will be offering the system by the time you read this.

products/technology

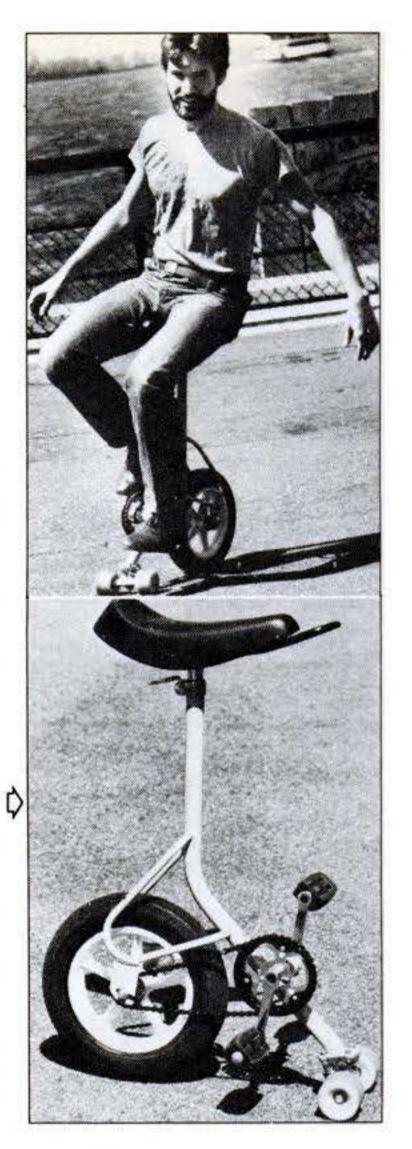


4 Guided bus

British bus drivers won't have to steer these double-deckers—at least on part of their routes: Buses leave ordinary roads and enter traffic-free tracks where guide wheels handle steering. England's first guided buses are slated for service in Birmingham this year.

Three-wheeler

Pedal away on Uni-Bike without the weeks of practice needed for unicycles, says its maker (Products & Patents Ltd., 140 Broadway, Lynbrook, N.Y. 11563). The three-wheeler has skateboard wheels in front of its large wheel. The added stability also makes it faster.

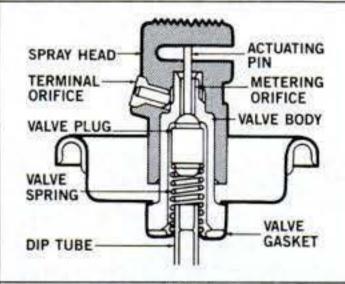




From Japan: two front-drives

Transverse front engines and front-wheel drive are features of Mitsubishi's new-for-'85 subcompact Mirage (top) and luxury sedan Galant (above). The Mirage economy-sedan and LS models have a 68-hp four-cylinder engine. Mirage Turbo has a 102-hp turbocharged four. Other standard features: independent front and rear suspension, rack-and-pinion steering, and power-assisted front disc brakes. The Galant has a 101-hp engine with electronic fuel injection, plus a four-speed automatic transmission with an overdrive-lockout button for heavy traffic.





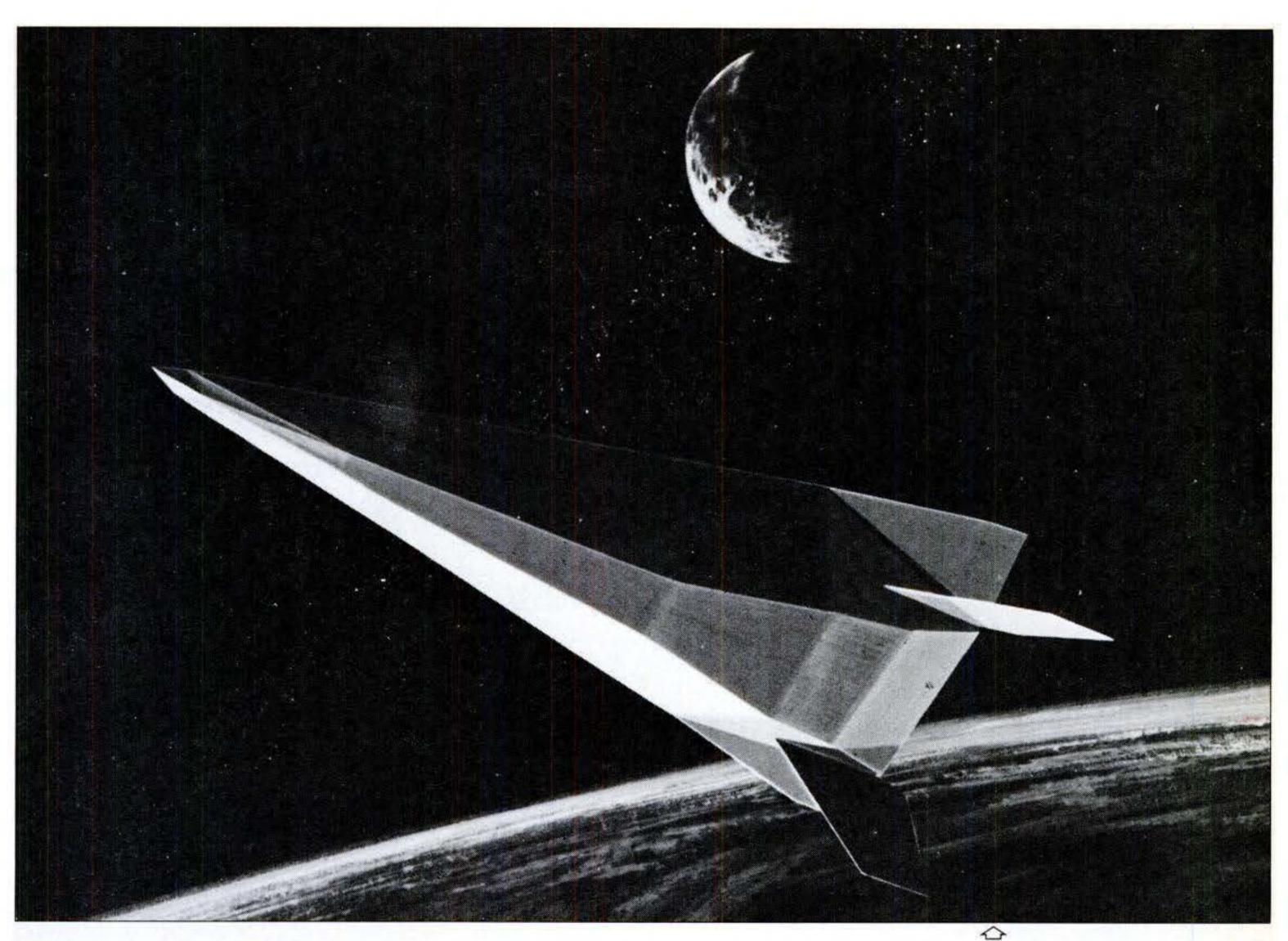


Glow tubes

Line Lite, a Dutch-invented, low-cost alternative to neon, glows when illuminated with ultraviolet light. The PVC tubing, available in various sizes and 11 colors, can be shaped as desired. For information: Netherlands Consulate General, 1 Rockefeller Plaza, New York, N.Y. 10020.

d Fan valve

A fan-shape pattern for better coverage and uniformity, clog resistance, and 50 percent less finger pressure—that's what Danvern Fanspray valves (top) offer for its spray cans, says The Lucas Group (Cleveland, Ohio).



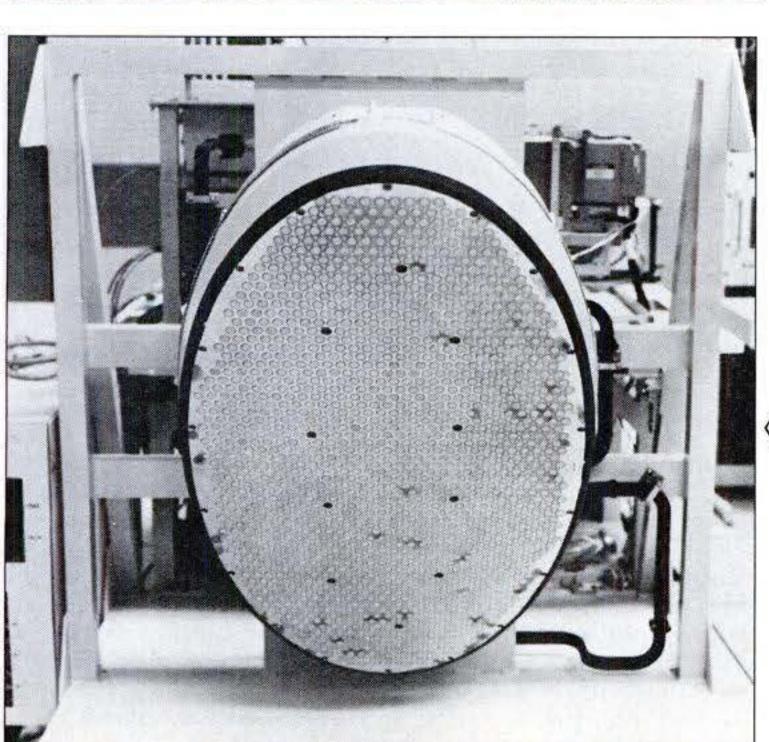


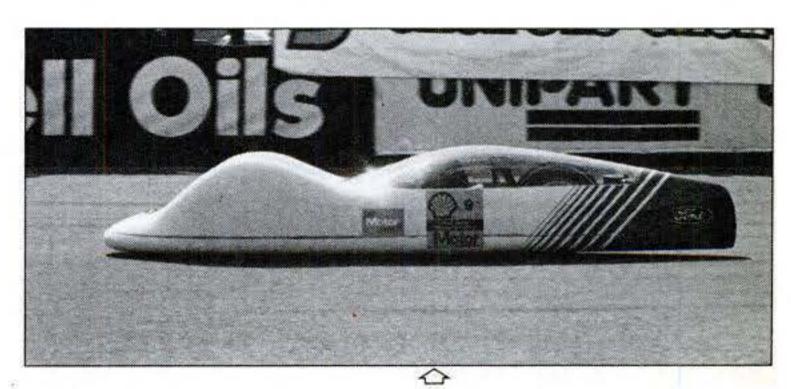
Classic kit

Like a classic 1952 Jaguar XK 120 in your garage? This version, built on a Pinto-Mustang frame, goes together with home-workshop tools, says British Motor Cars, Ltd. (100 Sonwil Industrial Pk., Buffalo, N.Y. 14225). A component kit is \$7,245; the frame package is \$1,750.

Mach-25 cruiser

A transatmospheric vehicle (TAV) under consideration at McDonnell Douglas Corp. would cruise at 25 times the speed of sound more than 300,000 ft. above the earth. TAVs are under study for the U.S. Air Force, which wants a near-space vehicle that lands conventionally.





Bomber radar

What looks like a honeycomb is the B-1 bomber's phased-array radar. The system has 1,526 phase-control modules that replace old side-to-side scanning dishes of earlier designs. Boeing Military Airplane (Seattle, Wash.) is testing the Westinghouse-built system.

3,803 mpg

British Ford's ultra-lowslung UF02 set a new fueleconomy record-an amazing 3,803 mpg—topping an earlier record by 670 mpg. The 49-lb. vehicle is made with composite materials. Drag coefficient is only 0.113. A 15-cc (nine-cu.-in.) engine chain-drives one rear wheel.



VIP jet

New winglets boost both speed and range on the military version of the Gulfstream Aerospace G-III. To replace the aging fleet of Lockheed Jetstars that now transport Air Force brass, the service will buy 11 of the \$13 million planes by 1988.

Tilt-rotor copter

The BAT is Bell Helicopter Textron's entry into the Army's "light helicopter experimental" design contest [PS, Feb.]. The 8,000-lb. advanced tilt-rotor chopper (shown in mock-up) has a single-pilot cockpit, retractable landing gear, and 20.5ft.-dia. rotors.

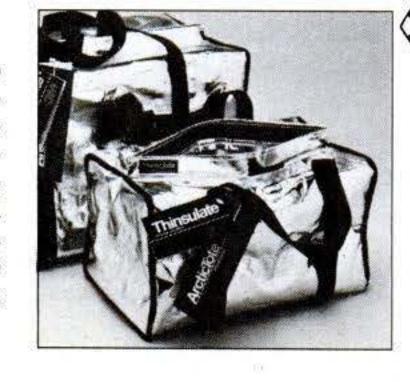






Pocket binoculars

For a slim look—and a sharp focus on a rare bird or favorite horse-Minolta's binoculars have roof-prism optics. The pocketable glasses (they fold) have internal focusing to keep out dust. Five models, from a 7×22 to a 7-18 \times 28 zoom, cost from \$158 to \$280.



Soft cooler

With four layers of insulating fabric and a magnetic seal, the Arctic Tote can keep eight lbs. of frozen meat from thawing for up to 36 hours, claims AMK Designs (Box 6232, Duluth, Minn. 55806). The 12-by-seven-by-sevenin. cooler costs \$25; 16-by-10-by-10-in., \$35.

Wireless alarm

An after-hours break-in? The worker's pendant alarm transmits a coded radio signal. Miniature radio transceivers plugged into electric outlets relay the signal via office or factory wiring to a security center. Maker: Rutal Ltd., Anchor Rd., Bristol BS1 5TT, England.

in Home *Improvement*

BY SUSAN RENNER-SMITH



Snap-on thermostat

Most programmable thermostats demand a tricky rewiring job. But the \$50 Autostat attaches to the existing manual thermostat. Microprocessor-controlled keys permit eight different settings daily. Pittway Corp. (780 McClure Ave., Aurora, Ill. 60504) also makes a round version.



Fresh-air supply

Is too much-or too little -outside air feeding your forced-air furnace? Air-Trol installers set the air-intake controller to provide the amount needed for maximum furnace efficiency. The \$100 unit also cuts drafts. says International Flue Saver (Box 42, Monee, Ill. 60449).

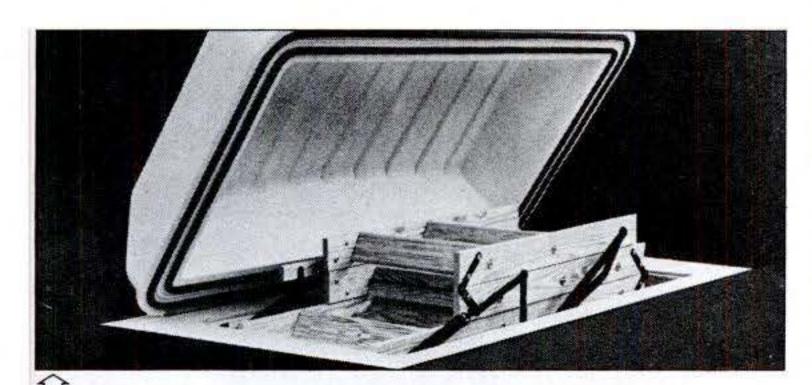


All-glass window

Raise the bottom pane, and the counterbalanced top pane drops the same amount to help convection cooling. Pulleys and cords link the plastic-edged, sashless panes, which slide in an aluminum frame. Kenneth Shugg Joinery, 27-31 Coora Rd., South Oakley 3167, Australia.



Made of double-walled, foamfilled aluminum, Mini Rollshutters insulate and protect. The German-made rolling shutters, recently available in the U.S., save up to 65 percent of energy costs, according to the importer, Perfecta (5885 W. 34th St., Houston, Texas 77092).

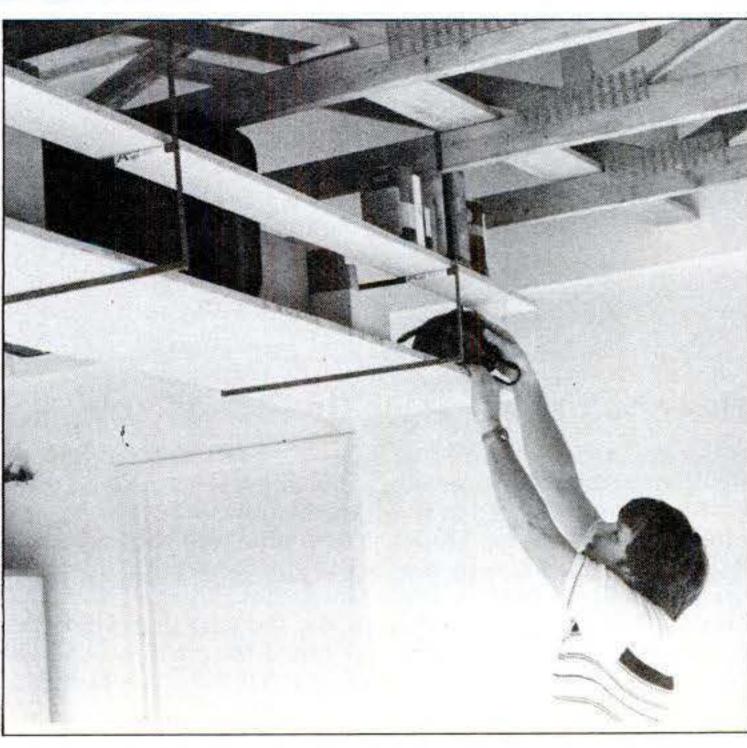


Stair sealer

Styro/Dome, a molded polystyrene shell fused around a foam core, insulates attic stairways without blocking attic access. Foam weatherstripping seals edges of the hinged dome. The \$189 unit has an R-value of 13, says Styro/Dome Corp. (Box 220, Yorktown Hts., N.Y. 10598).

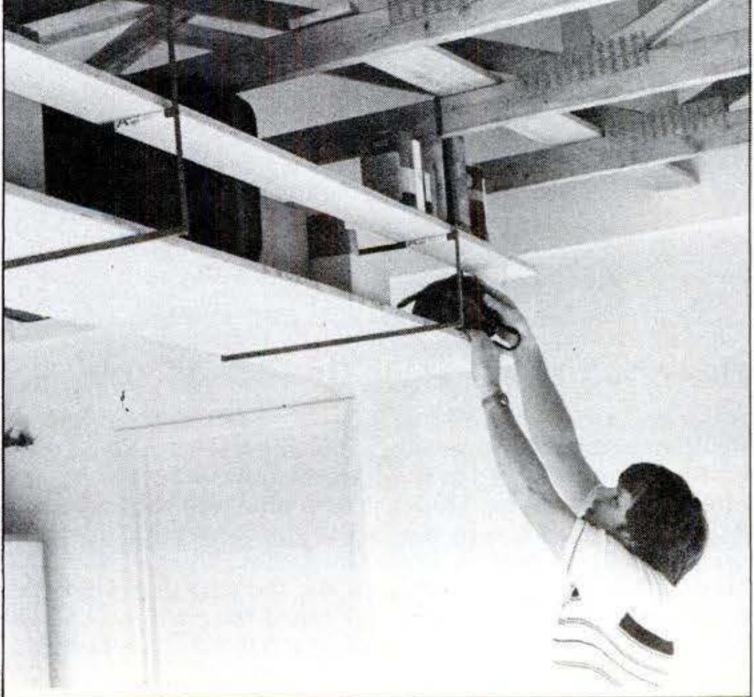


Open rafters convert to instant storage space with Suspend-A-Shelf. The 24-by-20in., heavy-gauge-steel shelf support hooks over the rafters. The \$20 set holds two 24-in. shelves. Marketing Concepts, 838 Lori Lane, Chula Vista, Calif. 92010.



Versatile lights

The Gimbal track light has a sparse, modern profileand more. It comes in linevoltage and low-voltage versions. A power pack converts line voltage to low voltage. Maker: Capri Lighting, 6430 E. Slauson Ave., Los Angeles, Calif. 90040. \$49.





in Tools

BY V. ELAINE SMAY

Back saver

You can sit on the swivel seat of the Garden Scoot (\$60) and roll down the rows, weeding, thinning, and harvesting without straining knees and back. It's also handy indoors, says G. S. Products (62 Locust St., Dubuque, Iowa 52001). A \$10 kit converts it to a three-wheeler.

New-tech hole saws

Metal-cutting and carbidetip wood-cutting Credo Enduro hole saws cut five times faster and last 50 times longer than others, claims Omark Ind. (2765 National Way, Woodburn, Ore. 97071). Two saws of a size (1 to $2\frac{1}{2}$ in.) lock together, as shown, to form a convertible system.



Auger add-on

You can convert your chain saw to a burly drill with Stihl's BT-310 drilling attachment. It fits 10 different Stihl saws. Bits are available in two lengths and a variety of diameters (from 5/16 to 11/4 in.)—for drilling wood, ice, or rock. Price: \$120; the bits are extra.



Second BS-50N



Big-bite band saw

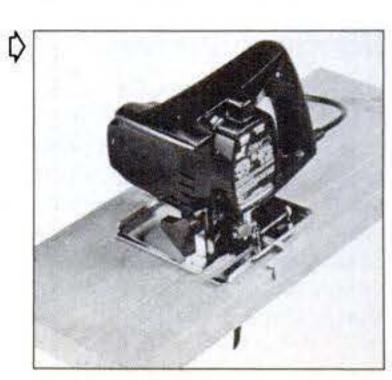
The BS-50N bench-top band saw (\$995) from Ryobi (1158 Tower La., Bensenville, Ill. 60106) will cut wood up to seven in. thick and has a nine-in. throat. Also from Ryobi: The BS-360NR band saw (not shown) cuts wood up to 12¾ in. thick, has a 12-in. throat, costs \$1,400.

Flex-shaft saw

A flexible drive shaft on two Craftsman table saws means more power delivered to the blade, claims Sears. Model 24168 (\$500) has a 1½6-hp motor and a 27-by-40-in. table. Model 24169 (\$600) has a 1¾6-hp motor and a 27-by-44-in. table. They'll be available in stores in January.

One-for-all saw

Here's a saw that cuts six-india. logs; does plunge cuts, circles, and scroll work; and cuts pipe and thin-wall tubing up to two in. thick. Its large base tilts to let you cut a 4×4 at a 45-deg. angle. No wonder the maker, Wen, calls it the All Saw. Around \$35.







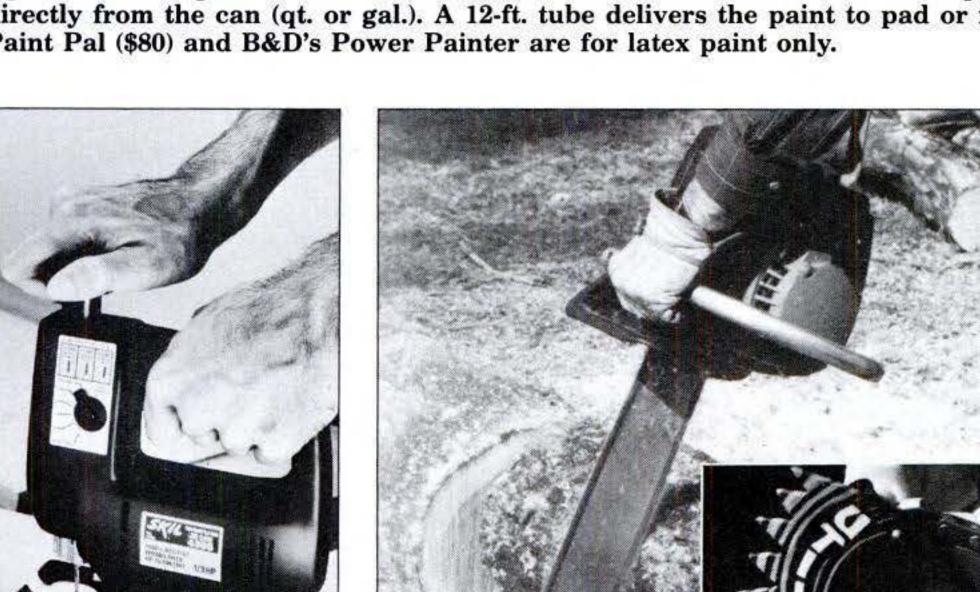
SKILSAW

Powerful circular

The latest line of Skilsaws offers increased horsepower, integral blade-wrench storage, and a lock-off button designed for right- or lefthanders. Most-powerful in the four-model series, model 5350 (shown), has a $2\frac{1}{3}$ -hp motor, 71/4-in. blade, and costs less than \$80.

Three new ways to roll on paint

A 1/5-gal. reservoir in Sears' E Z Roller (top left) holds your paint, which is picked up by a feed roller and transferred to the paint roller. One fill covers an eight-by-10-ft. area, according to Sears. E Z Roller is \$20. Black & Decker's Power Painting System (above left) uses a carbon dioxide cartridge, seltzer-bottle style, to pressurize the system and move paint from the refillable container up the four-ft. tube to the control handle, which holds a roller, brush, or pad. Result: quiet, cordless power painting. The kit (about \$50) comes with two one-qt. containers and a faucet connector for cleanup. The Paint Pal (above right) from Campbell Hausfeld (100 Production Dr., Harrison, Ohio 45030) pumps paint directly from the can (qt. or gal.). A 12-ft. tube delivers the paint to pad or roller. Both Paint Pal (\$80) and B&D's Power Painter are for latex paint only.

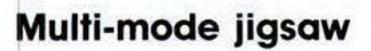


Tools or art?

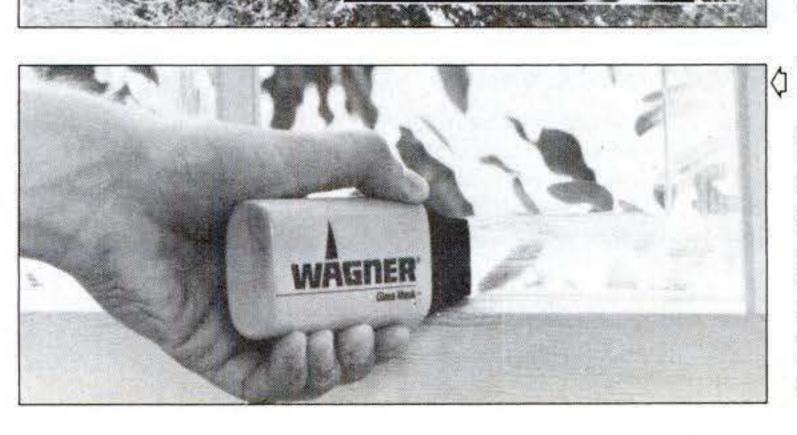
These brass, steel, and rosewood tools are museum quality but made for use. The TS-2 try square (\$47) is accurate to within ± 0.002 in., claims Bride City Tool Works (2834 N.E. 39th Ave., Portland, Ore. 97212). The \$27 SA-2 scratch awl's blade flexes for accurate scribing.



You'll work with less fatigue and end kickback hazards with the Utilitip stabilizing tip on your chain saw, says Utilitip Inc. (Box 11704, Rock Hill, S.C. 29731). The tip has jagged teeth that dig into the ground; to cut, you simply pivot the saw down through the log. Price: \$19.



For intricate cuts, you set the Skil model 4395 jigsaw on auto-scroll, and the blade follows as you steer the saw. The \$60 saw has five orbit settings to let you choose the best cutting speed and action for the material. Also, the blade can be locked at 90-deg. intervals.



Liquid mask

A release agent in Wagner's Glass Mask keeps paint from sticking tightly to glass. You apply it with the sponge applicator; when the paint is dry, you pop on the scraper blade and clean off the glass. The tool (\$8) leaves a 1/16-in. band of paint to seal between glass and trim.

in Electronics

BY WILLIAM J. HAWKINS

Smart terminal

The 14-in. screen on the Radio Shack DT-100 terminal displays up to 132 cols. by 24 rows of data and shows special character attributes, such as underlining. Software parameters may be changed and stored in its nonvolatile memory. (It's DEC VT-100-compatible.) \$795.





EPSON

Home controller

Pressing buttons on that infrared remote signals the GE Homeminder control box to turn on lights and appliances around your home or to adjust the heat or air conditioning. The box connects to a TV for on-screen menus of times and events. Price: about \$500 with six remote modules.

Credit-card radio

ed in its \$100 price.

Pop the top-it's an eight-



LCD portable

line-by-80-character LCD display-and go to work on this Epson four-lb. portable computer. Included programs such as WordStar are in the ROM; the PX-8 saves data on a built-in microcassette or optional disk drive. With 64K of memory, it's \$995.



Roll-up phone line

Adding an extension cord to your phone is easy. But where do you put all that spidery wire when it's not needed? Answer: in the Cord Caddy, made by Recoton (46-23 Crane St., Long Island City, N.Y. 11101). Its 50-ft. extension rolls up with

Copyrighted material

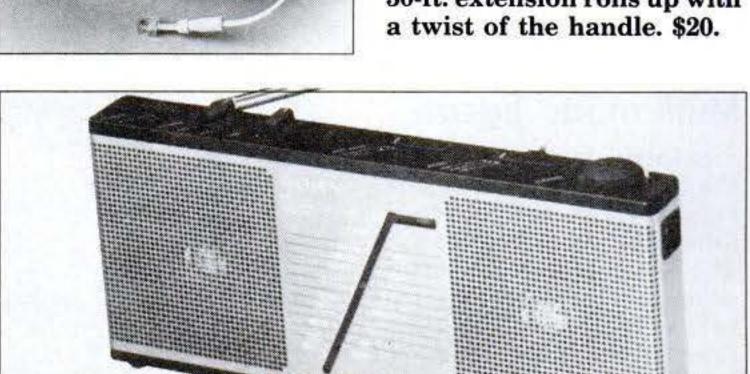


Name caller

Remember her name but not her phone number? Don't worry: Type "Mom" on the keyboard, and the Alpha X phone looks up the number in its 255-number memory and dials it. Distributed by Panel Research and Development, 105 W. 55th St., New York, N.Y. 10019. \$550.

FM-and-AM stereo

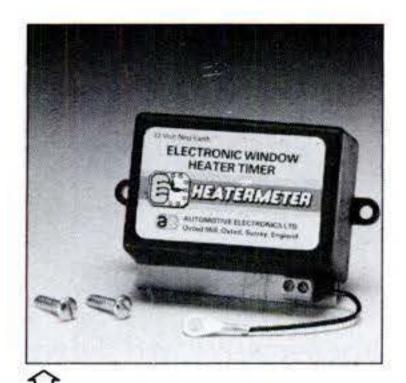
You're looking at the first AM-stereo radio that's not a prototype-you can buy it for \$90. The Sony SRF-A100 portable decodes all four AM-stereo encoding systems (Harris, Kahn, Magnavox, and Motorola). And it plays FM stereo, too.





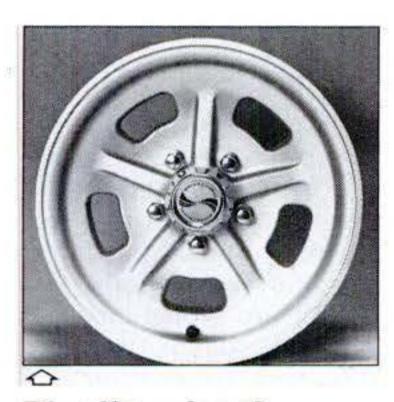
for Your Car

BY JACK KEEBLER



Battery saver

Heatermeter automatically cuts off the rear-window defroster after 15 minutes to prevent unnecessary battery drain. The electronic timer is easy to install, says the maker, Automotive Electronic Ltd. (Oxted Mill, Spring Lane, Oxted, Surrey RH8 9PB, England).

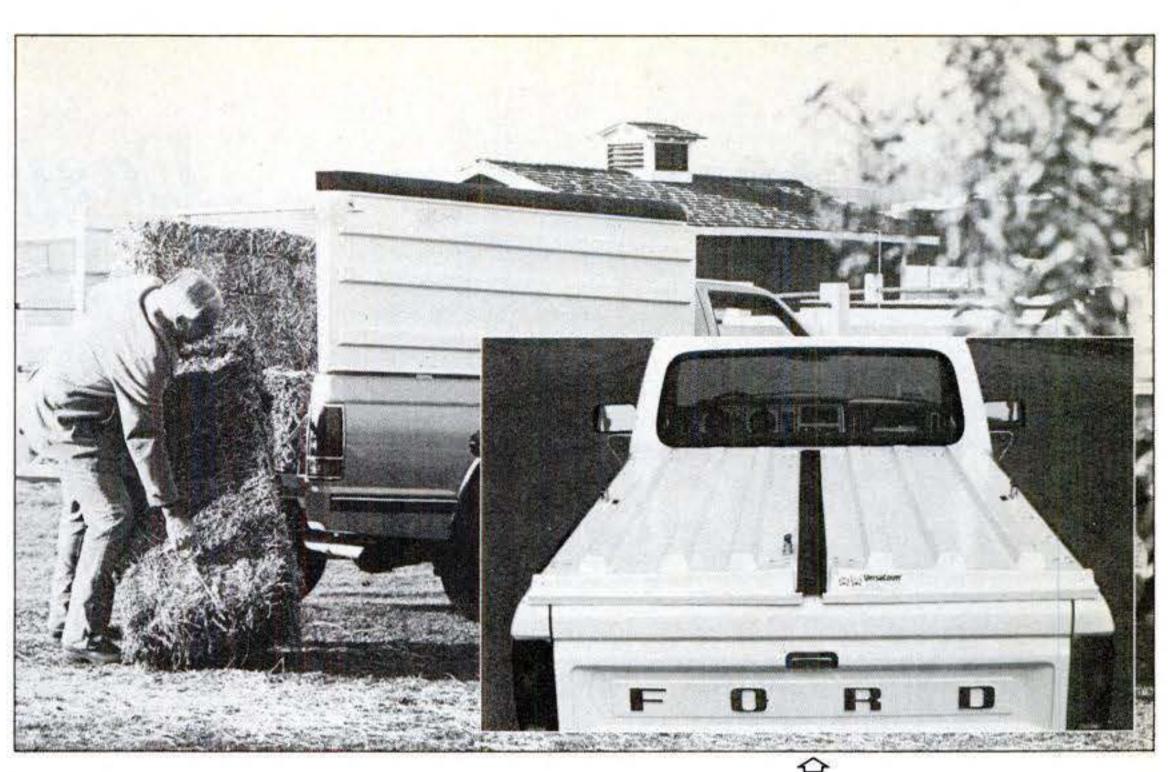


Plastic wheel

This fiberglass-reinforced composite wheel weighs 17 percent less than comparable aluminum wheels, won't corrode, and improves balance, says Motor Wheel Corp. (Lansing, Mich.). The company plans to introduce it to the U.S. automobile industry this year.

High-speed tires

The Michelin Sport XGT is the latest VR-rated (130-mph) tire from Europe. Wide longitudinal grooves, open-block tread pattern, and openshoulder design allow rapid water escape from beneath the tire to combat hydroplaning and increase wet-weather handling. Price is not yet set.



TOYOTA



Hazard light

Firefly flashes its warning to traffic for up to 75 hours in all weather on a set of six D-size flashlight batteries, according to Firefly International (7300 Lincolnshire Dr., Sacramento, Calif. 95823). Electronic circuitry reduces power needs. Price: \$39.95.



VersaCover turns your minior full-size pickup bed into lockable storage space. It's made of high-impact ABS plastic. R.K. Hather (6000 Joan Place, San Luis Obispo, Calif. 93401) says it improves highway mpg when closed by up to nine percent. Mini, \$454; full-size, \$554.

Pickup tent

Mini-Dome, a nylon tent by Engel Design (Box 16766, Seattle, Wash. 98116) for pickup beds, collapses into a fivelb. bundle that stows behind the truck's seat. Aluminum poles support it; screened entry and windows lock out insects. Price for short bed, \$249; long bed, \$259.



Snow grip

Campbell 1900-series snow cables are easier to store and mount than conventional snow chains, and provide snow-chain-style bite without as much vibration, even at higher speeds, says Campbell Chain (Box 3056, York, Pa. 17402). Price: \$60 to \$78 for 12- to 17-in. rims.

Easy-to-install Wireless security systems

Without wires to link transmitters to a central receiver, these systems can usually be installed in a day. They have many advantages over hard-wired systems, and because the receiver monitors the transmitter's computer-encoded messages constantly, you always know whether the system is working.

By DAVID PETRAGLIA
Drawings by Adolph Brotman

ard-wired security systems will deter would-be burglars, but installation can be time-consuming and tricky. So if you're looking for a reliable, easy-to-install method of protecting house and family, here's your chance to stop a thief.

Now you can secure your home's perimeter in one day—with a wireless security system. You won't need to wire the sensors to a control panel—as in a hard-wired system—because they're linked to battery-powered transmitters. These components can be easily concealed, so there's nothing to advertise the location of security components to a prowler; what can't be seen can't be bypassed. And unlike a hard-wired system, you can take a wireless system when you move.

This approach to security might more accurately be called a wireless sensing system. You'll still need to wire the receiver to a control panel (where you can turn the system on and off) and to an alarm. A wireless system works on a simple principle. A transmitter is alerted when a sensor's circuit is opened (as when a door or window is moved) and broadcasts a radio-frequency "sound-the-alarm" message to a central receiver. In the better systems (see table) the communication between transmitter and receiver is sophisticated and constant.

In these systems, the transmitter's broadcasts consist of eight to 20 bits of computer-encoded information and are monitored or supervised by the receiver at intervals that vary from system to system. Transmitters are linked to a channel on the receiver: Each channel has a display to indicate that the alarm has been triggered or that the transmitter's signal isn't being received. (Reception problems may be due to low batteries or blockage of the signal by later installation of a large metal appliance such as an air conditioner.) The display can be a two-digit numeric code or two lightemitting diodes (LEDs), depending on the system. If both LEDs are unlit or if the code remains "all's well"—which you can spot at a glance—your house is protected.

Prices and installation methods for wireless systems vary, depending primarily on whether the system is, say, the Sentrol 7000 series—the most advanced system—or one of the others. However, in all of the better systems you will have to program in a computer code, install and test sensors and transmitters, and find a central location for the receiver.

What singles out the Sentrol 7000 series is the ingenious combination of sensor and transmitter. In other systems each sensor is wired to a cigarette-pack-size outboard transmitter, which attaches to a nearby surface with dual-faced foam tape. In the Sentrol system one part of a two-piece magnetic switch is enclosed in the same unit as the transmitter, so you don't have to run a wire between the two components. And both the transmitter and magnet are easily concealed in holes drilled in the frames of windows and doors.

A Sentrol 7000 system, however, isn't for everyone. It's the most expensive wireless system, and not every house has door and window jambs and frames deep or wide enough to accommodate the transmitter. A system with an outboard transmitter costs less, adapts easily to various installation conditions, and can also be concealed.

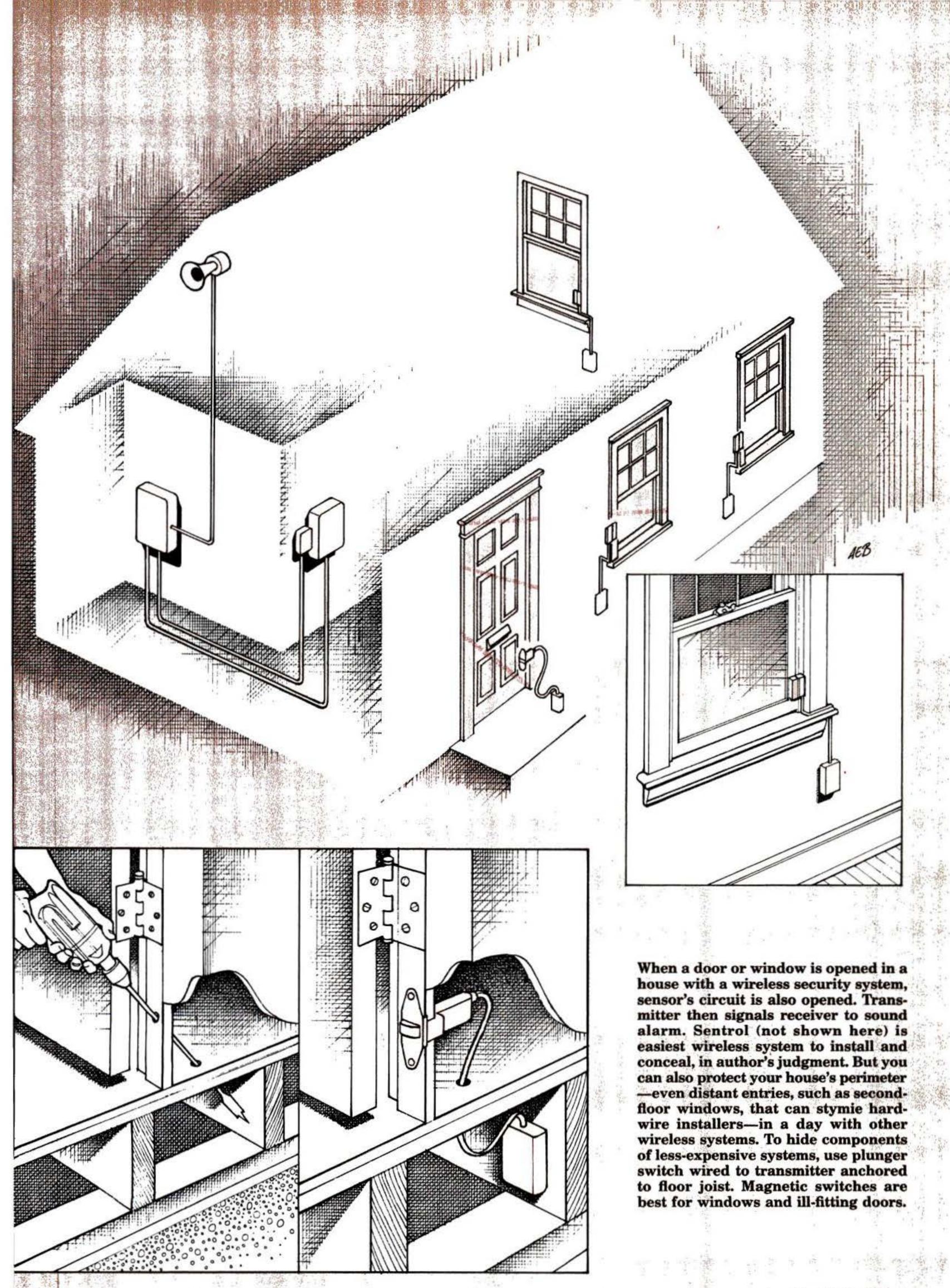
Picking a code

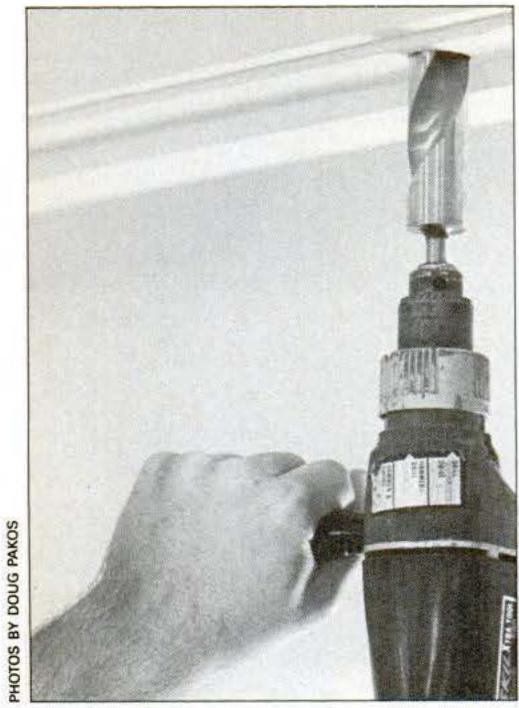
The first step in installing any of the better wireless systems is to formulate your own computer-encoded signal for the transmitters. All receivers have a bank of dip switches, which you throw or don't throw to devise your code. There are two sets of switches, one for a general code for the house, the second for each transmitter.

You can devise a code for each transmitter, which assigns it a channel on the receiver, or you can have two or three transmitters share the same code and a single channel. If you have French doors, for example, you'll need two sensors and transmitters, but you may want to consider them as protecting one entry.

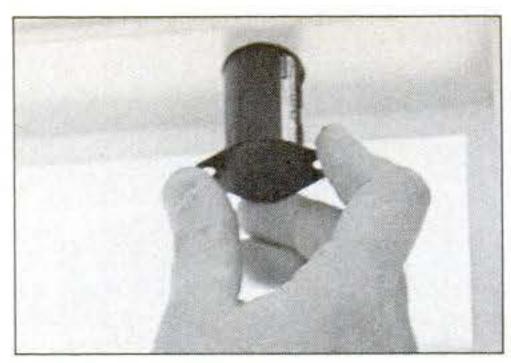
Next, decide where each sensor and transmitter will be installed. The distance from the receiver should be no problem, as transmitters have a range of 200 feet. But keep in mind that the transmitter's talk path can be blocked or deflected by metallic materials such as the foil face of insulation or metal studs.

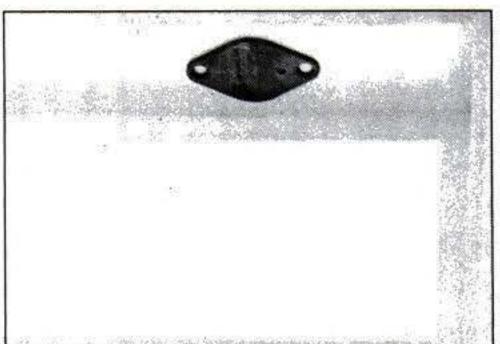
To be sure the transmitter will function in its proposed site, turn on the receiver (but don't connect it to the alarm). Now hold the transmitter and





Install Sentrol transmitter vertically (photos above). Use 1½6-in.-dia. auger bit to drill five-in.-deep hole to take the transmitter. Directly opposite in top





edge of door, about 3/8 in. off center from the first hole, drill 3/4-in.-deep hole for the magnet. Position of magnet and transmitter can be reversed.

sensor in place, and break the sensor's circuit. If the alarm light goes on, the placement is fine. If the alarm light remains off, move the transmitter—usually a few inches is all that's needed—and retest.

Many types of sensors can be used with outboard transmitters in wireless systems. For doors, I recommend a plunger switch, which is one-piece and easily concealed; for windows (and ill-fitting doors), a magnetic switch.

To install a plunger, use a ¾-inch spade bit to drill a hole 2½ to three inches deep, several inches from the floor on the hinge side of a door. Clear the weatherstripping around the

switch to ensure that the plunger will be completely depressed when the door is closed. Drill holes for the anchoring screws, then drill a ¼-inch hole through the jamb for the wires to the transmitter.

Use standard 22-gauge, two-conductor wire to connect the sensor and transmitter. Plunger switches don't have wire terminals, so you'll have to solder and tape the leads together. Magnetic switches, on the other hand, are surface mounted and have terminals, so installation amounts to drilling holes for the anchoring screws. The location of a magnetic switch on a window varies, depending on how

the window opens. On a door, however, install the switch just below the header, where it's least likely to be jolted by passing feet. Secure the magnet part of the switch on the door and the other part directly opposite it on the frame.

You must test the connection between the sensor and transmitter before proceeding, particularly if you're using a plunger switch. Test the sensor by connecting the wire to an ohmmeter. Then install the sensor, and mount the transmitter. This connection must also be tested. Turn on the receiver, but don't connect it to the alarm. Close the door or window, and check the alarm light. If it's on, the connection hasn't been made. In the case of a plunger, the wires probably aren't firmly connected.

Next, break the sensor's circuit. If the alarm light is off, the wires probably shorted. This is more likely to happen during installation of a plunger switch than of surface-mounted switches. The hole may not be large enough to accommodate the wires and sensors without pinching them together. Remove the plunger, and drill the hole deeper. Then re-wrap the wires.

You can conceal an outboard transmitter in the basement between joists, but you'll have to drill a hole for the connecting wire. Make sure there's nothing in the drill's path besides wood. Then drill down at a 45-degree angle with a ¼-inch bit.

Finally, install the receiver in a well-traveled part of the house so that you'll have numerous opportunities throughout the day to check the status of the sensors and transmitters with a glance.

PS comparison table: four popular wireless security systems

Manufacturer and model	Automatic supervision	Frequency of supervision	Transmitter battery life (yrs.)	Concealed transmitter	Compatible with other sensors (smoke detector, panic button)	High radio-frequency interference immunity	Receiver	Receiver	Transmitter price (\$)
Ademco, 165 Eileen Way, Syosset NY 11791 (Tel-Stat)	No	Supervision	1	No	Yes Yes	Yes	3	30	30
Linear Corp., 347 S. Glasgow Ave., Inglewood CA 90301 (SS-32)	Yes	1 min,	í	No	Yes	Yes	32	n.a.	n.a.
Sentrol, 10831 S. W. Cascade Ave., Portland OR 97223 (7000 series)	Yes	35 sec.	5	Yes	Yes	Yes	16	240	50
Transcience, 179 Ludlow St., Stamford CT 06902 (R-350)	Yes	1 hr.	1	No	Yes	Yes	16	90	30

The best systems share three traits: immunity from radio-frequency interference, constant self-supervision, and concealment. Immunity, guaranteed by sophisticated computer codes, prevents false alarms that can be set off by garage-door openers, portable

phones, or other signals in the area. Only Tel-Stat's receiver, among the better systems, doesn't monitor or supervise the transmitter's signal—you must open the sensor's circuit to test the system. Concealment is easiest with Sentrol, but other systems can also be

hidden. A wireless system is not complete without a control panel (\$100), a siren (\$50), and a key-switch or push-button remote control (\$50) to turn the system on and off. Optional are smoke detectors and hand-held panic buttons, which are linked to the receiver.

Prices down, quality up:

PS HOME ELECTRONICS

hot new compact-disc players

The new CD machines cost less but offer better performance and more features than early high-end players. Some of these machines correct disc errors and track better than others with similar specifications. And now there are CD players for your car.

For exclusive report on 14 new models, turn the page



By LEN FELDMAN Photo by Greg Sharko

The author is an outstanding authority in the audio and video fields. He maintains a fully equipped testing lab to evaluate the latest products.

bout two years ago, when the price of compact-disc players averaged \$1,000, I acquired one of the first-generation machines. At that time it was almost impossible to find enough digital discs for the new players in U.S. stores ["Bye-bye, LP.... Hello, CD?" PS, Nov. '83].

Things have changed. Now, secondand even third-generation players cost less than half the price of early CD machines. And there's no skimping on features or performance in the new models. In fact, some \$500 CD players today offer *more* features and *better* technical performance than my "vintage" \$1,000 machine.

In part, that's because new superdense microcircuits developed for CD machines have added features and trimmed manufacturing costs. And experience gained from making the machines, along with growing competition, has helped further cut back prices. Most major audio firms now offer one or more CD players.

Discs are more plentiful, too. Some stores discount the 2,000-odd CD albums now available to between \$13 and \$18. And by early 1985 you should see another 1,000 titles in catalogs.

Lab tests I've conducted on more than 50 CD players, including many newer models in recent months, make it clear why some of the newer lowcost machines are better than earlier high-end models. The new units offer:

- Better automatic correction of disc defects.
- Superior tracking of the laser pickup.
 - More programming capabilities.
 - Faster selection-access time.

And although the fundamental electronic-performance specifications are similar for all CD players, I've found that subtle sonic differences do exist from one player to another.

The developers of the compact-disc format, now an accepted world standard, established an elaborate error-correction system—compensation for "missed" digital data. This includes a combination of redundant encoding as well as other sophisticated signal-manipulation techniques that enable a CD player to recover and reproduce the intended signals correctly.

Given a perfectly produced mintcondition CD that hasn't been mishandled in any way, you probably couldn't tell the difference between a CD player with only basic error-correction circuitry and one that can handle long data omissions without missing a beat in the music. But you can be sure your CDs will gradually acquire minor imperfections: fingerprint smudges, dirt particles, and the like. And that's when the differences in error-correction capability from one machine to the next become more apparent—and more important.

In my tests for error correction I use a special test disc from N.V. Philips, a co-inventor of the compact-disc system. Three types of internal defects on this test disc—an opaque wedge, opaque dots, and a simulated finger-print smudge—partially or totally obscure microscopic disc pits that represent music.

I've tested some first-generation players that mistracked on the narrowest section of the wedge. My more recent tests have shown that most of the newer machines are much better in this respect than earlier players. All of the models listed in the table passed this test.

But a CD player depends on more than error-correction circuitry to track a disc. Also critical is the stability and precision of the servo-tracking mechanism, which guides the laser pickup over the disc surface. It's difficult to separate error-correction from servotracking accuracy when testing a CD player because the two are closely related. An inferior tracking system will produce the same audible effects as the inability to correct missing data on a disc. How do I test for tracking? I've found that simply tapping the top and sides of a CD player as it operates provides a good indication of tracking-system stability. You'd be surprised at the differences that show up between players when I conduct this simple test. This shock test will be even more important as car CD players become available later this year (see box, Digital Audio on the Road).

Random-access programming

In addition to superior error-correction and tracking capabilities, new machines offer more convenience features. Discs may store more than an hour of music on one side. Often, especially with popular-music albums, more than a dozen selections are available on a disc. Besides the digitally

Continued

Digital audio on the road

About 18 months ago some other audio writers and I toured factories throughout Europe where players and compact discs were already being made. Our hosts from N.V. Philips managed to mount a standard CD player atop the dashboard of the minibus we traveled in. The player was perched on a sponge-like pad, and its power supply was adapted for 12-volt battery operation. We were all amazed that the CD player could play "on track" as our little bus sped along the highways of Holland, Belgium, and West Germany. Only occasionally, when we hit a major pothole in a city street, did the player mute. But even then playback was restored in a split second.

After that experience I wasn't surprised to learn that several manufacturers are about to introduce CD players for cars. Sony, Pioneer, Mitsubishi, and Fujitsu have all exhibited prototypes of car CD players. Sony, for example, is offering two models, both of which are DINsized units. (DIN is the German standards organization, which has, among other things, standardized the size for car-dashboard cutouts.) The Sony CDX-R7 is a combination AM-FM-radio-CD player; the CDX-5 is a CD player only. The optical laser pickup in both of these models is only one-third the size of laser pickups in Sony's home CD machines. Very-largescale integrated circuitry has also contributed to the small size and light weight of these first car units.

The CDX-5 is designed for the car driver: You can operate it with ease and a minimum of distraction. As you insert a disc, for example, it is automatically drawn into position for play. A large "music sensor" button lets you skip directly from song to song in either direction. A "music scan" feature runs through

About 18 months ago some other audio writers and I toured factories throughout Europe where players and compact discs were already being made. Our hosts from N.V. Philips manning, but at reduced volume.

Pioneer has handled the problem of fitting a CD player into a car somewhat differently. The company's CDX-1 player, slated for introduction early in 1985, consists of two separate components: an operating module and a hideaway processing module. The processing module houses the power source and the converter that converts digital information on a disc into music. The processor can be installed in a remote location such as underneath the car seat. The operating module—the "hands-on" unit—can be installed in almost any car-stereo dashboard opening.

An anti-vibration design is said to eliminate tracking errors, and a doorless, dustproof disc-insertion slot protects the compact disc from scratches, stains, and cigarette smoke. The CDX-1 will be equipped with convenience features that include music search with two-second access time, skip search, music scan, song repeat, and complete-disc repeat. A feature specifically designed for the car environment is the CDX-1's temperature-sensing system. If the unit detects a dramatic rise in ambient temperature, the disc playback automatically disengages to prevent damage to the laser-pickup system.

In the months and years ahead, you'll see CD players offered as factory-installed options by domestic and foreign car manufacturers. The transition from eight-track cartridge tape players to cassette players in cars took almost a full decade. I have a feeling that acceptance of CD players in cars won't take nearly as long.—L. F.

encoded audio signals, CDs carry other useful encoded data: track numbers, time per selection, and total time per disc, for example. Although most early CD players displayed the track or selection number being played, few permitted you to program selections in any order. But some of the new lowercost machines do just that.

For example, Sansui's \$500 PC-V300 can be programmed for up to 23 different selections, played in any order you like. The new Marantz CD-54, a very compact machine with a price of \$649, lets you program 24 separate selections.

Classical-music CDs often have their tracks subdivided into separate portions known as index numbers. For example, a complete symphony's four movements might be recorded on a CD as tracks one through four; each movement might then be further subdivided into index numbers. These index points might indicate the start of specific musical themes or melodies within a movement. Some new CD players not only display these index numbers along with the main track numbers but also allow you to start the music at the index points within a given track. There are even some CD players (usually the higher-priced models) that enable you to find a given point on the disc by means of a time reference. You might, for example, command the player to begin playing two minutes and 23 seconds into track four.

Player differences

Are there any major performance differences between various CD players? The measurements I traditionally use to evaluate amplifiers, tuners, and other audio electronic gear don't tell very much about how a CD player will sound. Frequency response is flat from 20 Hz to 20 kHz, with maximum variations rarely exceeding one dB over that entire audio spectrum. Minor frequency-response variations usually occur near 20 kHz, where sharp cutoff filters roll off the response. In addition, harmonic and intermodulation distortion typically measure 0.008 percent—far below human perception.

Dynamic range

The dynamic range of CDs, one of their most outstanding advantages, typically measures more than 90 dB. Most players are about the same in this important specification.

So if the basic performance specifications are about the same for all CD players, what should you look for when comparing one CD player with another? Besides the error-correction and servo-tracking capabilities just described, convenience features—programmability, access speed to a given point on a disc, control simplicity, and information on the digital display—play a role. But other, more subtle, differences also exist.

When I first started testing and listening to CD players it seemed as though no differences existed between them in sound quality. My first CD experiences were overwhelming: The absence of background noise, the increased dynamic range, and the superb frequency response masked subtle quality differences.

But early compact discs weren't all

they could have been. Recording engineers, I suspect, have had to learn new audio-mixing and microphone-placement techniques to produce CDs that are musically and artistically satisfying to critical listeners.

They've succeeded. But there are also subtle differences that many people hear when comparing CD players. In general these can be traced to circuit-design approaches favored by one company or another.

In the CD decoding process, which converts digital signals to analog form for your hi-fi system, it is essential to cut off any frequencies above 20 kHz to prevent interaction with the sampling frequencies. Many CD players use conventional analog electrical filters that sharply cut off these frequencies. But steep-cutoff filters introduce severe phase shifts—changes in timing—of high-frequency signals. Some listeners say these phase errors are audible.

To avoid phase-shift problems, some manufacturers use digital filtering. This filtering occurs before the digital-to-analog stage and introduces little or no phase shift. Other manufacturers couple the filtering with a technique known as oversampling: In CD systems, the standard digital-sampling rate is 44.1 kHz. But by "reading" each sample twice or even four times in some CD players, the effective sampling frequency is converted to 88.2 or 176.4 kHz.

As a result, analog filters that don't cut off signals as sharply can be used following digital-to-analog conversion. They introduce far less phase shift within the audio band. Many listeners find this circuit approach more pleasing than one with sharp-cutoff analog filters.

Superior sound

My own reaction to this growing debate is a middle-of-the-road approach. I do hear differences between machines using the two approaches to filtering and sampling, but it would be hard to say which sound I prefer. Both types of CD players yield sound that, to my ears, is infinitely superior to anything I've heard from an LP record or cassette tape.

Having followed the steady rise of compact-disc-player introductions and the steady decline in prices for two years now, it's clear to me that 10 years from now CD systems will be as commonplace as conventional record turntables and phono cartridges are today. Fortunately, I haven't waited to switch over to compact discs until everyone else owned a CD player. I might have missed 12 years of superb musical pleasure.

PS comparison table: new \$500-\$800 CD players

				Displa	ay				
Make & model	Price (\$)	Programmable	Selections programmable	Remaining time	Track	Repeat phrase	Remote control	Cuin Time	g by Index
Fisher AD844B	650	•	n,a.	•	•	•		•	
Hitachi DA-3500	550	•	15		•	•			•
JVC XL-V2	750		12		•	•			
Kenwood DP-800	500		n.a.		•	•			•
Magnavox FD3030	799		15		•				
Marantz CD-54	650		24	•	•	. 1	+ 1 %		
NAD 5255	548				•	•			
Onkyo DX-100	650		-	•	•				•
Sansui PC-V300	500		23			•			•
Sharp DX-500	650		15		•	•			
Sony CDP-400	800			•	•	•	•		
Teac PD-11	650		23	•	•	•			
Toshiba XR-Z50K	500			•	•	•			
Yamaha CD-2	599		12	•	•	•	•		•

Fisher Corp., 21314 Lassen St., Chatsworth CA 91311; Hitachi Sales Corp. of America, 401 W. Artesia Blvd., Compton CA 90220; JVC Co. of America, 41 Slater Dr., Elmwood Park NJ 07407; Kenwood Electronics, 1315 E. Watson Center Rd., Carson CA 90745; Magnavox/NAP Consumer Electronics Corp., I-40 & Straw Plains Pike, Knoxville TN 37914; Marantz Co., 20525 Nordhoff St., Chatsworth CA 91311; NAD (USA), 675 Canton St., Norwood MA 02062; Onkyo USA Corp., 200 Williams Dr., Ramsey NJ 07446; Sansui Electronics Corp., 1250 Valley Brook Ave., Lyndhurst NJ 07071; Sharp Electronics Corp., 10 Sharp Plaza, Paramus NJ 07652; Sony Corp. of America, Sony Dr., Park Ridge NJ 07656; Teac Corp. of America, 7733 Telegraph Rd., Montebello CA 90640; Toshiba America Inc., 82 Totowa Rd., Wayne NJ 07470; Yamaha Electronics Corp. USA, 6660 Orangethorpe Ave., Buena Park CA 90620

New engineering gives fail-safe

auto-lube for outboards

Four outboard makers now offer engines with automatic oil injection. The systems eliminate the bother of premixing oil with gasoline. Each system matches oil-gasoline ratios to engine load, but each does the job differently.

By E. F. LINDSLEY

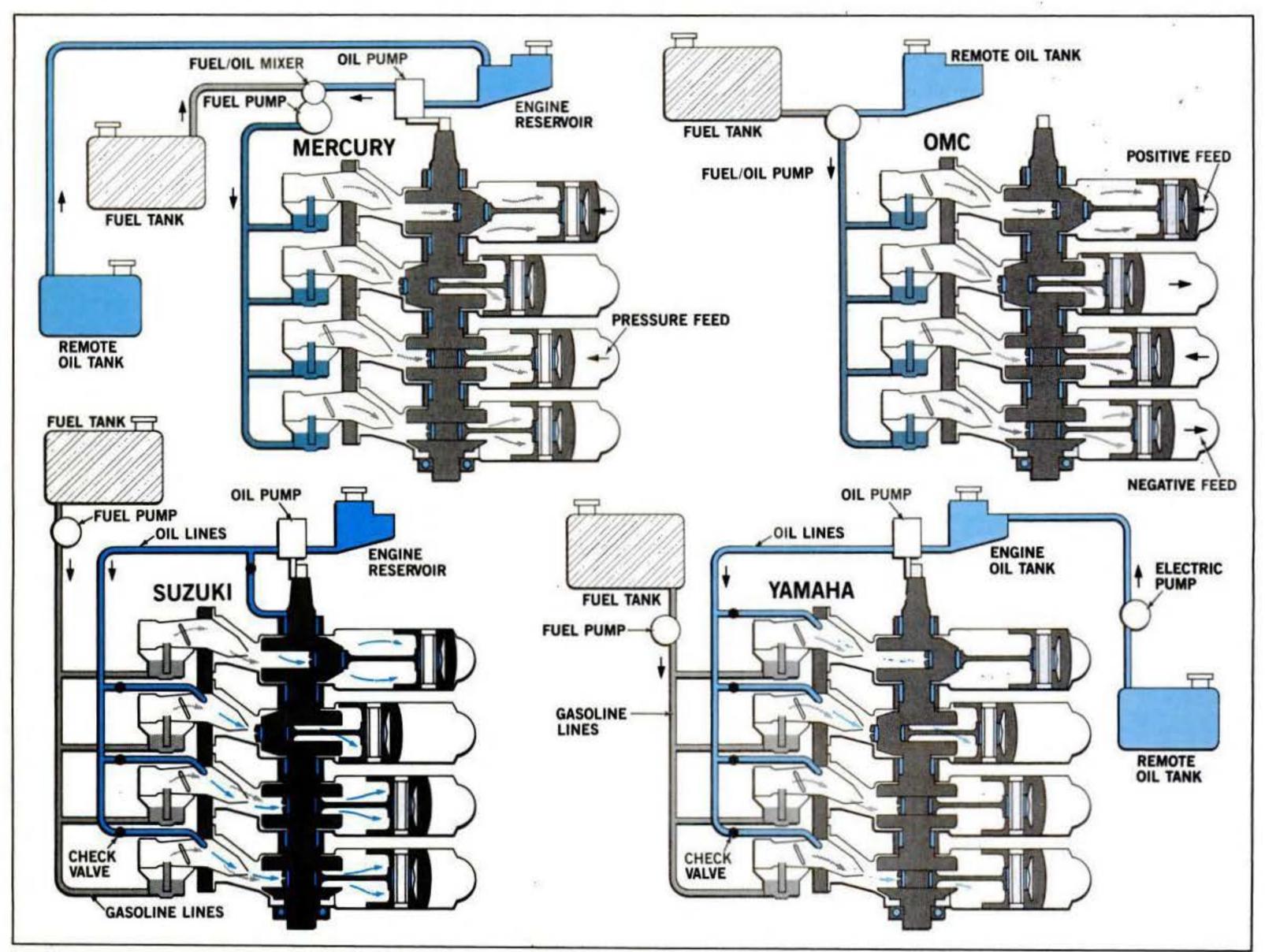
Illustrations by Gerhard Richter

t wasn't until we got to the truly big outboard engines with 150-gallon built-in tanks that people started to see the need for automatic oiling," says Bill Mayer, lead project engineer at Mercury Ma-

rine. "Mixing oil with 100 gallons of fuel is really painful."

The Japanese were the first to bypass this bothersome chore. Suzuki offered an outboard engine with automatic oil injection in 1980, and Yamaha followed. Both now feature it on engines from 40 hp up. Recently both Evinrude/Johnson (OMC) and Mercury/Mariner introduced automatic oiling for the V4 and V6 and 150/200 models, respectively.

Why this growing trend? Mixing oil with gasoline is not only messy—it's worrisome. Every boatman knows the nagging thoughts that usually begin someplace out on the water: Someone miscounted; the oil-gasoline ratio is



Both Mercury and OMC mix gasoline and oil at the fuel pump, but Mercury has two oil tanks—a three-gal. remote tank and a small reservoir. OMC has only a 1.8-gal. remote tank. The Mercury system uses a positive crankcase pulse to pressurize the remote tank and force oil to the reservoir. On OMC engines the positive crankcase pulses move a diaphragm in the combination fuel/oil pump. Suction from this pump draws the oil from the remote tank. Like Mercury, Suzuki and Yamaha use a crankshaft-driven pump to draw oil

from the engine tank. But both Suzuki and Yamaha feed oil directly to the intake manifolds. Yamaha uses an electric pump to extract oil from its remote tank (capacity ranges from 3.5 qt. to 2.8 gal., depending on engine size); Suzuki has only a 4.2- to 12.7-pt. reservoir.

wrong; maybe the engine is ruined....

"Over the years we've had to develop engines that could run on the wrong ratios," Mayer says during my visit to Mercury's Oshkosh, Wis., engineering facility. "With big boats a customer may dump in a gallon of oil and 50 or 100 gallons of gasoline on top of it. Sometimes you've got 50:1, and sometimes you've got 100:1," he adds.

Even if you mix it right you can mix only one oil-gasoline ratio. But all makers recommend different ratios for different speeds, ranging from about 50:1 for full power down to 100:1 or less for slow trolling. The leaner mix helps prevent plug fouling, carbon buildup, and water pollution.

Premixing oil means settling for the heavy mix needed for full power, or compromising. But the new oil-injection systems match the amount of oil

to engine load and speed.

With all these benefits, why haven't we seen automatic oiling before? Some owners and dealers feel that it might be just one more complication to go wrong, Mayer told me. That's why Mercury/Mariner is offering automatic oiling as an option only. And both OMC and Mercury have no immediate plans to extend the feature to their smaller engines.

Different strokes

Though the major outboard manufacturers agree on the benefits of automatic oil injection, they differ on the

best way to do the job.

To sort out these differences it helps to think of oil injection as two systems. The first gets the oil from a storage tank to the engine. The tank can be remote and stowed wherever convenient, built into the engine, or both (see table and drawings for details).

The second system actually mixes oil with gasoline. Here there's a basic design difference between U.S. and Japanese designs. Both OMC and Mercury engines mix oil with gasoline at the fuel pump, then feed the mix to the carburetors in the conventional way. In Yamaha and Suzuki engines the oil is injected directly into the intake manifolds, where it mixes with the fuel-air mix from the carburetors. In theory this oil-delivery method provides a faster oil-ratio change for sudden throttle openings.

"But mixing the oil and gasoline at the fuel pump allows us [and OMC] to keep the rest of the carburetion system we've refined over many years," Mayer points out. And fuel-pump mixing doesn't require a nest of oil lines on the engine.

Although their oil-metering systems differ radically, both OMC and Mercury rely on pulses of air from the en-

PS comparison: oil-injection outboard engines

How they are alike Mercury/Mariner, Evinrude/Johnson, Suzuki, Yamaha

Use standard TCW (two-cycle, water-cooled) oil Vary oil-fuel ratio with power output Low-oil warning Extend running time after warning

Remain primed after initial start

Can be operated with conventional oil-fuel mix

Mercury/Mariner	How to Evinrude/Johnson (OMC)	hey differ Suzuki	Yamaha
Remote oil tank and engine reservoir	Remote oil tank	Engine tank only	Remote oil tank and engine reservoir
Pressure feed from tank to engine	Vacuum feed from tank to engine	No remote feed needed	Electric pump in remote tank
Mixes oil with gasoline at fuel pump	Mixes oil with gasoline at fuel pump	Mixes oil with gasoline in intake manifold	Mixes oil with gasoline in intake manifold
Crankshaft-driven oil pump	Air-motor-driven oil-fuel pump	Crankshaft-driven oil pump	Crankshaft-driven oil pump
Separate oil-metering pump linked to throttle	No mechanical linkage between throttle and oil-fuel pump	Separate oil lines to each injector	Separate oil lines to each injector
Ratios— 50:1 to 100:1	Ratios— 50:1 to 150:1	Ratios— 50:1 to 100:1	Ratios— 50:1 to 100:1

gine crankcase to feed the oil to the pump. To picture this, remember that the crankcase of a two-stroke outboard is sealed and subjected to alternate negative and positive impulses as the piston moves on the intake and compression strokes.

According to Gay Borst, chief engineer at OMC Accessories, "The pulse is positive when the piston comes down and negative when it goes up. We use both pulses." (See caption for details.)

On OMC engines the pulses move a diaphragm that operates both the oil- and fuel-pumping parts in a combination pump. This setup automatically matches the proper amount of oil to fuel. Since the pressure pulses reflect engine speed and load, the oilgasoline ratio varies accordingly (see table).

Mercury delivers the oil, pressurized by the crankcase pulses, to a mechanical pump driven by a spiral gear from the engine crankshaft. "The oil pump is manufactured by Mikuni," Mayer says. "It's the same type used in motorcycles and snowmobiles for years." The Mikuni pump meters the oil in two ways. The pump's output varies with engine speed, and a linkage to the carburetor throttle control changes the pump stroke to match the throttle opening.

What happens if one of these linkages fails? Both Mayer and Borst told me that if the oiling systems failed, you could mix oil with the fuel in the tank and operate conventionally. In fact OMC recommends an initial runin with premixed fuel and oil.

Although neither Suzuki nor Yamaha mention running on premix in their literature, a check with their service engineers affirmed that this was possible. Adds Ted Zahorski at Yamaha: "We build them for premix in a lot of our engines sold overseas."

With automatic oiling, of course, it's always possible to forget to fill the oil tank when you gas up. All four outboard makers have provided audible and visual low-oil warning signals that let you know long before you're really out of oil.

Yamaha's warning system is the most sophisticated, with colored lights and an engine-speed-reduction feature. Mercury has an additional beeper signal to warn you if the mechanically driven pump stops turning.

How much running time do you have left after the warning signal? According to Mayer, "If you run out of oil in the reservoir to the point where it sets off the alarm, you can still run 30 to 45 minutes at full throttle before being completely out." Obviously, pulling the throttle back to use a leaner oil-fuel ratio would extend your running time.

OMC, with no mechanical pump to monitor, uses a warning beeper only to indicate low oil level. "You still have quite a bit of running time left when the horn goes off," says Borst. "The V4 will run four hours at cruising speed, but the horn will be going off every half minute."

Despite the warning systems, all the outboard makers suggest carrying a modest supply of spare oil in a separate container.

After looking closely at auto-lube systems I feel that they eliminate more hazards than they introduce. My bet is that buyers of smaller outboards will soon clamor for automatic oiling.

Update an old bathroom with a tilea tub deck

To remodel a bathroom without moving plumbing or walls, deck out your tub.

By SUSAN RENNER-SMITH

ou're tired of your boring bathroom with its (pick one) tacky plastic tiles; ersatz wallboard tiles; 1950sstyle, pink-and-gray ceramic tiles.

You'd like to bump out the walls and create a spacious spa-bath, complete with redwood sauna and sunken whirlpool. But you can't spare the space—or the cash.

Building a tiled deck around your tub can transform your bathroom without the need to relocate plumbing, tear down walls, or buy new fixtures. Keeping the old fixtures means you can afford to invest in a lavish display of elegant tile. You may even choose to re-tile walls and floors, as the homeowners did for the bathrooms shown here.

If your walls are covered with old plastic tile, it's a simple matter to pull it down and re-tile. If you've got wellanchored wallboard, you can roughen the surface and tile right over it. If you have ceramic tile you want to keep, you may be able to find a match. Or you may choose to replace the tile closest to the tub with a patterned feature tile that you can then lay on the upper tub deck.

Each bathroom has its own design potential, but you can glean some ideas from the portfolio of tub decks presented here. One option not shown is decking out a tub that's surrounded by walls on three sides. You're limited there, of course, to building out from the one open side. As in the decks shown, you frame with $2 \times 4s$ and cover with 3/4-inch exterior plywood.

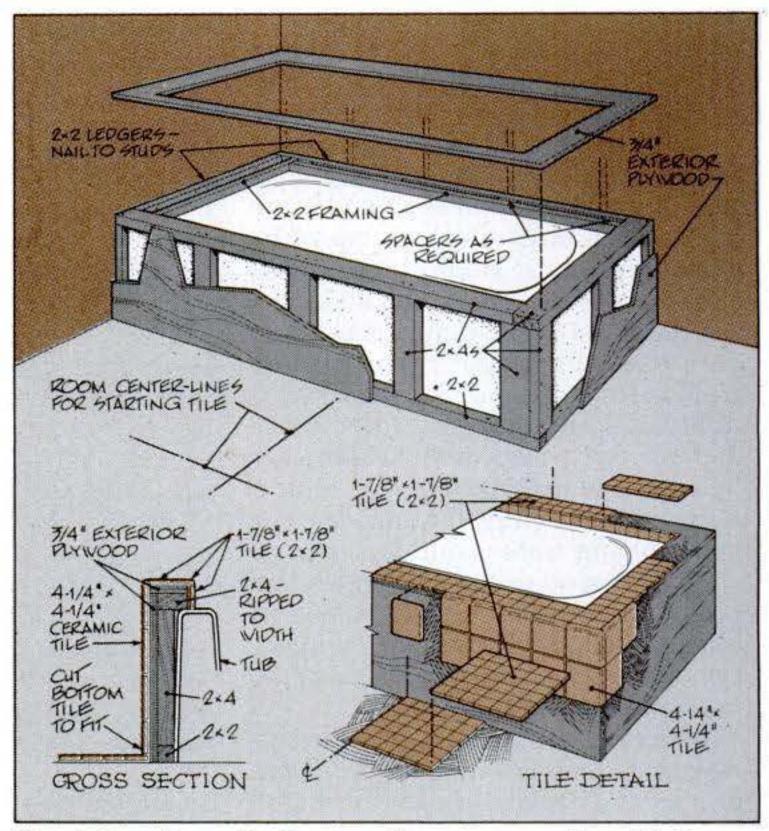
No matter what type of deck you plan, the design experts at Color Tile Supermart, Inc. (515 Houston St., Fort Worth, Texas 76102, with stores in most cities), suggest the following guidelines:

To minimize tile cutting, coordinate deck size with tile dimensions. You'll still have to do some fitting around corners and against walls, but careful planning will reduce the amount of cutting needed.

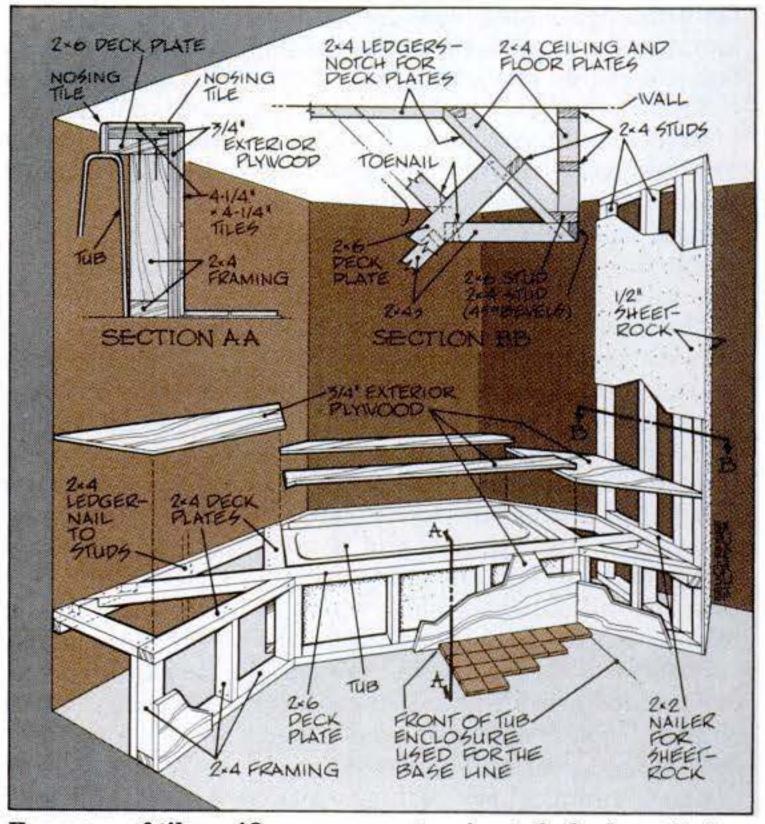
Be sure to use at least a 3/4-inch plywood deck in any built-out structure. A lesser thickness might result in deck "give" that could cause tiles to loosen.

Before you start work, line the tub bottom with cardboard to protect it from any dropped tools or tiles.

Finally, dry-lay the tiles over the deck surface before you apply adhesive. This gives you an accurate idea of how the tiles line up, and you can shuffle them around to determine the layout with the fewest cuts.



Simple box frame built around a corner-anchored tub produces a built-in look (right), dramatized by the mix of mosaic and patterned tiles. The Color Tile mosaics come on pre-spaced backer sheets, easing installation. Space between existing tub and both walls was closed as shown (top sketch), and front and foot of tub were capped (section) to support frame of plywood. At least 11/2 to two in. of tub edge should be left exposed around tub perimeter. Fill tub before running caulking bead where tiles and tub-top meet.



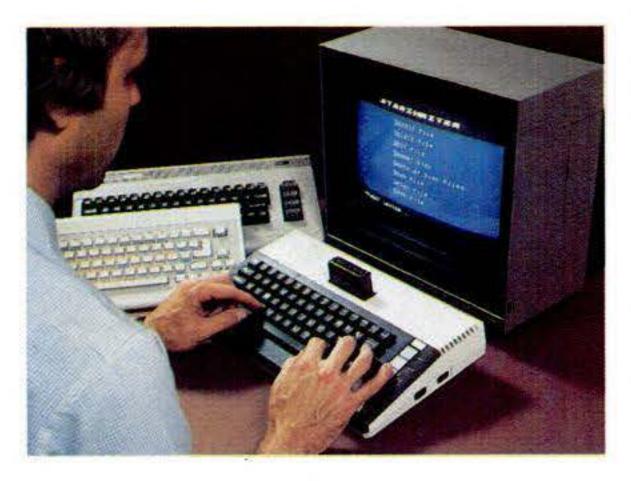
Expanse of tile unifies a corner-turning tub deck and triangular stud wall (right). The stud wall creates a private alcove for the tub, separating it from the toilet. (All studding should be 16 in. on center or less.) The built-out deck makes the eight-by-10-ft. bathroom seem larger and converts waste space into ledges for bathing supplies and houseplants. Using the front of the angled tub as the floor-tile baseline gives a neat look and minimizes tile cutting. Matching vanity tile extends the seamless look.





Angled tub deck (above) adds to the elegance that new tiles bring to this vintage bathroom. The deck, a simpler version of the one below, was scaled to minimize tile cutting. Deck's top (front) edge is exactly the width of two tiles plus grout lines. Deck height equals height of four tiles plus grout.





PS showdown:

7 top home computers

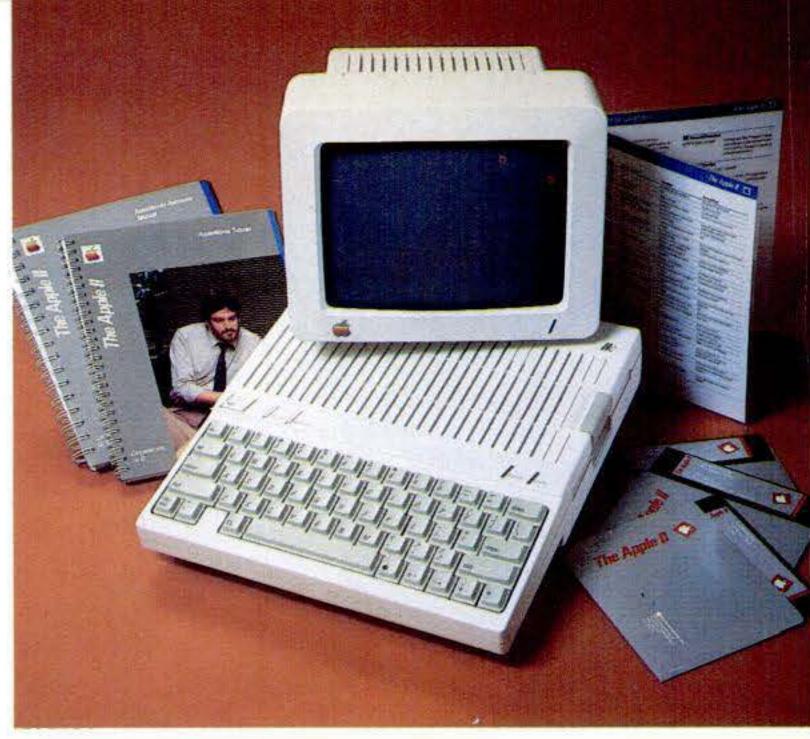
They all have exceptional power and features. But for the basic task of word processing, how do seven popular computers stack up against each other? To find out, Popular Science experts gave each lots of words to process—and then kept score.

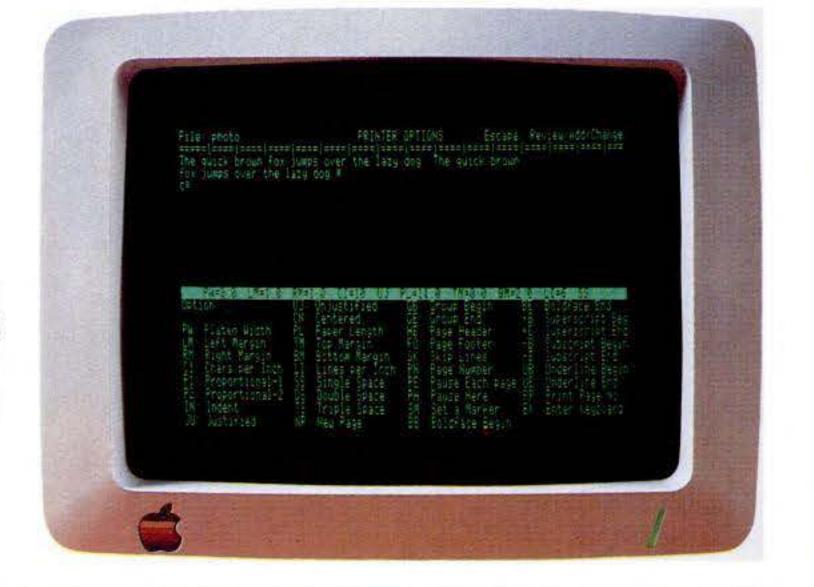
By WILLIAM J. HAWKINS Photos by Greg Sharko

ou scratch your head and ease back in your chair. Your mind is filled with thoughts—words—and your fingers dance over the keyboard to make them permanent. But there's a typo here, a misplaced sentence there, and an entire paragraph needs to be moved. No problem. These mistakes can be fixed later. You're running a word-processing program on your home computer, and all your errors can be corrected by simply touching a key... or can they? As I found out, that may depend on the system you're using.

Word processing is one of the most important uses of a home computer—for letters, notes, or school compositions. According to a survey of PS readers, it accounts for 38 percent of their home computers' time. (Games and education head the list.) Word processing is second only to games, according to a survey of Family Computing readers. And

[Continued on page 112]



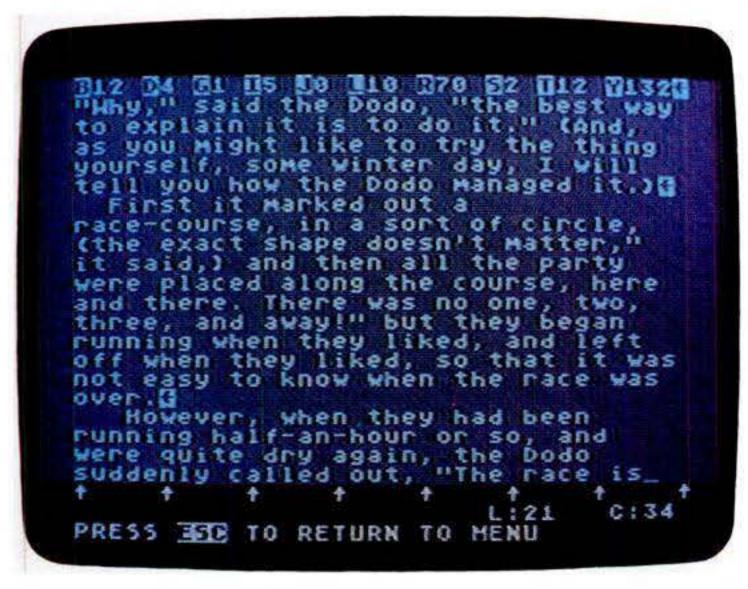


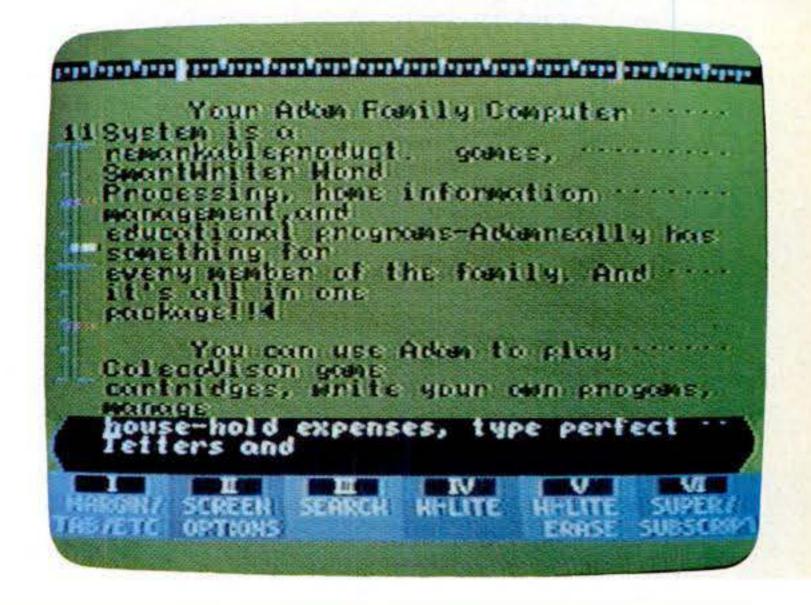
APPLE IIC

The Apple IIc system consists of the computer, built-in disk drive, monitor, and AppleWorks combination word-processing, data-base, and spread-sheet program. Apple IIc goes out of its way to be easy to use. The screen is called a "desk top," and you may place more than one file on the desk at one time. This lets you move easily from one document to another. (I accidentally asked for a file twice, but the clever program told me I was about to clutter my desk with a duplicate document.) You give commands (to find text or move or delete blocks, for instance) by pressing a special apple-labeled key and a letter key. There are lots of commands, but they're relatively easy to remember: "F" for find, "M" for move, "D" for delete, etc. In case you forget, pressing the apple and "?" keys produces the entire list of commands on the screen. When you move or copy a block of information, you may do it immediately within the file, or you may place it on a "clipboard" (a buffer of memory) for retrieval later. That allows you to cut and paste sections of text from one file to another easily. Or, by marking the start and end of an entire file, you can merge two files. (There is no dedicated merge command.) Screen and print formatting are done throughout the text with codes you select. To choose a code, you press the apple key and "O," for options, and the bottom half of the screen displays 37 options, ranging from centering the text to setting the margins. You type the option's two-letter code (DS for doublespace, for instance) and press the return key. Double space appears in the text at the cursor position. When you press the escape key, the menu disappears—and so does the double-space message in the text along with all other format messages. This keeps the text workspace "clean," but if you wish to see them again for checking or changing, you merely press the apple key and "Z" (for zoom), and they reappear. I like AppleWorks. On-screen menus slow the program down a bit, but its commands are extremely useful and easy to learn.







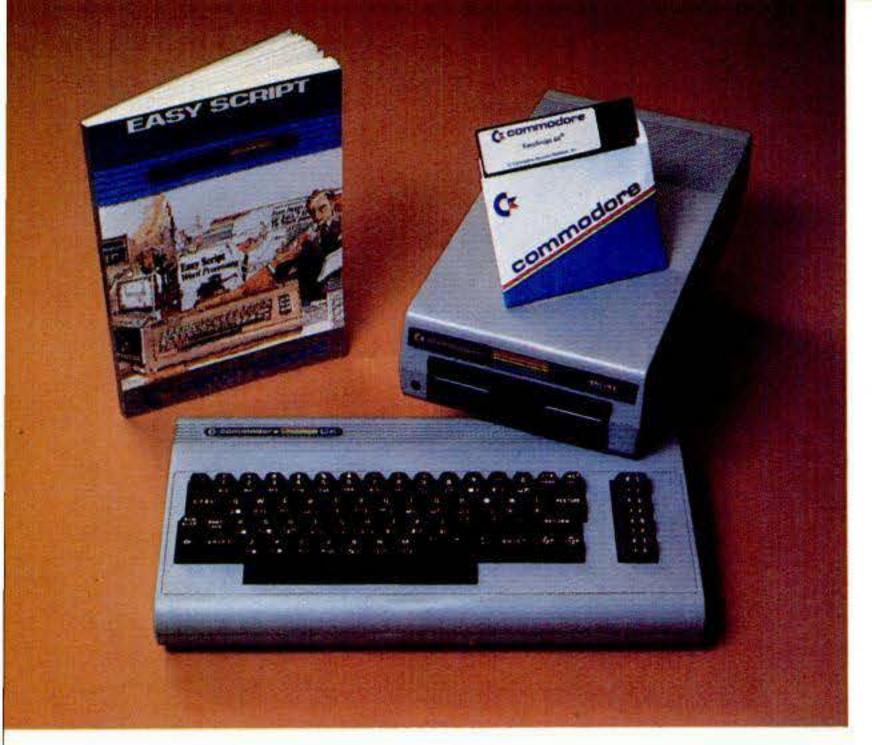


ATARI 800XL

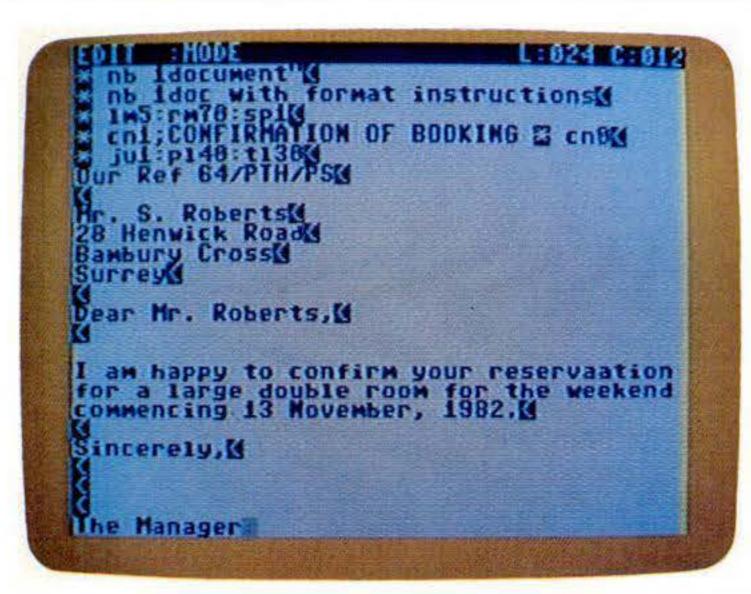
The AtariWriter system includes the software (in a pop-in cartridge), 800XL computer, disk drive or cassette recorder, and a letter-quality printer. The program begins the moment you turn on the computer. You see a list of choices: CREATE, DELETE, EDIT, PRINT, SAVE, LOAD A FILE, Or perform disk functions (directory and format). To begin word processing, you type "C" (to create a file). The next screen image you see contains a top row of letters (in reverse video) and numbers that represent the default format values. (I'll tell you more about them shortly.) Now you're ready to type. The keyboard has a good, firm feel. There are five specialfunction keys along the right side. They, along with the control key, are used with standard character keys for giving commands, such as moving blocks of text or previewing a document before printing. There are four cursor-control keys. Unfortunately, they perform three additional functions, depending on whether you press them alone, with "shift," or with the control key (for cursor control). It would be easier, it seems, if these keys in particular had only one function. Formatting is done by adding codes (by pressing the control key and a number) within the text. The default formats at the beginning of the file may be changed by merely editing the line. An "L10," for instance, can be erased to remove a left margin of 10 spaces, or you may edit it to any other number. New format codes may be entered anywhere you wish; the format of the text that follows the new code will then change when printed. The AtariWriter is a fast, fun-to-use, and extremely flexible word-processing program. It has capabilities not found on even elaborate business systems (or in our table). For example, you can specify multiple headings to automatically print individual section headings. You can chain files together for printing. And you can ask the printer to stop at strategic points in a text for you to fill in the blanks from the keyboard. It is, however, a more difficult program to learn because it lacks menus—you'll be forced to memorize a rather confusing combination of control and function keys.

COLECO ADAM

Adam comes as a package: keyboard, high-speed cassette for saving and retrieving data, software, and letter-quality printer (see text). When first switched on, Adam becomes an electronic typewriter—whatever you type on the keyboard appears directly on paper. Pressing the escape key starts the built-in word processor. The screen graphically displays a typewriter: A black bar represents the roller (a two-line typing area), and vertical and horizontal markers at the screen edges show the "paper" length and width. Six rectangular blocks at the bottom of the screen represent the six special-function keys on the keyboard. Messages within the blocks on the screen describe what each function key does. But as you work, the jobs—and messages—change to keep up with what you are presently doing (editing, printing, saving text, etc.). There are two typing modes: "standard" and "moving window." In the standard mode, only the two lines that appear on the black roller can be edited (you must use the cursor keys to shift the text through the roller to get to the line you want). Also, each displayed line can contain only 36 characters. When you tire of the black roller (and I did very quickly), you press a key. The graphics disappear, and you enter the moving-window mode. Here, the cursor freely moves around the screen, and the text moves horizontally so you can see an entire line. I found that Adam is a fine word processor for home use. It can, however, become a bit frustrating because it guides you through so many choices for each operation. (The functions of the function keys change so often that it's difficult to remember the sequences for faster use. And the more advanced window mode doesn't change any of the command operations.) Adam's dedicated keys (see text), however, help it get better marks in our tests. Documents can be saved or retrieved quickly. In fact, Adam proved to me that data cassettes can be an economical alternative to disks for home use. A 1,000-character document, complete with backup file and directory, took just about 45 seconds to save, as opposed to about 10 seconds on a disk.









COMMODORE 64

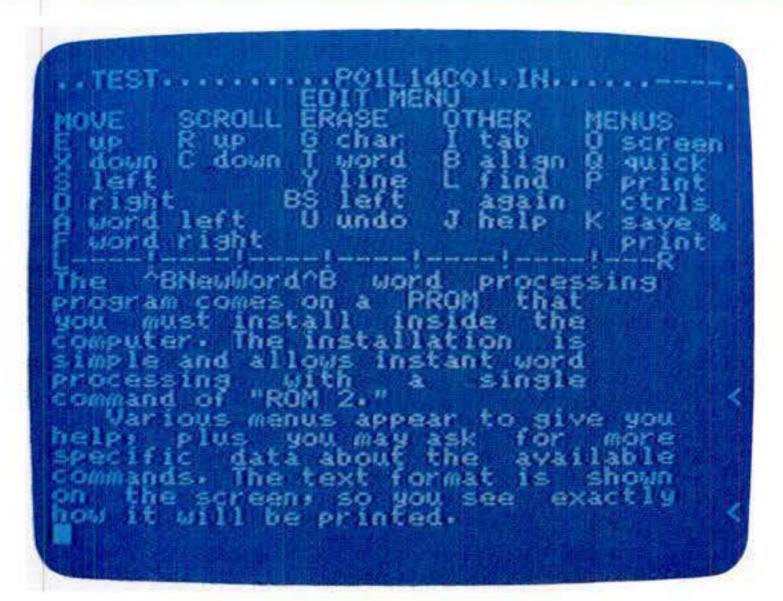
The Commodore 64 system consists of the computer-keyboard, a disk drive or audio-cassette recorder, and Commodore's Easy Script wordprocessing software. When Commodore 64 is first switched on, it enters BASIC—and simply waits for your commands. To start Easy Script, you type "load "0:*", 8,1." That's not exactly friendly, but it works. The disk spins, and you soon see a preliminary list of parameters specifying the number of characters per line, use of disk or cassette-tape files, and the type of printer. You can change any of these or leave them as is by pressing "return" at each line. Now a new screen image appears: It's empty except for a STATUS line at the top. The right side of the line shows the line and column number at which the cursor is located. (An Easy Script command allows you to instantly position the cursor at a particular line number.) The left side of the line shows the mode of Easy Script. There are three: EDIT (for normal text editing), COMMAND (for special instructions such as printing), and DISK or TAPE (for file operations, such as viewing the directory or deleting.) The mode of operation, as well as commands you give, is set by pressing one of the four function keys on the right of the keyboard followed by other characters. The program begins in the edit mode—you may begin typing immediately. The keyboard has good response; the function keys are out of the way but convenient. Controlling the cursor, however, can be frustrating. There are only two keys for the cursor: One key pressed by itself moves the cursor to the right; pressed with the shift key, the cursor moves to the left. The other key moves the cursor down, and up when pressed with "shift." I was constantly going in the wrong direction. Four separate keys would be a welcome addition. Easy Script is fast and one of the most powerful and flexible word-processing programs I've used. But "easy" it's not. All formatting is done by entering twoletter (or more) codes. And because there are no specially marked keys or menus to help, you must memorize them all. Even the manual doesn't list them all in one place; you must refer to the table of contents.

IBM PCjr

The IBM PCjr is a three-part system: keyboard, main unit with disk drive, and the HomeWord word-processing software. To start HomeWord, you put its disk in the drive and turn on the computer. In a few seconds, HomeWord begins. Icons (pictures) make HomeWord easy to use for the novice. The bottom of the screen displays icons of a printer, pages of text, and a filing cabinet. There is also an empty block—an icon of a sheet of paper—in the right corner. It gradually fills (with unreadable characters) to show the relative position of the text you see on the screen with the final text that will be printed. As you type, up to 40 characters per line are shown on the top of the display. (You can change it to 80, but the characters will be hard to read on the monitor.) Four cursor-control keys allow you to move freely throughout the document. The keyboard is unique: It can be plugged directly into the computer as usual, or, with the addition of four batteries, it becomes wireless —the keys you press signal the computer remotely, with infrared light. The keys are not meant for touch-typing, however (see text). The icons are well done: They're simple to understand, and you merely move the cursor over one to select a function. (Move it to the picture of a printer, for instance, to print a document.) And the icons change to carefully and slowly guide a novice through an operation. But best of all: Once you become an expert, you don't need them. They can be switched off, allowing the entire screen to be used to display up to 25 lines of text. All the functions they provide can be done by pressing special key combinations for much faster operation. (That's why there are two columns—novice and expert—for IBM PCjr in the table.) Special printing commands, such as justify, underline, or center the next lines of text, appear as English words on their own line in the document. That makes the format simple to interpret. The PCjr is a good word processor for the home. Its two different modes of use-icons for the novice, function keys for the expert—make it useful for the whole family.







The TRS-30 Color Computer can be used for home, personal, or educational pumposes. Travel into outer space with Project Hebula or challenge the computer in a game of Chess. The Personal Finance program util help you set up a budget and you il find Investment Analysis extremely useful in wanaging your stook pontfolio. Tingo Math teaches children Mem=01005 Line=032 001-032

MEMOTECH MTX512

The Memotech MTX512 system consists of a keyboard-computer, dotmatrix printer (see text), and NewWord word-processing software. NewWord comes on a circuit board that installs inside the keyboard; it uses an audio cassette to save or retrieve documents. (A disk-based version was not available for our tests.) NewWord is instantly available for use from the built-in BASIC program by merely typing "ROM 2" after you turn on the computer. It begins with a simple list of one-key commands for creating a new document, editing an old one, or returning to BASIC. There is also a help selection: Any time you press the line-feed key, the screen displays help messages to guide you along. (The messages change to keep up with what you're doing.) NewWord looks and acts like a smaller version of WordStar. There are menus for editing, on-screen formatting (what you see on the screen is how the document will appear on paper), and print formatting (underline, boldface, and pause). There's also a "quick" menu to move the cursor instantly from one end of the document to the other or to find a word or phrase. Most commands require only the control key plus two standard keys, accounting for the Memotech MTX512's speed in our tests. The first key selects the menu, such as "O" for on-screen; the second key selects the item, such as "C" for centering a line. NewWord also accepts some instant commands when you use the function keys on the keyboard—that's the reason for the additional (expert) column in the table. All menus are not shown immediately. In fact, if you know what keys to press for a command—and you type fast—they won't be displayed at all, saving you additional time. But when you wait more than a few seconds before completing a command, NewWord assumes you need help, and the menus appear. The Memotech system is a powerful word processor. It doesn't have all the commands of its WordStar cousin. (One major problem is the lack of block operations; they are included in the disk version.) But MTX512's built-in refinements, such as one-key operation, make it easy and quick to use.

RADIO SHACK COLOR COMPUTER 2

The Radio Shack TRS-80 Color Computer 2 is a keyboard-computer that uses an external disk drive and the Scripsit word-processing program. Turn it on, and the computer enters its built-in BASIC program. To enter Scripsit, you type "run DOS." The disk spins, and in a moment the program begins with a list of primary selections to clear the memory; edit, print, save, or retrieve files; change on-screen and printing parameters; or return to BASIC. When you select the edit-text option, the screen switches to a checkerboard pattern of rectangles that represent each typing position. As you type, each rectangle is replaced by a character. Displayed lines are 32 characters long, but the screen will shift (horizontal scrolling) to allow entries of up to 132 characters per line. A status line at the bottom of the screen displays the present character-per-line setting, cursor position, and remaining memory. The amount of memory in the TRS-80 Color Computer 2 is a severe restriction. Under normal conditions, the 16K model can hold only about 1,400 characters (less than two pages of text). To allow you to work with longer documents, the computer has a few tricks. One is a command to specify upper-case characters only. The graphics program required to display lower-case characters on the screen is then eliminated from memory, allowing it to hold another 7,000 characters. In this mode, upper- and lower-case characters are accepted and will be printed, but only upper-case characters are shown on the screen. The second trick is called "print spooling." Instead of creating one long file, you make a few smaller ones and save them on the disk. Then, when it's time to print, you specify the names of all the files. They are spooled—sent to the printer one at a time—until all are printed as one long document. And you can continue editing other files while this is being done. The computer actually does two jobs at once. Another cure: Choose the 32K-version Color Computer 2 (\$260), and use the lower-case mode. The screen will be easy to read, and documents may be over 17,000 characters long—more than enough for work at home.

PS report card for word processors

PS report co	are	: 11	101	N	10	ra	P	ro	CE	>5	50	rs						
	As	ple	At	ari	Co	leco	Co	mm.	NO. 1990	BM Wice		BM pert	1,3000	mo. vice	1 - 7	mo. pert	MA-0009-83	idio ack
	100000000000000000000000000000000000000	TOTAL COLUMN	100000	20 34.53	Pts.	Steps	Pts.		1003230	May 27 C (2027)			*KH900	10000	200,000	E. C. C. C. C.	D-1500 P	Sec. 11.
Screen editing Cursor moves by:			*	2				3111				1.0				i i		
Letter (10)	10	1	10	1	10	1	10	1	10 6	1	10	1	10 6	1	10	1	10	1
Word (6) Line (10)	6 10	i	10	1	10	1	10	i	-	-	-		10	1	6 10	1	10	1
Paragraph (2) Screen (8)	8	7	8	1	8	7	8	2	8	7	8	-	8	7	8	1	2	
Block (4)	4	i	-	9	Ě		4	4	_		8	<u> </u>	4	1	4	i		
Page (4) End/begin (8)	8	1	8	1	8	ī	8	4	8	1	8	1	8	2	8	2	8	1
Delete by: Letter (10)	10		10	1	10	1	10	,	10		10	1	10	1	10	,	10	1
Word (8)	-	=	-	1	_	-	-	-	-	_	-	<u></u>	8	i	8	i	8	i
Line (4) Paragraph (2)	1	2	4	1	Ξ	_	2	4	I	Ξ		_	4		4	1		
Undo (8) Block:		-	8	1	8	1	-	-	8	3	8	3	8	1	8	1		
Move (10)	10	7	10	6	10	8	10		10	10	10	7	-	_	_	_	10	6
Copy (10) Delete (10)	10 10	7	10 10	6	10 10	8	10 10	8 5	10 10	12 9	10 10	7 5	Ξ		_	_	10 10	6
Print (2)			=	-	2	4	-	-			-	-	-	-	-	-		
By column (4) Search:			•	0			-		1377 182		1	1 3				_		
Find (10) Find next (8)	10		10	5	10 8	3		8	10	9	10	5	10 8	5	10	4	10 8	-5 1
Wild card (2)			Ľ	-		_	-		-		-	-	F	-	_	-		
Search & replace: Single (10)	10	10	10	9	10	6	4	3	10	14	10	9	10	8	10	6	10	7
Global (10)	10	9	10	10	10		10	9	10	13	10	8	10	9	10	7	10	7
Screen & print format Up/low. case (8)	8		8		8		8		8		8		8		8		8	
Line number (4)	4	5	4	-		4	4		10	7	10	3	4	4	4	-	4	-
Page break (10) Word-wrap (6)	10		10 6	1	6		10	4	6	 	6	_	10 6	4	10	4	10 6	
Tab. change (8) Marg. set, 1./r. (8)	8	8	8	3	8	5	8	3	8	9	8	3	8	4	8	3	8	4
Justified, r. (1)					٠	-	1	4	1	10	1	3		-	-	-	1	8
Justified, I.&r. (6) Centering (6)	6	12 12	6	3	=	Ξ	6	10	6	1000000000	6	3	6	3	6	2	6	8
Hyphenation (6) Marg. set, top—bot. (8)	8	7	8	<u>-</u>	8	5	6	2	- 8	<u>-</u>	8	-6	8	-	8		6	4
Headings/foot (8)	8	7	8	3		-	8	6	8	CONTRACTOR AND ADDRESS.	\$100° A.L.L.	7	-	- -	-	-	8	6
Superscript (2) Subscript (2)	2 2	12 12	2 2	3	2 2	4			_	\overline{z}					=	=		
Line space set (10)	10	6	10	3	10	4	10	4	10	10	10	5	10	4	10	4	10	10
Print options Print pause (10)	10	ħ.	10		10		10	. 44.	10		10	E(#15# #10	10		10			
Boldface (6)	6	等。 92	=		-		6		6		6		6		6	-		
Underline (6) Second font (4)	6		4		6	11	6		6		6		6	7 (9) 7 - 8	6		6 4	in the
Second color (2) Mult. copies (6)	6		6	1.5			6			1000 1000 1000 1000	-		6		6		 6	
By page number (8)	8		8	16 .52	8		8	OJ. 8	8		8		8		8		8	
Saving document	10		10		10				10		10		10		10		10	
All (10) Block (6)	-		10		10 6		10 6		10		-	010	10		10		10	
Screen (2) Page (2)	2		_	7	2					7	_				_			
Directory (8)	8		8		8		8		8		8		-		-			
Backup document (6) Conveniences	0				6		-		6		6				_			
What you see (8)	-		-	. X	-		-				-		8		8	9		
Document preview (6) Def. set save (4)	4		6				6	20	6 4		6	100			_		4	
Menus (6) Icons (6)	6	X			6		4	Ta.	6		-		6		6	200		
Escape/abort (10)	10		10		10		10	. *	10		10		10		10		10	
Clear all (6) Key repeat (4)	6		6	2.7	6		6		6		6		6		6		6 4	
Document merge (8)	8		8	2.0	8		8		8		8		8		8		8	
Letter merge (6) No. features & steps	44	139	41	86	36	79	6 44	109	39	167	38	90	36	61	36	53	33	90
no, leatures e steps Usefulness score	318	1.50	306	28	276		313	100	303		36 297		36 276	5525	276	12.5	33 255	89
Speed (step/no. features)	TOTAL STREET	40.50	2.1		2.2	S00 800	2.5	3.0	4.3	4,350	2.4		1.7		1.5		2.7	F-12 /2 /2
Total	386	200	385		354		388		360		373	7.0	359		361		328	N. W. 1525
Personal evaluation			31.0			C 7	. 8		\$ 1 2 2	311.32 343					^			
Keyboard Display	A 200	el.* cel.	N. 18	.** cel.	F	G. air	■ Y**	ood	. Y	4 1 1 2 2 3	air cel.	11.3			G. G.		100	bod
Ease of learning Ease of use	10000000	cel. G.	Contract (1987)	iir G.	E-10.15.11	G. ood	1 2	air ood	3 (A) 3 (A) 5 (A) 6 (A)	275.52	cel. G.	# 12			od G.		Fa	air air
Documentation	100000	cel.	NO. 55 S. S. S.	oir	1000000	100		air			G.	3			od od	0.000	80,000,000	ood

*Excellent **very good

in a similar survey done by *Dial*, a magazine for public TV, it's the main task for 76 percent of home-computer owners.

That makes word processing an important consideration when you choose a home computer. But each computer is different, and each of those selected for this article accepts only its own word-processing program. That makes each word processor—the computer hardware combined with its word-processing program—totally different from all others. Word processors vary in features, speed, ease of operation, and, of course, price. How much different are they? Which one is best? Which features are most important when you choose?

To find out how they compare in their word-processing roles, PS assembled seven top home computers. Six are well-known models: Apple IIc, Atari 800XL, Coleco Adam, Commodore 64, IBM PCjr, and Radio Shack TRS-80 Color Computer 2. The seventh, Memotech MTX512, is a new European unit just now available in the U.S. Each of the seven was equipped with the software recommended by the manufacturer and, where possible, a disk drive to save or retrieve documents.

The overall winner in features and speed was the Commodore 64, with a score of 388 in our tests. (I'll tell you how they were scored shortly.) But it was hardly a land-slide victory. The runners-up were close indeed: Apple came in with a score of 386; Atari, 385; IBM, 373 in expert mode and 360 in novice (see caption with PCjr photo for explanation of modes); Memotech, 361 in expert mode and 359 in novice; Coleco, 354; and Radio Shack, 328.

And there were other results. The easiest to learn was the IBM. The fastest to use was the Memotech. And the one with the most-useful features was the Apple. The table at left shows the numbers by which the scores were derived. But as you'll see, the word-processing scores represent only part of a system's value. Each computer has special features and qualities that set it apart from the others. Their importance will largely depend on you—and how you intend to use the system. (Specific features are discussed in the captions that accompany the photos of each system.) By studying all the information you should be able to pick the machine that comes closest to meeting your needs. Here's how the tests were done.

The tests

All word processors have common goals: to create a document, edit or change it, print it on paper, and save it for future use. To do these tasks, each program contains a variety of commands. The number of commands and their complexity differ from one system to another. To compare the differences, the table lists 38 standard editing features, 13 possible features for printing and saving, and 10 convenience features. The latter are not needed to actually do word processing, but they make work easier.

In the table, each computer gains points in its first column according to the number and type of command features it has. Each command feature, according to its importance, is assigned a point value (a number from 1 to 10). The more important the feature, the more points it's worth. For instance, some features, such as deleting characters or moving entire blocks of text, are considered essential and are worth 10 points. Others, such as adding subscripts to the text, are not as important for home use and rate two points. The number of points each computer garners is its raw score, an indication of its useful features.

The second consideration is the complexity of commands—how fast can the word processor be used? To measure that, the minimum number of steps required to follow each command was tallied for each computer and entered in the second column. Each single key or key combination (such

INTRODUCING A SPEAKER PHONE SPECIALLY DESIGNED FOR YOUR HOME.

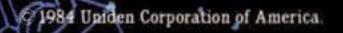
At last, General Electric gives you a very good reason to replace your main phone. With the GE Speakerphone, you can carry on your household chores while you carry on a phone conversation.

Simply press the Speaker button and you can talk from virtually anywhere in the room, no matter which direction you're facing. The sound transmission is so exceptional the whole family can talk at once, or you can use the separate handset for a private conversation without using the speaker. The Speakerphone will even remember 3 emergency numbers and 9 other numbers you call most often.

All with the assurance of GE quality. Its rugged construction has been rigorously tested. Its high-grade components assure years of reliable performance. And it's all backed up by a full two-year warranty and the GE Answer Center,™ there to help 24 hours a day. (800) 626-2000.

The new GE MAINFONE™ SERIES. The quality rings true.





PREPARE TO RECEIVE VISITORS FROM SPACE

TV VISITORS FROM SATELLITES

Welcome to a range of television programming you've never experienced before—signals from the satellites, captured with perfect clarity by Uniden, a recognized leader in electronic communication. And all for a low initial investment, about the same cost as a good projection TV set.

THEY'RE HERE!

Today, many television signals are beamed down from Geo-stationary satellites. Uniden is making these signals more and more available to private homes with a simple yet highly sophisticated system of components. Your home becomes a private earth station, able to receive over 100 channels day or night. And since October of 1979, it is authorized by the Federal Communications Commission. You'll watch it all: unlimited first-run movies,

all kinds of sports—football, golf, basketball, tennis—educational TV, the Performing Arts and more.

WHY UNIDEN* BEATS THE SYSTEM

Because we are a complete system-





compatible, professional, state-of-theart components designed to fit together and work together as one finely-tuned, highly-advanced system. From the environmentally attractive dish to the advanced receiver, Uniden offers efficiency and simplicity that is compatible with your existing home entertainment center, from TV to VCR to stereo. And the entire Uniden system is FCC approved and easy to install.

LET THE INVASION BEGIN!

So prepare to receive visitors from space. See your nearest Uniden Dealer. And get ready for an outer space invasion like you've never seen before.

SATELLITE TECHNOLOGY

Uniden Satellite TV Systems

7 top home computers

The computers: how they compare

						ooard (eys)		Out	tput	Tex displ		The Company of the Co	rage tem	PH 000,419	rinte incl.	\$155A000X.90	Software (incl., avail., or price)			rice)				
Brand	Model	Price (\$)	RAM (K)	Standard	Programmable	Numeric	Word processing	RF	Video	Screen (cols. × lines)	Max. col. (hor. scroll)	Type (disk/cass.)	Price (\$)	Туре	Speed (cps)	Max. cols.	Word processing	Mail merge	Spell check	BASIC	Spread sheet	Data base	Games	Comments
Apple	llc	1,295	123	57	-	4	1	1	1	37×20	-	D	Incl.		-	-	250*	-		1	*		-	*Part of AppleWorks program
Atari	800XL	799	64	56	5		1	V	1	35×21		D	350	LQ	10	80	1		50	4	100	100	Α	Prices scheduled to drop
Coleco	Adam	750	80	54	6	5	10	V	1	36 x 20	80	С	Incl.	LQ	10	80	1	25*		1	50		Α	*Part of same program
Commodore	64	219	64	57	4	2	3	1	1	40×24	80	D	250				55*	*	22	1	50	50	Α	*Part of same program
IBM	PCjr	999	123	53	2	4	3	*	1	40/80 x25		D	Incl.		1		75	_	60	65	250	149	A	*Modulator required (\$30)
Memotech	MTX512	999	64	59	8	12	-1	1	1	40×14	80	С	-	CQ	96	80	1	*		1		*	Α	*Included in \$1,995 disk system
Radio Shack	Color Computer 2	160	16*	49	-	4		4	-	32 x 15	132	D	400				50.			1			Α	*32K model available (see text)

as "control" and "S") is counted as one step. (This differs from a "keystroke," which counts the control and S keys as two, but it is more realistic because a typist accustomed to a two-key combination can work as fast as someone removing his fingers from the keyboard to use a dedicated key.)

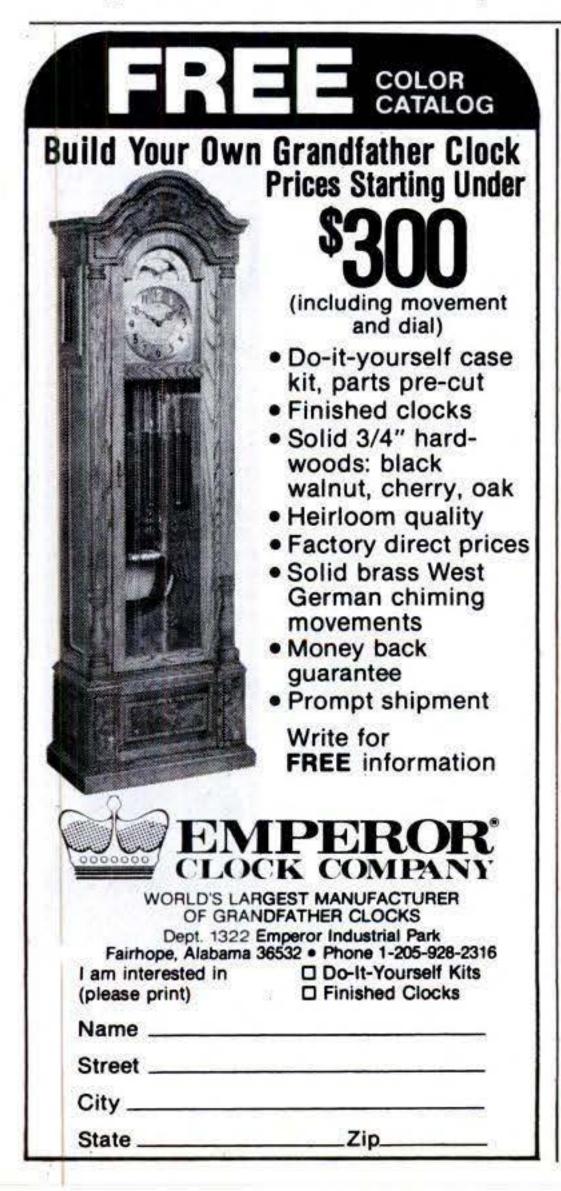
In some cases, such as in the Centering command, an additional step was added to allow for placing the cursor in the correct position. When more commands were required to turn off a function, they were also added. For example, to center a line of text, one step for cursor movement was added to the number of steps required to give the Centering command. If only that line was centered, the counting was complete. But with some word processors, the centering

continues on subsequent lines until a CENTER OFF command is given. On these, the additional commands needed to stop centering were added. The number of steps for saving or printing a document are not included because this is usually done only once or twice during each session.

To determine speed, the total number of all steps for each word processor was divided by the total number of commands the program contains. The result is an average number of steps required for a command. The lower the number, the fewer the steps and the faster the program is to use.

With a winner in usefulness and another in speed, the final step was to decide which system excelled (or traded

Continued



Within 30 Days — <u>or Less</u> You Can Have Your Own Business...

...And Pocket More Money In A Day
Than Most People Earn In A Week!
How? Easy. It's Not Hard At All When You Own A
CASI Computer Portrait System

A sure winner that combines 3 of today's hottest trends ... video, computers and instant pictures ... plus the know-how and guarantees of Texas Instruments, Panasonic and CASI. An all cash business. Customers come to you. No selling. No stress.



It's not a franchise. All the money and the profits are 100% yours. Tailor-made for families, individuals or absentee owners. Part-time, full-time or weekends. There's no need to leave your present job. With the CASI System you take someone's picture with a T.V. camera and instantly print it with a computer. It's so push-button simple, a child can run it. But the profits aren't kid stuff. The CASI is portable, sets up in 30 minutes or less, anytime, anywhere. The world is your territory. There are thousands of locations waiting to be filled . . . plus tremendous mail order application.

Call Today Toll Free 1-800-221-7660 or Call Collect (212) 929-8355 Ext. K-94

CASI[™] Computer Amusement Systems, Inc. 95 Morton St. N.Y., N.Y. 10014

lf	you	ı're	se	rious
				ating
mo	ney	in	your	own
fun	bus	ines	8	. ask
for	the	fac	ts.	You'll
rec	eive	pr	oof,	pic-
tur	08,	ansv	vers,	and
tes	timo	nials	. Qu	iite a
pac	kag	e. A	nd it	's all
free	D 10			

		, N.Y. 10014 [nave my own busin	Dept. K-94 less in 30 days or less.
Name			
Address			
City	 State _		Zip
Tel. Home (mbers for add	50 C C C C C C C C C C C C C C C C C C C)

7 top home computers

off, depending on how you look at it) in both. To determine an overall score, speed was evaluated on a 100-point system and added to the usefulness score. If a system averaged 2.2 steps per command, for instance, it was given a 78 $(100-[2.2\times10])$, which was then added to the system's raw, or usefulness, score.

The results are numbers by which you can compare one system with another. But don't run to the store yet. There are other considerations. First, you may have specific requirements for a word processor, such as printing in second color, and that could mean that some point values are not accurate for your purposes. For that reason, the values assigned are shown in parentheses in the table: Change them to reflect your needs, and recalculate the numbers.

Second, and most important, the numbers are based on the word-processing-program capabilities only, and the results are extremely close. That makes judging the hardware —the computer system—a subjective evaluation on your part. Here's some help.

Processing words is the computer's job; entering and using them is yours. To type words into the system, naturally, you use the keyboard. The keyboard's "feel" becomes important to your typing speed and error rate. The Apple keys, for instance, are excellent. They have a short excursion (top-to-bottom movement), and you feel a definite click (tactile response) in your fingertips when they are pressed; there is no doubt you have entered a character. The IBM PCjr is at the other extreme: Its button-type keys are difficult to press and have no tactile response, so you must look at the screen to be sure of an entry. (The new standard keyboard for the PCjr was not available for our tests. See "Bits & Bytes," this issue.)

Key placement is another important factor. Although all of the systems use the conventional QWERTY layout for standard keys, some add word-processing "enhancements." The Coleco Adam, for instance, is excellent in this respect. It has separate cursor-control keys to move the cursor around the text, numbered function keys for special operations (you're told which one to push by on-screen displays), and dedicated keys for such things as moving, deleting, storing, and printing text. My vote for the most frustrating keyboard design? Memotech, and for one reason: Its "return" key is small and located just below the large "line-feed" key. Unfortunately, pressing the "line-feed" key signals the word processor that you'd like help. (It displays help messages that you must manually clear.) As you might guess, I got help—like it or not—every time I tried to end a line.

Entering information is one thing; getting it out is another. It's done in two ways: on-screen as you work and on a printer when you're through. First, be prepared for sticker shock: Except for the Apple, you'll need a color TV or monitor, such as the \$350 Sears model 4084 used in the tests. Although a black-and-white set will work, the word processors normally use colors to help you distinguish between the background, text, and special text attributes (centering, justification, underlining, etc.). On a black-andwhite set, the colors blend to shades of gray, often making the display difficult to decipher. (Most systems have commands to change the colors, which can be used to somewhat improve a black-and-white image.)

The Apple works in monochrome only. But forget your [Continued on page 134]

MANUFACTURERS' ADDRESSES

Apple Computer, Inc., 20525 Mariani Ave., Cupertino CA 95014; Atari, Inc., 1265 Borregas Ave., Sunnyvale CA 94086; Coleco Industries Inc., 200 Fifth Ave., Rm. 1234, New York NY 10010; Commodore Business Machines, Inc., 1200 Wilson Dr., Westchester PA 19380; IBM, Boca Raton FL 33432; Memotech Corp., 99 Cabot St., Needham MA 02194; Tandy Corp. (Radio Shack), 300 One Tandy Center, Fort Worth TX 76102.

The Top 6 in our Hit Parade of Products

A Video Processor That's **Five Units In One**

One of the most versatile video processors on the market today. Can be used as a stabilizer (video guard remover), image enhancer, video to RF converter, video fader for professional fade in and fade out scenes and a dual output distribution amplifier.

#V-1880

Shipping Charge \$4.50

\$135.00



Till William

Video Entertainment System

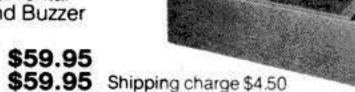
The BP V-4804 is a switcher that can accept six inputs and direct them to three outputs. By utilizing a switch similar to the one used on home VCR's we avoid signal loss incurred by using splitters. Eliminates the chore of connecting and disconnecting cables in the back of your TV. You can record a premium channel while viewing a regular channel. Push button control. \$49.95

#V-4804 Shipping charge \$4.50

Reduce Wear and Tear of VCR Heads

Protect your valuable VCR heads. Ideal for retail rental stores. Features a LED "power on" indicator and Buzzer sounds when rewinding process is complete.

#V-7777 BP VHS Tape Rewinder **#V-7778** BP Beta Tape Rewinder \$59.95





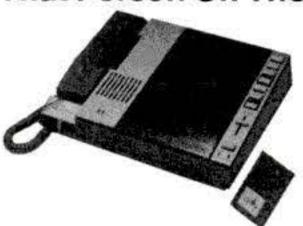
An Audio Enhancer For Your TV. Makes Sound Come Alive.

Connects to any TV and Stereo Amplifier for simulated stereo sound. Makes taping TV Audio simple, TV can be located any distance from stereo.

#V-2250 Shipping Charge \$2.50

\$19.95

Telephone/Answering System For That Person On The Go.



People on the go.. working, playing, vacationing...make owning a Cobra Telephone Answering system with Remote Key and Built-in Telephone a must! Installs in seconds. Mute button and redial feature.

#ANP-3770 Shipping Charge \$4.50

\$149.95

A Best Friend In An Emergency

Cobra's S.O.S. 40 Channel Emergency 2-way Radio. Needs no installation. Simply plug into your cigarette lighter and you're ready to go. The S.O.S. features a built-in microphone, LED channel display, emergency channel 9 indicator and more. Shipping Charge \$3,50

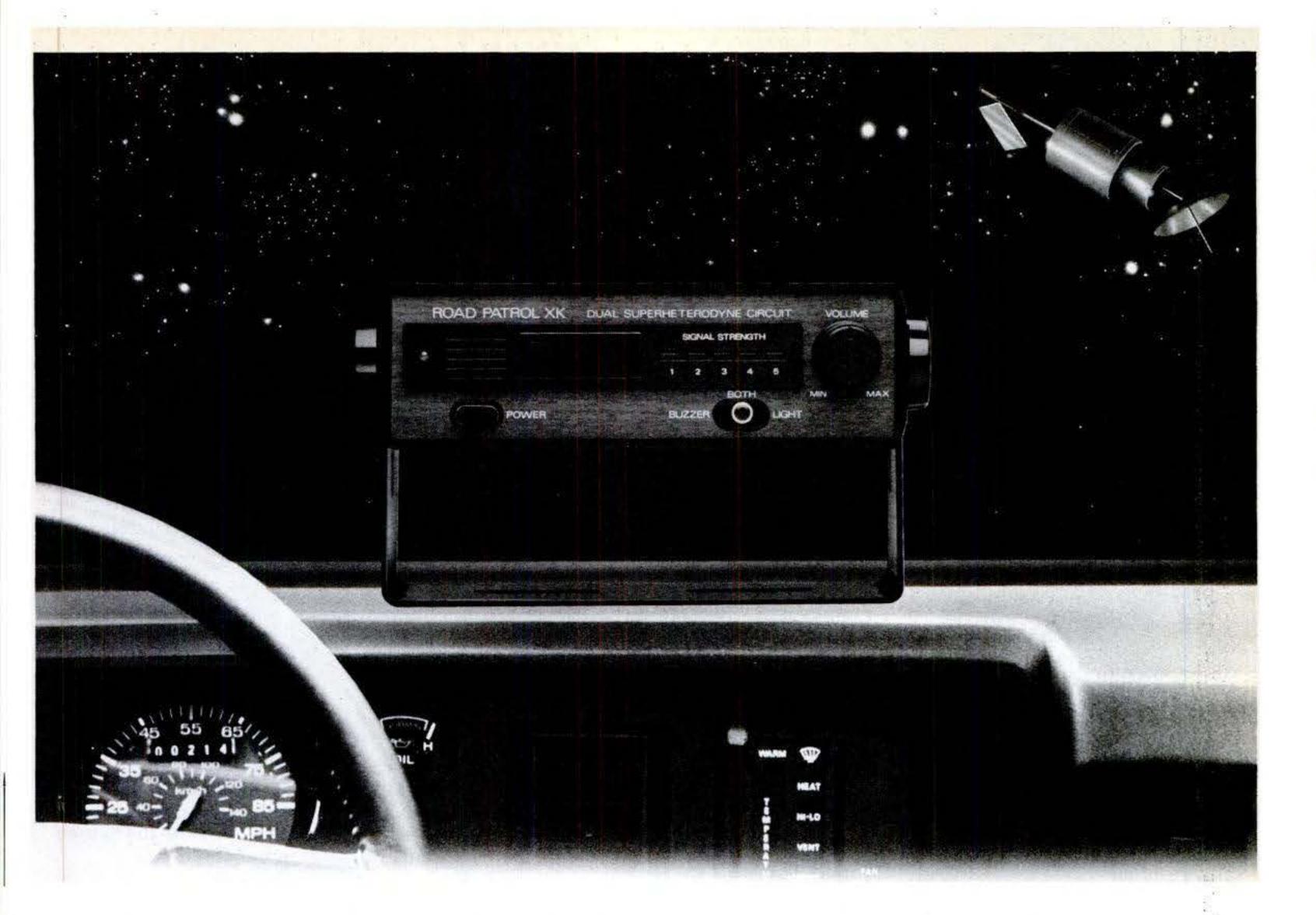
#39 LTD



■ Mastercard ■ VISA ■ C.O.D. ■ Money Order ■ Check C.O.D.'s add additional \$2.00 . N.Y.S. Res. add appropriate sales tax

Call Toll Free N.Y.S. Call 516-582-6626

639 Old Willets Path, Hauppauge, NY 11788



Radio Shack's Advanced Technology Radar Detector Brings Satellite Engineering Down to Earth

TECHNOLOGY

Radio

The Micronta Road Patrol® XK Superhet is the first of a whole new generation of radar detectors. With it you get incredible range, up to ten times the distance of conventional detectors. And it detects all types of speed radar from every direction. Around curves. Over hills. Even from behind you. It's by far the longest-reaching protection you can get on the road.

A unique GaAs (gallium arsenide) Schottky Barrier Diode front end makes it all possible. It's the same advanced technology that detects a satellite TV picture through over 25,000 miles of space. Just think of what it can do for you on earthbound roads

and highways.

The XK Superhet is extremely quiet until an authentic signal is received, thanks to the most advanced filter circuit on the market today. Interference caused by other radar detectors is virtually eliminated.

And Micronta's exclusive triple warning system lets you choose your own alert signals. Select the flashing caution light and/or Geiger-type audio alarm. Or you can monitor signal strength on the sequential LED bargraph display. Any way you choose, you'll always be alerted to speed radar before it's aware of you.

Come see it today. Our new radar detector with satellite technology is at a down-to-earth

price, too. Just \$199.95. And you can use your Radio Shack/
CitiLine credit card.

Radio Shaek

A DIVISION OF TANDY CORPORATION

GET YOUR FREE 1985 CATALOG Mail to Radio Shack, Dept. 85A-801, 300 One Tandy Center, Fort Worth, TX 76102

| Name ______ Apt. #______
| Address ______ Apt. #_____
| City _____ State ___ Zip_____

Price applies at participating Radio Shack stores and dealers.

Not sold where prohibited. Use may be regulated by state or local laws.

TECHNICAL BOOKS!

Discover hundreds of manuals, industrial handbooks, paperbacks, reprints, and privately published papers on unusual technical subjects ranging from melting metal to building windmills, and from tanning hides to video technology.

You'll see instantly why this is the most remarkable mailorder bookstore ever! You don't know what you've been missing! We probably have just the information you've been searching for for years!



RUN THREE PHASE MOTORS ON SINGLE PHASE POWER!

Run three phase motors on single phasel Learn three proven methods in use since turn-of-thecentury! Two are easily installed! No motor rewinding! Booklet Cat. no. 81 \$3.00

ALTERNATOR SECRETS!

Get thousands of watts from common auto alternatori Run tools, lights, AC-DC appliances, charge batteries, light arc welding, and more. Tips for building custom regulator! Great info! Low price. Booklet

Cat. no. 80

\$3.00

POWER INVERTER TECHNOLOGY

Convert low voltage DC into 110 AC! Learn how they work, why some won't, why some will! Covers smallest up to large industrial models. Sources of plans supplied. Rare info! Large booklet Cat. no. 83 \$5.00

OTHER GREAT BOOKS

Motor Test & Repair — Troubleshoot, rewind and repair small motors.

\$7.25 Cat. no. 303

Chemistry of Powder & Explosives — Detailed survey of explosive technology of early 1940's.

Cat. no. 515 Electroplating & Electroforming - Formulas and howto for plating precious metals, copper, nickel, and more.

Cat. no. 153 Radios That Work for Free - Design and build high-

performance crystal set radios. \$5.00 Cat. no. 314

Liquid Piston Stirling Engines - Hardcover industrial reference on specialized Stirling engines. \$24.95 Cat. no. 1146

Art & Craft of Handmade Paper - Make your own paper. Complete how-to by Vance Studley. \$9.95 Cat. no. 43

Complete Details in Catalog!

Other books! Tan hides, build sheet metal brake, troubleshoot hydraulic systems, spin metal, build kilns, clocks, telephone accessories, melt brass, and much, much more. Every book of highest quality. Guaranteed!

CHARCOAL FOUNDRY by Dave Gingery

Learn how to build a powerful little furnace from a 5 gal. pail, fire clay, a blower and other scrap materials. Use it to melt pot metal, aluminum, even brass, and pour custom castings!

You'll learn how to make the furnace, cure it, build a crucible, select, load and melt scrap metal. It's easy! Dave will show you how to make the molding flasks, tools, even the foundry sand you need to pour custom castings. When Build a you're finished you'll have a com- complete plete, versatile foundry and the knowledge to use it.

Imagine how much easier building machines and equipment Pour custom casting rather than have a **custom** part custom machined from solid stock. This foundry can save you castings! money! (And you can make your friends think you're a genius!)

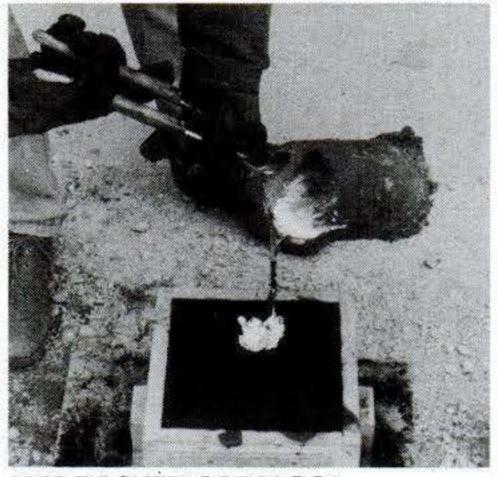
Order a copy of this hot-selling book, today. Jam-packed with practical, proven how-to! 51/2x81/2 paperback 80 pages Cat. no. 163

CHARCOAL FOUNDRY!

by Dave Gingery

foundry!

\$6.95 Metal!



JAM PACKED CATALOG!

HOW TO ORDER

Send your name and address, the Technical Books books you want along with check or money order. Or send your VISA or MASTERCARD numbers and your signature. Include 75° shipping for the first book and 25° for each additional book. (III. residents add 6% sales tax.) Satisfaction guaranteed. You may return any book within 7 days for refund. Free catalog sent with order. Or send \$1.00 for catalog without book order (\$3.00 foreign airmail).



PUBLICATIONS LINDSAY

Box 12-FF Bradley IL 60915-0012

Name	 	
Street		
2		

FACTORY DIRECT WHOLESALE **PRICES DO-IT-YOURSELF** and SAVE

YOU CAN BUY YOUR OWN COMPLETE HIGH QUALITY/NAME BRAND SATELLITE TV SYSTEM AT FACTORY DIRECT WHOLESALE PRICES YOU CAN INSTALL YOUR OWN SYSTEM WITH OUR FULLY ILLUSTRATED-EASY TO UNDERSTAND/EASY TO INSTALL "DO-IT-YOURSELF" MANUAL INCLUDING: SYSTEMS AVAILABLE + COST

- HOW TO INSTALL
- FROM START TO FINISH
- SHARING THE SYSTEM (We Take the Confusion Out of Owning A Satellite TV System)
- ► LEGALITY/SCRAMBLING ► PROGRAMMING/
- SELECTING A TV GUIDE
 - MUCH, MUCH, MORE

FOR YOUR DO-IT-YOURSELF MAN'S UAL AND SYSTEMS PRICING PLEASE SEND CHECK OR MONEY ORDER FOR \$12.95 TQ

INTERNATIONAL P.O. BOX 518 GLIDE, OREGON 97443

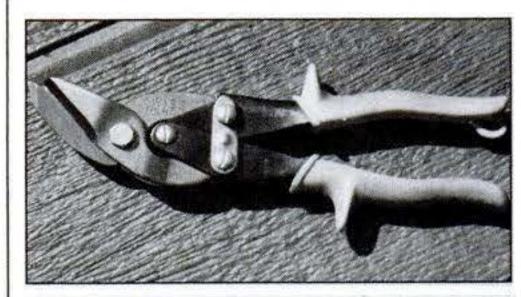
Understand Satellites & Know What Works -- Before Your Purchase

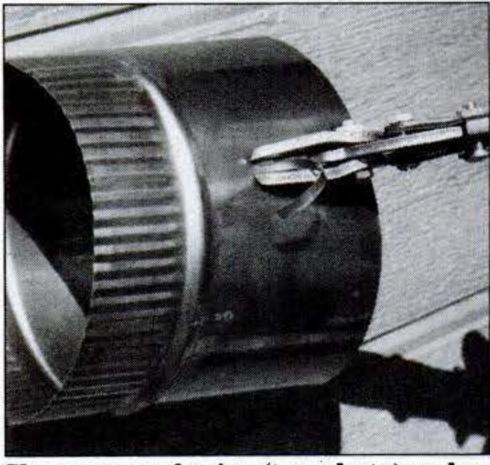
You can own this two-passenger HEALD SUPER TRYKE Tough, American-Made, Go Anywhere

for only \$85995 Shown with optional acceptance when you build it yourself from a KIT By HEALD. Also available assembled through dealers. For FREE brochure with complete details, contact:

Carl Heald, Inc. Benton Harbor, MI 49022-1148 1-800/253-1030 (in Michigan 616-849-3400)

How to use curved-blade snips





Sharp nose of snips (top photo) makes it simple to begin a cut. Note the 1/8-inch curl of metal in cut (bottom).

With wood-stove installations, additions to homes where flashing is required, and various other do-it-yourself metalwork confronting homeowners these days, choosing the proper type of metal-cutting snips is difficult.

Recently I discovered a partial solution to this problem. I had to make five cuts in a stovepipe and then cut a center hole in a section of sheet metal covering the front of a fireplace. Friends had borrowed all but one of my cutters—a pair of Metalmaster M41R Wiss compound-action snips. Because of the blade curve, the tool looked as though it was best suited to cutting curves, but I found it to be easier to hold on a straight line than any snips I'd ever used.

The center blade on the tool brings the metal being cut against stationary exterior blades, shearing it cleanly. This action leaves a waste strip about 1/8 inch wide but eliminates the usual curls and kinks. Gentle right- and lefthand curves may also be cut, even in 20-gauge metal.

The M41R is faster and neater than any hacksaw, no matter how fine the blade, I found, and nearly as fast as standard compound snips. The parts that do the cutting are replaceable.

Suggested price is \$16.15, but the tools are often discounted—to as little as \$11 at a sheet-metal-supply house.—Charles R. Self

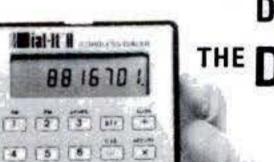
ALPHA X

The Ultimate Computerized Telephone



This impressive french import revolutionizes memory dialing. It will automatically dial 255 numbers - you simply type a name or initials (up to 8 letters) on the soft touch keyboard and let Alpha X do the dialing. (No memory codes to look up.) The 32 digit memory even stores area codes and MCI code with each number. Built in monitor speaker lets you hear your calls answered before you pick up handset. Features: Mute; Auto Redial; Key Lock for confidential numbers; Handset plugs into left or right of unit. Works on all phone lines, plugs into AC outlet and phone jack. One year warranty.

Alpha X \$549.00 plus \$7.50 p/h



7 8 9 = =

Dictograph

THE Dial-It II

World's Smallest Cordless Auto Dialer

This amazing new system is just 2-1/4"W x 3"H x 5/8"D. Simply hold the Dial It II firmly to the telephone receiver, press a two digit code and automatically dial up to a 32 digit number. Access local, long distance or rate reduced computer services. The Dial-It II converts traditional rotary dial telephones, that are on a Touch Tone system, to push button efficiency. The Dial-It II also provides you with 100 memory storage, automatic redial, LCD display, electronic lock, universal clock, wake up alarm, call timer, reminder timer and calculator. Great for road, home, office super gift idea! One year warranty.

Dictograph Dial-It II \$69.00 plus \$2.50 p/h or 2 units--\$129.00 plus \$3.50 p/h

Lumiscope Digitronic

Gives You
Accurate
Blood
Pressure
& Pulse
Readings
at a Super
Low Price!



Digitronic makes it easy to get virtually failsafe readings at home, office or while traveling. No stethoscope required with this compact unit. Simple push-button operation gives big locked in liquid crystal readout; Easy wrap cuff with velcro fastener; symbol key tells you to correct procedure errors. Comes complete with leatherette case and instruction booklet. One year warranty-9 volt battery not included.

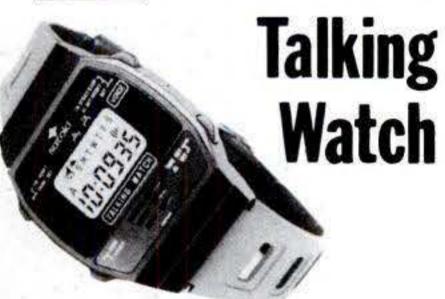
Digitronic 100-048 \$69.00 plus \$3.50 p/h **Bionaire 500**



Create a clean air zone in your home or office! Bionaire 500 is an air purifier, a negative ion generator, and an air freshener all in one! Its unique double filtration system traps particles deep within the filter and eliminates dust, dirt, pollen, smoke, molds and fungi - leaving air clean, invigorating and fragrant. Cleans average room (10' x 10' x 8') 3-1/2 times an hour; uses no more electricity than a 45 watt bulb; two speed fan control; size: 12-3/4"W x 5-3/4"H x 7-1/2"D; lightweight and portable just 4.4 lbs.; available in elegant wood-grain finish or gleaming high-tech aluminum finish. One year warranty. Terrific for allergy, asthma and hay fever sufferers!

Bionaire 500
BT500 Wood Grain Finish - \$129.00 plus \$6.50 p/h
BT500AA High-Tech Aluminum Finish
\$129.00 plus \$6.50 p/h

NEW! Soundsational



The first watch that speaks for itself! The Satoki Talking Watch tells you the time at the touch of a button. This Japanese import gives a digital display of the hour, minute, second, month, date and day. It features a 12 hour format with AM/PM indication; alarm with snooze feature; stopwatch with lap time counter; and hourly and half-hourly voice and chime alarm signal. Super gift idea for anyone--a real must for the visually impaired. 90 day warranty.

Satoki Talking Watch \$49.95 plus \$3.00 p/h

Deci-Mate 300D

Drives Insects
& Rodents
out of
your home
with
Ultrasonic
Sound



Say goodbye to household pests without toxic chemicals! Deci-Mate works by emitting powerful blasts of ultrasonic sound that sends pests in search of a new home. These high frequency sounds are inaudible to humans and common household pets. Just one 4-1/2" Deci-Mate cube protects 2,000 sq. ft. Plugs into any AC outlet and uses less electricity than a 7-watt night light. Great for home or office--one year warranty.

Deci-Mate 300D \$39.00 plus \$3.50 p/h or 2 units--\$69.00 plus \$4.50 p/h

To order, please state product name and quantity. Within USA, IL residents add 7% sales tax. Mail check, money order, Master Card or Visa number and expiration date to:

FOR MORE GREAT GIFT IDEAS WRITE:

LS&S GROUP, Inc. P.O. Box 673, Northbrook, IL 60062

Lights go On Automatically

of the Fingers!

 home security—the slightest sound turns lights on to scare off intruder.

 home safety—no more groping in the dark for the light switch.

 saves energy—turns lights off when room is empty...great for children.

Audiolite! The new way to turn your lights on and off without touching a switch. When the switch hears a sound, it turns on the lights and keeps them on as long as the sound persists. Actuating the switch starts a clock which works on a time control. Includes dimmer control and manual on/off positions. Installs in place of your light switch, and connects to the same 2 wires. Easily installed in place of your regular light switch. Requires a standard 2-hole face plate, the same used on ordinary electric outlets. One Audiolite controls up to 300 watts. Audiolite has solid-state microcomputer circuitry to ensure years of trouble-free service. One year warranty. Incandescent model only.

Audio Lite 1000 Switch \$32.00 plus \$2.50 p/h or 4 units--\$98.00 plus \$4.50 p/h

Lumiscope Deluxe Digitronic

Gives You A Printed Record of Blood Pressure & Pulse

S

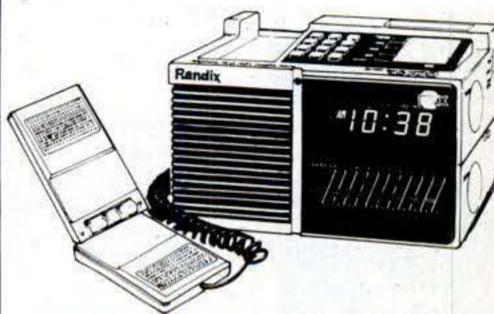


This amazing compact unit provides a tape readout of both systolic and diastolic pressures, pulse rate, date and time. Save the print out for later comparisons, or keep a record for your physician. No stethoscope required; easy push button operation; easy on cuff with velcro fastener; symbol key indicates errors; display holds readings for 5 minutes, then becomes a digital clock. Comes complete with carrying case and instruction booklet. One year warranty, 4AA batteries not included.

\$129.00 plus \$4.50 p/h

Randix CP700

The Little Phone with Giant Features



A compact answer to nightstand clutter - this new Randix has everything you need! It's five items in one -- an AM/FM clock radio, tape player, electronic alarm, compact folding phone and hands-free speakerphone. This compact 8-1/2"W x 5"H x 5"D unit wakes you with alarm, radio or tape...battery backup takes over if power fails. Phone features touch pulse dialing, (compatible with rotary and touch tone service), mute and last number redial. 90 day warranty. A super new gift idea!

Randix CP700 \$99.00 plus \$5.50 p/h

30 Day Money Back Guarantee

CALL: TOLL-FREE 1-800-421-5300 Ext. R-23



HANDS-FREE TELEPHONE HEADSET

ONLY \$39.95

Free your hands for more important things. Perfect gift for home, office, teenagers, etc. Fits most modular phones. 14 foot cord.

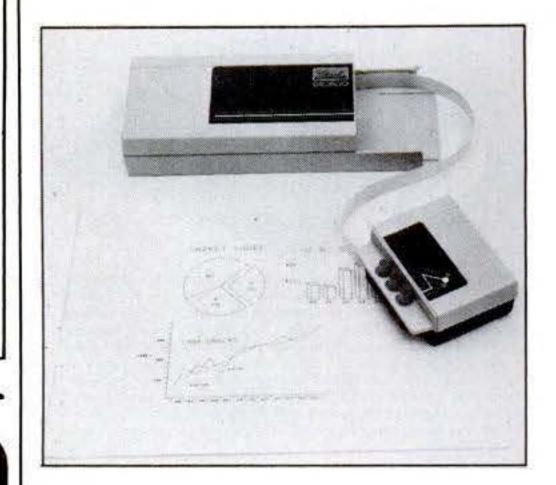
Send \$39.95 + \$2.00 Shipping (Calif. residents add 61/2% tax) to:

P&I SALES 18653 Ventura Blvd., Suite 131P Tarzana, CA 91356 (818) 708-1252

VISA, MC, AMEX accepted. Allow 4 weeks for delivery.



Robot plotter for low-cost graphics



You'd like a computer plotter for drawing charts, schematics, and other hardcopy graphics, but you balk at the prices? Here's a clever three-color robot plotter from Britain at about half the cost of a basic single-pen flatbed machine. The turtle-like robot (at right in photo above), barely four inches square, is driven from the control unit via a slim ribbon cable that allows full freedom of desk-top movement.

The Chessell GR 1500 plotter (Chessell Microproducts, Southdownview Rd., Worthing, W. Sussex BN14 8NL, England) plugs into any personal computer with an RS232C or RS423 standard serial interface. The control unit has built-in letter, character, and circle-drawing capabilities, and simple graphics such as drawings and shapes can be keyed in as X-Y coordinates as well.

As the robot scoots around on the sheet of paper, it automatically drops one of its three felt pens in exactly the spot dictated by the input color command. The weighted pens drop and retract as they receive signals from the control unit. Repeatable accuracy is within 0.2 millimeter (0.008 inch) with high resolution. Plotting speed of about two inches per second is a bit slower than on a flatbed, but time is saved by not having to change pens for each color.

The robot has only two moving parts -its drive wheels-giving it precise and reliable positioning, Chessell says. It also draws equally well in all directions without having to turn. This prevents any tangling of the umbilical cable, which would hinder free movement. When not in use, the robot nests into the control-unit case, forming a portable package weighing only 3.3 pounds. Price of the GR 1500 plotter in Britain is about \$400.—David-Scott

BEFORE YOU BUY

HEARING AIL

SPECIAL OFFER TO READERS OF POPULAR SCIENCE MAGAZINE





Made for

your ear & hearing loss High technology

CUSTOM IN-THE-EAR AIDS



NO POSTAGE NECESSARY

IF MAILED IN THE

UNITED STATES

Model 180-A

GET QUALITY HEARING AIDS AT AMAZINGLY LOW PRICES BECAUSE WE SELL DIRECT BY MAIL . YOU PAY NO DEALER MARK-UPS OR COMMISSIONS.

HUGE SAVINGS

Buy direct-Eliminate dealer markups and commissions.

30 DAY FREE TRIAL

We send you the Aid of your choice-FREE TRIAL-no obligation.

TIME PAYMENTS

Time payments arranged after you are satisfied with the Aid of your choice.

YEAR WARRANTY

One year warranty on all Hearing Aids from LLOYD'S.

NO SALESMAN WILL VISIT YOU

We promise no salesman will ever visit you.

LLOYD'S TRUST THE CUSTOMER PLAN

This plan has been a resounding success for over 20 years. We've sent thousands of Hearing Aids to customers in all 50 states. Over 250,000 Hearing Aids sold. Except for Custom In-The-Ear Aids, no down payment is required with approved credit. We have thousands of letters from satisfied customers . . . and from medical clinics, hospitals veterans organizations and institutions.

FOR FREE INFORMATION AND HEARING LOSS QUESTIONNAIRE, CALL

1/800/323-1212* TOLL FREE

*Illinois Residents please use coupon.

LLOYD HEARING AID CORP. . 128 Kishwaukee St. . P.O. Box 1645 Rockford, IL 61110 Dept. PS5 WE PROMISE Please send me FREE Literature and Low Prices NO SALESMAN on all types of Hearing Aids. WILL VISIT!

WE EVEN PAY THE POSTAGE . . . Just tape or paste this Postage-Paid label to the front of any envelope. No further postage or addressing is needed.

HICINE	 	

Dept. PS5

BUSINESS KEPLY LABEL

POSTAGE WILL BE PAID BY ADDRESSEE

FIRST CLASS PERMIT No. 1891, ROCKFORD, ILLINOIS

LLOYD Hearing Aid Corporation 128 Kishwaukee St. P.O. Box 1645 Rockford, IL 61110



Did you know you have a second mind? TAP THE AWESOME POWER OF YOUR SUBCONSCIOUS THROUGH SUBLIMINAL STIMULATION

You've read about the exciting success of subliminal techniques in Time, Omni, Psychology Today, Science Digest, the Wall Street Journal and more. Now, thanks to recent breakthroughs by leading psychologists, you can put these same innovative techniques to work in turning your life around.

Maybe you want to read faster, improve your memory, increase your income, lose weight, build your self-confidence. These are just a few of the accomplishments within your reach.

The subconscious is a mysterious thing. We're finding out more about it every year. It's not like your conscious mind. Instead it soaks up impressions. You'll be amazed how fast the "success-mechanism" within you makes big changes in your life. They are nothing short of incredible!

Subliminal Techniques Are the Problem Solvers for the 1980's and Beyond.

Subliminal stimulation is used today in countless ways. For example, to reduce shoplifting. Department stores nationwide are finding that a "hidden" message in the public-address music cuts pilferage substantially. This message repeats—over and over—such tested phrases as "I am honest; I don't steal."

Customers aren't even aware of it. Yet inventory statistics reveal a big decrease in shoplifting. In fact, in some cases by as much as 67 percent

Your Subconscious Is Your Ally. Let It Work Miracles for You As It is for Thousands Today.

Until recently, scientists were unable to harness the powers of the hidden mind. For years we knew it controls our destiny. But the question was: "How can we tap its strength?"

Through constant testing a breakthrough came. The credit goes to some of the top psychologists in this country. Their untiring efforts have enabled people of all ages, from all walks of life, to enjoy exciting self-improvement fast

Every Tape You Select Brings You Two Different Kinds of Stimulation.

On one side, subliminal stimulation. You hear waves breaking on the shoreline. But your subconscious hears more. There are subliminally embedded messages at work—literally hundreds. Chances are, you won't be able to hear them consciously. But your subconscious will. And, it will obey. Listen while you work, read, play, relax, watch TV, or even while jogging or driving your car. The sounds of the waves create a pleasant background while alone or with others.

While you go about your activities, you'll be fully awake and alert. Yet all the while your subconscious will be listening and heeding.

Subliminal stimulation is so new that you may not be familiar with it. If this is true, you're in store for a wonderful experience. You see, it's a completely natural process. A brief introduction on each tape lets you know the exact wording of the subliminal messages coming up. It's fun,

exciting and totally worry-free!

At Advanced Learning Systems we've earned the trust of forward-thinking people like you nationwide. Only after extensive research and testing do we market a new tape. This attention to quality keeps us in the forefront of the industry. We're harnessing many amazing breakthroughs—to make all people's lives better, including yours. Thanks to highly technical innovations, many things are possible today that weren't just a few years ago.

You'll get all the benefits of subliminal stimulation—and more. On the other side of each tape is an audible hypnotic session. You'll hear suggestions, affirmations, in a very real sense "orders to your subconscious." Yet all you do is relax. Put forth no effort whatsoever. You're in full control. Both sides provide you with an experience like you've never had before. And the results are sensational. In fact, these techniques are widely used by professional therapists and hospitals.

Each side inspires you and revitalizes you. So listen again and again. Very soon you'll see an exciting change in your life. All for the better! This is why more and more aware people people who want more out of life-are finding new happiness today. These ERSP Subliminal Tapes are the long-sought answer.

What Areas of Improvement Do You Need? These Tapes Will Surprise You with Dramatic Results.

By stimulating your subconscious, you'll feel better and look younger. You'll get more out of life—because you'll be programming your subconscious to bring out all your hidden abilities and resources. Instead of dragging from one day to the next, each dawn will be the start of a new experience, not just "another day."

You'll capture opportunities so much easier because your inner strength, your subconscious, will be working for you, not against you. You'll rid yourself of childhood-acquired hangups and misconceptions about yourself. In their place will be a truly new you—a you you'll like so very much more. You'll gain more happiness, more fulfillment, and a better life than ever before!

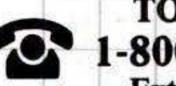
Order Today. Read about This Special Money-Saving Offer:

Each ERSP™ Subliminal Cassette Tape sells for \$14.95. But during this Special Introductory Offer to readers of this magazine, the price is only \$9.95. You save \$5.00 on each and every selection.

But here's still more good news. You get one FREE for every three you order! Just fill out the No-Risk Express Order Form and rush it back today, along with your check or money order. Or use your Visa or MasterCard. You're protected by our FULL MONEY-BACK GUARANTEE: We call it our "double-length" guarantee for it's good for 60 days, not 30. If you're not elated with the results the tapes bring, return them for a full, prompt refund-including the \$2 shipping and handling.

©1983 Advanced Learning Systems, Inc.

Prompt shipment guaranteed. Mail your order today! Credit card users, order



TOLL-FREE 1-800-227-3800

Extension 1146 ADVANCED LEARNING SYSTEMS, INC.

"DOUBLE LENGTH" 60-DAY **FULL MONEY-BACK GUARANTEE** plus Lifetime Warranty against Defects

Corporate Offices: 818-992-0880

27.00		를 보고 있다면 하는 사람들이 있다. [1] 전 사람들이 가득하는 하는 것이 되는 것이 되었다면 하는 것이다.
NO	-RIS	SK EXPRESS ORDER FORM
Che	ck y	our choices and mail today:
DAI	102	MEMORY IMPROVEMENT
Sec. 11 10 10 10 10 10 10 10 10 10 10 10 10	110000000000000000000000000000000000000	PINPOINT CONCENTRATION
		DYNAMIC SELF-CONFIDENCE:
	TO TOTAL	Overcoming Shyness
DAI	202	WEIGHT LOSS
DA1	106	UNLIMITED MENTAL POWER
DA1	101	READ FASTER
DA1	214	ENJOYING EXERCISE:
		Have Fun Getting in Shape
DAI	310	STRESS RELIEF
DAI	318	INCREASE PERSONAL POWER
DA1	316	SELF ESTEEM:
		Feel Good About Yourselfl
DAI	203	STOP SMOKING

□A1309 MAGNETIC PERSONALITY □A1105 BETTER STUDY AND EXAMS □A1507 PROSPERITY: Financial Success □A1304 DECISIVENESS: Stop Procrastinating!

□A1320 WINNING SELF-IMAGE □A1502 SUPER SALES POWER □A1509 STOP WASTING TIME □A1508 SUCCESS NOW! Get Ahead Fast

□A1211 HEALTHY EATING: Staying Off Junk Foods □A1317 SELF-ASSERTIVENESS

□A1402 IMPROVING RELATIONSHIPS □A1302 PROBLEM SOLVING: Creative Dreaming □A1411 MORE ENJOYMENT IN SEX

□A1401 ATTRACT LOVE/Make Contact □ A1206 RESTFUL SLEEP: Conquer Insomnia □A1306 FREE YOURSELF FROM WORRY □A1301 HFENERGY & ENTHUSIASM

□A1602 RUNNING: More Endurance, More Enjoyment □A1315 THINK POSITIVE □A9001 PANASONIC SLIMLINE

CASSETTE RECORDER \$39.95

Regular \$14.95 each.

No	W, 11	you nu	rry, only >	7.75 ea	icn.
4	E.	CHO	OSE ONE	FREE	FOR
FR	115	EVER	OSE ONE THREE	YOU	BUY
80	7		SUBTOTA		
V	Calif	fornia resider	nts add 61/2% sale	s tax	
PC	STAC	E & HAN	DUNG (Any si	ze order)	2.00

Outside USA—add \$ 1.00 per item (US Funds). □Cash □Check □MO TOTAL □VISA □ MasterCard (Exp. Date. Card Number NAME ADDRESS.

CITY, STATE, ZIP

ADVANCED LEARNING SYSTEMS, INC. 7236-D Owensmouth Ave., Dept. PS7 Canoga Park, CA 91303

Copyrighted material

"Say, Smokey—"

A clinic on cars by Smokey Yunick, America's most famous mechanic

Engine can't decide

I have a few problems with the V6 engine in my 1982 Pontiac Grand Prix. It stalls when I ease the throttle down, it surges at speeds between 40 and 50 mph, and it sometimes pings when I let up on the throttle or go uphill.

N. J. Ward, Mishawaka, Ind.

Your engine's computer and associated emissions, fuel, and ignition controls are out of adjustment. You can't fix it yourself; only a facility with diagnostic equipment and a technician thoroughly familiar with the system can balance it all out. The stalling, pinging, and surging are interrelated; the surge is probably caused by the torque converter.

Overactive idle

My Ford Bronco II with the 2.8-liter V6 engine has a decal specifying fast idle at 3,000 rpm. The engine sounds as though it's tearing its heart out. Should I slow down the idle, provided I can figure out all the hoses, sensors, and what-have-you?

Ed Sweeney, Bellerose, N.Y.

I'm afraid you'd better stay with the Ford manual. You cannot just go in there and back down the idle. The tiny man in there who works the throttle gets his dope from the computer, and it talks only to the oxygen sensor. So if you go away from the specs, you confuse them all and nothing works right.

Power swap

I'm dissatisfied with the borderline performance of the stock four-cylinder engine in my 1979 Chevrolet Luv four-wheel-drive pickup, especially on hills and at high altitudes. I'd like to replace the engine with a late-model Buick V6, but I need some help with the details such as clutch plates, engine mounts, etc. Can you help?

Timothy McGowan, Lund, Nev.

The Buick engine will go in there nicely. I've done it, and the result is a great little truck. It works best with an automatic transmission; the four-and five-speed manuals are a little small for a good-running Buick engine.

Write to John Thawley, Buick Motor Div., Windmill Place, 877 W. Fifth Ave., Flint, Mich. 48503, for the names and addresses of parts suppliers—he knows 'em all. This swap isn't cheap, but it's not that difficult if you use the right kits.

Grinding transmission

Since new, the automatic transmission in my 1983 Honda Accord has made an occasional grinding noise in park when the transmission is cold. I received a letter from Honda explaining that the problem is caused by the fluctuations of the hydraulic servo that engages reverse gear. Honda claims that this condition won't harm the transmission.

L. A. Liebig, Essex Junction, Vt.

I checked with Honda and got this reply: "In cold weather the movement of the servo valve is slightly restricted due to viscosity change of the ATF [automatic-transmission fluid]. In P and N modes this may result in some ratcheting as there is no hydraulic assist to move the servo valve from the reverse position to the drive position. Shifting the transmission to D3, D4, or 2 prior to shifting it into P or N from R will eliminate any ratcheting as the movement of the servo valve is now accelerated under hydraulic pressure."

Nonstop chirp

From the beginning there has been a rapid, oscillating chirp coming from the EGR air-switching valve on my 1983 Chevrolet Malibu with the 3.8-liter V6. I had the valve replaced, but the problem only got worse. I've been told that it's a chronic problem.

Billy A. Breed, Kent, Wash.

There is a replacement check valve, part number 22036195, that should stop the noise on the 3.8. Your Chevy dealer should have it.

Dirt in the tank

My 1983 Ford LTD wagon with the V6 engine has stalled twice; Ford has had to pick it up each time. The car starts OK but stalls soon after. When I attempt to restart the car, it shakes and backfires; black smoke comes out of the tailpipe, and the engine gives off steam and a strange odor. The Ford dealer said that there was dirt in the fuel line.

Merl Brown, Beachwood, N.J.

It sure does sound as though you have dirt in the fuel system. I suggest the fuel tank and carburetor be removed and cleaned. Look for contamination in the main, idle, and pump circuits.

Rough runner

My 1982 Chevrolet Camaro has the 2.5-liter four-cylinder engine with electronic fuel injection. After 20,000 miles it won't idle correctly, hot or cold. On start-up it acts as though it's not getting enough choke—although, of course, there is no choke. Also, it doesn't compensate at idle when the air conditioning kicks in. There are no trouble codes in the computer. What's wrong?

Kenneth T. Jones, Coalgate, Okla.

The engine's idle speed is controlled by an idle-air control valve that screws into the EFI unit. It controls the idle by increasing or decreasing the amount of air that bypasses the throttle blade in its closed position. Have the valve checked, and replace it if necessary; it's probably bound up. This, by the way, won't show a trouble code.

All locked up

After 25,000 miles of excellent service from my 1981 Cadillac Coupe de Ville diesel, it was like someone threw a switch. Now when the car has been sitting for about two hours, it acts as though it is vapor locked; it sometimes requires 20 to 40 seconds of cranking before it starts. It fires up perfectly when cold. Have you ever heard of this problem with a diesel?

John A. Bonin, Akron, Ohio

I sure have, but I can't give you all the answers from what you've told me. I suggest you begin by taking off the fuel-tank cap when you're ready to start the car after it's been sitting awhile. Don't replace the cap until the car starts. If this works, put the cap back on right away and ponder what you're going to do to correct the problem.

Diesel to gasoline?

The diesel V8 engine in my Oldsmobile is not an engineering triumph. Direct replacement with a gasolineburning V8 is one solution. An alternative would be to use the original block and change the camshaft, cylinder heads, and so on. Is either solution viable?

Regis Farrell, Ruffs Dale, Pa.

If the diesel engine is shot, the only real answer is a swap job. If you can find a good gasoline engine in a junkyard and get it put in at a small shop for \$10 an hour, you might make out. With new parts and \$30-per-hour labor, you'll take a licking.

Burned-up ignition parts

At anywhere from one-week to twomonth intervals, the ignition points and jumper wire to the point connection in my 1979 Dodge Colt burn up. I installed an original-equipment ballast resistor and coil, but the problem persists.

C. E. Miller, Newport News, Va.

I've received word from Chrysler that your model needs ignition parts made by Mitsubishi. (Never use replacement components for the coil, condenser, or points.) Use Mitsubishi's points-andcondenser set, part number MD607406, and the firm's resistor and coil, part number MD603229. Get 'em at your local Chrysler dealer.

Cold cutout

Both my 1977 and 1982 Oldsmobile Cutlass V6s cut out when cold after I depress the throttle. I suspect the problem lies with the automatic choke, because this never happens when the choke is open.

Ronald C. Baidy, Irving, Texas

Procedures for setting the automatic choke on the 1977 and '82 models are completely different. Both settings, I believe, should be done by an expert with the proper tools, equipment, factory specs, and know-how. Both need to have the carburetor-hot-air system and manifold heat working and the water-temperature sensor and thermostat up to spec. You might be able to do some of your own work on the '77; odds are that the heat systems need attention and the carburetor-choke parts need lubrication and adjustment. The '82, however, has a computer, an oxygen sensor, and a lot of other sophisticated gear, and you shouldn't try to tackle it.

Got a car problem? Send it to: "Say, Smokey-," POPULAR SCIENCE, 380 Madison Ave., New York, N.Y. 10017. All letters are read, and those of widest interest are answered in this column. Due to the large volume of mail, Smokey cannot reply to letters not selected for publication.





Havoline Supreme's formula blends nine additives with highly refined base oils. It helps protect against friction, wear and harmful acid, sludge and varnish deposits. It also helps save gasoline.

All Havoline motor oils exceed tough API-SF requirements, and Havoline Supreme 10W-30 and Havoline single grades exceed the API-CC requirements for diesel engine oils. For high performance engines, there's SF/CC rated Havoline Super Premium High Performance 20W-50.

Get the Havoline that's right for you, and get proven protection you can trust.



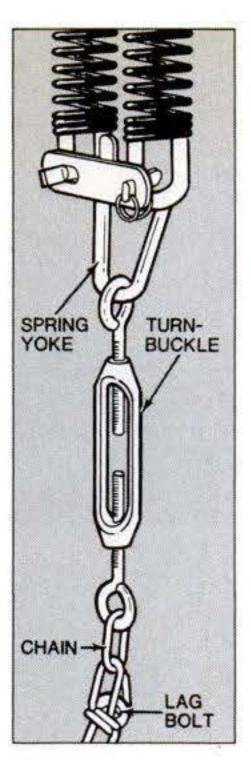


Replacing garage-door springs

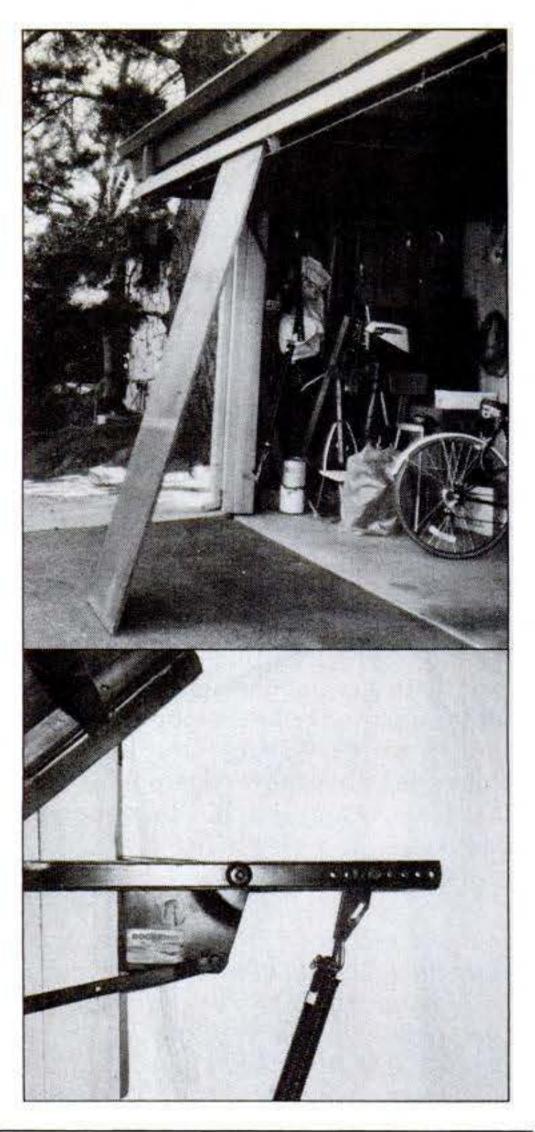
If you have a pivot-arm garage door, one of the most hazardous tasks you face is replacing its springs. The springs must be slightly stretched when the door is open so that it stays in place. This means that the springs have to be pulled beyond that tension point to be attached. The job usually requires that two persons be on hand—one to stretch the springs and the other to hook them on. You can make the job easy if you attach the springs to their anchor points with turnbuckles.

First, prop the garage door open. The bottom ends of the springs may be attached to chains, which in turn are secured to the door uprights by lag bolts. Disconnect the chains and attach a screw eye from a five-inch turnbuckle to the second link of each chain (or at a point that leaves as little slack as possible when the turnbuckles are fully extended). Fasten the remaining screw eyes to the spring yokes. Now thread on the turnbuckles and tighten, but don't stretch the springs excessively.

To check the door's balance, open it just far enough to make the pivot arms horizontal. If the door tends to close, prop it open again, loosen the turnbuckles, move the springs farther out on the arms (away from the door), and retighten the turnbuckles. If the door pulls open, the springs should be moved in.—Alvin B. Kaufman



Turnbuckle goes between chain and attachment point (above). Door must be propped open safely before beginning work (top right). At right: Spring-attachment point on pivot arm can be varied to balance the garage door.



FITNESS EXPERTS AGREE CROSS COUNTRY SKIING BEST EXERCISE

BETTER THAN CYCLING, JÖGGING AND EVEN SWIMMING.

The enjoyable sport of cross countryskiing is cited by leading physiologists as the most perfect form of aerobic exercise. Its rhythmic total body motion uniformly exercises more muscles than other forms of exercise and its smoothness causes no joint pain or damage. NordicTrack lets you get the same top fitness building benefits year round in the convenience of your home. NordicTrack eliminates barriers of time, weather, chance of injury, etc. Very effective for weight control.

More Complete Than Running Adds arm and shoulder exercise. Jarlessdoesn't injure the joints.

More Effective Than Exercise Bikes More complete. Adds important upper body exercise and provides more uniform leg muscle usage. Higher pulse rates, necessary for building fitness, seem easier because more muscles share the exercise.

Even Better Than Swimming When swimming, the water supports the body allowing major leg muscles to loaf. The stand up position on the NordicTrack exercises the leg muscles much more uniformly.

Features

Simple motorless mechanism. Independently adjustable arm and leg resistances.

Speedometer, odometer included. Pulsemeter optional. Red oak frame for quiet operation and fine furniture appearance. Pelvic pad provides user stability.

Exclusive Patented Flywheel Action Provides unmatched smoothness and continuity from stride to stride. Motion and resistances are same as in real skiing.

- Fits in your home or office
- Folds and stands on end to require only 15" x 17" storage area

Two year warranty, 30 day trial period. Call or Write for Free Brochure.

TOLL FREE-1-800-328-5888 Minnesota 612-448-6987

PSI 124-PS Columbia Court, Chaska, MN 55318



The Jarless Total Body Exerciser.



A Specialist In The Field.

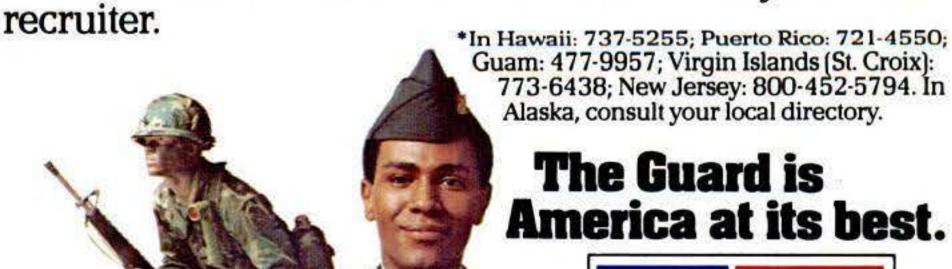
You're part of a Field Artillery team that can dig in a 28-ton howitzer in 30 seconds flat. Select, load and fire a 100-pound shell in under a minute. Spot enemy troops over 30 miles away. And figure your trajectory at computer speed.

For someone who's just 18, you've covered a lot of

ground.

If you're a high school junior, senior or graduate, find out more about the part-time jobs available right now in your hometown Army Guard.

Call toll-free 800-638-7600.* Or see your local





A1PSSF★★114NP

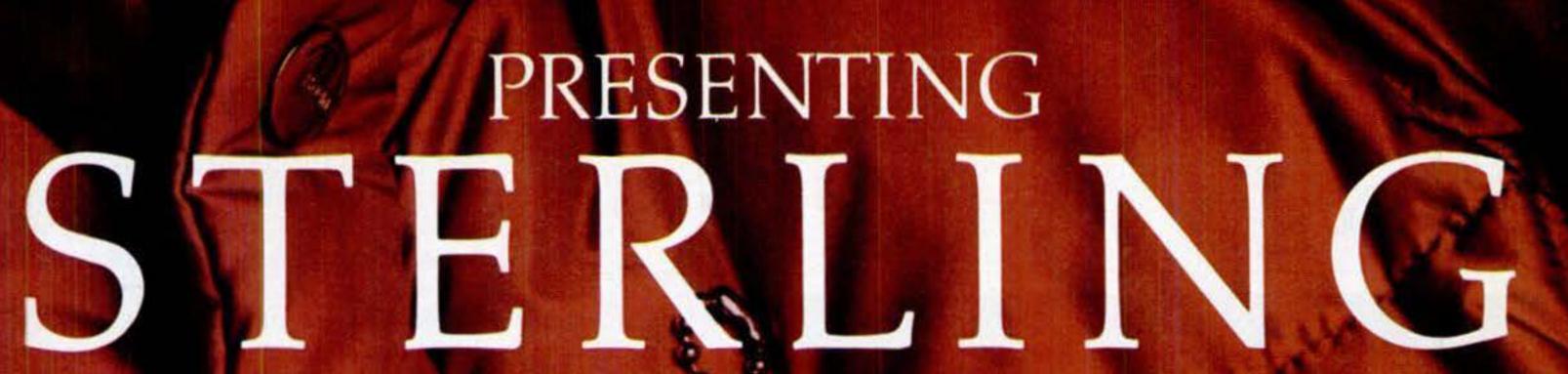
Copyrighted material

Wordless Workshop

By ROY DOTY

\$50 to Kurt S. Hollenbeck of Plano, Texas, for this idea. Send yours (with Social Security No.) to Wordless, Popular Science, 380 Madison Ave., New York, N.Y. 10017. Only purchased ideas are acknowledged.

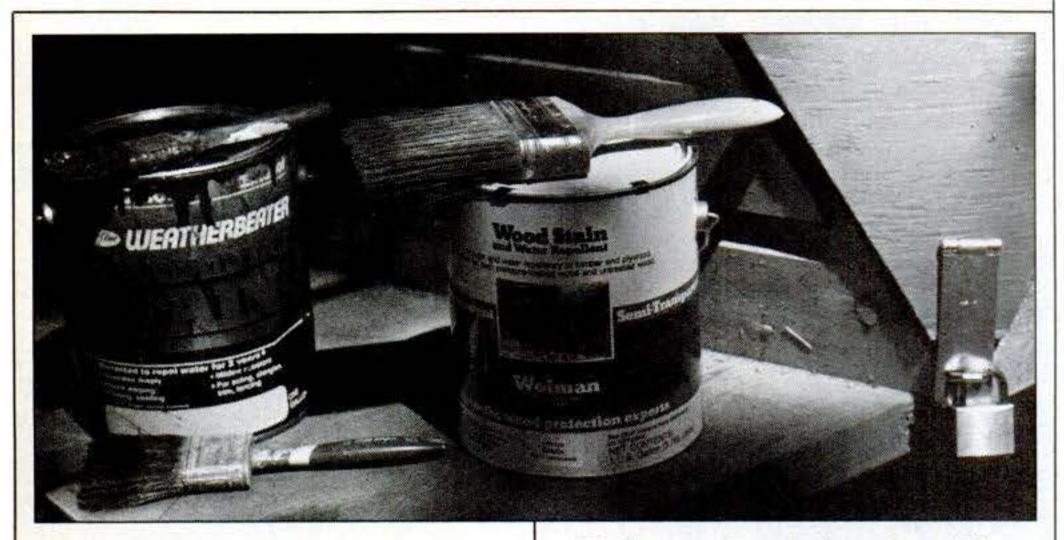






Shop Talk

By AL LEES



Testing two water shedders

Every weekend of the summer just past found me hanging on the side of a mountain gorge, constructing a gazebo. We'll publish plans for it next spring, but meanwhile I'd like you to know about the two new finishing products I've tried out on this project.

My screenhouse has shutters that

will close to keep winter out. These are made of plywood (like the padlocked panel at right in the photo) or waferboard, and I treated them all with Weatherbeater water-repellent oil stain. It's available in the solid coat I chose as well as in semi-transparent colors and natural wood tones-but only from Sears stores (it's not in the catalog).

It's remarkable stuff. I chose a dark brown, and it was a cool day when I first popped the lid off the can—to be confronted with chocolate pudding. As the day warmed up, the consistency thinned to chocolate syrup. Either way, I was surprised at how smoothly it brushed on for one-coat coverage. It's warranted to repel water for two years, and it contains a mildewcide. I've watched my coating shed water like a duck. It costs about \$18 a gallon.

The can to the right in the photo is a new Wolman wood stain and water repellent from Koppers. I chose semitransparent Glade (a gray-green) to tone my siding, my pressure-treated framing, and the underside of my roof deck. It couldn't be further from Weatherbeater: Using it is like brushing on tinted water and is a nuisance to work with overhead because it runs through the brush and down your arm.

But this stain succeeded in unifying my disparate wood tones. Its builtin repellent makes for fast drying after heavy rains. It comes in 10 solid or semi-transparent colors and retails for slightly more than \$15 a gallon.

These paths to wood preservation are of interest in light of the recent federal ban on consumer sale of pentachlorophenol, creosote, and arseni-



All Kent products incorporate a unique combination of futuristic design and technology, high quality materials, unsurpassed workmanship and state-of-the-art engineering.

A combination which makes Kent one of the most practical, efficient and effective wood burners found anywhere in the world. So much so that a panel of independent judges voted The Tile Fire Space Heater Of The Year in an award program sponsored by Wood 'n Energy Magazine one of the industry's leading trade publications

The clean, simple design of Kent stoves complement any room decor. And the Tile Fire add: even more flexibility with easily interchangeable tile sides.

Each model also offers a large view of the fire through a ceramic glass door that really does stay clean.

When you look at a Kent stove, it's obvious to see the design advantages it has over its competitors

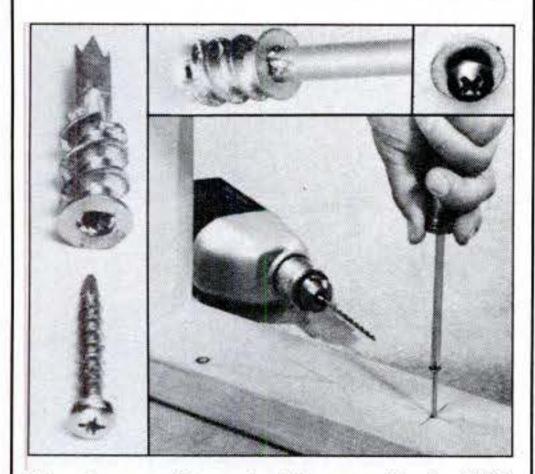
But equally important is what is inside Ken stoves - how they work. It's that engineering expertise that really makes Kent the flame of the future.

All Kent stoves (UL) listed

cals. At the Chicago hardware show (see next item), I was surprised to find many finish packagers still promoting penta-based preservatives, because these can't be sold to "uncertified" users after February. Other companies were proclaiming that *their* products are not affected by the ban (Darworth's Cuprinol, for example). PS has an article in the works on this topic.

New fastening system

The gizmos clustered below were among the many new products demonstrated at the annual National



Hardware Show held recently in Chicago (you'll find others in this month's

"What's New" pages and in future issues). Black & Decker's Grip-It is a multipurpose anchor system featuring a self-tapping, double-helix screw with high and low threads. It comes in three head types—flat, hex, and pan—slotted for a No. 2 Phillips driver.

The screws are all the same diameter but come in various lengths, and they can be driven directly (without anchors) into concrete, brick, and wood. For drywall installations there's the special anchor shown at left in the photo cluster. Note that it comes with its own little spade bit. You drill no hole in the drywall; the anchor bores itself in when turned with the Phillips driver (top photo). In other materials, you'll want a lead hole for the screw, so the system includes the special bit shown in the drill. Because it's basically a carbide-tipped masonry bit, you have to force it through wood, but it makes quick work of anchoring sills to a concrete floor, as shown. Some of the screws feature a knurled collar that locks them firmly in sheet metal. I've tried the screws in a variety of materials and prefer using a lead hole, though the self-drilling point can make its way into softwood. You'll find packet selections of Grip-It fasteners in hardware stores.

Organized toy making

Attention all regional volunteer helpers of that North Pole toyshop: As you are about to swing into full production toward Christmas, a major toymaker supply company announces an organized wood-parts caddy. It consists of nine interlocking plastic bins (with three dividers, to give you 12 compartments) plus printed labels for the hundreds of pegs, wheels, plugs, and buttons included. It's available only from Timbers Country Store (Lake Forest Rd., Carnelian Bay, Calif. 95711) for \$29.95 plus \$2 shipping. A catalog from this woodworker's specialty shop is free with the kit or \$1 if ordered separately.



What sets a Kent stove apart from others s a scientific combustion system that rediects carbon rich gases, normally lost up he chimney as smoke, down through the irebed and up into a secondary combusion chamber where complete combustion occurs.

The result is a more efficient and horough burning of the wood, producing maximum heat output.

The same process which creates better performance, also eliminates many of the naturally occurring pollutants caused by wood burning.

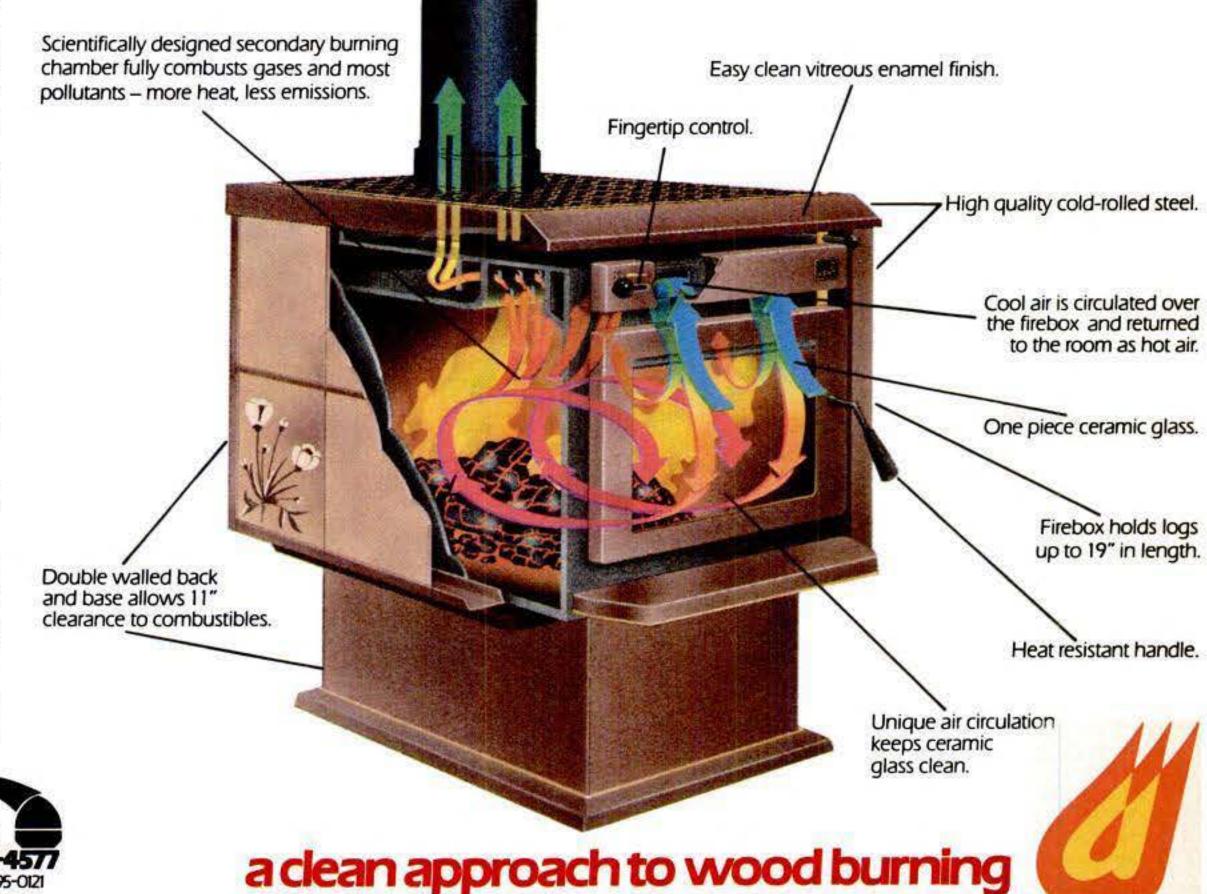
In fact, this combustion system has bassed some of the most stringent emissions and efficiency testing yet devised without the need for a catalytic system.

Kent stoves are manufactured to preciion standards and each carries a 5 year imited warranty.

Kent has emerged as a leader in the wood stove industry. Because, when you get right down to it, few, if any stoves can natch the design and technology of a kent.

See Kent stoves in action. Call oil-free for a Home Video Hand-

book, ½" VHS Format, a free prochure and the name of the cent dealer nearest you.





Over 1,000,000 consumers refer to this before buying their car or home stereos.

FREE STEREO Buyer's Guide

Before buying any car or home stereo, you should consult the famous Crutchfield Buyer's Guide. What you learn may save you hundreds of dollars.

- 96 pages of helpful articles, shopping tips, charts, installation guides & more.
- Hundreds of color photos of the finest name brand products.

You get more value shopping Crutchfield

- Low discount prices
- Helpful sales advisors
- 16 toll-free order & assistance lines
- Orders shipped within 24 hours
- Complete satisfaction guaranteed
- Extended warranties
- Huge inventories
- Free shipping
- All major credit cards welcome

Call or send this coupon for your FREE Buyer's Guide

800-336-5566

In Virginia call toll-free 800-552-3961 Be sure to mention Popular Science when calling. Rush me your FREE Buyer's Guide.

Name

Address

City

State

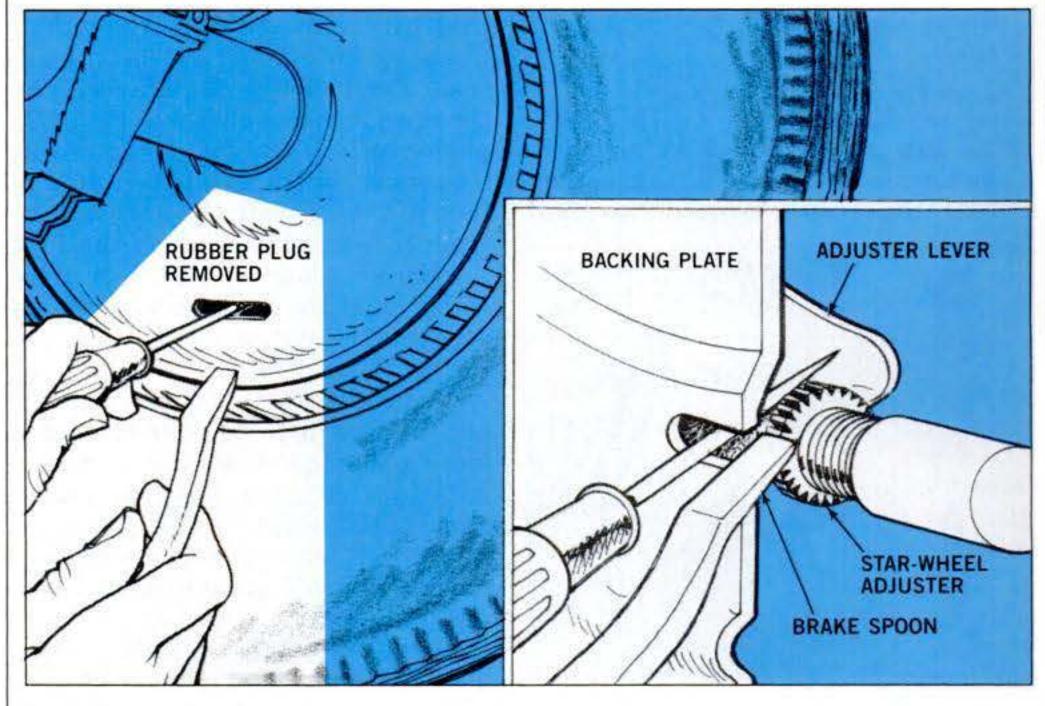
Zip Crutchfield Park, Dept. PS, Charlottesville, VA 22906

CRUTCHFIELD

Taking Care of Your Car

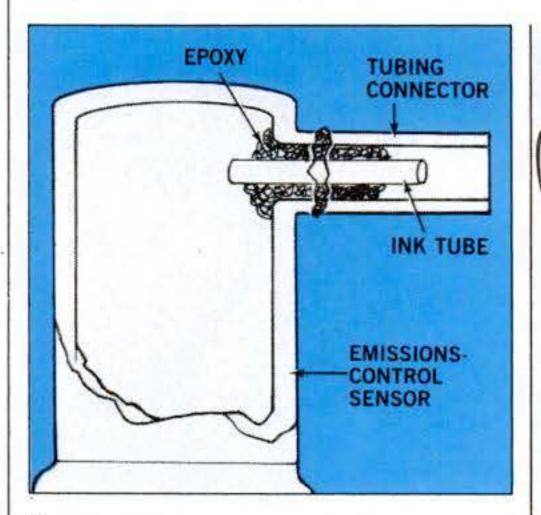
By STEVE MERCALDO

Got a useful car tip? Send it (with Social Security No.) to Car Care, POPULAR SCIENCE, 380 Madison Ave., New York, N.Y. 10017. We'll pay \$50 if we use it. If two or more readers send the same tip, payment goes to the one with earliest postmark. No tips can be returned.



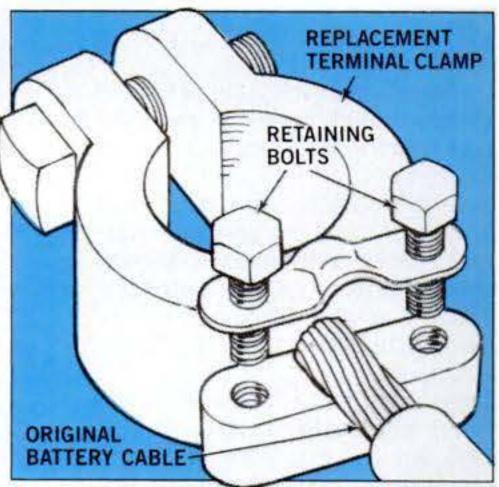
Stubborn brake drums

It's not uncommon to find it hard to pull a brake drum off the rear axle. Although the drum turns freely, it gets hung up on the brake shoes. Try this: Remove the metal or neoprene adjuster-hole cover from the backing plate. Then push the adjuster lever away from the self-adjuster star wheel with a thin-blade screwdriver. Insert a brake-spoon tool through the adjuster hole, and back off the star wheel. (Make sure you're turning the wheel in the proper direction.) Remember to readjust the brakes after the drum has been reinstalled. Otherwise, pedal travel will be excessive.



Sensor saver

Ever tried to remove a vacuum hose from an emissions sensor, breaking off the plastic connector in the process? Instead of buying a replacement, insert a ball-point pen's ink tube as deeply as possible into the sensor. Trim the tube to fit halfway into the hose connector. Finally, epoxy the connector in place on the sensor.



Corroded clamps

Battery-terminal clamps that are corroded beyond repair are easy to replace. Remove both clamps from the battery, even if you're only working on one. Just cut off the old clamp and strip about 3/4 inch of insulation from the cable. Clean the exposed copper strands, and install a top- or sidemount replacement clamp.

Continued

Save Gas, Save Engine with 'POLY'

The following introduces one of the most fully tested and credentialed gas saving, friction reducing engine treatments ever to reach the market!

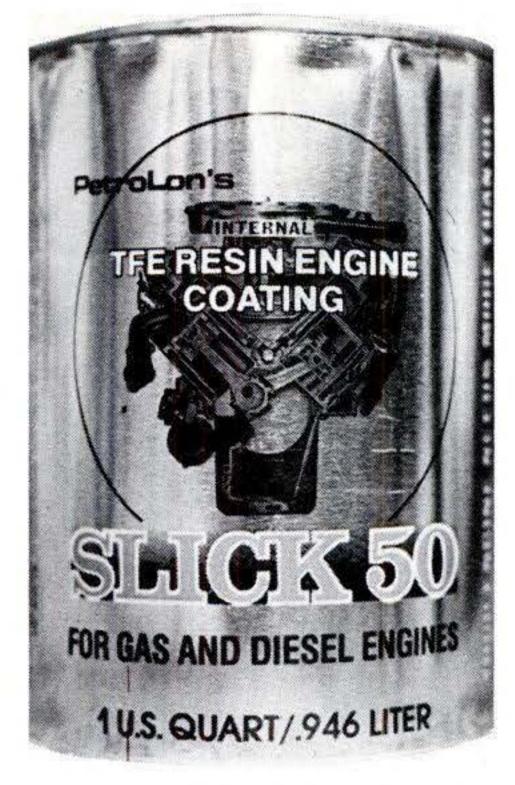
WHAT IS POLY? "Poly" is short for polytetrafluoroethylene (TFE). It is the slipperiest substance known to man (1981 Guiness Book of World Records, p. 188). The PetroLon Corporation, makers of Slick 50, has invented a way to permanently bind this slippery chemical to your engine with one treatment. All you do is add one quart of Slick 50 to your oil during oil and filter change. By reducing engine friction, Slick 50 increases gas mileage and horsepower and reduces engine operating temperature thus causing your oil and engine to last longer. Just as important, it reduces metal wear, defraying costly overhauls.

HOW DO I KNOW THIS ISN'T A FRAUD? Slick 50 has some very impressive credentials. The "Consumers Digest" magazine (March/April 1982, p. 35) states "Slick 50 does reduce engine heat and ordinary wear, and our informal tests indicate that it will improve gas mileage by about 2 to 3 miles pergallon...Slick 50 does exactly what Petrolon claims it does." Researchers at the Franklin Institute Research Laboratory, after applying a powerful ultrasonic cleaning process to a Slick 50 treated engine part, were surprised at its permanence. They stated, "We actually expected the PetroLon Slick 50 TFE Resin coating to also be removed, but later found it was still there."

The FAA (Federal Aviation Administration) has fully accepted Slick 50 Aircraft Piston Engine Treatment (F.A.R. #33.49). An FAA test simulating 1400 hours of engine use (equivalent to about 70,000 miles on a car) showed almost zero engine wear!

Twenty-five hundred miles after removing Slick 50 from the crankcase, tests done at the University of Utah **Engineering Experiment Station** showed that the benefits of Slick 50 were still there. They reported a horsepower increase of 16.9% and 9.9% for light and heavy loading respectively. The senior engineering researcher at the University of Southern Califormia in San Diego stated this, "Slick 50 does increase horsepower and decreases fuel consumption in tests done at the university." The Space Shuttle Columbia uses the chemical "poly" in its gears and bearings because it is the only chemical lubricant which can withstand the heat and corrosive elements of space.

Perhaps most dramatic of all is a torture-test overseen by the Automotive Services Council for Pennsyl-



vania and shown on television station WTVE. Three cars with between 75,000 and 129,000 miles on them were treated with Slick 50. Six months later the oil was drained from each vehicle and the cars were driven without the oil plugs for about a half hour. The water temperature never rose and the engines sustained no apparent damage. The Southwest Daily Times (Dec. 19, 1982, p. 6), reports that a man from Liberal, Kansas, flew his airplane without oil for 30 minutes. There are many more tests available. If you are still skeptical, send \$2.00 to defray printing and postage costs and we will send you additional, more detailed, test information, etc.

HOW DO YOU TREAT AN EN-GINE? Very simply. A few minutes before oil and filter change, add engine flush (sent free with each order) to clean out your engine. Let your engine idle for 5 minutes. Then drain your oil, change filters and add the proper amount of oil less one quart. Add one quart Slick 50, drive for 30 minutes, and leave it in the crankcase for 3,000 miles. As the engine operates, the oil carries the polytetrafluoroethylene between the parts where it is burnished into the pores of the metal. Once impregnated it is permanent, so you do it only once, not each time you change oil. One quart of Slick 50 will treat all standard 4, 6 and 8 cylinder gasoline and diesel engines.

Yes, Slick 50 will work with all petroleum based oils and all synthetics compatable with petroleum based oils.

WHAT ARE THE BENEFITS OF SLICK 50? Your actual benefits in

percentages may vary, depending on the kind of driving you do, vehicle condition, etc. By reducing friction, Slick 50 does all of the following: it increases gas mileage. It increases horsepower --small economy cars and large RV's really need this. It makes for easier starting. It reduces operating temperatures, thus increasing the lubrication and life of your oil and your engine. Last, but not least, the drastic reduction in engine wear defrays or eliminates costly overhauls which can save you over \$1,000. Slick 50 eliminates the "lubrication starvation" that all cars experience when first started before the oil has a chance to circulate. Up to 90% of the wear on a car can be caused by this lubrication starvation. You receive all of these benefits for less than the cost of two tanks of gas (\$34.95).

WILL SLICK 50 HARM MY ENGINE OR AFFECT MY WARRANTY?

No! Slick 50 is suspended in an excellent grade of petroleum oil which meets or exceeds every manufacturers engine warranty requirements. In addition, this oil carries an API (American Petroleum Institute) service classification SF-CC-CD. It also carries the

and MIL-L-46152-A.

DEALERSHIPS ARE AVAILABLE. OTHER SLICK 50 PRODUCTS

military specifications MIL-L-2104C

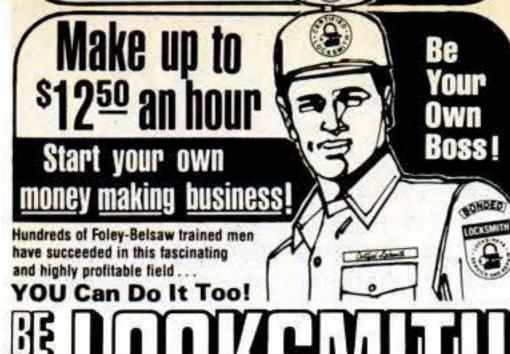
available are Small Engine Treatment (for 2-cycle engines), Aircraft Engine Treatment, Gear Treatment (manual transmissions, etc.), Grease, Ultra 9 Oil, Fuel Conditioner, and Fabric Protector. Free information is sent upon request.

Free engine flush sent with each order. Free shipping with orders of 2 or more.

For purchase or further information call toll free 1-800-228-6505, ext. 180 (in Nebraska, call 1-800-642-9606) or send to: FORT MORGAN SLICK 50, 407 Del Rio Road, Berthoud, Colorado 80513.

[In Canada, call 416-828-0166 or send Canadian funds of \$39.95 and \$4.00 shipping to: Petrolon/Slick 50, 2219 Dunwin Drive, Mississauga, Ontario L5L1X1.]

		PS 11
🗆 I enclose	\$34.95+\$4.00 sh	ipping & hand.
I want 2 o	r more (free ship	ping & hand.)
☐ Check	☐ C.O.D.	☐ Visa/MC
Card #		Exp
Name		
Address (Give s	treet address for U.P.S	6. delivery)
City		
State		Zip



before have money-making opportunities been so great for qualified Locksmiths, Now lucrative regular lock and key business has multiplied a thousandfold as millions seek more protection against zooming crime. Yet there's only one Locksmith for every 17,000 people: Train FAST at Home - Collect CASH PROFITS Right Away.

You're "in business" ready to earn up to \$12 50 an hour a few days after you begin Foley-Belsaw's shortcut training. Take advantage of today's unprecedented opportunities in Locksmithing for year-round EXTRA INCOME in spare time — or full time in a high-profit business of your own Hundreds we've trained have done it so can YOU! All lools plus professional Key Machine given you with course These plus practice materials and eqipment, plus simple, illustrated lessons, plus expert supervision, plus business-building guidance will enable you to KEEP THE MONEY COMNG INI Ideal for retirement — good jobs too

SEND FOR EXCITING FACTS—No Obligation! ALL SPECIAL TOOLS AND EQUIPMENT INCLUDED!





FOLEYBELSAW INSTITUTE 10578 Field Bldg. Send for details! Kansas City, MO. 64111

BELSAW

BOOKLET!

"KEYS

YOUR FUTURE"

Tells how you quickly

train to be your own boss

in a profitable Sparetime or Fulltime business of

Send for your

copy today!

There is NO OBLIGATION and NO SALESMAN Will Call-ever!

YOUR FUTURE

10578 Field Bldg., Kansas City, Mo. 64111

FOLEYBELSAW INSTITUTE

Please rush FREE Book "Keys to your Future."

money in CITY-STATE-ZIP



Shpg. 300 lbs Split Wood For Yourself For Profit,

Earn Money From Rental Operation

AVAILABLE WITH HIGH SPEED WHEELS FOR HIGHWAY TOWING ITEM 1965-HS \$979.50

DOUBLE-ACTING SPLITTER RAMS

-062-24 \$137.50 45 lbs.

3-1/2" x 24" stroke. R-lgth.

Shpq. AUTOMATIC CONTROL

32". 1-1/2" rod. 1/2" ports.



2-STAGE PUMPS

ITEM 9-1169 \$147.50 Shpg.

 13.2-GPM at 3500-RPM, NPTF ports; IN 3/4", OUT 1/2". Shaft 1/2" diam. Uses 5-HP engine.

10-1/2 tons splitting force

Powerful 2-stage hyd. pump

Detent control valve returns

to neutral automatically

5-HP BRIGGS gas engine

 Fast splitting cycle (10-sec.) Splits logs up to 26" long

Uses 8-HP engine. \$159.50 15.2-GPM at 3500-RPM.

SURPLUS CENTER

4-way valve. 3-position detent. Auto kick-out to neutral, 30-GPM. 3/4" IN/OUT, 1/2" work ports.



1956-TE \$119.50 40 lbs. Butt block, sliding block and splitting wedge (for cross tube)

Catalog Send To: SURPLUS CENTER; Box 82209; DEPT. PS-114. Lincoln, NE. 68501; 402-474-4366

Equipment

ORDER TOLL FREE! CALL 800-228-3407

HE HAS INNER VISION



The Ancients called it COSMIC CONSCIOUSNESS

There are no physical limitations to inner vision. . .the psychic faculties of man know no barriers of space or time. A world of marvelous phenomena awaits your command. Within the natural—but unused—functions of your mind are dormant powers which can bring about a transformation of your life.

Know the mysterious world within you and learn the secrets of a full and peaceful life!

The Rosicrucians (not a religion) are an age-old brotherhood of learning. For centuries they have shown men and women how to utilize the fullness of their being. This is an age of daring adventure . . . but the greatest of all is the exploration of Self.

FREE BOOK

Determine your purpose, function and powers as a human being. Write for your free copy of the *Mastery of Life* —Today!

The ROSICRUCIANS (AMORC)

San Jose, California 95191 U.S.A.

--- SEND THIS COUPON ----

Scribe KCE The Rosicrucian Order (AMORC) San Jose, California 95191, U.S.A.

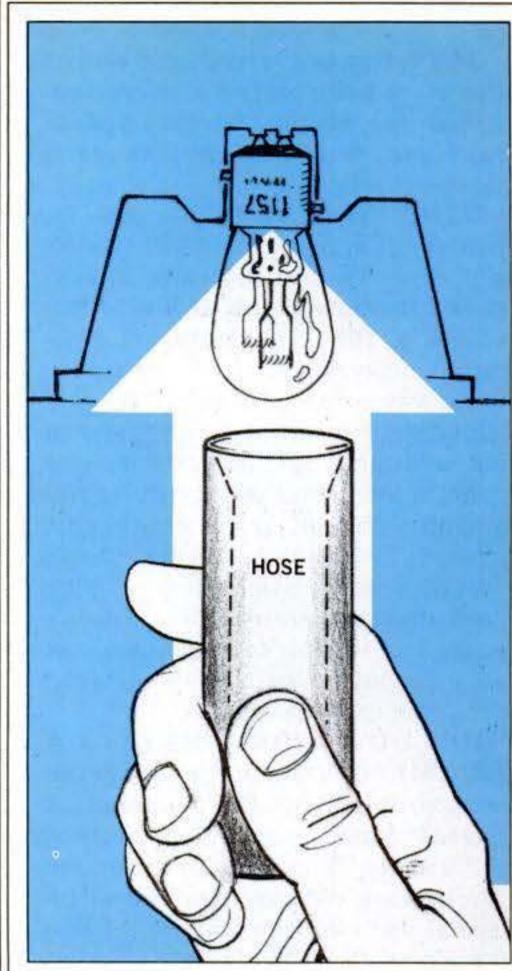
Please send me a copy of the Mastery of Life.

Name __

Address_

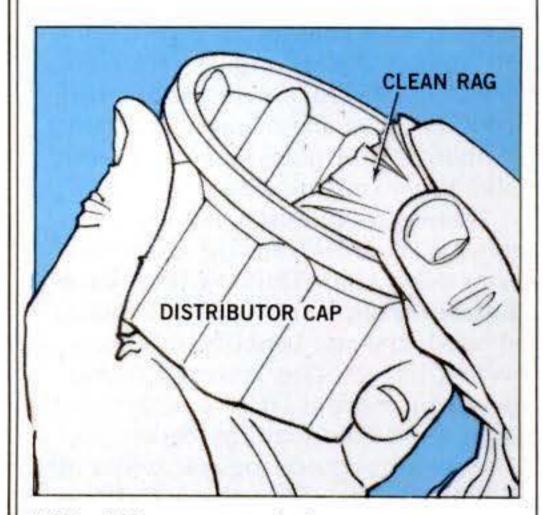
Zip

Car Care



Bulb remover

Removing small bulbs from taillight and parking-light sockets can be tricky. For safe and easy removal, carefully hone out the inner edges of a short piece of heater hose. Fit the modified end of the rubber hose over the globe of the bulb. Push in, and turn the bulb in the proper direction.



Mischievous misfire

A misfire that's most noticeable when the weather is damp or rainy may be caused by a dirty distributor. Why? Dirt tends to hold moisture and provide an alternative path for the ignition's high voltage, resulting in an engine miss, or even cross fire. Periodically, remove the cap and wipe away any signs of dirt or moisture.

In just a few hours you can build a collector's miniature masterpiece.

we crafts are as satisfying to a man **\Gamma** as working with wood. The beauty of the hardwood grain...the perfect smoothness from hand sanding...the gleam of the varnish finish - these are the pleasures you experience when you build our extraordinary museum quality miniature furniture kits.

The standard of excellence for expert miniaturists

As you assemble each kit, see how the drawers fit precisely and slide smoothly...how the doors swing easily on their hinges and how the solid brass fittings add that professional touch. We precision scale each kit to 1/12 of the full size original (the scale most used by knowledgeable miniaturists). We only use furniturequality hardwood, never veneers or plastic. And each kit comes with a layout sheet and easy-to-follow instructions.

Begin your crafting adventure with our miniature reproduction of the William and Mary clock for only \$1, when you become a trial member of The House of

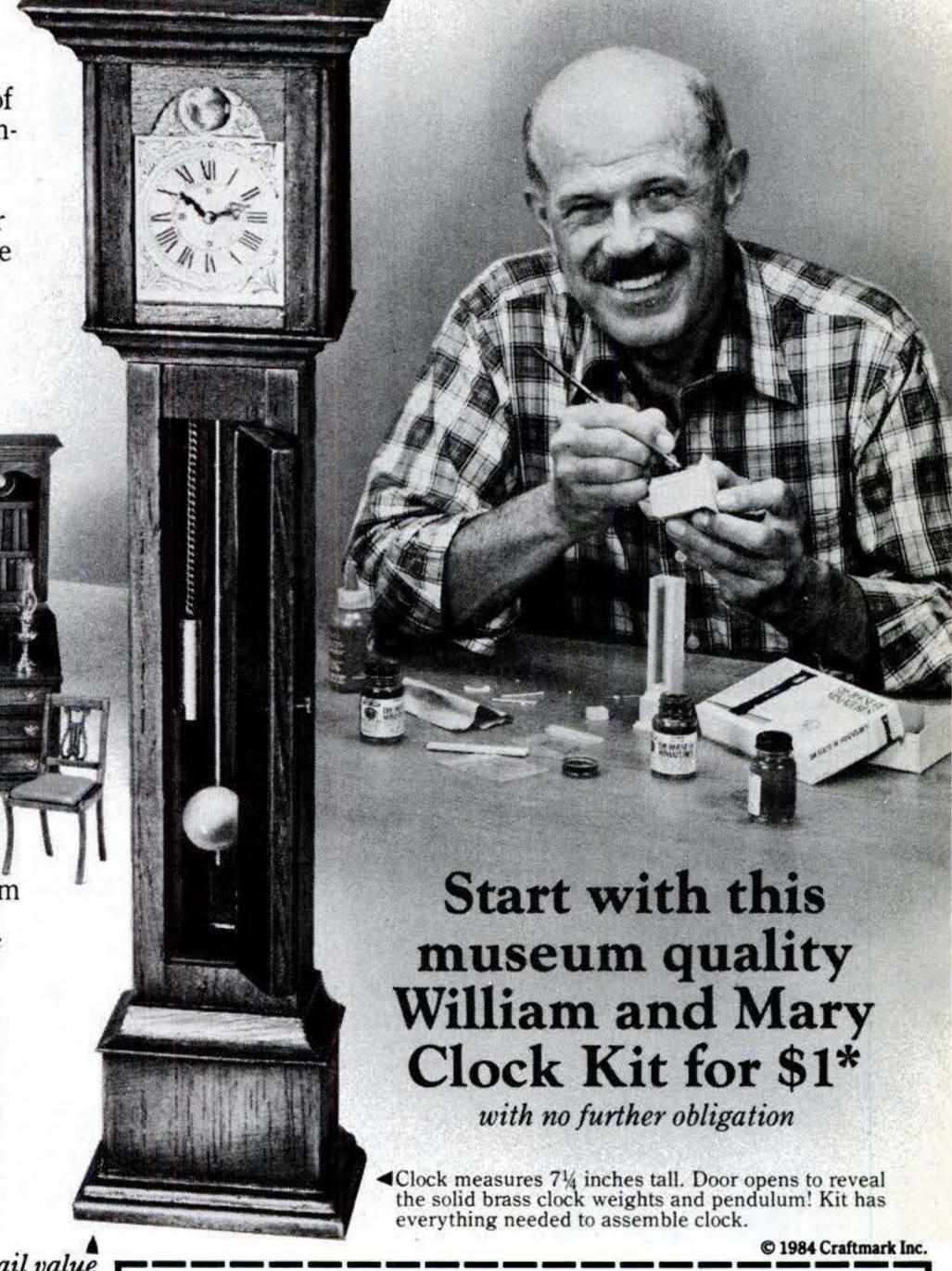
Miniatures Collectors Society.

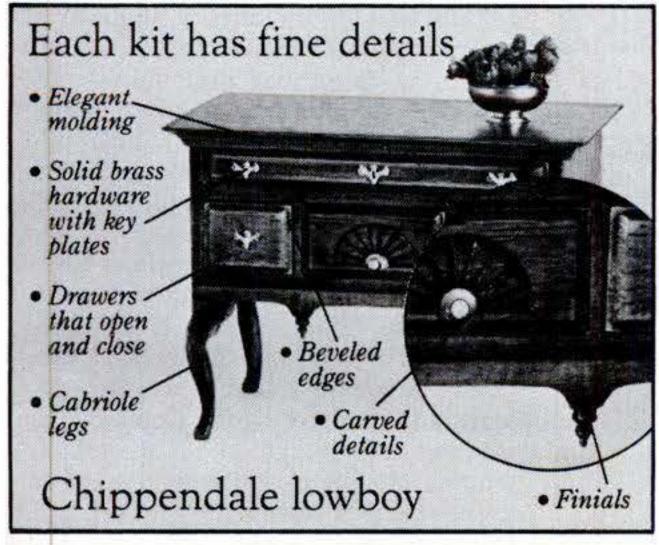
As a trial member, you will have the opportunity to purchase, if you wish, other museum quality miniature kits. However, you are not obligated to buy any additional kits-ever!

Remember, this William and Mary clock is available for \$1 by mail only. With no further obligation on your part.

Mail coupon today.

A \$9.95 retail value





THE HOUSE OF MINIATURES

Division of Craftmark Inc., 80 Newbridge Road, Bergenfield, NJ 07621 Please enroll me as a trial member of the Society and send me the William &

Mary clock kit. Bill me only \$1* If I am not completely satisfied, I may refuse delivery of the second shipment by writing "cancel me" on the shipping label. If I keep the second shipment, I will be a regular member and receive additional shipments every four weeks. Prices for each shipment, which will contain one or two kits, are \$9.95* or less. I may return any shipment and I am not obli-

gated to accept any minimum number. ☐ Mr. ☐ Mrs.

☐ Ms ☐ Miss. All enrollments are subject to acceptance.

Address City

State.

*plus shipping and handling, and sales tax.

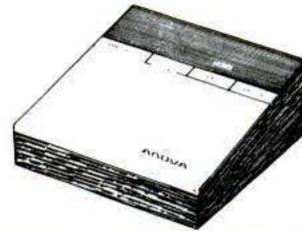
BQ29

Free Bonus

Professional Quality Finishing Samples

Include tinted glue, oil base stain (for authentic color), glaze stain for antiquing and highlighting and other materials to professionally finish your kit to museum quality.

Keep Out Burglars!



Protect your family from 4 types of tragedies – (1) break-ins, (2) fires, (3) flooding, and (4) personal medical emergencies!

The revolutionary ANOVA PRO-TECTION CENTER uses "wireless" technology. You can install this professional system in 30 minutes and save hundreds of dollars. And, if you move, you can take it with you!

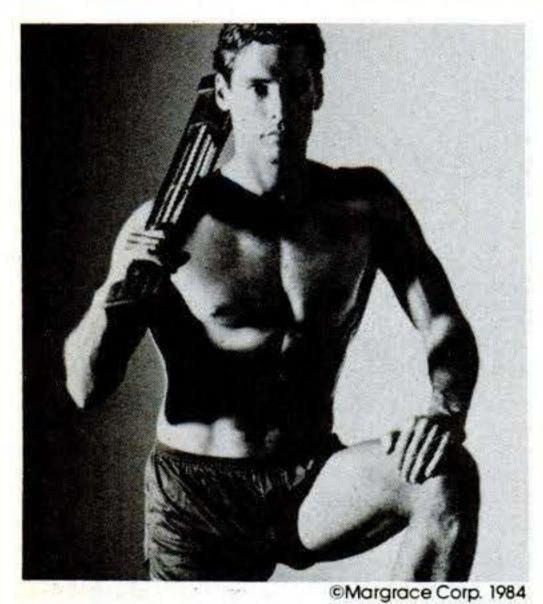
Proven reliability; battery backup; UL Listed; FCC Certified; and a one-year warranty.

Perfect for your house or apartment!

For a FREE brochure, write or CALL TOLL-FREE 800-227-1685, Ext. 921

ANOVA

Three Waters Park Drive San Mateo, CA 94403



HOW TO USE YOUR HEAD TO BUILD YOUR BODY.

Some people work out hard, others work out smart without strain, sweat or hours of pain with the new scientifically designed Bullworker X5.

Just 5 minutes a day doing a series of 7-second exercises you can do at home, the office, anywhere.

Exercises that harness the proven power of isometrics and isotonics. To expand your chest. Build your arms and shoulders. Firm up your thighs and legs. Flatten your stomach. All without

going to an expensive gym.

If you're smart and serious about building your body, try the Bullworker X5. **Now** available at most sports outlets and department stores. Or, order directly by sending check or money order for \$49.95 to:

P.O. Box 803, Dept. 2058, Middlesex, N.J. 08846 Credit card orders call toll-free 1-800-321-3400







7 top home computers

[Continued from page 116]

12-inch black-and-white TV: The software displays 80 characters per line, which on a conventional TV become blurry and impossible to read. The cure: Buy the Apple's \$199 green monitor shown in the IIc photo.

Why does distortion happen? An 80character line requires additional bandwidth that a normal TV can't reproduce accurately. That's why all the other home computers display a 40character (or less) line. The second half of the line (assuming the document will be printed at 80 characters per line) is shown on the next line of the display. That could be confusing when you create tables, for instance, but some systems allow horizontal scrolling (see captions). This makes your screen a 40-column "window." As you type (or move the cursor), the window moves to the right, allowing you to see one 40-character section of a line at a time.

The printed page

Printing a document may require you to dole out more of your bankroll. All of these computers can work with a variety of printers. (You tell the software which one you're using by entering its brand name or model number.) The prices of the printers range from about \$300 to \$1,500, depending on speed and print quality. Memotech, Atari, and Coleco include a printer as part of the package. The Memotech printer is a high-speed (96-characterper-second) correspondence-quality (CQ in the spec table) dot-matrix printer that's capable of producing different character sizes and graphics. The Atari and Coleco printers are letter-quality (LQ in the table) models that have excellent print qualitycomparable to that of any high-priced printer. The trade-off is speed. They type at about 10 characters per second, about as fast as a good typist who never makes mistakes. One criticism of the Coleco printer: It's noisy.

Your final consideration? Price, of course. Although the table shows the *present* cost of components, shop carefully. Competition is forcing manufacturers to cut prices routinely—and drastically—and dealers often make package deals that include the computer, software, disk drive, and printer.

My personal choices? Apple for serious work, largely because of its 80-column display and excellent keyboard, and Atari right after it. But I'd choose the Adam or PCjr if my children were to be operators, because these two computers guide you through work so simply; I'd pick Commodore for power at a budget price, Memotech for possible business use once the disk drives and new software are added, and Radio Shack for small jobs.

What do people say* about the amazing **FUELTRON** Gasoline Vaporizer?

V.H., Ft. Wayne, IN—Opel GT 1900CC

"... removes pause when accelerating and going from idle jet to high speed jet-motor now runs very smooth-plan on installing the Fueltron in three more of my autos, I'm so pleased."

J.D., Santa Maria, CA-1974 Ford Truck E100

"We the people should make a law requiring mandatory factory installation of the Fueltron in every car on the road. I get faster starts, smoother running, more power and acceleration, and my oil stays cleaner!"

G.W., West Warwick, RI— 1977 Dodge Van B200, 319 cc Engine

"Since installing the Fueltron the van starts easier, runs smoother, has definitely better acceleration and more usable power. My van hasn't run this well since I bought it. Keep up the good work!"

T.S., Burbank, CA-1980 Chevrolet Citation

"Starts easier—don't have to keep the choke closed as long to prevent stalling—better cold engine driveability and throttle response. I wish this had been available years ago. I think the new car makers should look into this."

J.C., Freehold Twp., NJ-1977 Pontiac Firebird with Holley 4 bbl (Edelbrock SP29)

...improved low end torque, acceleration and power."

C.H.A., Sheboygan, WI—1972 Buick Electra modified 455 (Stage 1-V8)

"Can now run regular gas with 10:1 compression—plugs stay cleaner. Lumpy cold idle is gone."

B.L., Polson, MT-1973 Chevrolet 3/4 Ton 350, 4 barrel

"I not only got easier starts and better acceleration, but it also improved gas mileage 2-3 miles per gallon and it stopped run-on that was sometimes a problem. I plan to buy another for my second vehicle."

C.L.H., Riverside, CA-1984 Pontiac 6000 STE

"Better low speed torque—helped performance under 3,000 RPM noticeably."

D.B., Bloomfield, CT-1979 Mazda RX7-45 DCOE sidedraft Weber

"My application was purely performance oriented—all aspects of part throttle operation improved dramatically—the

CARBURETOR THROTTLE FUEL/AIR FUELTRON MIXTURE **AMPLIFIER**

Fueltron's ultrasonic crystal transducer oscillates 1.3 million times a second to instantaneously vaporize

gasoline into a high density, cold vapor.

bination of benefits so economically.

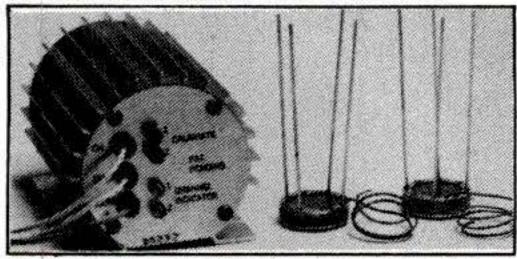
The Amazing **FUELTRON**" **Ultrasonic Gasoline Vaporizer**

Gives your car more power, more torque, better acceleration, easier starts

WHAT FUELTRON DOES

To deliver peak performance a gasoline engine needs a completely vaporized fuel-air mixture. But even the best carburetors will not vaporize all the gasoline delivered by the fuel pump. A certain amount of raw fuel is pulled into your engine's cylinders where not even the hottest spark will ignite it. Besides being wasted, that fuel washes vital lubricant off cylinder walls and rings. Fueltron's ultrasonic transducer turns raw fuel into an easy-to-ignite vapor in millionths of a second! This vapor ignites completely and burns with high energy before it can be exhausted.

Fueltron is manufactured under U.S. Pat. No. 4401089



A complete Fueltron kit includes an ultrasonic amplifier and either one (for single-barrel carbs) or two (for 2 or 4 barrel carbs) transducers.

YOU NEED FUELTRON ... if you know your car should be capable of faster throttle response, smoother idle and quieter running...if gasoline waste concerns you...if you want to use lower

octane fuel with reduced engine knock. Only the easily-installed Fueltron can give you this com-

HOW YOUR ENGINE WASTES FUEL

Cold-engine starts waste fuel, because the droplets of gasoline can't vaporize before they're swept into the cylinders, so they don't all burn. Low speed operation can be a problem, because air isn't flowing rapidly enough through the manifold to mix the fuel droplets evenly, resulting in an uneven mixture and ragged running. When you accelerate, the gasoline from the accelerator pump can't be vaporized quickly enough so it floods the nearest cylinders, while those farthest away can suffer from lean-mixture knock.

HOW FUELTRON CUTS FUEL WASTE

Fueltron vaporizes gasoline instantaneously, fooling the engine into thinking it's hot even when it's cold. Those droplets which would normally hit the hot spot at the bottom of the manifold will fall on the Fueltron transducer instead, and burst into a cold vapor instantaneously. The vaporized gasoline mixes more quickly and uniformly with air so your engine starts faster and runs smoother, giving better driveability and increased low end torque. The uniform fuel/air mixture virtually eliminates leancylinder knock, hesitation, stalls and flooding. The

rotary is more eager to accelerate nowruns smoother and is more responsive to light throttle change—exceeds your claims of improved performance".

H.B.M., Danville, IL— 1984 Ford Tempo

"Took 11/2 hours to install—improved starts—runs smoother—better acceleration—now get about 26 mpg city".

M.L.F., Phoenix, AZ— 1973 Ford LTD 400cc

"Better acceleration from idle up to speed-smoother running. As a designer of electronic circuitry, I found the Fueltron to be a very well designed and built device".

W.F.M., Mechanicsville, VA— 1979 Ford Fairmont, 8 cyl.

"It will do all you claimed and more. I am a mechanic with forty years of experience, and I believe that with it on our car there would be no need for pollution equipment."

J.L., Tacoma, WA— 1978 Mercury Z-7, 6 cyl.

"Eliminated a dangerous flat spot in acceleration-easier starts-used to die 2 or 3 times".

*Full names and copies of letters on file.

Fueltron Ultrasonic Fuel Vaporizer meets the requirements for sale in California(1) works with regular and turbocharged engines, boosting energy while reducing waste and pollution.

THE DETAILS

Fueltron works with any fuel (or fuel mixture), including water injection systems. Installation is simple; if you know how to remove your carburetor, the rest is easy, no modifications to carburetor or manifold required. In the unlikely event that Fueltron fails, normal engine performance will not be affected.

(1) State of California Air Resources Board: Exec. Order No. D-132.

Thousands of Fueltron Ultrasonic Fuel Vaporizers are in use improving engine performance. ORDER YOURS TODAY!

© 1984 Fueltronics Corp.

Fueltronics Corporation 9101 Greenwood Ave., Niles, IL 60648

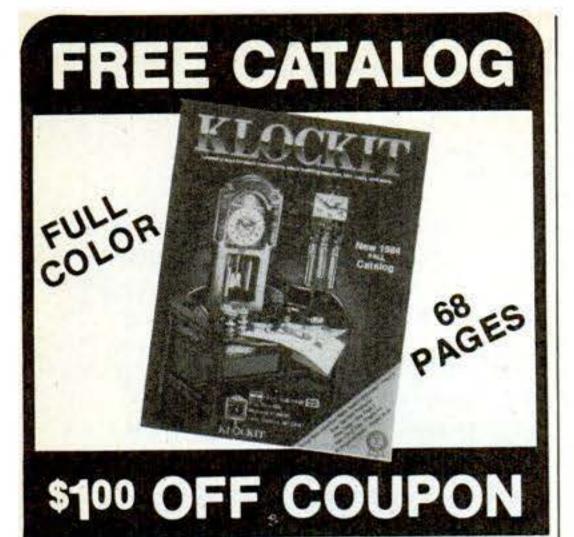
Please send me a Fueltron Kit:	PS11
☐ Model 7000 (2 or 4 Barrel) \$129.95 + \$4.75	shipping/handling
☐ Model 7100 (1 Barrel) \$99.95 + \$4.75 shippi	
(Illinois residents add 7% S.T.) Instructions and warran	nty supplied with kit.

NAME			
STREET		104	
CITY/STATE/ZIP			
Payment is by: Check	☐ Money Order	☐ Visa	☐ MasterCard
Card No	Evn		

Fueltronics Corporation will refund purchase price less shipping and han-

Distributor, National Account and OEM prices furnished upon request. (Minimum opening order 250 Fueltron Kits.) Include D&B rating or bank & credit references.

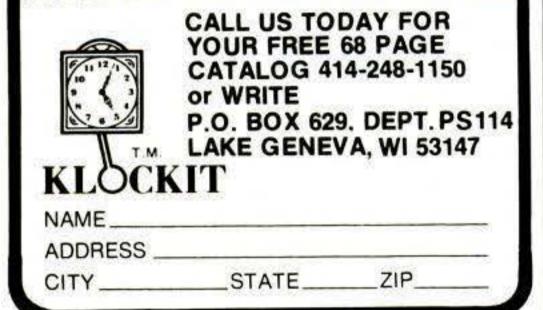
Copyrighted material

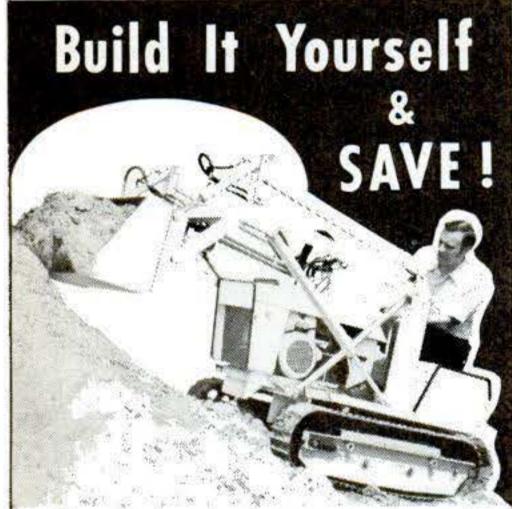


KLOCKIT'S newest catalog is packed with kits, plans and supplies for building clocks, furniture, toys, lamps, music boxes and more! All at our famous low prices! Clip and save this coupon for \$1.00 OFF. Include it with your next order from KLOCKIT!

CLIP AND SAVE!

(Limit one coupon per order)





Build a road or landscape your home—Dig a swimming pool or pond—Clear brush and haul firewood—Excavate for a patio, basement or solar addition...Do it all yourself and Save with a Magnatrac Bulldozer Kit!

Buy Kit factory-direct...assemble it in a weekend. Do odd jobs for extra cash! Send for: Catalog showing Kit construction and uses—\$1 or Plans to 'Build it yourself'—\$7. Write to: STRUCK-KIT

Dept. PS114 Cedarburg, WI 53012







one-million new engines are being built each month. With

Foley-Belsaw training, you can soon have the skill and

knowledge to make top money servicing these engines.

Professional Tools and Equipment PLUS 4 hp 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. 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.

Foley-Belsaw Institute • 50587 Field Bldg.

Kansas City, Mo. 64111

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





Goop? It sticks, stretches, seals

When an adhesive manufacturer calls its product Goop and sells it for three types of uses—household, automotive, and plumbing—and then admits that it's all the same formula, you've got to wonder why. I found out. Goop does so many different jobs that it would be confusing to show all these uses on one package.

Originally, Goop was sold for repairing hard-to-fix outdoor gear such as waders, beach balls, wet suits, and leather goods. Now, a refinement of the formula makes it a unique sealant and adhesive that sticks and holds strongly to concrete, metal, wood, plastics, and glass—in fact, almost anything you'd want to repair, mount, or plug up.

I first tried Goop to re-attach a floppy shoe sole. It worked great. Because Goop flexes, it doesn't tend to shear away in the joint. After 24 hours, a bead of the stuff I'd squirted on a piece of wax paper was so tough I couldn't break it with an all-out pull.

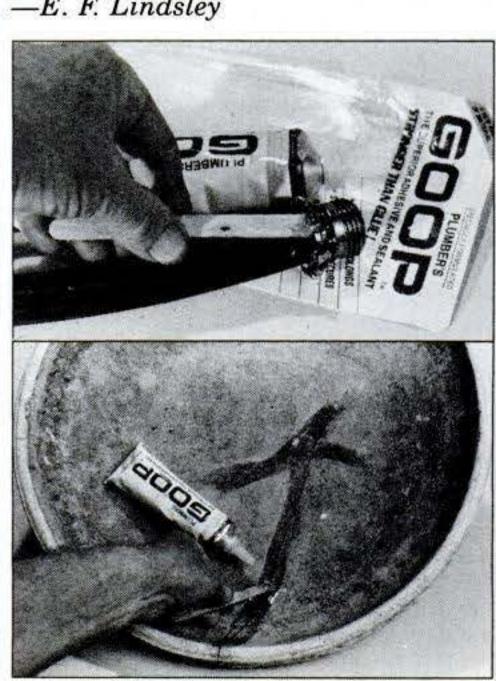
My next test was a delicate one on a flash-gun cord with an intermittent electrical break in the camera-end plug. After carefully cutting away the top of the plastic plug and resoldering the break under magnification, I rebuilt the cutaway part with Goop. It now works perfectly.

Later I tried Goop on garden hoses, a cracked bird bath, and a leaky plas-

tic pipe—all with success.

Sold in hardware, automotive, and sporting-goods stores for \$3.69, Goop is made by Eclectic Products Inc. (729 Basin St., San Pedro, Calif. 90731).

—E. F. Lindsley



MUSTLIQUIDATE AT LOW CLOSEOUT PRICES! POWER GENERATORS

Factory new! First quality! (Except for reconditioned 20,000 watt model.)

Don't let a storm rob YOU of vital electric power! With a Power Generator, you ALWAYS have a reliable standby source of electrical power quickly available. Choose from models for home, commercial use or camping.

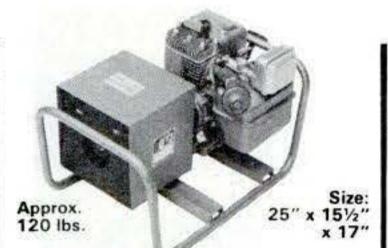


1000 watt

- 76cc. Kawasaki engine!
- Two 110V AC, 15 amp. outlets! 12V outlet for battery charging!
- · Compact, lightweight! Weighs only 43 lbs.!
- Take it camping!
- Runs lights, small appliances!
- · Gasoline operated. Easy recoil start!

Comparable Value: \$488.00

Liquidation Item No. 1186 Ship, handling: \$13.50

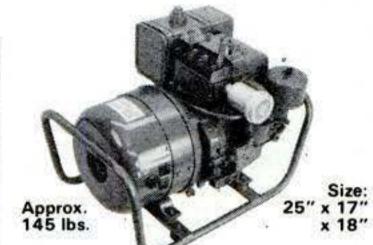


2500 watt

- 5 hp. Kawasaki engine!
- Four 110V AC, 15 amp. outlets!
- Ideal at campsites!
- Use on construction sites!
- Provides plug-in emergency electric power for your home!
- Runs lights, small appliances and power tools!
- · Gasoline operated. Easy recoil start! Manual choke.

Comparable Value: \$845.00

Liquidation ... Item No. 1187 Shipped freight collect



Multi-Fuel!

LP gas or

natural gas!

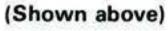
Uses gasoline,

4000 watt

- 8-hp., 4-cycle Tecumseh engine.
- · Gasoline operated. Easy recoil start.
- Two 110V AC, 20 amp. outlets. One 220V AC, 20 amp. outlet.
- Runs motors up to 1/2 hp.
- · 4-qt. fuel tank.
- · Ideal for home, cabin, camper vehicle, construction sites.

Comparable Value: \$1000.00

Liquidation Item No. 1196 Shipped freight collect



Approx. 151 lbs. Size: 25" x 17" x 18"

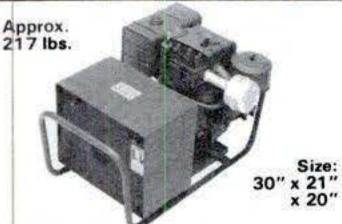
4000 watts

Electric (battery) start (Battery NOT included)

- 8 hp. Tecumseh engine! Four cycle, single cylinder.
- Two 110V AC, 20 amp. outlets! One 220V AC, 20 amp. outlet!
- Runs motors up to 1 hp.
- · Gasoline operated. Easy recoil start! Manual choke.
- · 4-qt. gas tank.
- · Ideal for home, cabin, camper vehicle, construction sites!

Comparable Value: \$1195.00

Liquidation Item No. 1194 Shipped freight collect



5500 watt

- 11 hp. Briggs & Stratton engine!
- · Four 110V AC, 20 amp. outlets. One 220V, AC, 20 amp. outlet.
- Runs motors up to 1 hp!
- For emergency power at home or for small stores and construction sites!
- Gasoline operated. Easy recoil start!

Comparable Value: \$1275.00

Liquidation Item No. 1188 Shipped freight collect



8000 watt

- 16 hp. Briggs & Stratton engine!
- · Four 110V AC, 20 amp. outlets! One 220V AC, 50 amp. outlet!
- Runs motors up to 3 hp.
- · Ideal for emergency power in small stores and buildings!
- Gasoline operated!
- Pushbutton electric start and recoil start.

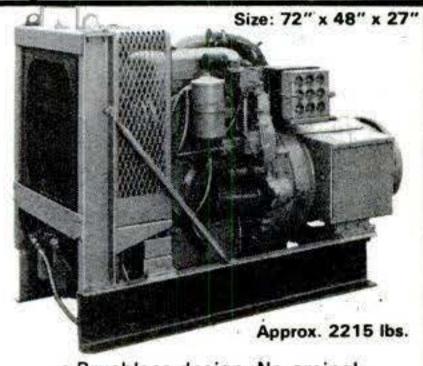
Comparable Value: \$2295.00

Liquidation Item No. 1189 Shipped freight collect

20,000 watt **Detroit Diesel Allison Industrial Model**

The Santa Fe railroad used these units for their refrigerated cars. But they changed to a NEW type refrigerated car, and these generators were no longer needed. Each one has been thoroughly reconditioned, refurbished and load-tested for reliable performance.

- 42 hp. Detroit Diesel engine!
- Low 1200 rpm. for longer life!
- Pushbutton start from 12V battery (not incl.).
- · Safety shutoff if oil pressure drops too low.
- Gear type fuel pump and lube pump.
- · Delco ball-bearing brushless design generator.



Brushless design. No arcing!

- 60 amps. at 220V, 3-phase. 55 amps. at 120V on each of three groups of single phase!
- For supermarkets, farms, drilling and construction sites!

Value When New: \$11,000.00

Liquidation Item No. 1184 Shipped freight collect













Credit card members can order by phone, 24 hours a day, 7 days a week.

Toll-Free: 1-800-328-0609

C.O.M.B.CO.®

Authorized Liquidator 14615 28TH AVENUE NORTH MINNEAPOLIS, MINNESOTA 55441-3357

SEND ME THE ITEMS I HAVE LISTED BELOW (All prices subject to change after 60 days.

Offers void outside original 48 states.)

Item No.	How Many	Item	Ship/ Handl.	Price
			51	

C.O.M.B. CO./Liquidators Item X-166 14615 28th Ave. N., Minneapolis, MN 55441-3357

Send the items indicated at left. (Minnesota residents add 6% sales tax. Allow 3-4 weeks for delivery. Add 2-3 weeks extra if paid by check. Sorry, no C.O.D. orders.)

My check or money order is enclosed.

Charge: ☐ MasterCard® ☐ VISA ☐ Am. Ex. ☐ Diners Club

Acct. No. PLEASE PRINT CLEARLY

Phone ____

Sign here ____



NOW...CASIO'S NEW MEMORY BANK

The microcomputer timepiece that organizes your life.

Now there's a timepiece that delivers a whole lot more than time information. This new CASIO contains a computer that never forgets: telephone numbers, addresses, codes, timetables, appointments, etc. But that's not all.

Imagine a timepiece that alerts you to important dates — as they approach — with the help of preprogrammed reminders.

And there's more, much more...for much less than \$100.

MEMORANDA MEMORY ON THE WRIST

This technological miracle was the talk of the Consumer Electronics Show 1984 and was given the 1984 Design and Engineering Award for innovative consumer electronic excellance.

With this memory bank watch you can store 50 separate sets of personal information you want to keep on hand. Each set can contain up to 6 letters and 12 numerals. It's ideal for storing timetables for flight and train schedules or daily appointment schedules for each day of the week. Or other information such as telephone numbers. bank accounts, credit card numbers, anniversaries, birthdays, postal codes, price tables and telex codes.

This computer-on-a-wrist will edit each of the 50 separate information displays for you. With a touch of a button, you can easily retrieve the programmed information in alphabetical order. Unused pages will not appear. It's your miniature personal record book and file cabinet.



EDISON'

78 90 IZ

TELE-MEMO

TIMETABLE

*B.EXON

16 00

SCHEDULE

20-

12 3456

PERSONAL MEMO

THE COMPUTER THAT NEVER FORGETS

This electronic genius also has an extraordinary organizing talent. It reminds

you of important dates — as they approach — by sight and by sound.

You can program it months in advance. Events like meetings, appointments, birthdays, and anniversaries (yes, this timekeeper sees to it your anniversary is remembered before someone special has to remind you).

When that special date arrives, this CASIO reminds you with an alarm, date and 6-letter message. What's more, you can program this multi-talented timepiece for daily events. To wake you up. Catch your bus. Program it for any minute you choose.

Or set it to beep-beep you every hour on the hour. And because of the AM/PM indicator, you won't be setting it for the wrong time of day.

PRECISION STOPWATCH AND COUNTDOWN TIMER

This precision timepiece also boasts a full-function stopwatch and countdown timer alarm. With a press of a button you can set the fiercely talented stopwatch into motion. Record split times, 1-2 finishes (up to 24 hours), or freeze the figures anytime to 1/100 second accuracy.

The countdown timer alarm can be set from 1 minute to 60 minutes and times to 1/10 second accuracy. When you reach zero, the alarm sounds and the pre-

1985

APRIL

Date/appointment memory

bank with alarm helps you

as your calendar. Reminds

organize your day as well

you of those important

dates as they approach.

entered time is automatically retrieved.



This intelligent timepiece also gives you hours, minutes, seconds, am/pm, year, month, date and day. And you can change over from 12-hour to

24-hour formats with a touch of a button. All with uncompromising accuracy to 1/2 second per day.

Other distinctions? You have your choice of sporty lightweight black polysulfone model **DB-50** for \$49.95, dressy chrome/stainless model **DB-500** for \$59.95, or gold-plated model **DB-500G** for \$79.95.

OUR DOUBLE GUARANTEE

ON THE RUN is America's source for innovative timepieces and we back this watch with our double guarantee.

First you get the included warranty: Oneyear parts and labor (in the rare event repair is needed you'll find this service-by-mail feature very convenient). Secondly, we guarantee your satisfaction. If not delighted with your

new CASIO, return it in new condition within 30 days for a full refund.

We're one of the largest timepiece dealers in the United States and we're as close as your phone. Orders are accepted 24 hours a day, 7 days a week. We almost always have the watch you want in stock. Shipments are generally made within 48 hours from the day we receive your order.

Order now and be delighted.

CREDIT CARD HOLDERS ORDER TOLL-FREE TODAY

Credit card holders may use toll-free numbers below, or send check or money order plus \$2.50 for each watch. Add an additional \$2.00 for U.P.S. BLUE LABEL air delivery.

North Dakota residents add 4% tax.

800-437-4385 On The Run

107 Roberts St., Dept. PS-11 P.O. Box 67, Fargo, ND 58107 Telephone: (701) 232-9400

Memory Bank/1224

© 1984 On the Run

What's New at **AMERICAN SURPLUS TRADING?**

"The Source" of electro-mechanical components for the hobbyist.

W e warehouse 60,000 items at American Surplus Trading—expensive, often hard-to-find components for sale at a fraction of their original cost!

You'll find every part you need-either brand new, or removed from equipment (RFE) in excellent condition. But quantities are limited. Order from this ad, or visit our retail showroom and find exactly what you need from the thousands of items on display. Open Mon.-Sat., 9-5.

THERE'S NO RISK.

With our full 90 day warranty, any purchase can be returned for any reason for full credit or refund.



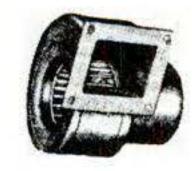
Receive only. Non-impact, thermal paper. 5 x 7 matrix-80 characters per line. Printing Rate: selectable, 10/30 char. per sec. Full/Half Duplex. Interface: Serial type/ RS232/C & Current loop. 300 baud rate. Dim: 14.6" x 15.25" x 4.25"

X. 19" COLOR X-Y DISPLAY

Originally designed for use in Atari coin-operated games. Contains a 19VLUP22 3-gun color tube, focus and brightness controls. Has electromagnetic deflection and solid state circuitry with three "Z" amp inputs (red, green, blue). Ideal for arcade replacement or, with the addition of external circuitry, for color graphics display

\$129.00 NEW

A. 160 CFM BLOWER



83/4"H x 629/32"W x 81/16"D. Air Outlet: 3"H x 33/8"W. 115VAC, 60HZ. Used in heating, ventilating, and exhausting. \$9.95 RFE B. APPLE 2C DISC DRIVES



Original equipment drives. Cosmetic rejects.

\$139.50 RFE

C. 115 CFM MUFFIN FAN'



Metal frame with 5 highimpact plastic blades. For cooling HiFi, electronic equipment, computers, etc. Mounts for intake or exhaust, 115VAC, 60HZ. Dim: 411/16" x 11/2"D.

\$7.95 RFE

D. VACUUM PUMP



Rotary vane pump, oil-less. 4CFM/15PSI max. (or 26" HG). Directly connected to a (GE 1/3HP, 1625RPM, 115VAC/60HZ) thermally protected motor. Mounted on a metal base. Mfr: GE& Gast

\$39.95 RFE

E. DOT MATRIX THERMAL PRINTER



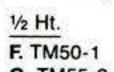
Sinclair #2040

32 columns. Requires 24 VAC 1.2 amp. transformer (supplied). Factory returns. (Sold as is-may require* repair.)

\$14.95 RFE

51/4" TANDON DISC DRIVES

IBM Compatible



SS/DD \$ 99.50 G. TM55-2 DS/DD 179.00 H. TM55D-2 DS/DD 199.00 Full Ht.

J. TM100-1 SS/DD

159.00 K. TM100-2 DS/DD L. TM100-1 w/o controller boards (mechanics only) \$45.00

\$ 99.50

Other 51/4" P.C. Drives

1/2 Ht. M. TM55-4

Full Ht. N. TM101-4

DS/Quad \$199.00 DS/Quad

\$199.00

O. T.I. SILENT 700 PRINTER



\$199.00 NEW

P. HIGH QUALITY INTELLIGENT KEYBOARD

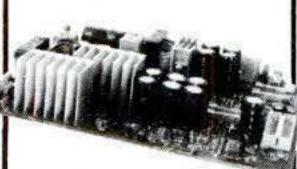


60 Key Typewriter Layout

Utilizes 8041 8 bit microprocessor, 8243 10 expander, 2316 ROM and more. Charcoal grey key caps with sound transducer. Power requirement: 5 VDC. 26 pin header connector. Mfr: Brothers Ind. Ltd. 556-504. Full documentation.

\$14.95 NEW

Q. COMPUTER DISC **DRIVE SWITCHING POWER SUPPLY**



Input: 115V AC. Output: ± 12V @ 1 amp. +5V @ 6 amp. -5V @ 1 amp. Dim: 91/2"L×7"W

\$29.95 NEW

R. 1/2 H.P. MOTOR



CCW Rotation 115 VAC General Electric #5KC47KR319AS 60 HZ. 9.2 Amps, Size: 61/2D" × 83/4"H × 81/4"; shaft 5/8 dia x 2"L with 3/16" keyway slot.

\$39.50 NEW

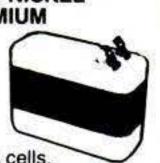
S. 24V @ 6 Amp DC POWER SUPPLY

Industrial qualityregulated, providing variable output from 20-28VDC. Input: 105-125 VAC, 60HZ. Compact solid state package with integral heat sink. AC fuse protection, terminals are quick-connect slide on type. Dim: 4" x 81/2" x 73/4"D.

\$19.95 RFE

PUMPS—COMPRESSORS—BLOWERS—MOTORS—POTENTIOMETERS—COUNTERS TIMERS—RELAYS—VOLTAGE REGULATORS—POWER SUPPLIES

T. 12V BATTERY PACK-NICKEL CADMIUM



Pkg. of 10-1.2V AA cells. Delivers 12V @ 450ma. Recharge rate 45mA, 16-18 hours. Case with tab output connections. Dim: 21/16"H x 11/4" x 215/16"L. Mfr: GE #123233 or equiv. \$5.95 RFE U. TIMEX SINCLAIR 1000 COMPUTER

Factory

returns.



TV tested. Utilizes Z80A CPU (socketed) 2016P and other chips.

\$14.95 RFE

V. 60 RPM GEARHEAD



Reversible; 60 in-lb torque 1/12 HP w/capacitor. 6" Lx 31/2" D shaft 3/4" Lx 5/16" Dia. 115V 60 hz 1.3 amps. Molon EM5 or equiv.

\$9.95 NEW

W. MAGNETIC **RECORDING TAPE**

Pre-recorded bulk erased, by a variety of manufacturers such as: Ampex, 3M, or Scotch. 7" Reels. 1800 ft.-1 mil. 2400 ft-

> Bakers Dozen 13 reels/ \$9.95

> > MINIMUM ORDER

American Surplus Trading 62 Joseph St., Moonachie, NJ 07074

.75 mil.

REET,	MOONACHIE, N.J. 07074
	□ M., shock as manay asdes in apple

AMERICAN SURPLUS TRADING, 62 JOSEPH ST YES! Please send me the following items:

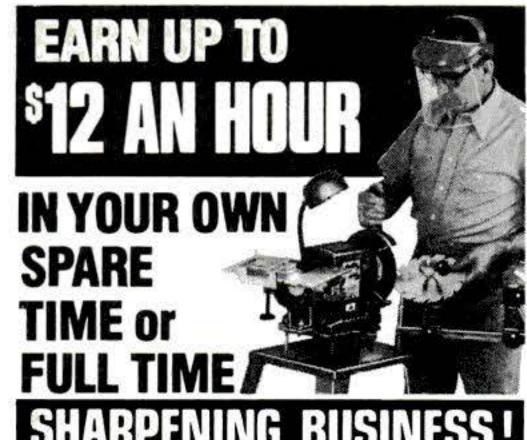
A,B,C, etc.	How Many?	Description	Price	Total
- 3				
				9
			740	
15.2			Total	

FREE CATALOG of electro-mechanical devices sent with every order.

Shipping and handling, we ship UPS unless otherwise specified. Add \$3 plus 10% total. Canada \$3 plus P.P. cost. Charge only. Sales Tax (N J residents only, please add 6% of total) ORDER TOTAL

☐ My check or money order is enclosed. ☐ Charge my credit card.		\$15.	
□ Visa □ Maste		PS-114	
Card No			
Exp Date			
Signature			
Telephone Area Code	Number		
Name			
Address			
City			
State	Zip		

All inquiries and free catalog requests call 201-939-2710. For all phone orders, call TOLL-FREE 800-228-2028 ext. 825. In Nebraska, 800-642-8300 ext. 825.



SHARPENING BUSINESS!

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 ... cutting edges.





Send for all the facts! Our free Book tells how to start a profitable, lifetime home sharpening business. how we help you grow, how we'll finance you.

Send for FREE details - mail coupon below or postcard TODAY! Foley Belsaw Co. 60400 Field Building, Kansas City, Mo. 64111

	ubligationr				
YES.	FOLEY BELSAW CO.	60400	FIELD BL	DG., KANSAS	CITY, MO. 64111
	send me the FRE				
Name		lease Print	-		

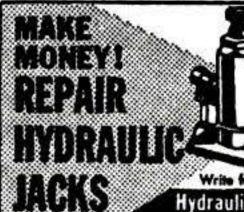


Train at home in spare time. No previous experience needed. Tools and materials included with course. No special talent required. We show you what to do, how to do it. No salesman will call. LEARN DRAFTING AT HOME!

SEND FOR FREE FACTS ADDRESS.

CITY/STATE/ZIP

NORTH AMERICAN SCHOOL OF DRAFTING, Dept. PC0A4, 1 4400 Campus Dr., Newport Beach, CA 92660



Earn while you learn at home. Millions of jacks in gas and auto service stations, trucking firms, body shops, riggers, factories and tarms 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. for folder No. PS11 and free bonus offer

Hydraulic Jack Repair Manual Co., Inc.

Need a never-ending flow of cool, clear water? You can drill your own water well with our amazing little low-cost drill. Easy to operate as a power lawn mower.

"All the free water you'll ever need!"

For a free, illustrated booklet, phone tollfree, 1-800-821-7700 (Operator 5693),

or write: PEROCK 5693 Anderson Road Opelika, Alabama 36802 Established 1962



CALL NOW (KS) 1-800-332-0274-371001 TOLL-FREE: (OTHER) 1-800-255-0390-371001

Send ____ Liter-Starts at \$14.95 ea. plus \$3.00 ea. for postage and handling.
Check or money order enclosed.
Mastercard
VISA

Acct. No. _____ Exp. Name Address

State ___ Zip _

Q PRODUCTS P.O. Box 2069 Kansas City, KS 66105

150 PROJECTS • BUILD NOW FOR XMAS

•TRUCKS•PLANES•BOATS •TRAINS•JUMP & WIGGLE TOYS FURNITURE & HOME PROJECTS •KID RIDE-ON VEHICLES FREE XMAS PLAN WITH ORDER

ILLUSTRATED CATALOG \$1.50(US) DUTCHMAN'S SAWMILL. DEPT. S P.O. BOX 5381 PHOENIX. AZ 85010

FREE! How to Offer Your **Invention for Sale**

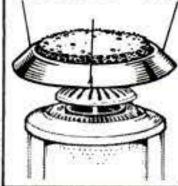
Got a great invention you'd like to sell? Send for a FREE copy of our fact filled booklet tells how to offer your invention for sale. No cost . . . No obligation. Send your name and address to: Kessler Sales Corp., Dept. D-711 Fremont, OH 43420. TOLL FREE 1-800/537-1133, Ext. -711. In OH 1-419/332-6496.

GREAT SAUSAGE RECIPES

227 page illustrated book explains sausage making plus home curing and smoking of meat, fowl and fish. Over 100 recipes. We now have Low Salt Seasonings. Free equipment and supply catalog has more information.

THE SAUSAGEMAKER 177-12 Military Road Buffalo, N.Y. 14207

STOP KEROSENE ODOR



New pure a fire " Catalytic Filter for Kerosene Heaters eliminates odors and oily residues. Hangs easily over burner. Satisfaction guaranteed. \$19.95 plus \$3.00 shipping. Credit card buyers call toll free 1-800-554-8000, ask for operator 282 or send check to Catalytic Damper Corp., Dept. PS11, Flint Hill, VA 22627.

pure•a•fire

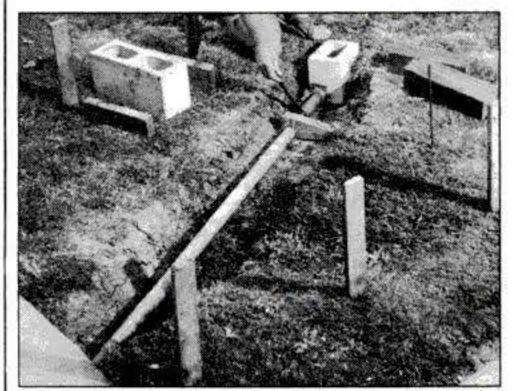
REPAIR IT! "Nu-Thred" FILE For Right or Left Hand-Any Diameter No. 1 for Most Popular Pitches HEX No. 2 for Coarser and Finer No. 8 for METRIC DIES Works in tight spots: No. 6F, Set for NF-SAE 1/4" thru 9/16" Add \$1 Handling — Satisfaction Guaranteed JAWCO, BOX 213-P, READING, PA 19603

Driving a pipe under concrete

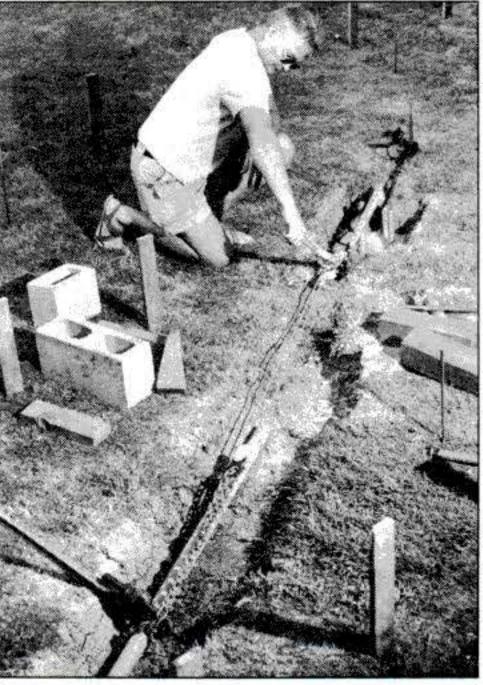
Need pipe laid under a concrete driveway or sidewalk? Don't break up the concrete; drive the pipe instead. That's how pros do it. They use power equipment, but you can do it easily with a hydraulic auto jack (or screw jackperhaps even a bumper jack).

Tom Miller (Huntington Beach, Calif.) devised the technique. First, dig a trench long enough for the pipe and the jack, plus a concrete block. Use the block to bear against the end of the trench. Then lay the parts in the trench, with the pipe end starting where you want it, and force it in with the jack. Bottle-type hydraulic jacks will work in the horizontal position as long as the driving piston is not topside. A block of wood between the jack's ram and the pipe cushions the connection. As the pipe goes in, add blocks of wood and concrete to give the jack a fresh bite. Unless the soil contains large rocks, it's a breeze.

—Richard Day



Miller drives a 11/2-in.-diameter pipe under a nine-ft.-wide concrete patio.

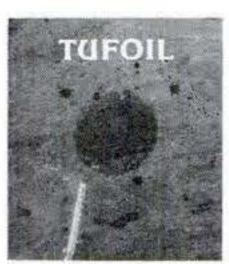


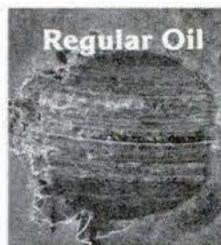
To back the pipe out to install a smallerdiameter one in the same hole, Miller anchors a ratcheting hoist, as shown.

Bergen Record; Thursday, July 5, 1984

"Tufoil® is Car's Fountain Of Youth."

"Developments in improved gas mileage and auto longevity are not coming out of Detroit or Japan, but rather a small factory in New Jersey", says Michael Deverey.





Over A Decade Of Development

Fourteen years of development have produced a fantastic lubricant additive that can make your car's engine last longer and run better. We've gotten six U.S. patents and several foreign patents so far . . . more are pending.

Independent lab tests in Australia and Israel, Holland and the United States confirm that TUFOIL does what we say. It makes engines work better and saves fuel.

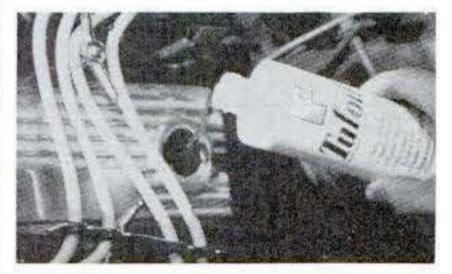
Popular Mechanics' test team said TUFOIL is "Absolutely spectacular".

Winter Starting Is Easier

TUFOIL's low friction means that batteries and starting motors don't have to work as hard. They'll last longer! Those sub-zero days won't be as big a problem as in the past.

Satisfaction Guaranteed

We like our customers! If you are not satisfied with TUFOIL for any reason, give us a call and we will | cheerfully send a refund!



TUFOIL® Has The Lowest Friction And Wear Of Any Known Lubricant

We have run thousands of 4-ball tests in our laboratory. Scanning Electron Microscope photos show extraordinarily low wear for TUFOIL and it's derivatives. The Scanning Electron Microscope photos on the left show two steel balls tested under identical conditions. One was tested with a standard lubricant. The other with TUFOIL. Quite a difference! Just imagine what this means in your engine!

Our Pledge To **Our Customers**

At Fluoramics, our goal is to cut your gas bills and make your car last longer. If you can get your car to last 200,000 miles or more using our product, TUFOIL, you will save yourself a heap of money. Just figure the cost of a new car, it's financing and maintenance and you will see right away that the savings can be gigantic!

How To Use TUFOIL®

Just add one 8-oz. container of TUFOIL to your standard crankcase. (It'll treat 4 to 5 quarts of engine oil.) If you want to super treat your engine, add two bottles! You will see the results in less than 1,000 miles.

MAKES YOUR CAR'S ENGINE WORK BETTER, LAST LONGER!

Once your engine is broken in on TUFOIL, add 4 ounces (1/2 bottle) with each oil change to keep new performance levels. Use TUFOIL repeatedly over the life of your engine to help keep it purring like

for ENGINES

Better Mileage

* Easier Starting

• Increased

Engine Life

Better Performance

· Fewer Oil Changes

Proven, Patented

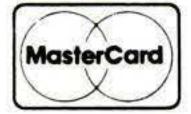
Guaranteed & Insured

8FI. Oz. (.237 Liter)

Where Can I Get TUFOIL®?

It's simple! Just fill out the card below or pick up your telephone. Call us anytime - day or night -seven days a week!

Don't forget to have your Visa or Master Card ready!





Order by Phone - Today!

TOLL FREE: 1-800-922-0075 in N.J. (201) 825-8110

Buy a	gallon of	TUFOIL®	to share with y	our friends	& SAVE!
				MACH VALUE	

One 8 oz. bottle — \$9.95 (plus \$1.50 shipping & handling)
Two 8 oz. bottles — \$18.00 (plus \$2.00 shipping & handling)
One gallon — \$98.00 (plus \$4.00 shipping & handling)
N I residente add 6% calce tay

Mail to: FLUORAMICS, INC. 103-105 Pleasant Avenue Upper Saddle River, NJ 07458 (201) 825-8110 / 1-800-922-0075

I IO I COIGC	ille dad 0 /6	Suics tax		
No C.O.D.s	☐ Check	☐ M.O.	□ VISA	☐ MASTERCARD
Acct. No.				

Exp. Date_

	Apt. No
State	Zij
	State

Signature Orders to Canada check or money order must be made payable in U.S. dollars. \$3.00 must be added to total cost of order. TUFOIL® CUTS THE COST OF OWNING A CAR.

STOP WINDOW HEAT LOSS WITH LOW COST-EFFICIENT ENERGY ARSENAL WINDOW INSULATING SYSTEMS.... COMPLETE KITS FOR AS LOW AS \$6.95



Stop Window Heat Loss Even If You Have Storm Windows!

With the low cost-effective Heat Window II Inside Window Insulating System . . .

Energy Arsenal Mfg. Window Systems stops cold air infiltration and prevents excessive heat loss for less cost than window systems that cost many times more. By creating an insulating pocket of air, you can keep your living and working areas comfortable with lower thermostats to save on heating costs.

This system uses an interlocking fastener that is postioned on the window trim in a matter of minutes. The 100% clear window film is snapped into place between the two fastening interlocks, thus forming an air-tight seal.

ALL ARE COMPLETE KITS - NOTHING FLSE TO BLIV

ALL ARE CO	MLTE IE VIIO - MOTUINO E	LOE TO DOT.	
40 INCHES WIDE BY	50 INCHES WIDE BY	60 INCHES WIDE BY	
25 Ft. long & 75 Ft. Fastener Stock #IF-100 Cost:\$19.95 50 Ft. long & 150 Ft. Fastener Stock #IF-101 Cost: \$35.95 75 Ft. long & 200 Ft. Fastener Stock #IF-102 Cost: \$49.95 Add \$2.50 for Postage and Handling	25 Ft. long & 75 Ft. Fastener Stock #IF-200 Cost: \$22.95 50 Ft. long & 150 Ft. Fastener Stock #IF-201 Cost: \$38.95 75 Ft. long & 200 Ft. Fastener Stock #IF-202 Cost: \$52.95 Add \$3.00 for Postage and Handling.	25 Ft. long & 75 Ft. Fastener Stock #IF-300 Cost: \$24.95 50 Ft. long & 150 Ft. Fastener Stock #IF-301 Cost: \$44.91 75 Ft. long & 200 Ft. Fastener Stock #IF-302 Cost: \$67.95 Add \$3.50 for Postage and Handling.	
Patia Boar / Dicture Window Size _ 8	Aln v Q Et & 35 Et Fastener Stock	#PIF-101	

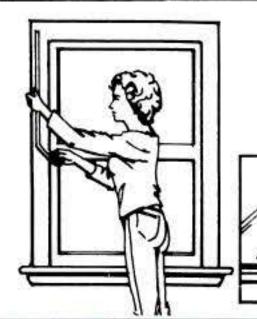
Patio Door/Picture Window Size — 84 In. x 9 Ft. & 35 Ft. Fastener Stock #PIF-101 (Add \$2.00 for Postage and Handling.)

Heat Window Plastic Film

Cost: \$9.95

This high quality plastic film has been developed especially for storm window applications. It's 100% optically clear - durable and strong with a high-tensile strength. This is an inside gauge film that can be used with excellent results. This film can be tightened with a household hair dryer.

CI	HOOSE FROM THE M	ANY SIZES AVAILABI	E
40 INCHES WIDE BY	50 INCHES WIDE BY	60 INCHES WIDE BY	84 INCHES WIDE BY
40 Ft. long — Stock #PF-401 Cost: \$7.95 80 Ft. long — Stock #PF-402 Cost: \$14.95 120 Ft. long — Stock #PF-403 Cost: \$19.95 Add \$2.50 for Postage and Handling.	40 Ft. long — Stock #PF-501 Cost: \$9.95 80 Ft. long — Stock #PF-502 Cost: \$17.95 120 Ft. long — Stock #PF-503 Cost: \$24.95 Add \$2.50 for Postage and Handling.	40 Ft. long — Stock #PF-601 Cost: \$11.95 80 Ft. long — Stock #PF-602 Cost: \$19.95 120 Ft. long — Stock #PF-603 Cost: \$29.95 Add \$2.75 for Postage and Handling.	40 Ft. long — Stock #PF-801 Cost: \$14.95 80 Ft. long — Stock #PF-802 Cost: \$25.95 120 Ft. long — Stock #PF-803 Cost: \$35.95 Add \$2.75 for Postage and Handling.



Our Economical Low Cost Tape On Window Insulating System . . .



A fast and easy low-cost effective window sealing system. Our Heat Window can't be beat. Stops cold air infiltration — installs in minutes from the inside — 100% crystal clear — shrinks tight with hair dryer. No tedious measuring or cutting. Uses double-sided acrylic polypropylene fastening tape. Comes in a complete kit nothing else to buy.

50 INCHES WIDE BY	60 INCHES WIDE BY
25 Ft. long & 80 Ft. Tape Stock #HW-201 Cost: \$10.95	25 Ft. long & 80 Ft. Tape Stock #HW-301 Cost: \$11.95
50 Ft. long & 160 Ft. Tape Stock #HW-202 Cost: \$18.95	50 Ft. long & 160 Ft. Tape Stock #HW-302 Cost: \$22.95
Stock #HW-203 Cost: \$24.95	75 Ft. long & 240 Ft. Tape Stock #HW-303 Cost: \$30.95
Add \$2.75 for Postage and Handling.	Add \$3.00 for Postage and Handling.
	25 Ft. long & 80 Ft. Tape Stock #HW-201 Cost: \$10.95 50 Ft. long & 160 Ft. Tape Stock #HW-202 Cost: \$18.95 75 Ft. long & 240 Ft. Tape

OUR GUARANTEE: Should you not feel satisfied, keep the portion you have installed and return the unused portion within 15 days for a complete refund less postage and handling.

> Energy Arsenal-Dept. PS-11 254 County Line Rd., Hatboro, PA 19040

DOUBLE-SIDED ACRYLIC **FASTENING TAPE**



This tape has been developed for this special application. Used to fasten heat window type plastic to window frames, mouldings, walls, etc. For use from the inside. A paper separator strip is pulled off to expose the side that the window

film adheres to. A fast and easy method to use.

1/2" wide and 110 Feet long -Stock #T-101

Cost: \$3.95

3/4" wide and 110 Feet long -Stock #T-102

Cost: \$5.95 Complete instructions with every roll. Add \$1.00 for Postage and Handling.

INTERLOCKING FASTENING SYSTEM



A quality way to seal off windows and door openings. This will work with any film from 1 to 4 mills thick. Comes with a foam self adhesive attached to bottom portion. Installs on trim or frame and can also be

Cost: \$6.45

painted. No special skills or tools needed to install. Comes in white — brown —

25 Feet long/Stock #FS-101 50 Feet long/Stock #FS-102

Cost: \$11.65 75 Feet long/Stock #FS-103 Cost: \$17.45 Cost: \$23.25 100 Feet long/Stock #FS-104

Please note color on order form. Comes in lengths 26" long. Add \$2.50 for Postage and Handling.

ATTENTION

ENERGY ARSENAL MFG. CAN CUSTOM MAN-UFACTURE ENERGY SAVING WINDOW KITS FOR YOUR EXACT NEEDS — OFFICE BLDGS., SCHOOLS, HOSPITALS, FACTORIES. Call our Industrial Sales Dept. for information.

ORDER TOLL FREE

Call 24 Hrs. a Day — 7 Days a Week 1-800-523-2004 VISA — MASTERCARD

A minimum charge order is \$15.00.

254 County	STOCK #	QTY. & COLOR	PRICE
		+	
☐ Check ☐ M.O.			
□ VISA □ MC EXP. DATE:	Postage & Handling		
	PA add 6% Sales Tax		
	тот		
CARD NUMBER			
NAME		unio Maria	
ADDRESS			
CITY	STATE	ZIP	CODE

A MINIMUM CHARGE ORDER IS \$15.00.

Shoppers' Showcase

Satellite TV Book

This "BOOK" takes the mystery out of satellite technology. The distinguished AT&T Bell Labs, prestigious M.I.T., U.S. Army, Navy & libraries worldwide have bought our best selling BOOK.

DISH ANTENNA \$ DOWNCONVERTER

New Multichannel MDS complete receiving system ready for TV hookup.



Satellite TV 4FT. PKG.

This total package will receive TV signals directly from the satellites. It is ready for TV hookup with all TV cables included. The featuring of the four-foot TVRO system and the new Multichannel MDS system in this ad is for the purpose of highlighting our new 1984 updated BOOK. Satellite TV Inc.

P.O. Box 3108, Dept. S-11, Delray Beach, FL 33447. Send REFERENCE BOOK for \$11.95 plus \$2.95 shipping & insurance (U.S. funds) or call our 24-hour C.O.D. Order Line (305) 276-2941.

100's of plans, kits, colored and unfinished hardwood parts for toys, crafts and furniture (Colonial, Shaker, primitive & modern). Bulk prices available. Color catalog \$1. (614) 484-1746 Cherry Tree Toys . Box 369-25, Belmont, OH 43718

NEED THREE PHASE POWER

The "THREEPHASER" allows you to operate three phase motors ¼ thru 7½ horsepower from 220 \$6995 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. Telphone 305-862-3038.

RELIANCE ELECTRIC MANUFACTURING COMPANY INC. Rt. 1, 1024 W. Lake Brantley, Altamente Springs, FL 32714

QUARTZ CLOCK MOVEMENTS



We feature battery, pendulum, chime quartz movements of all types. Urgos, Hermle, Grandmother, Grandfather cable drive and chain drive, key wind movements of all types. 400 day clocks, music box movements, flat and bezel type dials-plus a vast assortment of weather instruments. Hundreds of clock items. Very competitive prices. Write or call for 75 page free catalog-or \$2.00

(818) 845-0555 NEWPORT ENTERPRISES INC. Dept. PS 2313 W. Burbank Blvd., Burbank, Calif. 91506

SATELLITE TV VIEWERS

Get the most complete weekly listings Send \$1 for sample copy.

P.O. Box 308P, Fortuna, California 95540 800-358-9997 (U.S.) • 800-556-8787 (Calif.) 707-725-2476 (all others)



our complete, fully-engineered kit. Or, you can save money by purchasing just our plans and heavyduty, easy-to-use connector system, and cut your own lumber. Catalog, \$6.

> Timberline Geodesics, Inc. - Pli 2015 Blake, Berkeley, CA 94704 (415) 849-4481



MAKE THIS SHADE FOR LESS THAN \$75.00

Send \$1.00 for our big catalog of stained glass supplies.

WHITTEMORE, Box 2065DE, HANOVER, MASS. 02339

AT HOME! SPARE OR FULL TIME . .

MEN & WOMEN ALL AGES! send for free book on learning to reupholster chairs, divans, footstools, all furniture for BIG MONEY in spare or full time. No experience needed, no age or educational limits. We show you how and provide **EVERYTHING** needed to start: (1) Self-study program covering all phases. (2) All tools and 3 big

furniture kits for practice. (3)... all supplies, frames and materials to build \$300 worth of furniture, yours to keep or sell. Write for big, free opportunity book. No obligation, no salesman will call. MODERN UPHOLSTERY INSTITUTE.

80353 FIELD BLDG. . KANSAS CITY, MO. 64111

COMBINED JOINTER-THICKNESS PLANER with a 5-year FREE warranty you probably will never need

The REX 2000 is one of the finest combination woodworking machines made today and it's priced below competition. With over 40 years of "Old-World" manufacturing excellence you are assured a machine that is inspected and tested then reinspected and retested to ensure balance, smooth operation and unexcelled accuracy. The EMCO REX 2000 will stand up to years of cabinet making, remodeling or any woodworking and we stand behind each unit with the most comprehensive buyer protection plan available in shop tools today!

The ONLY combined Jointer-Thickness Planer with: 30-day Free Trial
 Lifetime Maintenance Program

Call or write for FREE brochure and price list.

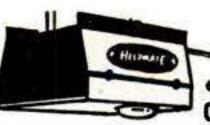
1-800-521-8289

In Ohio 614/445-8382





Dept. PS-A4R • 2080 Fairwood Avenue P.O. Box 07795 • Columbus, Ohio 43207



Radio Controlled

GARAGE DOOR OPENERS

HELPMATE

Buy Factory Direct and Save

Thousands In Use
 Free Brochure

 Easy Homeowner Installation Immediate Shipment by UPS or PP

HELPMATE Equipment Co. Dept. PS-114 Baroda, MI 49101



New from Burro! 17 ft. fiberglass travel trailer and original 13 ft. model. Assembled or kit. 750-1500 lbs. Ready to tow. Sleeps 4. Color catalog; send \$3 to Burro, 12775 Co. Rd. 43, Chaska, MN 55318, Dept. PS-11.



TELEDAPTER®

Model TE-200 easily connects bet-ween any TV or VCR and your stereo systems' aux. or tape inputs. Tele-dapters matrix stereo circuitry takes a mono signal from the TV or VCR. and synthetically produces two stereo channels, so exciting and dimensional, you will think you're at the theatre. The TE-200 also matches the impedances and serves as an isolation interface. Order yours today, com-plete with all instructions, cables, and prompt 30 day refund guarantee il you're not satisfied. Only \$39.95 plus \$3.00 ship. Mail: check. MO. Visa. MC or DC # or call 24 hours. ask for our free catalog and the name of your nearest dealer.

TOLL FREE 1-800-251-8608 DEPT. 124, P.O. BOX 1316

COLUMBIA, TENN. 38402-1316

New No. 107 Color Catalog 200

eath productions, inc. 6717 N. Benjamin Rd., Tampa, FL 33614

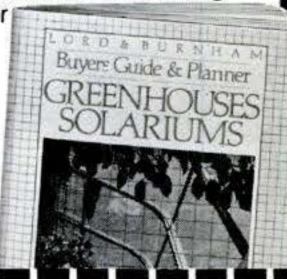


RHOADES

WHY... everyone who ever bought a greenhouse wishes it was a Lord & Burnham!

Because — You buy the best from people who have been building

greenhouses for 127 years! You get superior quality and you get service. See why. Send coupon today!





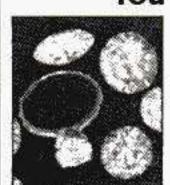
Division Burnham Corporation

CSB 3181, Melville, NY 11747 "the greenhouse people since 1856"

Rush my "Buyers Guide and Planner" by first class return mail for which I enclose \$2 (cash or check).

650000	5. 5. 56a-8a.
Name	
Address	

YOU CAN SELL DIAMONDS



Our Diamond Wholesaling Program shows you EXACTLY how you can sell fine Diamonds, from ¼ to 10 Carats, simply by advertising in your local classified ads. We also show you other ways to sell and build your business. Send \$1 for our complete program in this REWARDING business. International Diamond Distributors.

One Diamond Plaza, 724 South Central Ave., Dept. 10, Medford, OR 97501

GERMAN W.W.II



ONLY

\$50 (3.00)

DELIVERY CHARGE

(ORIGINAL-Repainted) COLLECTORS! SEND FOR FREE CATALOG W.W. II Medals, Civil War Hats, Flags, etc. 100's of items The COLLECTOR'S ARMOURY, Inc., Dept. PS 800 SLATERS LANE, P.O. BOX 1061, ALEXANDRIA, VIRGINIA 22313

YOUR COMPLETE ROBOT SOURCE Armatron to Zenith

Heath's Hero Jr. | IF | HAD A ROBOT "...I am your friend, companion and security guard!" Book \$995 plus \$1.50 s/h

an overview of ROBOTIC technology and application

CALL FREE 800-243-7148 (orders only) \$995 Free Catalog and Discount Coupons with order

\$2.50 catalog and coupons only . MasterCard, Visa, American Express NEW ENGLAND HOBBY SUPPLY . 71 Hilliard St., Manchester, CT

Classified Opportunity Mart

CHRISTMAS GIFTS

PUREST WATER from HOME DISTILL-ER, WATER WISE, Box 45981, Centerhill, FL 33514, (800) 874-9028.

BEERMAKING KIT, makes five gallons American lite beer, \$31.95 postpaid. Mountain Cellar Supplies, 346 Weaverville Highway, Asheville, NC 28804.

STOCKING stuffer. Give the opportunity for success. Home Computer Income. Covers writing, copyrights, marketing. Rush \$3.00 today. James Holland, 7828 Alpine, Sparta, MI 49345.

CHRISTMASTIME, let children color the cards, \$6.00, S & C, P.O. Box 831773, Richardson, TX 75083.

EMERGENCY STROBE-BLINKER!

Powerful signal may save your life! Pocketsize "STARFLASH" KL007, ideal for hunters, backpackers, skiers, snowmobilers, boaters, etc. Only \$17.50 each, two for \$31.90 ppd (w/o batteries). A-Tech, 6265 Little Applegate, Jacksonville, Oregon 97530.

GIFTS novelties specialties general merchandise. Lone Star Products, 1612 N.W. 21st Street, Fort Worth, TX 76106-7832.

CUSTOMIZED Sound Effects!!! Details -S.a.s.e. RFD, 2162 Leghorn, Mountain View, CA 94043.

NEW FROM EUROPE!

High-Tech Swiss "MILZ RING" snow chains, mount in seconds even if stuck! German "UMO" electric heated 12 V car seatcovers beats the cold! Money saving introductory offer, free information. A-Tech, 6265 Little Applegate, Jacksonville, Oregon 97530.

SELF-INKING STAMPER. Prints Your Name & Address. \$2.00. CUSTOM **STAMP, Box** 12211, Arlington, VA 22209.

ELECTROPLATING CHEMICALS sold by the pound. List & Info-\$1.00. Electroplaters Supply, Box 38A, Shady, NY 12479.

FREE CATALOG. Over 300 distinctive gift items. **VERA'S GIFTS**, 68 Birch St., Port Washington, NY 11050.

Perplexagon" Removable Nut?? YES - the nut comes off \$7.95 NEW Send Check or Money Order to: Mind boggling \$ "PERPLEXAGON"

AUTOMOBILE

P.O. BOX 3 . VALLEY CENTER, KS 67147

TURBO-CARB 500, HI-MILEAGE CAR-BURETORS FOR SALE. DISTRIBUTOR-SHIPS AVAILABLE. WITTER, INC., 76 BRUSHY PLAIN, BRANFORD, CT 06405.

E-Z Chain—Up Method. Sase. Enterprises, P.O. Box 1831, Carmichael, CA 95609-1831.

GASOLINE ADDITIVE! Why give \$\$ to giant industry? Make your own from common chemicals! Secret Formula! Simple! Send \$5.95 to S & S Distributors, Dept. PS101, 325 East 2nd St., Bicknell, IN 47512.



BOATS, INBOARD/OUTBOARD MOTORS

EVINRUDE—Mercury 1984 Bargains .. all sizes ... \$2.00 handling ... Scott Mc-Culloch parts... Electra Marine, 610 Merrick Road, Lynbrook, New York 11563.

BOATKITS - PLANS - PATTERNS -FRAMEKITS - LARGEST CATALOG - 300 Designs 8'/80' - Plywood - Fiberglass -Steel - Strip Planking - POWERBOATS Inboards - Outboards - Cruisers - Sportsfishers - Houseboats - Hydroplanes - Runabouts (Canoes Kavaks) - SAILBOATS Daysaliers - Trailersailers - Multihulls -SUPPLIES - Epoxyplus - Epoxyglue - Cloth - Resins - Foam - CATALOG \$2.00 (Airmail \$4.00) - (Book AMATEUR BOATBUILDING - Fiberglass - Plywood/Epoxy - Steel - \$6.00) CLARKCRAFT - 16-S-Aqualane, Tonawanda, NY 14150

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-84, 3800 West Highway 13, Burnsville, Minnesota 55337. 612-890-3000

JOHNSON Wholesale, \$1.00 Handling. Sealand, 551A Broadway, Massapegua, NY 11758, (516) 541-6950.

BOAT PLANS-FRAME KITS-PATTERNS

Hundred of designs-WOOD-FIBERGLASS-STEEL - Sailboats - Powerboats - Outboards -Canoes — Kayaks — Rowboats — Duckboats — Dories-Houseboats Proven methods include instructions especially for amateurs. Professional results! NO LOFTING! "SUPPLIES" - Fastenings — Fiberglass — Resins — Glues — Books. Send \$2 00 for HUGE 144-page catalog or \$4 00 AIRMAIL Includes FREE "BOATBUILDING SUP-PLIES" brochure. Investigate our "POXY-SHIELD" /"POXY-GRIP" wood/epoxy boatbuilding system. -Manual = \$2.00. GLEN-L MARINE, 9152 Rosecrans, Box 756SP, Belttlower CA 90706

BOAT KIT — 2 PLACE Easy Assembly — 40-60 Hours All parts molded plastic No special tools Up to 40MPH with 550cc engine Good Father/Son Project INFORMATION KIT - Send \$5.00 UNIVERSAL CRAFT Box 460 Ontario, Oregon 97914

AVIATION

BOOMERANGS — INCREDIBLE RE-TURN! You can do it. Exciting! Order your FREE catalog today. Boomerang Man. 312 Park, Monroe, LA 71201.

GYROCOPTER Hovercraft, Ultralight, Airboat, Landyacht, Dunebuggy build your own, Drawings \$10.00. Aircraft Supplies, 7932 Ontario, Omaha 68124.

FLY TO THE MOONIII Ride the Shuttle! NASA Videocassettes \$10.00 up. 800-443-0100 ext. 122B.

BALLOONS/AIRSHIPS. Magazine, plans, Video. \$15/yr. ABAC, Box 7S, Rosemead CA 91770.

MASTER Guide To Small Helicopter Construction, \$6.95. Box 50485, Midwest City, OK 73140.

GYRO-JET. True helicopter flight, easy composite construction. Single/dual, lowcost, ultralight. NASA blades. Photos, Drawings, specifications \$10. Moffett Field Aviation, Box 1108, Sebastopol, CA 95472.

ParaPlane" featured by SKY SAILS INC. Authorized ParaPlane' Instruction, Sales, and Service.



- Noassembly required!
- Car trunk portability! 20 minute set-up!

For information pack send \$5.00 to: SKY SAILS INC. P.O. Box 1414 [7] Schenectady, NY 12301

Phone: (518) 370-3261 | Telex: 6710528

BUILD YOUR OWN JET HELICOPTER

EASY TO FLY-INEXPENSIVE TO BUILD! Carries one person-plus Uses low-cost fuel Simple hand-tool construction. PLANS—completely illustrated. \$9.00

HELICOPTER EXPERIMENTER'S **HANDBOOK** A valuable source of designs—data—methods—suppliers for the rotary-wing hobbyist Fully illustrated Only \$9.00

BOTH ABOVE BOOKS: ONLY \$15.00

P.O. Box 16488-A HELI (RAFT Baltimore, MD 21217

ASTRONAUTICS

ANTIGRAVITY Propulsion Device. Free Brochure, RDA, Box 873-NS, Concord, NO 28025.

SPACE PEN—exact model of pen used by both Astronauts and Cosmonauts. Send \$10.00 to: H-Space, Box 3053, Torrance, CA 90510.

ANTIGRAVITY AND UFO'S PROPUL SION SYSTEMS RESEARCH COMPEN-DIUM. Free Brochure. HEER, P.O. BOX 5286, Springfield, VA 22150. Introductory Volume \$20.00 (190 pages). Volume I \$65.00 (450 pages).

FREE: Catalogue of SPACE ART and SHUTTLE PHOTOGRAPHS. FFN, 726-C North Milwaukee Street, Milwaukee, WI 53202.



AN EVENING! Write for our brochure and we'll send you a WORKING SAMPLE of an electric igniter that YOU CAN MAKE YOURSELF from materials you'll find around the house.

Dept. PS 12 THE TELEFLITE CORPORATION. 11620 Kitching St., Sunnymead, Calif. 92388

ENGINES, MOTORS

NEW Engines For Mowers, Tillers, Etc ... Fantastic Savings! Illustrated Catalog \$2.00. (Refundable First Order.) Discount Engines, Box 166PS, Ashland, MO 65010.







DUMP UP TO 13,000 LBS

\$465.00 COMPLETE PIERCE HYD. DUMP SYSTEM \$465.00 COMPLETE 3 or more \$415.00

System includes - 12 V Pump & Reservoir, 4" Cylinder & Scissors, Lines, Switches and Braces necessary for installation on truck or trailer



EXPRESSWAY 287. HENRIETTA, TEXAS 76365. (817) 538-5643

HOVERCRAFT

HOVERCRAFT Plans, Catalog \$1.00. Universal Hovercraft, Box 281, Cordova, IL 61242.

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.

HOVERCRAFT Plans & Publications! Catalog \$1.00. Venture, 13820 Greenland, Uniontown, OH 44685.



Easy to build, fun to fly & powered by ordinary lawn mower engine—Complete plans, photos and supply sources. \$6.00 Money back guarantee. Send to: Herb Bartlett, Box 156-S, Silverdale, WA 98383.

AUTO SUPPLIES & EQUIPMENT

CARPETS, tops, shocks, suspension parts for all cars 1935-1980. Free catalogue. Kanter Auto Products, 76P Monroe, Boonton, NJ 07005.

MOTALOY ring valve job while driving guaranteed \$9.99 two \$17.50 postpaid. Andris, Box 34081, Dept. 5, San Francisco, CA 94134.

ALTERNATOR Generator Rebuilding Book. Information: \$2.00 (Refundable). Hedelund Engineering, Box 26024, Las Vegas, NV 89126.

CARTER KNOCK ELIMINATOR

Save your engine, save gas dollars. Only \$79.95 plus \$3.00 handling. Full year Guarantee. Ammec, Box 15178, St. Louis, MO 63110.

FREE Details! Save money, gas and repairs. Save the life of your engine. Fight back engine friction now! Get the facts! Distributors welcomed. B. Nathan & Company, 41 Carnegie Avenue 10-A, East Orange, New Jersey 07018.

DRIVE THROUGH SNOW, ICE.

Better Traction than tire chains. Durable. Smooth Ride. California Approved. YETI SNOW NET, Dept 16, 20366 Harper Ave., Harper Woods, MI 48225. 800-821-5679.

DO IT YOURSELF

1600 CATALOGS Every Subject Imaginable!!! Directory \$4.00, Catalogs Galore, 7914-L Springfield Village, Springfield, VA 22152.

1400 CATALOGS listed and described. Sources for everything imaginable. \$4.00. Masterlog, Box 879-A, Fairfax, CA 94930.

PROJECTION TV...Convert your TV to project 7 Foot picture ... Results comparable to \$2,500 projectors...Total Cost less than \$30.00 . . . Plans and 8" Lens \$19.95 ...Illustrated information FREE. Macrocoma-ac, Washington Crossing, Pennsylvania 18977. Creditcard orders 24 Hours (215) 736-3979.

PAINT REPAIR VIDEO TAPE approx 30 min. Simplified detail instruction for perfect chip and scratch touch up. Send \$29.00 to: P.O. Box 123, Coarsegold, CA 93614.

STOP LEAKS PERMANENTLY IN-STANTLY. Incredible Aluminum faced asphaltic adhesive mass back tape. 50 mils thick adheres. Water tight to all building surfaces. Stops leaks in mobile homes, Metal building, Farm buildings, Gutters, Chimneys, Skylights anywhere 33' × 3" roll \$19.95. NUTEC, Box 72-3, Ballentine, SC 29002.

DO-IT-YOURSELF Order "The Common Sense Approach To Appliance Repair" 322 Photos. FREE Details. DLR Publication, #16 Richardson Height North, Richardson, TX 75080D.

ELECTROPLATING. Complete Textbook. All Metals. Electroplate Metallic/Nonmetallic Items. \$11.95. Details Free. Tropic, Box 95P, Palm Bay, FL 32905.

NEW! . . . REPAIR ANY TV . . . EASY. Write, Research, Rt. 3 Box 601BA Colville, WA 99114.

SURVIVAL Radio! No Power Required. Simple Plans \$5.00. Hobbsco, Box 140, Dept. 37, Sterling, IL 61081.



LASER DEVICES

 LC5 BURNING CUTTING CO2 LASER\$15.00 RUB3 RUBY LASER RAY PISTOL15.00 LRG3 IR LASER RIFLE/PISTOL10.00 LGU3 VISIBLE RED LASER RIFLE. LHP/LLD LASER LIGHT XMTR/RCVR SYS .. 10.

LHC2 BEGINNER simulated VISIBLE LASER...5.

SCIENTIFIC & ELECT

 TCL3 SOLID STATE TESLA COIL 35KV7.00 BTC3 250 THOUSAND VOLT TESLA COIL ... 10. BTC5 1.5 MILLION VOLT TESLA COIL 15.00 HVM3 125 THOUSAND VOLT DC SUPPLY .. 10.

 PTG1 PLASMA FIELD GENERATOR8.00 ULTRASONIC ACCOUSTICAL PPF1 PHASOR PAIN FIELD GENERATOR 15. PSP3 PHASOR SHOCK WAVE PISTOL 8.00

 IPG5 POCKET PAIN FIELD GENERATOR....8.00 RAT2 RAT AND PEST ELIMINATOR HT9 HIGH FREQ. LISTENING DEVICE8.00 SECURITY & PROTECTION BLS1 BLASTER WAND

 PPG1 PHASOR PROPERTY GUARD.......15.00 MFT1 MINI VOICE XMTR 2-3 MILE7.00 INF1 INFINITY TRANSMITTER15.00 VWPM5 TELEPHONE XMTR8.00 SD5 SEE IN DARK NIGHT EYE......10.00 WE STOCK ALL PARTS NECESSARY FOR CONSTRUCTION OF THE ABOVE PROJECTS

 CATALOG CONTAINING HUNDREDS MORE OF ALL NEW AMAZING and FASCINATING PLANS. EASY TO BUILD KITS AND ASSEMBLED ITEMS \$1.00. CATALOG INCLUDED FREE WITH ANY OF THE ABOVE PROJECT PLANS. SEND CASH, CHECK, MO. VISA, MC TO:

INFORMATION UNLIMITED P.O. BOX 716, DEPT. P8 AMHERST, NH 03031

SOLAR, GREENHOUSE, & ENERGY SAVING PRODUCTS CATALOG!

Components: Complete Systems. 88 pages, 18 sections. Our 11th year! Order from one expert source—

the country's largest energy saving mail order house! Send \$1.00 postpaid.

SOLAR COMPONENTS CORPORATION Dept. P. P.O. Box 237 Manchester, NH 03105.

FREE ENERGY

Extract abundant free energy anywhere using permanent magnets. Know the truth! Plans, instructions, patents, and previously secret government report. Money back guarantee. Only: \$15.00

RESEARCH & DEVELOPMENT PO Box 873 Concord NC 28025

HOME CRAFTSMAN

"GETTING Started in Stained Glass" \$1.00. Whittemore, Box 2065X, Hanover, MA 02339.

BATTERY CLOCK MOVEMENTS. Below wholesale prices. Best quality. Catalog \$1.00 (refundable). Yankee, Box 26S, Thompson, CT 06277.

MAKE WOODEN TOYS-PROJECTS 100's plans, kits, hardwood parts (toy, craft, furniture)—Catalog \$1.00—Cherry Tree Toys, Belmont, Ohio 43718.

HUNDREDS woodworking patterns, books, tools, wood parts, best values; TIM-BERS FREE CATALOG #PS21, Carnelian Bay, CA 95711-0850.

WOODWORKERS, CRAFTSMEN, over 250 plans, patterns for do-it-yourself furniture, toys, storage cabinets, decorative items. \$1.00 refundable Pattern Pak Dept. 39L, 3838 N. 36th Avenue., Phoenix, AZ 85019

DOES YOUR SUMP PUMP WORK during power failure - Ours Does - without a plumber. FREE Catalog. Residental Safety Systems Inc., 899 Boulevard E, Room 2D, Weehawken, NJ 07087.

MUSIC Box Works 700 Tunes Free List. Music Box, Avon, NJ 07717.

WOODWORKER'S supplies catalog!! . . Hundreds veneers, toymaking, hardwoods, patterns, books, cane, dowels, pegs, spindles, more! Bargain offers included. Send \$1.00. Morgan, PO2MO4-D, 1123 Bardstown, Louisville, Kentucky 40204.

SUPER Woodcraft Patterns, Windmills, Wishing Wells, Whirligigs, Weather Vanes, Bird Houses, Catalog \$1.00. Crafter's 11840 North US. 27, Dewitt, MI 48820.

BEVELED Glass and Mirrors. Top Quality. Catalog \$1.00 Refundable. BG&M, Box 6618, Chesapeake, VA 23323.

FOR THE HOME

FIREWOOD Bandits Cost You Money! 40 page report, \$2.95. HO Publications, P.O. Box 610907, Dept. PS-11, DFW Airport, TX 75261.



TOOLS & MACHINERY

Books, Dept. P4XP, P.O. Box 2018

Latham, N.Y. 12111

BOLTS, SCREWS, TOOLS. WHOLE-SALE, DIRECT. Guaranteed. Catalog \$1.00 (refundable). Camelot, Dept. 33, Box 65, Bristol, Wisconsin 53104.

SMALL FOUNDRY Furnace. Supplies. Free Literature. Pyramid Products, Dept. M, 3736 South 7th Avenue, Phoenix, AZ 85041.

4" METAL Cutting Lathe \$87.25: Taig, 15048 Proctor, Industry, CA 91746.



SILVO Hardware, 188 page Hand & Power Tool Catalog \$1.00. PS4-11, 5301 Tacony St., Philadelphia, PA 19137-2399.

MACHINE TOOLS, Lathes, Mills, Catalog \$1.00. Mack, Box 541-PS, Scranton, PA 18501.

TOYMAKERS Cutters For Wheels. Free Brochure. Deaton, 5905 Gullstrand, San Diego, CA 92122.

ALTERNATE ENERGY

MULTI FUEL HEATER! FREE HEAT! Self addressed stamped envelope. 122M Compu-Heat, 1625F Sycamore, Bohemia, NY 11716.

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 only \$10.00

> RESEARCH & DEVELOPMENT Post Office Box 873-PS Concord. North Carolina 28025

LOWER HEATING BILLS with inexpensive, easy to build solar heater. Complete, illustrated plans \$10.00—B. Sadler, Box 12461, St. Paul, MN 55112.

SOLAR Electric Panels at drastically reduced prices! Off-spec and surplus modules from major manufacturers. Up to 50% off list. Styles, outputs vary. Call FREE for details - 800-638-8304. Major Credit Cards Welcome.

WIND Generator tested innovative design, high efficiency. Professionally drawn plans \$7.00. Wind, 27 Wilde Ave, Framingham, MA 01701.

PASSIVE SOLAR HOME PLANS. From 1008 sq.ft, and up, high solar fractions, catalogue \$2.00. Dove Design Co., P.O. Box 1456, Belen, NM 87002.

NEWSLETTER features plans. Six issues \$3.00. FESS, Comfort, TX 78013-0904.

WIND-ELECTRIC. Largest selection of high quality, low cost generators, gearboxes, batteries, propellers and all other materials. Cat. \$1.-. P.O. Box 26, Homestead, FL 33030.

ENERGY SAVING

TANKLESS Water Heaters, Models For Every Requirement, Paramount, 627 Hazel, Allentown, PA 18102. 215-821-7741.

LOWER your residential utility bill nationwide. Send Sase Legal for literature. Barnett Enterprises, PO Box 29160, San Diego, CA 92129-0160.

POOR MAN'S HOUSE HEATER can be built for less than \$100.00 using common, available materials. How I did it diagrams explanation \$5.95. Poor Man, Box 25273, Rochester, NY 14625-0273.

BURGLAR/FIRE ALARM

BURGLAR Proof premises. \$6.95 PPD P.O.B. 477, Thorofare NJ 08086.

SCIENCE & CHEMISTRY

1985 CATALOG, 200 pages. Thousands of chemicals, glassware, science/hobby equipment. \$2.00. Merrell Scientific, 1665 Buffalo Road, Rochester, New York 14624.

ECONOMICALLY Priced Chemicals Apparatus. Catalogue-\$1.00. Hagenow Laboratories, 1302 Washington, Manitowoc, Wisconsin 54220.

225 PAGES! 1984 Glassware—Chemical — Lab. Equipment — Experiments. Most comprehensive catalog offered by anyone in this column. Established 1970. \$3.00 REFUNDABLE. Aldrich Scientific. P.O. Box 675-PS50, Helotes, TX 78023.

TESLA COIL DESIGN MANUAL Complete plans, technical information, and experiments. \$10.00. J. L. Laboratories, P.O. Box 5070, KAFB, MS 39534.

MICROSCOPES, Biological supplies, prepared slides, 1984 catalog, 203 pages, Send \$3.00. Benz Microscopes Optics, P.O. Box 7022, Ann Arbor, Michigan 48107.

1000's OF CHEMICALS

LOW Prices. Catalog \$2.00. Call for orders/ prices. Chem-Lab, 13814 Inglewood, Hawthorne, CA 90250, 213-973-2391.

HALLEY'S COMET is coming! See it, photograph it. Comet Trivia. Send \$3.00 cash, money order, check to: Comet Handbook, Dept. S. P.O. Box 12484, Portland, OR 97212-0484.

FORMULAS, PLANS

MONEYMAKING FORMULA CATALOG \$5.00 (REFUNDABLEI): GWA6, Box 193, Brookfield, WI 53005-0193.



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, handymen, home experimenters, electricians,

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 indispen-sable as a dictionary, Satisfaction guaranteed, 900 pages hard cover-cloth binding. Only \$14.95 plus \$1.75 postage & handling. Dealer's Inquiries Invited

EMBASSY SALES Dept. 70

Box 67, East Elmhurst, N.Y. 11369

HOBBIES & COLLECTION

MILITARY Medals Catalogue 50¢. Subscription \$4.50. Vernon, Box 1387PS, N. Baldwin, NY 11510.

UNPAINTED 21/8 ins. Lead Soldiers all Nations. Collector quality. Fully illustrated. Catalog #2 \$1.00. Bussler, Box 471-PS, Quincy, MA 02269.

FOREIGN NEWSPAPERS

WORLDWIDE ENGLISH Newspapers. 65 Countries! Sampler: 4/\$2.98. **FREE** brochure. Multinewspapers, Box DE-3A, Dana Point, CA 92629.

RADIO/TV

POLICE Scanners, Regency, Bearcat, Fanon. HPR, Box 19224, Denver, CO 80219.

CONVERTERS. All types for all systems. Lowest prices anywhere. Dealer inquiries accepted. T.V.'s, VCR's, etc., P.G. Video Corp, P.O. Box 296, Latham, NY 12110 (518) 274-6593.

cable facts. Cable TV Installation and Technical Procedures. Easy to Understand, Very Thorough Schematics and Suppliers List Included. ACS, Box 711-PS, Pataskala, OH 43062.

UHF GATED. Satellite systems. Catalog \$1.00. AIS, Box 1226-P, Dublin, PA 18917, (215) 249-9411.

COLOR PATTERN GENERATOR (On Video Cassette)

No need to purchase an expensive color pattern generator. Our product allows you to align or trouble-shoot your television using your VCR. Pays for itself in just one use! Includes: color bars, dots and cross-hatch patterns to align to manufacturers specs. To order, send check or money order for \$17.95 plus \$1.95 for postage and handling to:

P.O. Box 7575 Newark, DE 19714-7575

Indicate VHS or Beta/Allow 4-6 wks. for del.

RECORDS & TAPES

DISK & tape carrying & protection cases. Send S.a.s.e. for info. Bergeron Enterprises, 443 Roberta, Fullerton, CA 92632.

ELECTRONICS, STEREO, HI FI

ELECTRONIC EAVESDROPPING DE-VICES. Catalogue \$1.00. HUNTER, Box 3132, Winston-Salem, NC 27102.

VIDEO EQUIPMENT

CABLE TV Equipment, Notch Filters For "Beeping" Channels. Information - \$1.00. Goldcoast, Box 63/6025, Margate, Florida 33063.

VIDEO MOVIES. VHS. Beta. Giant catalog \$3.00. Tower, Dunkirk, MD 20754-0213.

"THE GRAND CANYON" Spectacular, endlessly repeatable, 2-hour sight and sound AERIAL journey through this magnificent natural wonder, enhanced with timeless classical and synthesizer music. VHS or BETA \$49.93. Norman Beerger Productions, 3217 S. Arville, Las Vegas, NV 89102, (702) 876-2328.

PAY TV Receivers, cable converters, all types, kits. \$2.00 price list. American Video-Tech, Box 132, Troy, NY, 518-273-2699.

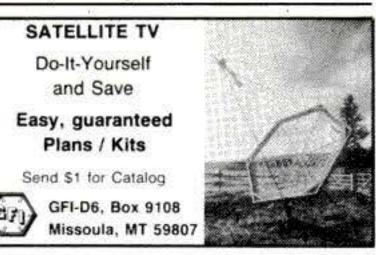
SATELLITE TV

SATELLITE TELEVISION ANTENNAS complete detailed plans for home construction by anyone. \$5.00. Jansen Electronics, P.O. Box 168A, Dundee, OR 97115.

Build your own system and save! Instruction manuals, schematics, circuit boards! Send stamped envelope: XANDI, Box 25647, Dept. 24S, Tempe, AZ 85282.

SATELLITE TV . . . LOW PRICES on dishes, receivers, LNA's, etc. . . . Factory guaranteed. Send \$5.00 for the most complete catalog and information available. Satellite World, P.O. Box 640, Cuyahoga Falls, OH 44221.

FREE SATELLITE Prices-Installation/ Alignment Instructions \$4.98, SNYDER Box 1s, Port Leyden, NY 13433.





SATELLITE TELEVISION SYSTEMS

- Super programming
- · Heaviest of its kind
- Easy operation
- Advanced component controls
 Dealerships available

We manufacture sizes ranging 8', 9', 11', 14', 16', 23'.

P.O. Box 906 314-989-3248 Poplar Bluff, MO 63901.



BUSINESS OPPORTUNITIES

VENDING Machines - Compact, Attractive, Mechanical, Low cost, "Profitmakers." BPI, Box 345-PS, Flourtown, PA 19031.

Caps. Inexpensive, professional heat transfer machines. All supplies. Press Magic, P.O. Box 22809, (LLC), Tampa, FL 33623.

START Your Own Home Business! Write, Century-11PS, 3255 Squire Lane, Conyers, GA 30208.

UNUSUAL Opportunity for extra income. Sell "How to Make Money" Books by mail. Details. WAD Publishers, 1D11, Box 135, Tullahoma, IN 37388.

Panda Distributors, Dept. PS114, 1126 Dearborn, Waterloo, IA 50707.

EARN \$100,000.00 YEARLYI Innovative Career Services Everyone Needs! PROTECTED COUNTWIDE TERRITORIES GOING FAST! Write: I.O.C.A., Box 32141-P, Cleveland, OH 44132.

\$1,000.00 WEEKLY Possible!! Best 175 Second Income Businesses! 750% Profit Within 30 Days! No Personal Selling Necessary! "New". Handling \$2.00. Manbert, 323 Franklin #804/M308/C, Chicago 60606-7095.

BORROW \$300-\$30,000 Interest Free! Keep Indefinitely! Free report! Write: American, 1601 Main, Plainfield, IN 46168.

GREYHOUND FANS! "Winning Trifectas at Dog Tracks." Shows how to win big. \$10 cash. Satisfaction guaranteed. Sports, Box 15364-PS, Colorado Springs, CO 80935.

PRINT BUMPERSTICKERS: Fun/Profits. Easy Kit-\$29.95 FREE Brochure. Bumperprinter, Box 4-P11, Point Arena, CA 95468.

TELEVISE YOUR PRODUCT Successful producers of National

TV commercials seek new products for joint venture TV marketing campaign.

RLP MARKETING, INC. 1728 Cherry St. Phila. Pa. 19103 215-568-6400 \$500. WEEKLY Recycling Discarded Tires! Stamp Appreciated. LaVallees, Fountain, FL 32438.

NEW Mercedes - Benz, \$120.91 monthly, or BMW, \$81.51 . . . Guaranteed . . . Write: FoxCo, Box 2655-41P, Springfield, VA 22152.

REPAIR HYDRAULIC JACKS—Free details. Hydraulic Parts Supply, Dept. S, Box 4157, Brownsville, TX 78520.

YOU can make money wholesaling free details. Brokerage, 109E Circle, Burns, TN 37029.

MECHANICALLY inclined individuals desiring High Weekly Profits operating Small Manufacturing business Without Investment write: Businesses, 92-P Brighton 11th, Brooklyn, NY 11235.

Fast Sellers, including Westerns, Truckers, Motorcycles, Wildlife, etc. Big Profits. Complete dealer set up. Catalog \$1.00. Anchor, Box 3958-BPS. North Providence, RI 02911.

\$1,000 WEEKLY Home Business Directory Details. Box 2019-PS, New York, NY 10163.

PIANO Tuning quickly learned with home study course. Diploma granted. American Tuning School, 17050 Telfer Drive, Morgan Hill, CA 95037.

Simple, Portable. Free details Bumper, POB 22791(LLC), Tampa, FL 33622.

CONCRETE Block Machinery; Catalog \$1.00. Route One, Box 3740, Rapid City, South Dakota 57702-3740.

world-wide, mail order business from home, without capital. We ship plan for no risk examination. Experience unnecessary. Free Report. Mellinger, Dept. M269C, Woodland Hills, California 91367.

START YOUR OWN PROFITABLE BUS-INESS. Free details. Vanburik, Dept 228, Broadway, NJ 07882

NEW DISCOVERY in battery reconditioning. Give eighteen months guarantee! This means Big Profits Fast! Electoan, 7415 Gable Dr., Little Rock, AR 72205.



NEXT AVAILABLE ISSUE FOR CLASSIFIED ADVERTISING IS JANUARY 1985, CLOSING OCTOBER 24.

PROFITS GUARANTEED

We have developed a 100% guaranteed program for you to start and make big profits in your own mail-order business. \$10,000s possible your first year. Complete guidebook gives secrets to success. Plus our expert consultants will give you FREE, INDMDUAL, CUSTOM-TAILORED advice to help you and assure profits. Write for free booklet with all details. Kashanico. Dept. F, Box 937. Cambridge, Mass. 09238.

Distributor—Representatives to grow, sell and promote unique system and technology. Investment required. WIGGLE WORM HAVEN, 7802-P Spring St., Racine, WI 53406. 414-886-2665.

HUGE PROFITS! Reconditioning used car batteries. Secrets others don't tell. Stamp please. Battery Outlet, Box 3300, Hickory, NC 28603.

5,001 MONEYMAKING Opportunities
—Free Catalog! Dynamics, Box 1306 H,
Stow, Ohio, 44224.

\$40,000 ON 1/3 ACRE! New hydroponics—inexpensive, pleasant, practical! Free information. Planter's, Box 1657, Brenham, TX 77833.

SCREEN Print T-Shirts. Inexpensive kits. Free Details. "T-Printer," POB 23991 (LLC), Tampa, FL 33623.

MAIL Order Profits! For Disclosure. CRIB, Box 257, Stuart, FL 33495.

sionally 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.

ALUMINUM SCRAP-Recycle Yourself-MAKE \$25.00/POUND! Free Information: Industrial-PS411 Box 127, Alexandria Bay, New York 13607.

make Homemade Booklets. I've earned \$187,000 with mine. Free information: Dasher, Box 37169, Fort Worth, Texas 76117.

BORROW by Mail! \$500-\$25,000 Fast! Easy! Confidential! For info application write: Accurate, 2120 Crestmoor, Nashville, TN 37215.

FUL multi-level part-time home businesses revealed in 24 page book. \$1. Secrets, Box 59001-PS, North Redington Beach, FL 33708.

\$1000's WEEKLY Mailorder Details: Rahmani, 210 Welch 1014P, Ames, IA 50010.

KNOWLEDGE = Money Free Information. Quill Publishing Co., 1036 S.W. 74th St., Oklahoma City, OK 73139.

PRIME KNOWLEDGE—Become financially independent with your own home business. For Information: SGF Ent., Inc., PK DIV. P.O. Box 116, Little Neck, NY 11363.

SEIZED IN GOVERNMENT NARCOTICS RAIDS!! Automobiles . . . Vans . . . Boats
. . . Furniture . . . TVs . . . Stereos . . . Thousands other items. Buy Dirt Cheap—Resell
for Big Profits! Free Information: Marcel,
Box 7557-E, Monroe, LA 71211.

CANSI Easy \$458 weekly! Free information, Hornsby's, Box 1657, Brenham, TX 77833.

\$25,000 LOANS INTEREST FREE! Secret Federal law WIPES OUT DEBTS!! Details FREE! Moneywise-S, LaGrange, NY 12540.

GET RICH using OTHER PEOPLES'
MONEY!! Unique—amazing business! Details FREE! Finance-S, Billings, NY 12510.

BRASS SIGNS. Fast, Inexpensive, Profitable. Details, Signet, 50 High, Suite LL7-A, Buffalo, NY 14203.

PRODUCE BEAUTIFUL COPPER OR

your own home. Tools furnished. Southwest Dental, 1501 E. Chapman Ave., Suite 252PS, Fullerton, CA 92631

PIANO Tuning learned quickly at home! Free information. Empire School, Box 1014, Jupiter, Florida 33458.

MAKE MILLIONS MANUFACTURING BATTERIES!!! Supplies available. Everlast, Box 365, Bogota, NJ 07603.

PVC PIPE FURNITURE Opportunity. Earn quickly, easily. No risk. Information Free. Owen, 771P, Battle Ground, Washington 98604.

MAKE BIG MONEY REPAIRING WIND-SHIELDS, & Plate Glass! Up to \$60,000 yearly! Call TOLL-FREE for Valuable FREE report. 1-800-321-2597. Glas-Weld Systems, Box 5755-C, Bend, OR 97708.

cash for your simple ideas Corporations pay \$1000s daily to anyone. For details send two 20¢ Postage Stamps to MGMCO, Box 14645C, Spokane, WA 99214

\$240 DAILY possible with spectacular home business opportunity. Free details Langco, 2521½ S. Vista Way, Suite 251B Carlsbad, CA 92008.

BARGAINS! Buy Wholesale and Below! Name Brands. Appliances . . . Furniture . . . Sports Equipment . . . Televisions . . . Cameras . . . Watches . . . Jewelry . . . Thousands More. Free Details. Bargain-hunters Opportunities, Box 913-B, Holland, Michigan 49423.

BATTERY RECONDITIONING made easy. Proven big cash profits! Spare time. Free details. Owen, 771 K, Battle Ground, Washington 98604.

BORROW \$30,000 without interest! All eligible. Repay anytime. Free details! Infohouse-PS, 808 Post, San Francisco, CA 94109.

PROJECTION TV ... Make \$\$\$'s assembling Projectors . . . Easy . . . Results comparable to \$2,500 projectors... Your total cost less than \$20.00 ... PLANS, 8" LENS & Dealers information \$17.50...Illustrated information FREE . . . Macrocomaacx, Washington Crossing, Pennsylvania 18977. Creditcard orders 24 Hours (215) 736-2880

START A SUPER PROFITABLE BUSI-**NESS** from scratch. Free Subscription to Opportunity Magazine tells how. Write: Opportunity, Dept. C88, 6 N. Michigan, Chicago, IL 60602.

MAILORDER Opportunity! Start profitable home business without experience or capital. Write for free book, plus details. Mail Order Associates, Inc., Dept. 593, Montvale, NJ 07645.

HOME MONEY BROKER OPPORTUNITY Earn up to \$25,000 part time without capital. Huge demand worldwide. Experience unnecessary. We ship plan for no-risk examination. Free report. Financial, Dept. 11-F-11, 1145 Reservoir Avenue, Cranston, Rhode Island 02920.

you can get rich. Start at home. No experience. Free details. ACAM, POB 2770, Fernie, B.C. Canada V0B 1M0.

HOW-To, Information Books. Catalog \$1.00. Youngers/Books, Princeton, IA 52768.

\$100,000 YEARLY!!! Assemble "PRO-FESSIONAL" GIANT SCREEN PROJEC-TION TVS-"Don't be fooled by imitations!" "Build the best with lenses and screens utilized by Sony, Zenith, Sylvania, and Magnavox!" . . . Simple construction! . . . Illustrated information and complete parts catalog \$2.00 . . . Money back guarantee! POLI-VISION, 187-W Cypress St., Throop, PA 18512.

EARN Big Money! Easy business. Start parttime. National firm trains, assists. Opportunity, Box 6489-C, Laguna Niguel, CA 92677.

TAKE Catalog Orders. We drop-ship 2500 best-selling specialty products. Lowest below wholesale prices. Immediate delivery. Spectacular home business opportunity. Free Book. SMC, 9401 De Soto Ave., Dept. 28-47, Chatsworth, CA 91311-4991.

NEW Luxury Car without cost! Write: Amco 15, 1601 Main, Plainfield, IN 46168.

\$92.00 FROM Square Foot Plywood (Huge Demand), Revealing Proof 25¢ (Refundable), Woodwins, Bridgewater, MA 02324.

GET RICHII Secret law smashes debtsbrings cash and credit! Details FREE!! WealthKit-S, Billings, NY 12510.

PROFITABLE Gold Foil Printer. Personalize business cards, pencils, matches. Free Details. Gold, POB 24986(LLC), Tampa, FL 33623.

MAKE Rubber Stamps. Highly Profitable Business. Free Details. Stamper, POB 22809(LLC), Tampa, FL 33622.

EARN STEADY INCOME operating your own Collection Agency. Free Details! Credit Network, Dept. PS-702, 210 Fifth Ave., New York 10010 (718) 768-6803 xt.70.

MAILORDER Buyers all categories computerized in zip code order. These people will respond to mailorder offers. Guaranteed deliverable! For full details rush s.a.s.e to: M.E.M, PS-11, Box 767877, Roswell, GA 30076.

BECOME A Tax Consultant. Our students earn \$3,000-\$5,000 every tax season preparing returns, evenings. Accredited Program. National Tax Training School, Monsey 5MR, New York 10952.

MAILORDER buyers list available for immediate use! Computerized in Zip Code order. All categories. For complete details send Sase to: A.E. Smith, R1, Box 147-PS, Pepin, WI 54759.

IMPROVE PROFITS. mailing lists available. Most Categories. For information write: Gal-Tex, 6608-Stewart RD. #422, Galveston, TX 77551.

COMPUTERS

\$8.00 INCLUDING disk thousand name brand programs for Apple IBM-PC details. Reliant, P.O. Box 33610, Sheungwan Hongkong.

ATARI Commodore owners. Send for your free educational software catalog. Frost Computer, P.O. Box 2573 GMF, Woburn, MA 01801.

TI-99/4A OWNERS: Many good programs available. Free catalog. /4A PRO-GRAMMERS: Inquire if you want in the catalog. TIMOSSA, 159 Dover Rd., Spartanburg, SC 29301.

COMPUTER DESK PLANS - Easy weekend project. Low cost, unique. Complete instructions and cutting pattern, \$2.75. Wooden Leg, 447 West Broadway, Suite 104, Mesa, AZ 85202.

BIGGEST TI-99/4A selection. Newest exciting software and hardware bargains. hard to get items. Send for free catalog. Fast Service: ENTERPRISES, Box 690, Hicksville, NY 11801.

SMALL COMPANY—BIG SOFTWARE **IBM-PC** Compatible

Mail Mgmt.....\$29.95 Inventory Mgmt.....\$39.95 Accts Payable\$39.95 Accts Receivable\$39.95

E-Z to run, self-prompting, self-documenting. Why spend more? Our software does a big job, 'cause we're small enough to care. Postpaid and in the mail within 48 hours (personal checks need 10 days to clear). Cal. res. add 6% tax.

> PFISTER RESEARCH P.O. Box 529.

Garden Grove, CA 92642-0529

COMMODORE OWNERS - FREE "How to Copy Software" when you join the National Commodore Users Group. Newsletter, hints, tips, advice, reviews, more. Send \$15 annual membership to: N-COM, Box 521A, Stony Brook, NY 11790.

TELEPHONE & ACCESSORIES



OLD GOLD, JEWELRY WANTED

HIGHEST CASH for Gold, Jewelry, Gold Teeth, Rings, Diamonds, Watches, Silver, Platinum. Mail Articles Today. Free gift with Information. Chicago Gold & Precious Metals, 10 S. Wabash, Dept. 357, Chicago, 60603.

TAKE NO CHANCES. Deal with oldest, most reliable firm in old gold business. Established 1934. We buy Gold, Silver, Platinum, Diamonds. Highest Cash. Free information. Rose Industries, 29-Y East Madison, Chicago 60602.

JEWELRY

CLOSEOUT Jewelry. 55¢ dozen. (Catalog .25¢). Roussels, 107-1635 Dow, Arlington, MA 02174-7199.

HOLOGRAPHY

HOLOGRAM and Catalogue \$2.00. General Holographics, Box 82247-SN, Vancouver, Canada V5C 5P7.

PLANS & BLUEPRINTS

PASSIVE SOLAR HOME PLAN-Energy efficient, compact, 1513 sq. ft. plus low cost greenhouse, open beam, simple construction. Floor plan/Elevations or 24×36 blueprint. Send \$15.00 to P.O. Box 123. Coarsegold, CA 93614.

TRAILER PLANS! Horse, stock, utility. \$17.50 each. FREE information. Pride Trailers, 41969S Holden, Springfield, OR 97478.

BOOKS & MAGAZINES

OUT Of Print Books Found, Send Wants. Catalogue \$1.00. Booklook, 51S Maple Ave., Warwick, NY 10990.

OUT Of Print Books Located. Write: Stilson, P.O. Box 1040, Glendale Height, IL 60139

INDEXES to POPULAR SCIENCE available: full set of 12 for \$12, postage paid. For 1983 only, send \$1.75 to: POPULAR SCIENCE INDEXES, 380 Madison Ave., New York, NY 10017.

SUBCONSCIOUS MIND REPROGRAM-MING BOOKS. Scientific. Inexpensive. Personal Improvement Guaranteed. Free Brochure. MBS-466, 2895 Biscayne, Miami, FL 33137.

FREE SUBSCRIPTIONS over 50 Engineering, Scientific, Technical magazines. For Directory send \$5.00 to: NCS Publishing, Box 13151, Ft. Wayne, IN 46867.

CARTOONING SIGN PAINTING

CARTOON for Fun and Money!!! Free booklet!! Cartoons, Box 40614B, Detroit, Michigan 48240.

CARTOONING = Money, fun, popularity!! Learn by mail. Free booklet!!! Cartooniversal, 72 Kendal, Toronto, Canada M5R 1L9.

CARTOONING Taught by Mail. Write For Free Brochure. Cartoonerama, Box 263-YQ, Branford, CT 06405.

DETECTIVES

DETECTIVE Profession, easy home study; free tie-tack or lapel pin, certificate, future. Professional Investigators Training School, Dept. CB, P.O. Box 41256, Los Angeles, CA 90041.

DETECTIVE TRAINING HEADQUAR-TERS: for homestudy education that works. Exciting, easily learned cassette courses. Diploma, Free details: GLOBAL INVES-TIGATION, Box 191PS, Hanover, MA 02339.

ELECTRONIC DEVICES. For SURVEIL-LANCE, COUNTERSURVEILLANCE, and PERSONAL PROTECTION. Giant catalogue \$1.00 refundable. HUNTERA, Box 3132, Winston-Salem, NC 27102.

MISCELLANEOUS

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 84120-0005.

VACUUM CLEANERS "Discount Prices" "New" Rainbow \$399.95, Kirby, Filter Queen, Compact, Details: ABC Vacuum Warehouse, 6720 Burnet-PS, Austin, Texas 78757.

FREE BOOK. Prophet Elijah Coming Before Christ. Megiddo Church, Dept. 58, 481 Thurston Road, Rochester, NY 14619.

SAFETY Fuse! 3/32" Green Waterproof Fuse. 100'/\$10.00, 300'/\$25.00. Postpaid, Greenman, Box 9026D, Peoria, IL 61614.

"REPEAL THE INCOME TAX" bumpersticker. Free. Send Sase: Box 831, Huntsville, TX 77340.

BETTER HEALTH

ATHLETES Foot Home Remedy For Details Send \$5.00. AGS, P.O. Box 5783, Napa, CA 94581.

REAL ESTATE

CALIFORNIA. Acreage. Lots. \$40 down. 40 monthly, 4602 Ethel, Sherman Oaks, CA 91423.

FREE! FALL-HOLIDAY '84 CATALOG! 266 pages; over 5400 properties, 2300 pictures! Values in every type of real estate, many owner financed! From 600 offices in 43 states. Get your FREE copy NOW! STROUT REALTY, Plaza Towers, Dept. 5810, Springfield, MO 65804. Call toll free: 1-800-641-4266.

NURSERY STOCK

GROW GINSENG. Very Profitable. Have seeds, roots. Complete information. G. Collins, Viola, Iowa 52350.

GARDENING

OVER 70 kinds of carnivorous plants. Peter Pauls. Canandaigua, NY 14424.

MAGIC TRICK PUZZLES

PROFESSIONAL MAGIC! Huge Catalog. Over 1,000 tricks and books. \$2.50. Hank Lee's Magic Factory, Dept. PS11, 24 Lincoln Street, Boston, MA 02111.

ARTS & CRAFTS

LEATHERCRAFT KITS & Tools over 75 kits and 100 tools get you started in leather carving. Plus over 100 Emboss-Stamping tools, 35 "How-To" books. Most trusted name in Mail Order Leathercraft supplies. \$2.00 color catalog refunded first order. Berman Leathercraft, 145PS South, Boston, MA 02111-2882.

GLASSBLOWING: Equipment, Books, Supplies. Catalog \$3.00. Glassblowing, Box 668812, Charlotte, NC 28266.

OF INTEREST TO ALL

MESSIAH PROMISED LIFE TO THE OVERCOMER. Send for your free copy of "The Psychology of Purity & Chastity" to: Schizophrenics International, P.O. Box 50456, Ft. Worth, TX 76105.

WITCHCRAFT—HARNESS FORCE. Understand the Old Religion and the consensus reality. Gavin and Yvonne. Box 1502PS, Newbern, NC 28560.

FREE Air Compressor Already Built. Complete Information. Send \$1.00 to: Jim Payne Associates, Box 148PS, Overton, NE 68863.

The ELECTRIC

FIST ® can protect you from attackers.

Safe to user, with huge voltage from small 9v battery; safety switch. Cannot transmit shock to you from person you touch with Electric Fist. Small (fits in your hand), light-weight (101/2 oz). Fully transistorized solid state. Much more wallop than ordinary prod of Shock-Rod. Rugged cycolac case. Fits in pocket or use genuine leather holster. Special price \$34.50, 2 for \$33 each, 3 for \$31 each, 6 for \$29 each. Batteries are included. Holsters \$3. Why pay more? We pay all shipping costs. MC or Visa orders call toll free 1-800-821-5157. Or send check or money order to

DUTCHMAN's, 9071 Metcalf, Suite 158, OVERLAND PARK, KS 66212.

BATTERIES & GENERATORS

GENERATOR FLASHLIGHT



needs no batteries! Generate electricity by squeezing the grip lever. Shockproof and water repellent made of high-impact plastic. Measures just $5" \times 2"$ with carrying strap ideal for cat boot, camper or general use. Send \$9.50 plus \$1.60 handling in check or money HP MARKETING

8306 Wilshire Blvd. Dept. 1227-P4 Beverly Hills, Ca. 90211

STAMP COLLECTING

25 DIFFERENT older U.S. 10¢ with approvals. Hill Co., Box 51, Defiance, Ohio 43512.

FREE Surprise collection with approvals. Jay, Box 2130, Petaluma, CA 94953.

35 DIFFERENT Old U.S. Revenue Stamps \$1.00. Winchester Stamps, Box 3592, Mansfield, Ohio 44907.

OLD U.S. Stamps on approval. Chester, Box 15355R, Philadelphia, PA 19111.

50 DIFFERENT Old U.S. Between 1861 and 1939 \$1.00. Roush, 423 Shepard, Mansfield, OH 44907.

ONE! Two! Three! Cent Stamp Approvals, Regardless. Catalog, 17902 Marklee, Jamul, CA 92035.

FREE 100 Canada with request of World wide approvals. Briner's, P.O. Box 5607, San Mateo, CA 94402.

4 FOREIGN Sets-only 40¢ when requesting Approvals. R.G. Sales, P.O. Box 1065, Dept. S., Jamaica, N.Y. 11431.

444 DIFFERENT Stamps Only \$1.95 (\$15.00 Value)! 100 U.S. Commemoratives, Vatican, Israel, Zaire, Animals, Olympics, Space, Disney, Much More. Plus 64-Page Catalog. Only \$1.95 When Requesting Stamps To Examine At Home. Mission, Dept. W14, Placentia, CA 92670-0009.

LIQUIDATING Tremendous Old Accumulation. Bargain Lists Free. Alatalo, Maynard, MA 01754.

AFFORDABLE U.S. Year Sets. Cottage Stamps, Box 16, Pelham, NY 10803.

FREE US mint coil pair with approvals. Carlson, Rt. 2, Box 112-P, Annandale, MN 55302.

PLASTICS

CASTOLITE Liquid Plastics. Crystal clear, colors. For casting, embedding, coating, fiberglassing; in industry, laboratories, craft work. Reproduce your designs with our mold materials. Catalog \$1.00. CAST-OLITE, Dept. 84P/PS, Box 391, Woodstock,

PLASTIC Bags all Sizes, Free Catalog. Action Plastic Sales, 1690-P 94th Lane N.E., Minneapolis, MN 55434.

WINEMAKING

WINEMAKERS-BEERMAKERS Free Catalog. Fast Service. Large Selection. Kraus, Box 7850-N Independence, MO 64053.

FREE ENCYCLOPEDIA WINEMAKING Beermaking, Supplies, Equipment Ingredients. Vynox, Box S15498, Rochester, NY

WINEMAKERS - BEERMAKERS -GASOHOL. Free catalog, Equipment Supplies, Continental, Box 188-PS, Casselberry, FL 32707.

WINEMAKERS - BEERMAKERS -Fresh Stocks. Fast Service. Free Catalog. O'Brien's, Box 284A, Wayne, IL 60184.

BEERMAKERS! Free Specialist Catalog/ Newsletter. William's, Box 461-P, Oakland, California 94604.

FREE BEERMAKING BOOK plus catalog. Finest equipment, Ingredients. One-Day Service. Fully guaranteed. SPI, Box 784-S, Chapel Hill, NC 27514.

WINEMAKERS - Beermakers: Free Illustrated catalog of supplies. Semplex. P.O. Box 12276H, Minneapolis, MN 55412-0276.

WINEMAKERS - BREWERS Quality Supplies, Free Catalog. Village Store, Box C51PS, Westport, MA 02790.

WINEMAKERS/BEERMAKERS. Informative Catalog. LOWABS, 731 Warrington Rd., Pensacola, FL 32506.

EDUCATION & INSTRUCTION

UNIVERSITY DEGREES BY MAIL! Bachelors, Masters, PH.D.s . . . Free revealing details. Counseling, Box 389 SP11 Tustin, CA 92680.

FREE Lifetime. Ordination. Become Chaplain, Missionary Evangelist, Bishop. Box 744-PS, McKeesport, PA 15134.

LOCKSMITHING, Universal School of Master Correspondence And Shop Training. Box 214652PS, Sacramento, California

ELECTRONICS Degree (BSET) by correspondence. Grantham College, 2500 La Cienega, Los Angeles, CA 90034.

DEGREE PROGRAMS

IN Management, Economics, Philosophy, Business Studies. Credits and Experience accepted. Prospectus (airmailed \$2.00) Registrar. Sussex COLLEGE OF TECHNOL-QGY, HIGHFIELD DANEHILL, SUSSEX, ENGLAND Rh17 7EX. Founded 1969 students worldwide.

REISCH WORLD WIDE COLLEGE OF AUCTIONEERING, INC. The original—50 yrs.—World's largest! Term soon. Approved for VA. FREE Catalog. 515-423-5242. Col. Gordon E. Taylor, P.O. Box 949, Dept. 3, Mason City, Iowa 50401.

PREPARE to better handle your business, political and social opportunities. The Blackstone School of Law has met the law training demand for almost a century. Information: P.O. Box 790906, Dallas, TX 75379.

UNIVERSITY Degrees! Economical home study for Bachelor's, Master's, Doctorate. Prestigious faculty counsels for independent study and life experience credits. Free proof—Richard Crews, M.D. (Harvard), President, Columbia Pacific University, 1415 Third Street, Suite B311, San Rafael, CA 94901; Toll Free: 800/227-1617, Ext. 480; California: 800/772-3545, Ext. 480.

DRAFTING is a great carreer! Train at home in spare time. Free facts. Write: North American School of Drafting, Dept. PCCA4, 4400 Campus, Newport Beach, CA 92660.

ANTIQUE METAL REPAIRING, hands on training in Hawaii working with copper, brass, silver, pewter, glass, crystal, porcelain, ceramics. Send \$5.00 (deductable) for information. Repair Antiques, Box 27042, Honolulu, HI 96827.

TERMPAPER catalog - 306 pages -10,278 papers available. Rush \$1.00. Research, 11322 Idaho #206KT, Los Angeles, 90025 (213) 477-8226.

BRITISH DEGREES. Obtain yours now from London. Bachelors, Masters, Doctorates. Commerce, Industry, Sciences, Philosophy, Divinity, Medicine, Social Sciences. Free Prospectus. (Airmail \$1 refundable). College Registrar, Dept. 115, BCM -Collegiate, London, WC1N 3XX, England.

BE A BOOKKEEPER. Learn at home. Free book. Dept. 60311-114, Commercial Technical Institute. Little Falls, NJ 07424.

LEARN SMALL ENGINE REPAIR at home. Free book. Dept. 71311-114, Commercial Technical Institute, Little Falls, NJ 07424.

LEARN ELECTRONICS at home. Free book. Dept. 67311-114, Commercial Technical Institute, Little Falls, NJ 07424.

BE A LEGAL INVESTIGATOR. Learn at home. Free book. Dept. 11311-114, Commercial Technical Institute, Little Falls, NJ 07424.

BE AN AUTO MECHANIC. Learn at home. Free book. Dept. 70311-114, Commercial Technical Institute, Little Falls, NJ 07424.

LOCKSMITHING: Free book. Locksmithing Institute, Dept. 01311-114. Little Falls, NJ 07424.

THINK Up Money-making ideas. Hourlong cassette tape and printed guide tells how. \$6.95. Product Research, RD 5, Willoughby, OH 44094.

SAVE \$400-\$1200. Write your own will. Guaranteed legal. Family Will Kit. \$19.95. Cardholders call 303-449-8896 extension 321. Information and check orders: Country Lawyers, 2888-C Bluff, Suite 321, Boulder, Colorado, 80301.

KENO PLAYERS. An Engineered study of the game \$3.00. Daylight Publishing, Box 1461. Statesboro, GA 30458.

ENERGY AUDITORS NEEDED. Let us train you. For information send \$2.00 (refundable) to: Applied Environmental Technologies, Inc., Dept. PS, 5520 S. 31st, Kalamazoo, MI 49001.

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

COLLEGE DEGREE BY SPECIAL EVALUATION of EXISTING Credits & Job Experience. Fast. (614) 863-1791. Box 13151-S11, Columbus, OH 43213.

"JET/GAS TURBINE CAREERS!" Homestudy courses—theory, maintenance, overhaul. AMERICAN JET SCHOOL, Dept. PS-3, Darby, Montana 59829. (406) 349-2100.

LEARN WHILE ASLEEP! Astonishing New Method! Strange Catalog Free! Autosuggestion, Box 24-A, Olympia, WA 98507.

FREE 120 page Career Opportunities Guide—shows how to train at home for top paying jobs. Granton Institute, 263B Adelaide Street West, Toronto, Canada, M5H 1Y3.

MONEYMAKING **OPPORTUNITIES**

NEW Luxury Car Without Cost. Write: AMCO 15E, 1601 Main, Plainfield, IN 46168.

GET RICH!! Secret law smashes debts - - brings Cash credit! FREE report!! WealthKit-S, Billings, NY 12510.

BORROW by mail! \$500-\$25,000 Fast! Easy! Confidential! For info application write: Accurate, 2120 Crestmoor, Nashville, TN 37215.

BUMPER Sticker Printing Device. Cheap, Simple, Portable, Free details Bumper, POB 22791 (LLD), Tampa, FL 33622.

IMPROVE YOUR FINANCIAL STATUS Free information. FJM Information Co., Box 1051, Sanger, TX 76266.

MAKE Rubber Stamps. Highly Profitable Business. Free Details. Stamper, POB 22809(LLD), Tampa, FL 33622.

\$1000's WEEKLY! Unlimited Home Income. Pioneer, Box 986, Tualatin, OR 97062.

ULTIMATE income opportunity of all time! Details. Fred Barry, 1550 East Clark Road A#613, Ypsilanti, MI 48197.

EARN Big Money . . . Work smart . . . capitalize on the booming information explosion. Send for free details now! Samon, Inc. Box 5306-PS1184, Springfield, VA 22150.

HOW to operate seven of the most Powerful proven easyest at home Business in U.S. Free details. Sierra Publishing Co., 16875 Jacksonville Rd., Jamestown, CA 95327.

BORROW \$300-\$30,000 Interest free! Keep Indefinitely! free report! Write: American, 1601 Main, Plainfield, IN 46168.

\$100,000 A YEAR Brokering loans. I do it—you can too. Free proof and details. Westate, 975 Oak, Suite 710ML, Eugene, OR 97401.

PROFITABLE OCCUPATIONS

HYDRAULIC JACK REPAIR MANUAL and catalog \$5.00. Hydraulic Parts Supply, Box 4157, Brownsville, TX 78523-4157.

REPAIR lawnmowers thousands of parts and tools wholesale list 40¢. Ellwanger's P.S., P.O. Box V, Port Jervis, NY 12771.

FREE Catalog. Repair Air Conditioning, refrigeration. Tools, supplies, full instructions. Doolco, Inc., 2016 Canton, Dallas, TX 75201.

HYPNOTISM

FREE Hypnotism, Self-Hypnosis, Sleep Learning Catalog! Drawer PS400, Ruidoso, NM 88345.

FREE Hypnotism. Sleep Learning Publication DLP, Box 487, Anaheim. CA 92705.

EMPLOYMENT INFORMATION

OVERSEAS JOBS! \$20,000-\$60,000 and up! CALL NOW! (317) 839-1712 Ext. 30

OVERSEAS . . . \$20.000-\$60,000 + . Free Report! Employment, Box 19760-FK, Indianapolis, IN 46219.

OVERSEAS, U.S., JOBS AVAILABLE Write: Employers, Box 387-J, Orange Park, FL 32067.

OVERSEAS EMPLOYMENT DIREC-

TORY of U.S. Oil Companies, Construction Firms, Government Agencies, Defense Contractors. Over 265 Potential Employers. Send \$10. Directory, P.O. Box 801, Tonawanda, NY 14151. RIVERBOATS Tugs \$15,000-\$60,000.

Expenses Paid Work Month. Home Month. Experience Unnecessary All water ways including Alaska, Hawaii. Free report Send stamped envelope. Marine Employment, Box 223, Central, IN 47110.

AUSTRALIA—Openings Now! Top Pay! Transportation. Plus Worldwide listings: \$1.00. Jobworld, Box 681-F, Cypress, ČA 90630.

JOB HUNTING Contact 100s Employers, Free Information, PerSpec, Dept. P. Hummelstown, PA 17036.

SAUDI ARABIAN JOBSIII LEAHY. Department 1023, Box 29063, Washington, DC 20017.

SAUDI ARABIA HOW to find HIGH-PAYING JOBS; numerous professions: unique manual; FREE information kit. Mundo Trade (P11), P.O. Drawer N. Solana Beach, CA 92075.

LOANS BY MAIL

BORROW \$100-\$100,000! Instant Reply! No Co-Signers! Rush Stamped Envelope! Financial, Box 5487 (PS), Richardson, TX 75080.

IMMEDIATE Loans to deserving individuals refused elsewhere. Many plans included. Try us! Associates, Box 98-P31 Brooklyn, NY 11235.

BORROW \$300-\$30,000 Interest Free! Keep Indefinitely! Free report! Write: American, 1601 Main, Plainfield, IN 46168.

NEED credit cards? Bankrupt? Slow credit? No credit? Let us help. Call now 1-317-839-1712 Ex.c7.

BORROW by Mail! \$500-\$25,000 Fast! Easy! Confidential! For info application write: Accurate, 2120 Crestmoor, Nashville TN 37215.

ARAB BUSINESSMEN Have Money To Buy & Invest. Top Finders Fees Paid. Int. Middle East Assoc. 1184PS1, 8291 Flaxman Huntington Beach CA 92646.

BORROW By Mail. Any Amount! Any Purpose! Fast-Easy-Confidential! Details, Application Rushed! Creditmasters, Box 507-PPS, Floral Park, New York 11002.

BORROW \$30,000 without interest! All eligible. Repay anytime. Free details Infohouse-PS, 808 Post, San Francisco, CA 94109.

LOANS \$30,000! Interest Free! Repay Anytime—All Eligible! Details Free! Millionaire, Dept. A-20, P.O. Box 607, Elk Grove Village, IL 60007.

\$LOANS\$ On Signature To \$100,000-Any purpose! Write: Elite: Box 206-P S East Rockaway, NY 11518.

LOTTERIES

PLAY NEW YORK State lotto by mail Send s.a.s.e. for free subscription form. E Mueller, 88 Broadway, Greenlawn, NY 11740.

LOTTERIES, play 19 lotteries, by mail For directory, send \$5.00 to: NCS Publish ing, P.O. Box 13151, Ft. Wayne, IN 4686

WIN MILLIONS in Canadian Govern ment lotteries. For free information write Canadian Gold Club, P.O. Box 324, Station A, Windsor, Ontario, Canada N9A 6K7.

SPECIAL SERVICES

INFORMATION On Anything. Ferguson Research Specialists. 60-15 Woodside Avenue, Woodside, NY 11377.

INCORPORATE Without Legal Fees. Free Kit Includes Forms. Call Now (800) 345-Corp.

DEBT FREE!! Establish AAA-1 credit!! New secret law smashes debts!! Free Report!! Wealth Kit, PS-11, 13934 Dentwood, Houston, Texas 77014.

REMAILING SERVICES

CONFIDENTIAL Mail Receiving/Forwarding. Mail Drop, Box 18039PS, Orlando, FL 32860.

REMAILING: Envelope, \$1.00, package \$2.00. J.A.M.-2, Box 485, O'Fallon, IL

CONFIDENTIAL Canadian address. North America Mail Center, P.O. Box 3169, Dartmouth East, Nova Scotia, Canada B2W 5G2.

BUY IT WHOLESALE

CLOSEOUTS: Wholesale! Overruns! Freebies! Information (stamp): DDN, Box 20152-G, Ferndale, Michigan 48220.

400,000 BARGAINS Below Wholesale! Many Free! Liquidations . . . Closeouts! Job Lots . . . Single Samples. Free details. Worldwide Bargainhunters, Box 730-B, Holland, MI 49423

PARTS Catalog—Chainsaw, Three-Wheeler, Motorcycle, Snowmobile, Small Engines. (\$1.00). Manufacturer's Supply, Box 157PS12, Dorchester, WI 54425.

WHOLESALE PARTS for lawn equipment, Minibikes, Karts, Chainsaws, Small Engines. Quality products. Send \$3.00 for full line catalog. GRP Parts, P.O. Box 45245, Dept. S, Somerville, MA 02145.

BUSINESS SERVICES MAILING LISTS

FREE Mailing List Analysis. Details. GOC-8U, Box 1107, Stuart, FL 33494. (305)

MAILING LISTS all categories Guaranteed deliverable. Send sase for Information. Marketing Distributors, 66552 Mission Lakes, Desert Hot Springs, CA 92240.

MAILORDER BUYERS LISTS available for **IMMEDIATE USE** Computerized on Peel and Stick labels in ZIP CODE ORDER. GUARANTEED DELIVERABLE! For complete details **SEND** to: **MGS Enterprise**. Box 5008, Rapid City, South Dakota 57709.

PERSONAL

COLLEGE DEGREES, High School Diplomas Authentic looking Novelty. Free Catalog. National Certificate, Dept. PS-104, 210 5th Avenue, New York, 10010. (718) 768-6803 Ext. 100.

DON'T Die Without A Will! We'll send you Complete "Will-Kit", Legal Guide, Documents, Forms, \$6.25, 2 Kits \$11.35. Consultors, Box 6589-RC, Denver, CO 80206-0589

▲ COMING Whirlwind to sweep this earth. Free Information! Write: Harvest, PS, Jefferson City, MO 65102.

YOUR Credit Troubles Solved! Get Visa/ Mastercards, No Credit Checks! Debt Consolidation, Loans, Guaranteed Complete "Credit-Plan", Guide. \$13.95 "Credit/Consultors", Box 6589-RB, Denver, CO 80206-0589.

GAMBLERS BIORHYTHM CHARTS. When to play, when not to play. Month \$1.00, year \$10.00. Send birthdate. T.T., Box 2700B, Huntington Beach, CA 92647.

HAIR CARE

BALD? LOSING HAIR?

Amazing new formula stops hair loss and reverses it by attacking the cause. Details \$1. Lukats, Box 1642, Jensen, Fl 33457.

HAIR FARMING! stops hair loss—Stimulates new hair growth. FAST, FAST RE-LIEF No chemicals. Guaranteed results 30 days. Exciting facts free: Rogly Research, Box 570726, (PS), Miami, FL 33257-0726. Write today!

JOKES & NOVELTIES

FREE-World's Leading Novelty Catalog, 1600 Jokes, Tricks, Science, Sports, Hobbies. Johnson-Smith, C-6113, Mt. Clemens, MI 48043.

INVENTIONS WANTED

INVENTIONS Developed Marketed. Free Invention Certificates. MANUFACTURERS REPRESENTATIVE, Suite 3615-PS, Woolworth Building, New York, NY 10007.

EARN ROYALTIES, NUPRODUX INTER-NATIONAL, 1377 K 203, WASHINGTON, DC 20005.

IDEAS, INVENTIONS, NEW PRODUCTS WANTED FOR

presentation to industry and exhibition at national technology exhibition. Call 1-800-528-6050. Arizona. 1-800-352-0458 Ext. 831. Or Write:

IMI-PS 701 Smithfield Street Pittsburgh, PA 15222

INVENTORS, an idea is only that—unless pursued. Call AIM America's foremost invention development company for free patent & info kit. Call free 1-800-225-5800.

LEARN how to offer your invention for sale or license. Free Booklet Outlines procedures, royalty rates, requirements. Kessler Sales Corporation, C-7-IW, Fremont, OH 43420.

FOR INVENTORS

PATENT IT ECONOMICALLY! Free Details. M. Rainer, 2008 Fondulac, Richmond, VA 23229.

NONPROFIT foundation helps inventors. Widest range of services. Free recording forms. Free evaluation. Affiliated Inventors Foundation, 501-A Iowa, Colorado Springs, CO 80909 or Call toll free 1-800-525-5885.

PROTECT YOUR INVENTIONS AND TRADEMARKS. Registered Patent Attorney. FREE Preliminary review. Box 392PS, Millwood, NY 10546.

INVENTORS: Free information on offering your invention for sale. Kessler Sales Corporation. C-7-F1, Fremont, OH 43429.

INNOVATION Centre associated with University of Waterloo provides assistance to INVENTORS in: Development, Patenting, Licensing, Marketing and Financing. Canadian Industrial Innovation Centre. Dept. PS14, Waterloo, Ontario, Canada N2L 3L3.

INVENTORS! IDEAS HAVE VALUE!

Ever think of an idea, forget it and see it later on the market? Many people don't forget, act quickly and are rewarded by American industry. Write down your idea! We offer free disclosure registration and initial consultation regarding your idea's potential value. Call or write without delay for your free information package.

> American Inventors Corporation 82 Broad Street, Dept. PS Westfield, MA 01086

(413) 568-3753 A Fee Based Marketing Company Offices Coast to Coast

TREASURE FINDERS / METAL DETECTORS

FIND old coins, jewelry, gold nuggets. New patented revolutionary device. Free catalog. Gardiner, 4729L N. 7th Ave., Phoenix, AZ 85013.





FIELD GLASSES, TELESCOPES

FREE Catalogue! Thousands War surplus optical bargains. Lenses, Prisms, Telescopes, Binoculars, etc. Jaegers, 691G Merrick Road, Lynbrook, NY 11563.

WATER PURIFICATION

SAFE-CLEAN-WATER! Our products make others obsolete. Special Prices. Complete third faucet system. Call Free 800-643-SAFE. Safe Water, Building 3811, Gravette, AR 72736-0799.

PATCHES DECALS & BADGES

FREE CATALOG—Patches, Cloisonne Pins, Decals, Stickers, T-Shirts, Jackets, Caps, Group incentives. Eastern Emblem, Box 828PS, Union City, NJ 07087. 201-867 - 3159.

GUARANTEED Lowest Emblem Prices! Free Catalogue/Quotes. Stadri, 61R Jane, NY, NY 10014, 212-989-0009.

CAMPING EQUIPMENT

FREE Discount Catalog, Backpacking. Camping, Campmor, Box 999-P. Paramus, NJ 07653-0999.

EARTHWORMS, CRICKETS, FROGS

FREE Literature. Raise Fishworms. Crickets. Red wigglers-1000-\$8.95. 5000-\$42.50. Carter Farm-12, Plains, GA 317890

KNIFEMAKING SUPPLIES

MATERIALS FOR CUTLERY

38 Page Catalog \$2.00. Custom Knifemakers Supply, Box 308-PS, Emory, Texas 75440.

MODELS SHIPS CARS PLANS ROCKETS

LIVE STEAM MODELS!

Collect Fascinating Live Steam Models!
New!! "LIMOUSINE" \$189.95 "ROADSTER"
\$147.95 Complete "LOCOMOTIVE" set \$239.95
"TRACTOR" \$109.95 "ENGINE" \$39.50 ect. Kit
or ready to run. Large Stocks. 15% discount on
orders over \$200.00 "STEAM BOOK" \$4.95 Colored Circular Price list \$1.00 refundable. All Above shipped postpaid.
Diamond Enterprises, Dept. PS. Box
537, Alexandria Bay. NY 13607 Phone:
613-475-1771. In Canada: RR=3
Brighton, Ontario. KOK 1HO



GOV'T SURPLUS

18 It True you can buy jeeps for \$44 through the U.S. government? Get the facts today! Call 312-742-1142. Ext. 4606.

SPORTING GOODS

HEARING AIDS

HUGE SAVINGS. Eliminate dealer markup. Free Trial. Batteries wholesale. Terms Arranged. Lloyds-PSC, Rockford, IL 61104. Call 1/800/323-1212 Toll Free

GIANT SAVINGS Custom In-The-Ear Specialists 30 Day Trial Terms. Riteway, Box 59451S, Chicago, IL 60659.

HEARING AIDS 1/2 PRICE CATALOG FREE!

SUPER \$AVINGS! Newest. Finest. All types. Buy DIRECT & save up to HALF! No salesmen. Sold by AIR MAIL on HOME TRIAL. FREE Catalog. Write: MONEY\$AVERS,

9530 Langdon Ave., Dept. PS11D Sepulveda, Cal. 91343

Not sold in California.



All-in-th-ear Hearing Aid! Nothing over, under or behind the ear . . . no cords, tubes or wires. Simple slipin fit. Full range volume control. 45 day trial. NO salesman will call. Order your free catalog! Write Better Hearing today!

BETTER HEARING Brookport, IL 62910 Box 537-69M

MUSICAL INSTRUMENTS

INTERNATIONAL VIOLIN COMPANY, LTD., Catalog for makers, repairers of stringed instruments. Imported tonewood, tools, varnishes, parts, accessories, strings, cases. Fine European instruments, bows. Assemble-yourself carved violin kit. Catalog \$1.00 includes 10% discount certificate. Dept. KK, 4026 W. Belvedere Avenue,

SONGWRITERS

Baltimore, MD 21215.

POEMS-SONGS WANTED. Free Publishing/Promotions. Broadway Music, Box 7438-PS, Sarasota, FL 33578.

POEMS Wanted Immediately. Nashville Music Productions, Box 40001-PS, Nashville. TN 37204.

MUSICAL INSTRUCTION

PLAY PIANO—ORGANI (Newest Method Guarantees Instant Results!) Free Information: Music-PS, 4001 East Fanfol, Phoenix, AZ 85028.

SURVIVAL EQUIPMENT

FOOD, Delicious, no refrigeration, lasts 5 years. Send \$5.00 for sample and literature. Nutri-Science Center, 6229 Hwy 6 So., Houston, TX 77083.



Product Information

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.

- 1101 Windows and Gliding Doors A brochure from Andersen Corp. shows how the company's Concept IV system adds beautiful glass areas to your home without greatly increasing heating costs. You'll also learn about some discoveries that can put your remodeling solar years ahead. Free
- 1102 High-Security Safes Here's a booklet on Cannon Safe products, a range of highsecurity, good-looking safes that are at home in your office, home, or workshop. Free
- 1103 Toy Making This 20-page catalog from Cherry Tree Toys contains information and prices on hundreds of toy plans, wheel parts, and kits for all levels of skill. \$1
- 1104 Carbide Blade A leaflet from Clemson Group describes how Sanblade, a unique, industrial-quality carbide-tip blade, saves time, money, and energy by sanding while cutting. It's designed and built to ensure long life. Free
- 1105 The Stove Solution This full-color 20-page catalog features Earth Stove's full product line, including free-standing models, fireplace inserts, and the newest addition to the line: the Earth Stove Catalytic. Free
- about the innovative HP ThinkJet printer, HP-41CX, HP-71B, TI-66, and NEC 8201. The illustrated EduCALC catalog tells you just what these machines can do. It also shows you how to use them, with books, software, and accessories from EduCALC. Free
- 1107 Personal Showers Turn your bathroom into a spa with an Ondine personal-care shower. It bubbles, tingles, pulsates, and adjusts to any height, and also has water- and energy-saving features. A color brochure has the details. 50¢

Please send cash, check, or money order made out to POPULAR SCIENCE.

No stamps or foreign currency. Allow approximately six weeks' delivery.

- 1108 Sensual Spas Jacuzzi's beautiful 20-page full-color catalog features the firm's entire line of spas. To aid in decorating, all spas are shown in garden or patio settings. Free
- 1109 Radial Tires An informative brochure from Michelin Tire Corp. introduces the XA4, an all-season radial tire that performs equally well on snow, wet roads, and dry pavement. The XA4 provides extended tread life and fuel savings, too. Free
- 1110 Clothes for Work and Play This comprehensive 44-page full-color catalog from Montgomery Ward features top-quality clothing for work and weekend activities. Included are matched work sets, boots, overalls, and cold-weather garb to meet on-the-job-needs; and jeans, shirts, jogging suits, and even a rugged leather motorcycle jacket for leisure-time pursuits. Free
- 1111 Doors and Elegant Woodwork A complete set of full-color folders from Morgan Products Ltd. describes how to use exterior and interior doors, patio doors, stair parts, entrance trim, and mantels to decorate and insulate your home with the warmth, beauty, and elegance of wood. 25¢
- 1112 Heat Exchanger A catalog from NuTone Housing Group describes how the firm's residential air-to-air heat exchanger works to rid your home of stale air and other indoor contaminants. \$1
- 1113 Coated Glass This eight-page booklet from PPG Industries features Sungate 100, the most advanced energy-efficient coated glass for the home. Sungate 100 keeps heat in during the winter months and reduces heat gain in summer, all while admitting natural light into your home. Free

FILL IN COUPON AND MAIL TODAY

- 1114 Power Painting A brochure from Power-Flo Products describes the Power-Flo Roller Painting system. It pumps paint right from the can to the roller with the touch of a button. Free
- 1115 Humidifier This interesting booklet from Research Products Corp. explains the concept of relative humidity and lists several points to remember when shopping for a humidifier for your home. Now any type of heating system can be humidified automatically. Free
- 1116 Outdoor Power Equipment A 20page full-color catalog outlines the new line of Roper products, including walking lawn mowers, tractors, and front- and rear-tine tillers. Free
- 1117 Do-It-Yourself Moving Move it yourself, and save. This 27-page guide from U-Haul tells how to choose the right truck or trailer and estimate costs; it also includes a "plan-your-move" chart. Free
- 1118 Wood Finish A Watco finish makes a wood floor about 25 percent harder than with a conventional finish. It penetrates deeply for a long-lasting, durable surface; no wax or varnish is needed. Watco-Dennis has the details. Free
- 1119 Water Vacuum This multipurpose vacuum can be used for spas, hot tubs, fountains, and swimming-pool steps. A specifications sheet from Watkins Mfg. displays the product and its functions. Free
- 1120 Recreational Vehicles A full-color brochure from Yellowstone describes the company's products and models of RVs. It features travel trailers, fifth-wheels, and minimotor homes. Free

POPULAR SCIENCE NOVEMBER 1984

Please :	send the items chec any number of items	ked below. I am end	losing \$1 handling red for priced item	g charge is.	I AM EN	CLOSING
ii 1101	□ 1105	□ 1109	1113	1117	\$	for priced items
□ 1102	□ 1106	□ 1110	□ 1114	D 1118	80	\$1 for handling
□ 1103 \$1 □ 1104	□ 1107 50¢ □ 1108	□ 1111 25¢ □ 1112 \$1	□ 1115 □ 1116	□ 1119 □ 1120	\$	TOTAL REMITTANCE

150 POPULAR SCIENCE

A worker like this has no trouble carrying his share of the load.

The new 1985 Toyota Standard Bed holds 1,400 honest pounds of payload.** No ifs. No buts. No sweat.

Part of the reason is the heart under the hood—a 24 liter engine. Its relentless 103 horses with high torque push it from job to job. No standard grade small truck has a more powerful engine. Not one.

There are no overtime charges for the overtime extras Standard Bed brings to the

job, either. Standard on the Standard is

a fully transistorized ignition system, power assisted ventilated front disc brakes, rugged full box frame construction and

steering column controls designed to let you work them without working.

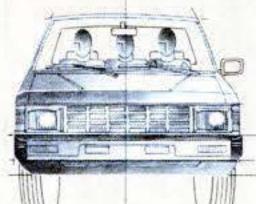
And the cab space offers a fullbench seat for three, side-by-side, without skimping on head room or leg room.

But the best thing about getting a worker like this may be the knowledge

OH WHAT A FEELING!

that Toyota owners reported the lowest incidence of repairs for any small truck-imported or domestic.***

Hire the truck. You'll never be sorry you did. Just ask the man that owns one.



 Manufacturer's suggested retail price. Dealer's actual retail price may vary. Price does not include tax, license, transportation, optional or regionally required equipment.

** Including occupants, equipment and cargo.

*** 1984 J.D. Power Compact Pickup Truck Survey.

TOYOTA TRUCKS. MOST POWERFUL EVER!

THE 1985 TOYOTA STANDARD BED. \$5,998. HARDWORKING, RELIABLE, NO CHARGE FOR OVERTIME.



