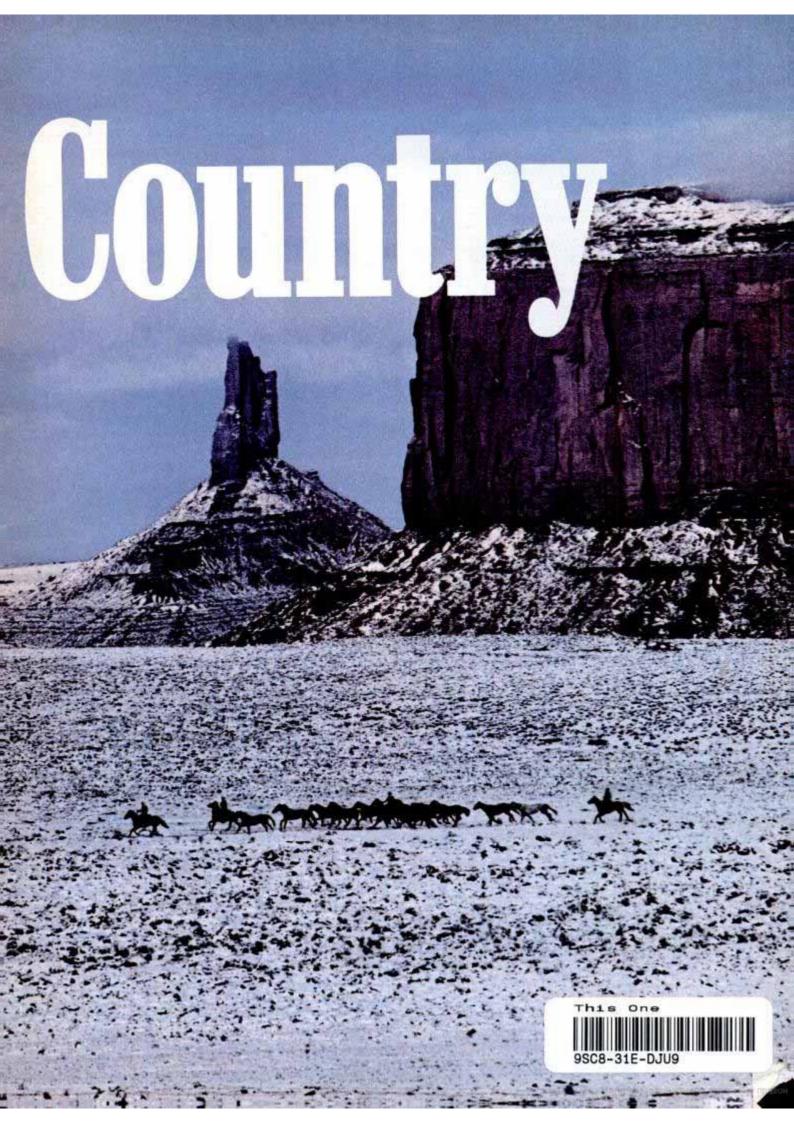
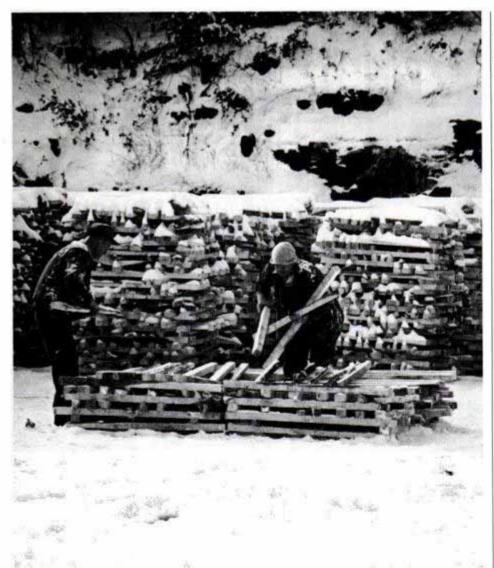


SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, And May Complicate Pregnancy.

Lights Kings: 10 mg "tar," 0.7 mg nicotine— Kings & 100's 16 mg "tar," 1.0 mg nicotine av per cigarette, FTC Report Feb. 85





know more about our charcoal mellowing process, just write

# BUILDING A HARD MAPLE RICK is tough work. But burning it down is still tougher.

You have to burn it in just the right way to get charcoal instead of ashes. Then, you have to grind up the charcoal into pieces no bigger than peas and tamp them tight into room-high vats for

mellowing the taste of Jack Daniel's. Doing all this is a big job. But you'll appreciate how important it is after one little sip of "charcoal mellowed" Jack Daniel's.



# CHARCOAL MELLOWED DROP BY DROP

Editor-In-Chief Joe Oldham

Managing Editor Bill Hartford **Graphics Director** 

Bryan Canniff

Science/Technology

Dennis Eskow, editor Ted Francis, contributing editor

Automotive
Wade A. Hoyt, SAE, editor
Norman S. Mayersohn, assistant editor
Jim Dunne, Detroit editor Michael Lamm, Steve Potter, Mort Schultz, Rich Taylor, contributing editors

Home And Shop Steven Willson, editor Joseph Truini, shop and tools editor Arthur Rooze, associate editor Roy Berendsohn, assistant editor Norman Becker, Rosario Capotosto, Steve Toth, contributing editors

Electronics

Stephen A. Booth, editor James B. Meigs, Ron Scibilia, Terry Shea, contributing editors

Boating/Outdoors Timothy H. Cole, editor

West Coast

Steve Parker, editor

**Editorial Production** 

Peter Francesconi, chief John Bostonian Jr., art Rebecca Harth, David Meyer, copy editors

**Design Director** 

Ira Herrick, design director

Ira Herrick, design director John Johanek, art director Alan Andresen, Ann Bennett, associate art directors

Diane DePasque, assistant art director

**Editorial Administration** 

Josephine Caronia, administrative assistant Barbara A. Novak, executive assistant

**Editorial Offices** 

224 West 57th St., New York, NY 10019
We cannot be responsible for loss of unsolicited queries, manuscripts, or photos, For return, they must be accompanied by adequate postage.

POPULAR MECHANICS (ISSN 0032-4558) is published monthly by The Hearst Corporation, 224 West 57th Street, New York, NY 10019, U.S.A. Subscription prices: United States and possessions, \$13.37 for one year; \$2.37 for two years, Canada and all other countries, aid \$16.20 for each year. Second-class postage paid at New York, NY, and additional mailing offices, Authorized second-class mailing-in-Canada privileges by Canada Post, Windsor, Out. Registered as second-matter at the Post Office at Mexico D.F., Mexico, June 20, 1950. © 1996 by The Hearst Corporation. All rights reserved. Printed in U.S.A.

c 1985 by The Hearst Corporation. All rights reserved. Printed in U.S.A.

POSTMASTER: Please send address charges to Popular Mechanics, P.O. Box 10064, Des Moines, IA 50850.

SUBSCRIPTION SERVICE: Popular Mechanics Magazine will, upon receipt from its reader of a complete new or renewal subscription order, undertake fullifilment of that order so as to provide the first-copy delivery either to the Postal Service or alternate earriers within six to twelve weeks. If for some reason this cannot be done, you will be promptly notified of the issue date that will begin your subscription, with a request for any further instructions you may have concerning your order. Please address all such orders to us at Popular Mechanics, P.O. Box 10064, Des Moines, IA 50850 • Should you have any problem with your subscription, please write Joan Harris, Castomer Service Department, Popular Mechanics, P.O. Box 10064, Des Moines, IA 50850 or call toil-free 1-800-247-5470; Iowa residents call 1-800-532-1272. Please enclose your mailing label when writing to us or renewing your subscription • Renewal orders must be received at least eight weeks prior to expiration to assure continued service. expiration to assure continued service.

Use this address for subscription orders & inquires. POPU-LAR MECHANICS, P.O. Box 10064 Des Moines, IA 50350.

JANUARY 1986

VOLUME 163 NO. 1



ON THE COVER

She was four city blocks long and 11 stones highspectacular steel city loaded with wealthy passengers. But on a starlit night in April 1912, the Titanic went down. Last summer, the great ship was rediscovered lying 2 miles below the surface of the Atlantic. And with booty estimated to be worth hundreds of millions of dollars, the tace may have begun for the most exciting salvage operation ever. The story starts on page 75.

—PM Illustration by

Tom Freema



82 The 6 billion dollar man



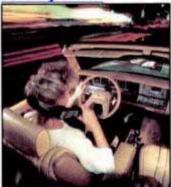
79 Bass boat battle



86 Family van test

# DEPARTMENTS

- **Editor's Notes**
- Letters
- 12 Imports
- Motorsports
- Freewheeling
- Appliance Q&A 20 Inside Detroit
- 26 Homeowners' Q&A
- Aviation 31
- Outdoors
- 40 Audio
- **Tool Tests**
- Photography Car Clinic
- Minicourse
- Cycles
- Computers
- 140 Science
- 143 Worth Writing For
- 146 Video
- 159 New/Workshop
- 162 New/Auto
- 164 New/Home
- 167, 168 Hints
- 180 Time Machine



4 Car phones



# FEATURES

# AUTOMOBILES AND BIKES

A Family Affair

We test five small vans equipped for family fun.

151 Saturday Mechanic

Here's how you can cure cold-engine stumble.

160 Firsthand Drive Report: Ford Supervan 2

## HOME AND SHOP

Hammers

Each of these 22 hammers is for a specific purpose.

100 Shaker Simplicity

Use our plans to build a cherry chest of drawers.

104 Supersander

Take a look at this versatile sanding machine.

129 The Better Home

In this new monthly section, learn about drywall.

# ELECTRONICS

**Television Art** 

The old boob-tube is getting a facelift.

**Phones On A Roll** 

The new cellular telephones go where you go.

## PHOTOGRAPHY

148 35-mm Camera Shootout

It's the Canon T80AF vs. the Minolta Maxxum.

# BOATING

**Battle Of The Bass Boats** 

Five top fishing machines clash in our showdown.

# SCIENCE AND ENGINEERING

Titanic: Lost And Found

The Titanic is about to surrender her mysteries.

The 6 Billion Dollar Man

The half man/half machine is becoming a reality.

Voyager's Next Stop

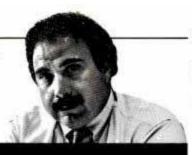
Voyager 2 will reach Uranus this month.

Technology Update

Spielberg makes a house fall apart. Tracking the northern lights. Balloon to trace acid rain. Detecting hazardous weather. Cylindrical turbosails at sea. Catamaran fireboat is on line. Solar vehicles break ground. New farm sprayer saves work. Industry seeks home in space. Ice detector for planes. Soviets add cargo plane. Airlines stretch jets. New turbofan jet engine. Copperhead is deadly. Laser guides missile.

73 Suit for gas warfare

# Editors



t least three major motion pictures, one Broadway musical, one "Twilight A Zone" episode and a dozen novels and books have tried to recapture the sinking of the Titanic on April 14, 1912. In 1953, the movie "Titanic" was released. There was the 1958 film "A Night to Remember." And in 1980, we saw the movie "Raise the Titanic." The Broadway musical "Unsinkable Molly Brown" (1962) was made into a movie in 1965. So much of the Titanic story is fascinating, no wonder 't's the stuff of books and movies. It's world history. The vessel was British. It was a towering statement about England's continuing supremacy at sea. It's American history since most of the first-class passengers were members of New York's and

Philadelphia's social elite. It's not only history, but it's mystery. What really happened that night? Was the gash from an iceberg enough to send her down so quickly? The Titanic was the first ship ever to send an SOS by Morse code. An international convention had agreed to the SOS the winter before. Until that fatal night, ships in distress sent out all kinds of signals in Actors Bobby James, their native languages, Clifton Webb and which made rescue difficult. Maximillian Schell Following the sinking of the prepare to abandon Titanic, ships were re- ship in the movie quired to carry one lifeboat "Titanic" as the seat for every passenger. It vessel goes down. also led to the creation of the The ship has been British-American North At- the stuff of books lantic Iceberg Patrol, which and movies, and now, still operates, and to the magazine articles. mandatory 24-hour radio





watch on cruise ships. When the Titanic sank, her radio was turned off before midnight-as was the custom.

Last summer, a team from Woods Hole Oceanographic Institute in Massachusetts struck pay dirt and located the Titanic lying over 2 miles beneath the surface. Robert Ballard and his colleagues plan to return this summer and dive down to the ship. But they aren't the only ones. There's a race to reach the ship and at least one millionaire has already announced his intentions to try and reach the wreckage first. Another group is considering ways to raise the Titanic. Read about the competition to reach, and perhaps raise, the Titanic in our exciting cover story (page 75). . . . In paging through this issue, you'll find we've freshened up the look of our front-of-book columns and added a bunch of new ones. Our list of new columnists is impressive. Jim Dunne, considered the dean of Detroit auto writers, joins us as Detroit Editor and, naturally, he'll be writing our Motor City news. Jim Meigs, our new home video columnist, is senior editor of Video Review. Terry Shea, who'll be doing our audio column, is editor of Audio Times magazine. Ron Scibilia, writing our computer column, is editor of Computer Electronics and west coast bureau chief of Consumer Electronics Monthly. Steve Potter, our new motorsports columnist, writes the auto racing column for the New York Times. Plus we've added columns on aviation, motorcycles and bicycles, and a footloose column on cars. These will be written by

staff editors Dennis Eskow, Norman Mayersohn and Wade Hoyt. Also joining our staff this month is Steve Parker, as west coast editor, and our longtime master craftsman, Ro Capotosto, as contributing editor. Hope you like the new lineup. 'Til next time.



Daniel J. Coleman Publisher

Advertising Director Floyd Sembler

### **Advertising Offices**

New York 224 West 57th St. New York, NY 10019 (212) 262-8824

Chicago 1 South Wacker Dr. Chicago, IL 60606 (312) 984-5190

Detroit 377 Fisher Rd. Grosse Pointe, MI 48230 (313) 881-3520

Los Angeles 3000 Ocean Park Blvd. Santa Monica, CA 90405 (213) 450-8881

**Business Manager** Agnes P. Maillaro

Marketing Director Edward Vaquero

**Production Manager** Lori Ellwood

Advertising Production Patricia Woods (212) 262-4800

Classified Sales Manager Sophie Gronowicz (212) 262-4825

Reader Service Department Gary Frederick, supervisor 224 West 57th St., New York, NY 10019 (212) 262-4292

Published by The Hearst Corporation: Frank A. Bennack Jr., President Randolph A. Hearst, Chairman Gilbert C. Maurer, President, Magazines Division Richard E. Deems, Publishing Consultant

POPULAR MECHANICS is published monthly by the Hearst Corporation, 969 Eighth Avenue, New York, NY 10019, U.S.A. Frank A. Bennack Jr., President; Randolph A. Hearst, Chairman; Harvey L. Lipton, Vice-President and Secretary, Edwin A. Lewis, Vice-President and Treasurer. Hearst Magazines Division: Gilbert C. Maurer, President; K. Robert Brink, Executive Vice-President; Mark F. Miller, Executive Vice-President; Mark F. Miller, Executive Vice-President; Mark F. Miller, Executive Vice-President; Thomas J. Hughes, Vice-President & Resident Controller; William S. Campbell, Vice-President, Director of Circulation; Daniel J. Coleman, Vice-President for Popular Mechanics.

INTERNATIONAL EDITIONS: CARIBBEAN, MEXI-CO, SOUTHERN HEMISPHERE

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



# **Small Wonder**

At last, pocket-size radar protection.

Quite simply, PASSPORT is the smallest superheterodyne radar detector ever made—only ¾" tall, 2¾" wide, and 4½" long. It fits your pocket as easily as a cassette tape.

### Small means nearly-invisible protection

This miniaturization is possible only with SMDs (Surface Mounted Devices), micro-electronics common in satellites but unprecedented in radar detectors. The result is exactly what you'd hope; high performance in a low-profile package. And the response is exactly what you'd expect. The experts at *Car and Driver* said, "In a word, the Passport is a winner."

The magazines report excellent performance. More than early warning, PASSPORT also provides a precise measure of radar range. Simply turn PASSPORT on and set the volume level. At radar contact, the alert lamp lights and the variable pulse audio begins a



In PASSPORT, 102 SMDs (right) do the work of ordinary transistors, resistors and capacitors.

slow warning: "beep" for X band radar, "brap" for K band. Simultaneously a bar graph of Hewlett-Packard LEDs shows signal strength. A photocell even adjusts the alert brightness to the light level in your car.

## Small means the size of a cassette tape

As you get closer, the pulse quickens and the bar graph lengthens. And if you should want to defeat the audible warning during a long radar encounter, a special switch allows you to "mute" the audio, yet leave PASSPORT fully armed for the next encounter. You get the complete radar picture.

# Small means never having to go without

You can take PASSPORT anywhere: on an airplane to another
city, or to work for trips in the company
car. Just install on dashtop or visor,
then plug into your lighter PASSPORT
keeps such a low profile, it can be
on duty without anyone noticing.
And PASSPORT comes complete with
a visor clip, windshield mount,
straight cord, coiled cord—even a
leather travel case. And we back
PASSPORT with a full one year limited
warranty.

Try PASSPORT at no risk. Call us toll free to order. When your PASSPORT arrives, take the first 30 days as a test. If you're not completely satisfied, return it and we'll refund your purchase and your mailing costs. You can't lose.

\$295 (OH res. add \$16.23 tax)



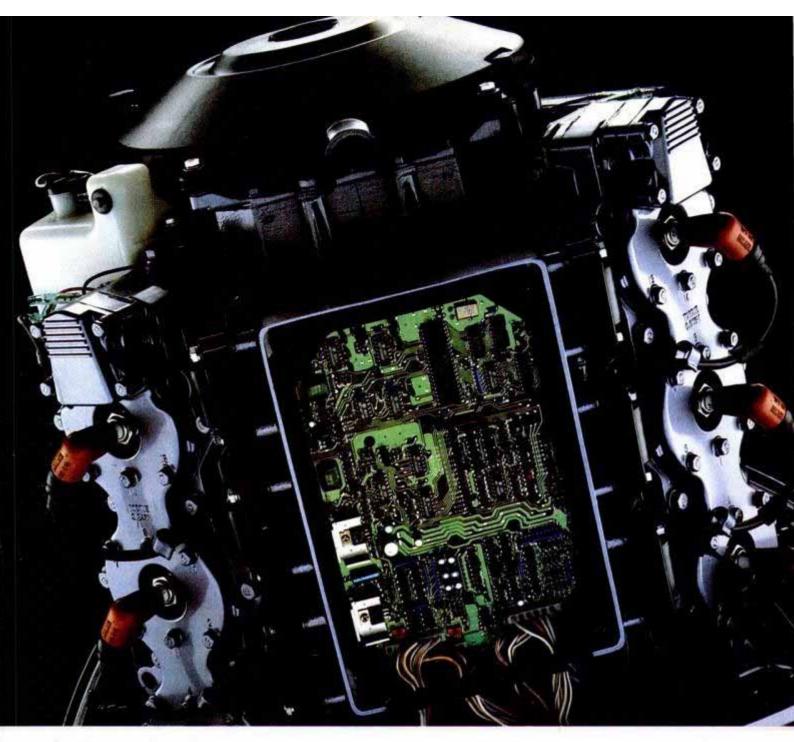


© 1985 Cincinnati Microwave, Inc.



### Call Toll Free 800-543-1608

Cincinnati Microwave Department 100-068-C13 One Microwave Plaza Cincinnati, Ohio 45296-0100



# The first computer with a propeller.

It's more than a new feature. It's a new direction.

Yamaha has put a micro-computer on an out-board motor. And boating will never be the same.

This technological wonder is on our 220-plus horsepower V6 Special. Sensors continuously monitor engine speed, load, temperature and fuel quality. This information is fed back to the computer

which adjusts ignition timing for optimum performance and efficiency. The V6 Special is at the top of an outboard line that has models in 18 horsepower sizes, right down to a lightweight 2-horse motor. Industry-rocking innovations abound. Precision Blend™ oil injection is one. Standard on

models 40 hp and up, this system gives the engine only the oil it needs, depending on how fast it's running and how hard it's working. That's a blow to blue smoke and a boost to performance and economy.

Your Yamaha outboard dealer is ready to show you all our new motors. All covered by a 2-year limited warranty. Including the one with a mind of its own.

YAMAHA

Expect a lot."

For your nearest dealer call 1-800-447-2882

# Letters



# Who needs plans?



Reader Eugene A. Vis modified our barn garage to suit his needs.

I made a few changes to suit my purposes when I made my barn (Build Our 'Country Barn' Garage, page 90, Sept. '84), and the results are great! Even though the dimensions of the knee walls were not in the article, I managed. EUGENE A. VIS (NO ADDRESS GIVEN)

Your obvious skills enabled you to do a terrific job with one of our largest projects, one that could not be detailed completely in the issue. Readers who need plans can send \$30 to Country Barn Garage, No. PL-1277, Popular Mechanics, Box 1014, Radio City Station, New York, NY 10101.

### In hot water

I think there's an error in The Heat Is On (page 143, Sept. '85). You state a leak of one drop per minute amounts to 800 gallons per year. Attached are my calculations indicating this is impossible. Did you mean one drop a second? MARK LORD ST. LOUIS, MO

One drop per second it is! This troubleshooting guide to hot-water heaters was very comprehensive, but we dripped over our own feat on that calculation.

### Private shuttles

In his article NASA's Next Spaceships (page 84, June '85) James Beggs, administrator of NASA, gives an excellent outline of our next steps into space. Excluded from his profile, however, is a second-generation version of the Space Shuttle and its potential benefits to America. A Shuttle capable of utilizing commercial airports is possible by the mid-1990s. Another glaring omission: private enterprise. If NASA develops a Shuttle system that will take off and land from commercial airports. payload costs for space launches will drop dramatically and space will be opened to nearly everyone. The path we must take is an agressive government partnership with private industry. Our hope for man's sucHO steam locomotive model was built by reader Andrews. cessful exploration of space and exploitation of space-related benefits depends largely on government's willingness to let nongovernmental entities get into the space business.

ROBERT S. WALKER
16TH DISTRICT, PA
CONGRESS OF
THE UNITED STATES
HOUSE OF REPRESENTATIVES
WASHINGTON, D.C. 20515

### Return of steam

Your article on steam trains (Steam's Back On The Fast Track, page 90, Sept. '85) prompted me to send a photo of my HO gauge locomotive. Steam tubes are placed in the saddle tank around the boiler. Fire bed is below the cab and under the forward part of the tender. Small, 2cylinder steam engines are mounted between wheels of each truck for power and a venting tube is mounted at the rear of the tender. The loco was built to replace an aging diesel on my model railroad layout. Now I can lay some small claim to the return of steam!

FRANK C. ANDREWS SHREVEPORT, LA

Name-dropping

Your story on GM's Saturn project (Detroit's New-Era Cars, page 96, Oct. '85) says that it's the first new General Motors' nameplate since Cadillac issued the LaSalle in 1927. Not true. GM introduced two new lines of automobiles in the year 1930: 1. The Viking V-8, which was



Plans solved problem of installing shelves in geodesic dome.

sold by Oldsmobile dealers, and 2. The Marquette 6 which was sold by Buick dealers. CHARLES F. KASCH DARIEN, IL

Wow! You've got a better memory than GM. The Saturn press release says "Not since 1918 when Chevrolet joined the General Motors' family have we added a new nameplate." We remembered the 1927-1940 La-Salle. The Viking was introduced by Olds as a lower cost version of the LaSalle. The Marquette was a small Buick with prices ranging from \$990 to \$1060. Both were actually introduced in 1929. By 1930, the deepening Depression had killed them both off.

Lots of spotters

The "brick-like generator" under the hood of the Willys MB (Only in A Jeep, page 94, Nov. '85) is the generator regulator.

JAMES W. ARCHER ROOSEVELT, UT

The voltage regulator is the brick-shaped component. The generator is just visible below the oil filter case. That's what and where they are on my '44 Willys MB Jeep.

AL HARVEY

(MILITARY VEHICLE COLLECTORS CLUB) CORTE MADERA, CA

Boy, did we take a lot of flak over that one.

Using your dome

My geodesic dome, made of polystyrene and concrete, makes installing heavy-duty shelves a challenge. Enter an adaptation of your Gravity Shelves (4 Handy Home Accessories, page 102, April '84). We had to reverse the upper load-bearing member to tie in with the second-floor ring. Many thanks.

R.G. VAN TREUREN EDGEWATER, FL



FORD'S NEW DESIGN PHILOSOPHY: TO ANSWER YOUR NEEDS BY LISTENING TO WHAT YOU WANT.

# FORD TAURUS.

# THE GOAL WAS TO BE BEST IN CLASS.

Even as the first designer or engineer began work, over 400 specific objectives were being established for Taurus.

The list was based on how you drive a wagon...what you want from it...what you need from it. The list included: How easy it is to fold down the rear seat; the effort required to open and close the doors; how comfortable the seat belts are to wear. The idea was this: If we



design each part, assembly and feature to make Taurus better to use, then we will have designed a better wagon overall.

# THE RESULT IS TAURUS.

A front-wheel-drive station wagon which has optional seating for up to eight. A wagon that is a delight rather than a chore to drive. A wagon where design and engineering come together in one functional unit. Its shape even uses the wind to help Taurus press its tires to the pavement for road holding.

Taurus. A wagon so well thought out, even its shape is part of its dedication to function. So you can judge it not only by how well it looks, but how well it works.

# BEST-BUILT AMERICAN CARS.

At Ford Quality is Job 1. A 1985 survey established that Ford makes the best-built American cars. This is based on an average of problems reported by owners in a six month period on 1981-1984 models designed and built in the U.S.

# THE LIFETIME SERVICE GUARANTEE.

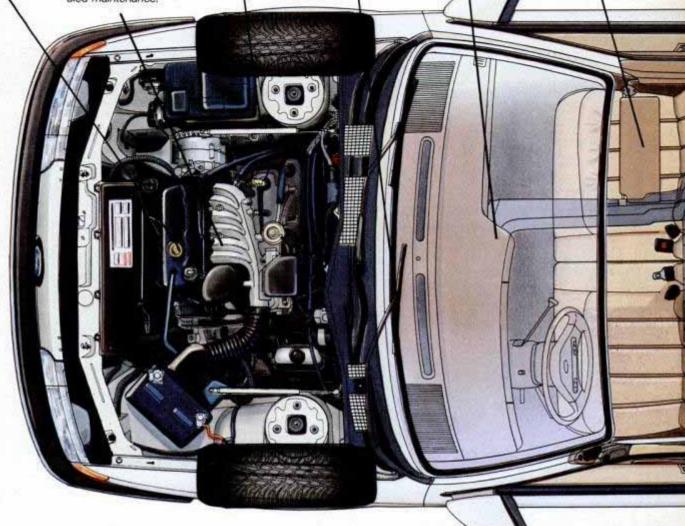
Participating Ford Dealers stand behind their work, in writing, with a <u>free</u> Lifetime Service Guarantee for as long as you own your Ford car. Ask to see this guarantee when you visit your participating Ford Dealer.



All do-it-yourself fluid checks (oil level, power steering fluid, etc.) are arranged in front of the engine. They are also color-coded to make them easy to find, easy to check.

A new, optional multiple port fuel injected V-6 engine designed for simplicity and responsiveness. Plus a new four-speed automatic transaxle so well designed, under normal use it requires no scheduled maintenance.

The hood features gas-charged struts which assist you to raise the hood and hold it open without a prop rod. 20" windshield wipers clear water nearly all the way to the driver's roof pillar to aid visibility. Optional electrically heated Insta-Clear™ windshield clears itself of mist and frost. Optional dual sun visors provide simultaneous front and side protection from the sun. Built-in extensions provide protection when the sun is low in the sky.



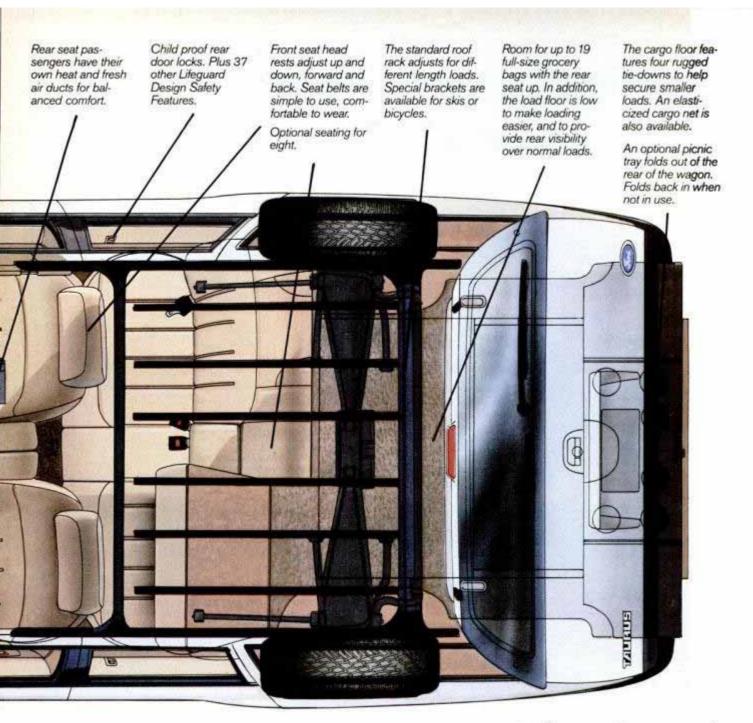
FORD'S NEW CONCEPT IN ENGINEERING BEGAN WITH YOUR NEEDS FIRST.

# FORD TAURUS.

# ENGINEERING... FOR PEOPLE.

The Taurus wagon was designed and engineered with a clear understanding of the special needs of a wagon buyer. It is designed to carry many different combinations of people and cargo.

Taurus seats feature a lower back support for comfort mile after mile. The seats are made of a high-density foam for pro-



Buckle up-together we can save lives.



# **Imports**



BY BILL HARTFORD

# Saab '86: Lots of models



Amazing how Saab builds excitement into its practical, unconventional-looking hatchback. The 900 Turbo not only hauls sofas but hauls off the line whiplash fast. The secret of its performance is a modestly sized 2liter Four, basically the same block that powers all of Saab's cars for '86. What Saab does with its company powerplant, however, is set it up for whatever horsepower you want-from 110 to 160. In the entry-level 900 (3-door hatch and 4-door sedan, \$13,000), the engine is fuel-injected only, but at 110 hp is no slouch. The 900S models this year (3-door hatch, and 2- and 4-door sedans, \$16,000) get the 2-liter Four with f.i., four valves per cylinder and twin cam, boosting hp to 125, up from 110 last year. The 900 Turbo 3-door hatch (\$19,000) and the new 9000 5-door hatch (\$22,000) fit the fuel-injected, 16-valve, twin-cam Four and then add a turbocharger and intercooler for a 160-hp punch.

Later this year when the 900 Turbo convertible arrives, Saab will be offering five different body styles, an



Saab 900 hatchback has standard a/c, heated seats, central locking.





Saab 9000 instruments are lighted by fiber optics; radio can be removed and taken with you, operates only with secret code.

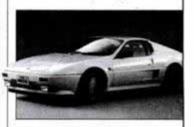
impressive lineup for a small Swedish automaker. And when it comes to a versatile hatchback in the luxury class, Saab has the only game in town with its 9000. Run it as a 4-door sedan and

you'll give your rear-seat passengers extraordinary comfort and limousine roominess. As a seats-folded hatchback, this 5-door gobbles up your gear whatever your hobby or sport.

### Two sidewinders

A couple of concept cars from Japan came out of the design studio door recently-loaded. Not with a lot of power options and doodads but designed from the ground up to be the ultimate in high-speed, well-balsuperior-handling anced. machines. The Mazda MX-03 and Nissan Mid 4 feature antilock braking, 4-wheeldrive and 4-wheel steering. That's right, the rear wheels turn slightly as needed to extend cornering potential. Mazda MX-03-The aerody-(Cd=0.25) 4-seat sports coupe, which you can see next month at the Chicago Auto Show, uses a new 3rotor, turbocharged rotary engine that's rated at 315 hp. Power goes to the ground through a full-time 4wd system with electronically controlled fore-aft torque-split mechanism. The 4-wheel steering is speed sensing, with the rear-wheel steering angles determined by computer. Antilock braking also uses the computer: It senses

when wheels are about to lock up, releases fluid pressure, then reapplies brakes. This pumping application of the brakes shortens stopping distance and lets you steer



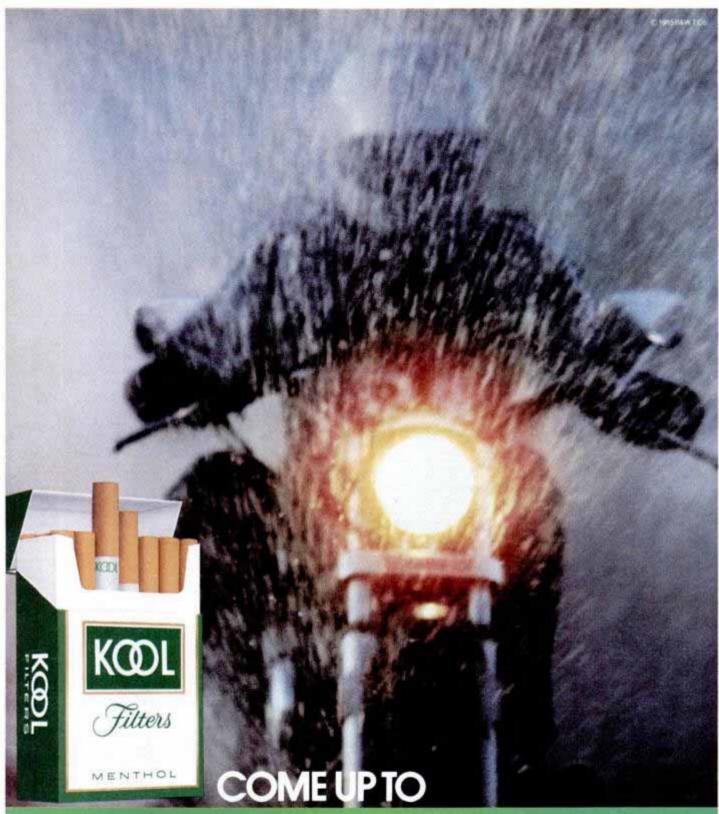
Nissan Mid 4 also features 4wd, 4-wheel steering for road hold.

while braking. At the steering wheel, a "heads-up" display projects digital speedometer readings onto the inside of the windshield.

Nissan Mid 4—The mid-engine, 3-liter V6 in Nissan's 2-seater coupe is mounted transversly and its output is 230 hp at 6000 rpm. As with Mazda's 4-wheel steering, the Mid 4's computer measures road speed and lateral acceleration, or side force, to determine rear-wheel steering angle.



Mazda MX-03 crabs around turns with 4wd and 4-wheel steering.



# NEW KOLBOX

SURGEON GENERAL'S WARNING: Quitting Smoking Now Greatly Reduces Serious Risks to Your Health.

16 mg "tar", 1.1 mg. nicotine av. per cigarette, FTC Report Feb. '85.

# Motorsports



BY STEVE POTTER

# Cold ice, hot racing



Front-drive and studded tires are the hot setup in ice racing. Twisting courses are plowed through the snow on frozen lakes.

Everyone who has the occasion to drive in the snow belt knows the feeling. That second of incipient panic when you hit a patch of ice on a twisty 2-lane road.

Now imagine a twisting roadway, with tight corners and long, fast straight-aways, like a road-racing circuit. Imagine it completely covered with glare ice, or even constructed of ice. Think about driving on that track at speeds approaching 100 mph.

Ice racing is an informal branch of motorsport, with different groups organizing events in New England, upstate New York, Michigan and the upper Midwest. The International Ice Racing Association (IIRA) sanctions half a dozen or more 2- to 4hour endurance races each winter on frozen lakes in Minnesota, Wisconsin and Ontario. While the organization may be informal, the racing is cutthroat. Indy 500 Herm Johnson veteran tuned up for the past Indy car season by winning the 1985 IIRA championship with a VW Rabbit GTI.

The ice-racing tracks, 1½to 3-mile road circuits with left- and right-hand corners, are laid out with snowplows on snow-covered lakes.

Normally, racing drivers swelter in their multilaver. flame-retardant uniforms and long underwear. Not at ice races. Many pilots don down jackets over their driving suits! It gets cold in the upper Midwest in January and February. On a frozen lake near Eau Claire, Wisconsin, last winter, the thermometer read minus 29° as the green flag dropped. A stiff breeze meant that the wind-chill factor must have been about minus 90°.

A balmy day for members of the IIRA is one where the temperature is up to 20° and the air is still. Indeed, if the temperature gets much warmer than that, the race is likely to be called off on account of mushy ice.

Fully modified sports cars used to be the order of the day in ice racing, at least until someone figured out that it was no fun to do the mandatory. at-the-track maintenance that came with highly tuned racing engines. Anyone who's ever tried to use a wrench in freezing weather knows what I mean. And besides, all of the power in the world is no help if you can't put it to the grounder, ice. Getting the power down is the reason that front-drive cars are preferred in ice racing; they have most of their weight concentrated over the driving wheels.

These days the popular class is for sporty showroom stock sedans. The cars still have more horsepower than the driver's right foot knows what to do with. You might imagine that an ice-racing track would be smooth as a skating rink, but it isn't. The ice cracks and heaves, creating a surface that's more like a bumpy gravel road. Even the supple, long-travel suspension of a showroom stock ice-racing car takes a severe beating over the course of a 4-hour race. There are more retirements due to broken suspensions and flat tires than to wrecks. In a sport where visibility is a big factor, a showroom stock car's headlights, defrosters and windshield wipers are essential. Oh, yes, the heater comes in handy, too.

Some sanctioning bodies require the use of stock, unstudded snow tires. Under those rules, speeds are limited by lack of forward traction and racers scrub off speed going into the corners by rubbing against the plowed-up snow banks and other cars!

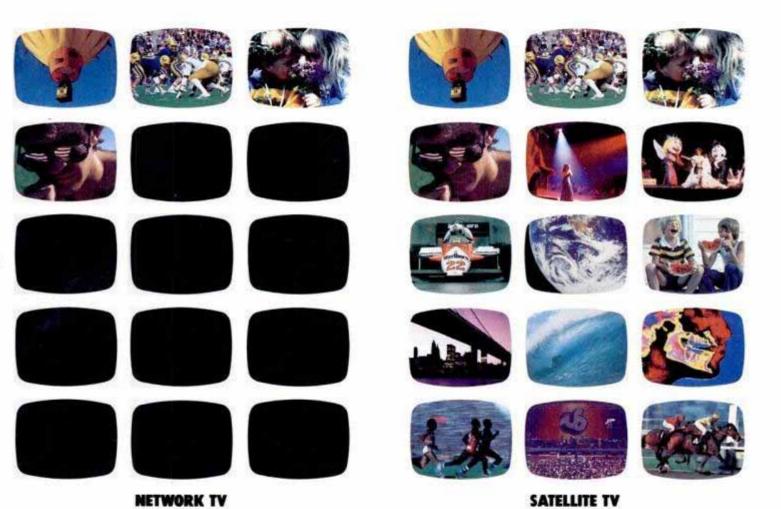
The IIRA permits the use of studded tires, and that makes the cars much more driveable and the speeds quite a bit higher. The most effective tire is a remolded Uniroval, which features very aggressive studs that are retained by big rubber cleats. With the Uniroyal tires, the cars actually have pretty good traction over the ice. The ride is bumpy, and the car is definitely sliding, but there's enough grip to control the direction of the car. Because most highway cars today are engineered to have a lot of understeer, the rule makers do permit modest suspension modifications. A car with an absolutely stock suspension will plow straight ahead into a turn, stuffing its front end right into the nearest snow bank. Savvy ice racers will fiddle with their suspensions to soften the front roll stiffness and increase the rear. That changes the balance of the car so that it will turn into a corner on trailing throttle oversteer that is, when the driver lets off the gas pedal, the rear end of the car will start to skid. The car then can be steered with a combination of brakes and throttle.

One thing is for certain. After a season of ice racing, snowy roads will never again hold any terror.



"Bank shots" are a common occurrence, and about the only way to change direction in races where studded tires are not allowed.

# THE REASONS FOR OWNING A SATELLITE TV SYSTEM SEEM CLEAR TO US.



There's only one problem with network TV.

You just don't get enough choices. Fortunately, now there is a choice.

With a M/A-COM home satellite TV system, you can get 45, 55, 65 or more channels to choose from. And you don't have to be a math whiz to know what that means.

You'll get hundreds of movies, from the best black and white classics to first-run feature films. Sports of all sorts, from drag racing to steeple chasing. And a ton of ball games to boot. You'll get shows that teach, preach, even make you blush.

And to keep the kids from getting their G's confused with their X's, every M/A-COM satellite TV system can

lock out adult entertainment.

We also have an optional VideoCipher™ descrambler unit that allows you to receive premium subscription TV services.

M/A-COM has an entire line of satellite systems to

choose from. Each built with the pride and precision that have made us a leader in satellite TV. So whether you're after the best deal on a system, or the best system money can buy, we've got what you're looking for. So sit back and take a look at the programming

choices you now have. Then, visit your local authorized M/A-COM dealer to clear up the situation.

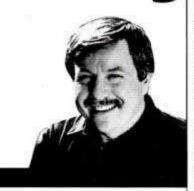
For a free brochure, write: M/A-COM Home Satellite Systems, P.O. Box 1729, Dept. 2D, Hickory. North Carolina 28603.





@1985 M/A COM Inc.

# Freewheeling



BY WADE HOYT

# Easy rider, '80s style



H&E executive smashes a brick through an ordinary car window and dives in after it in the best "smash-and-grab" form.

If today's newspaper headlines make you feel like you need a light armored car for city travel, Hess & Eisenhardt Armoring Co. has a deal for you! I visited Potamkin Cadillac on Manhattan's West Side, the world's biggest Caddy dealer, for a riveting demonstration of H&E's Personal Safety Vehicle (PSV). By the time I got out of the showroom, the floor was covered with broken glass.

H&E's sales vice president, Tom Burke, stressed: "This is not an armored car. It won't protect you from terrorist attacks, land mines or armor-piercing shells." What it will do is protect you from the kind of random violence you read so much about lately—stones dropped from overpasses, stoplight shakedowns, purse snatching, radio and car theft.



OmniGard glass took blows from bricks and baseball bats. Outer glass shattered but inner plastic was never breached.

Unlike full armoring, the PSV package doesn't add inch-thick glass, Kevlar armor, 1600 pounds or \$100,000 to the price of a big limousine. It can be applied to almost any car, from a Yugo to a Mercedes, and it will cost between \$12,000 and \$13,000.

The most impressive part of the package is the shatter-proof OmniGard window glass. It's simply the standard ½-in. auto glass backed up by  $^3/_{16}$  in. of a secret flexible adhesive plus  $^3/_{16}$  in. of polycarbonate plastic. This combination will run in the stock window channels but cannot be pierced by bricks, rocks, hammers, or even Saturday Night Specials or shotguns fired at close range.

After watching an H&E executive throw a brick through an ordinary car window, I got to wail away at an OmniGard window with bricks and a baseball bat. Although the outside glass splintered, most of it stayed in place and I couldn't penetrate the plastic layer. Rambo could probably get through, but your average punk will stay on his side of the glass.

The PSV package will not only foil radio thieves (who usually break into a parked car via a window) but also smash-and-grab artists—kids who throw a brick through the passenger window of a car stopped for a traffic light, then snatch a purse, attache case or camera bag.

To make sure you don't break down in the wrong part of town, the PSV is equipped with dual batteries, auxiliary cooling fans, engine compartment fire extinguisher and TyrOn steel tire bands that allow the car to be driven on a flat.

The power door locks have been rewired so that the driver's door works separately from the others, preventing a felon from lunging into the rear of the car when you unlock it to get out. A clever dead-bolt lock system on the door handles makes opening any door a 2-handed operation for the uninitiated—impossible for an armed robber, and slowing down an unarmed crook.

There's an inside-outside intercom so you can talk to street people without opening your window. And the usual burglar alarm, although this one has been jazzed up with a pair of piercing Ferrari air horns.

Where did H&E get all these devious ideas? Mostly by surveying executives and security officers of major corporations. When they spoke to California luxury car dealers, they found that crooks posing as customers had been going for test rides, then relieving the salesmen not of the cars, but of their fat wallets and gold jewelry, before locking them into the car trunks! PSV's trunk can be unlocked from inside.

The PSV isn't for every-

one. Its 12-grand price tag will see to that. But corporate bigshots worried about kidnapping attempts, salesmen with expensive samples from jewelry to computer chips and doctors carrying narcotics will want to consider it. H&E has the best name in the security business. They've built armored limos for every U.S. president since Harry Truman and for 34 foreign governments as well. One of the cardinal rules of security is surprise. If an armored car doesn't look like it's armored, an attacker probably won't be prepared to deal with it. The PSV looks like an absolutely stock Cadillac, Lincoln or Mercedes. It can be ordered through those dealers, or by contacting Hess & Eisenhardt at 8959 Blue Ash Rd., Cincinnati, OH 45242. A PSV package might be a good idea before you take a drive on the wild side.



# Celebrate '86 in style

We get a lot of car calendars around here and, frankly, most of them are throwaways. One we're going to keep is the Mercedes-Benz Century Of The Automobile. Its 250 illustrations-167 in color-depict 12 eras of automotive transportation, from Leonardo da Vinci's proposed 1505 wagon to cars of the '80s. Many cars are featured besides Mercedes-from Hudsons to Hondas. The calendar is available by making a tax-deductible \$25 donation to the National Multiple-Sclerosis Society, 205 East 42nd St., New York, NY 10017.

Appliance O&A

BY STEVE TOTH

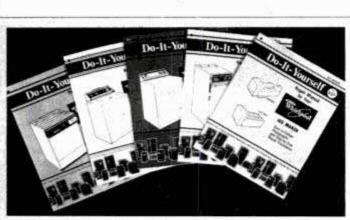
# Rumbling refrigerator

I have a 5-year-old General Electric frostless side-by-side refrigerator, model No. TFF19DYB, serial No. LF233238. For the past year, every time the refrigerator shuts off there is a loud rumbling noise—loud enough to be heard in the next room. The rumbling lasts for two or three seconds. Is this condition normal or is there something that needs repair?—Paige V. Simon, Leechburg, PA

The noise is probably caused by a loose compressor mounting. This is a common ailment in refrigerators as they age, but one that's fairly easy to fix.

To get at the rear com-

pressor mounting bracket, move the refrigerator away from the wall. Unplug it and remove the bottom rear access cover, which is held in place with six screws. At the rear of the compressor you will see two cup-like metal mounting brackets that are attached to the refrigerator's bottom rail. Inside each mounting bracket there is a rubber bushing on which the compressor rests. Remove both metal cup mounting brackets from the compressor and rotate the rubber bushings so the weight of the compressor will rest on a new spot on the rubber. Then re-install the mounting brackets so



# Repair manuals

Whirlpool has added an ice maker repair guide to its roster of do-it-yourself manuals. The other four manuals are for repairing Whirlpool automatic washers, dryers, dishwashers and trash compactors.

The 104-page ice maker repair manual sells for \$6.70, postpaid. The others sell for \$8.25 each.

All the manuals provide photos as well as step-bystep instructions. They are available through Whirlpool dealers, or can be ordered from the General Accounting Office, Whirlpool Parts Distribution Center, LaPorte, IN 46350. they are seated properly and tight.

Now go to the front of the refrigerator and remove the bottom grille. Behind the grille is the front mounting bracket with a rubber grommet that engages a forked tongue on the compressor. To check the rivet that secures the rubber grommet to the bracket, support the tubing running to the compressor with a towel or heavy cloth. Then remore the mounting bracket and bolt. If the rivet is loose, peen the end to tighten it. If this fails, drill out the rivet and replace it with a bolt, two washers and a self-locking nut. Tighten the nut to the point where the rubber grommet starts to compress.

Before reinstalling the bracket, cut a small piece of felt and place it under the mounting bracket where it attaches to the front rail. Then replace the bracket.

# Reluctant dryer

I have a Whirlpool gas dryer, Model W5807401W, that performs beautifully once I get it rolling off dead center. But it hums and will not start until I reach down and give the drum a boost. I have lubricated every point I can see. What do you think the trouble is?—Robert J. Poorman, Bloomington, IL

It sounds as if either the start windings or the start switch inside the motor may have gone bad on your 1958 dryer. The older dryers had a lot of turning resistance—that is, a lot of pulleys and belts. Over the years, a bearing or two may have worn or lubrication may have dried, putting extra drag on the motor, causing it to fail.

Disconnect the power to the dryer, remove the rear service panel, and remove all the drive belts from their pulleys. Turn each pulley by hand. If you find any pulley either binding or dragging, you may have to remove it from the shaft. Disassemble the bearing from its housing. Clean and lubricate the shaft with nondetergent 20-weight motor oil. Reassemble the pulley and check it for free movement. If it continues to drag, you may have to replace either the bearing or the shaft.

Remove the motor from the rear of the dryer. Tag each wire as you remove it. Take the motor to a local motor repair shop (you can find them listed under "Motor" or "Motor Repair" in the Yellow Pages) and have them test it to determine which parts need to be replaced or rebuilt. With the rebuilt motor, who knows—you may get another 27 years out of your vintage dryer.

# SERVICE TIP

Many appliance manufacturers provide toll-free 800 numbers to assist you in repairing their appliances. Manufacturers of the following major appliances offer specific do-it-yourself repair help, as well as information on where to locate parts and service in your area:

General Electric/Hotpoint 800-626-2000

Roper

800-447-6737 800-323-7778, Illinois

Whirlpool

800-253-1301

800-632-2243, Michigan The following provide parts and service information only:

Admiral

800-447-8371 800-322-6302, Illinois

Carrier

800-227-7437

Emerson

800-447-4700 800-322-4400, Illinois

Fedders

800-621-5199

800-972-5855, Illinois

Hamilton Beach

800-334-2785

800-672-5872, North Carolina

Kelvinator

800-245-0600

800-242-0580, Pennsylvania

Tappan

800-447-2882

800-322-4400, Illinois

White-Westinghouse

800-245-0600

800-245-0580, Pennsylvania

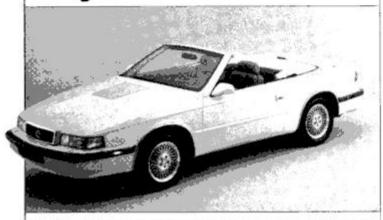
If yon have a problem with any appliance, send your question, along with the model and serial numbers, to Appliance Q & A. Popnlar Mechanics, 224 West 57th St., New York, NY 10019. Surry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.

# **Inside Detroit**



BY JIM DUNNE

# Chrysler's Maserati



Two-place convertible has a Maserati-like grille, but otherwise its Chrysler styling heritage is obvious: nothing radical here.

This 2-seat convertible will be added to the Chrysler line within 12 months as a direct competitor for Cadillac's Allante and Buick's Reatta. Planned to sell in the \$25,000 to \$30,000 range, the car will be built entirely in Italy by DeTomaso Industries of Modena. The Innocenti assembly plant in Milan will combine the European bodywork, suspension and drivetrain. Chrysler was supposed to supply turbocharged versions of its 16-valve 2.5-liter Four and transmissions, but a last-minute change has the drivetrain coming from Maserati as well. The strong-willed Alejandro deTomaso, owner of Maserati, insisted on supplying

his own powertrain made from European parts. His brand-new engine plant in Modena is perfectly suited to building low-production, high-output engines. And, with the "Built by Maserati" logo on the car, he figured that Maserati should control the drivetrain quality as well.

The car will be a soft-top convertible, with a plastic removable hardtop. Interiors



Interior is all tucked and wrinkled soft leather: very Italian.

will feature full power assists, and Italian leather over everything. Technical details include 4-wheel disc antilock braking, 15-in. road wheels, gas-filled shock absorbers, and a choice of either a 5-speed manual or 3-speed automatic transmission. Compact in size, the as-yet-unnamed luxury sports coupe will be 178.5 in. long and have a 93-in. wheelbase. Standing a mere 51.9 in. high, the car will weigh a moderate 2900 pounds. Chrysler expects to sell the new model at a 5000-per-year clip.



Cadillac's 2-seat convertible (seen here with the hardtop in place) looks like no other Cadillac, or GM car for that matter.

### Allante differs

It doesn't look like a Cadillac, and that's on purpose. The 1987 luxury 2-seat convertible from Cadillac was designed in Italy by Pininfarina without the traditional Cadillac rectangular grille or the usual Cadillac styling cues. "We want to keep it as a separate model from our luxury sedans," a Cadillac styling chief said. "And since the bodies will be built in Italy, it's best that their own people do the styling. They know what they can build."

Allante's steel body will be constructed in Pininfarina's plant, then shipped by air to Detroit, where the running gear and drivetrain will be installed. The car has both a hardtop roof made of plastic and a folding soft top. Its styling is marked by a long hood and deck, wide stance and a definite wedge shape overall. Its price, in the \$40,000 range, will put Allante in competition with the Mercedes 560 SL, an exclusive market that will limit the Cadillac to about 5000 sales per year.

### Second invasion

The Japanese automakers are sending a second wave of models to the U.S. market, this one with a "Made in America" label. Latest to join the trend is Mitsubishi which, together with Chrysler, will produce a sporty small coupe and a compact sedan in Illinois under the Diamond-Star Motors name. First will come the coupe, a front-drive model

powered by 1.8- and 2-liter engines, due out in 1988. Within a year, the 4-door sedan will make its appearance. With Diamond-Star, Mitsubishi will follow Honda, Nissan, Mazda and Toyota in building cars in this country.

# Hush-hush project

Pressured by the lower costs of the Japanese, the U.S. automakers have major projects under way to find less expensive methods to produce a car. You've heard of GM's Saturn and Chrysler's Liberty projects. They are aimed at getting more efficiency out of the way cars are built now. But even more advanced is GM's highly secret Trilby project. Its purpose is to redefine the design of a car, with the emphasis on computers. GM officials believe that this is the first time in the 100year history of the automobile that such a project has been undertaken. Trilby will get the most use out of automatic machines and computers in assembly plants and use a single computer to run most of the car's functioning parts, including steering, braking, handling and the transmission as well as the engine. One goal: Get the engine to run at one constant speed-its most efficient-no matter how fast the car is moving. Another: Use the computer to disable a car if a thief tampers with the doors or ignition. Started in March 1984, Trilby is still going strong.

(Please turn to page 24)



Interstate, the battery that starts This beautiful rare 1906 Lozier coma cranky seventy year ol

peted in the most grueling event possible for classic cars: The Great American Race. It not only completed the

10 day, 3500 mile coast-to-coast endurance rally, but finished third, within seven minutes and three seconds of a perfect time.

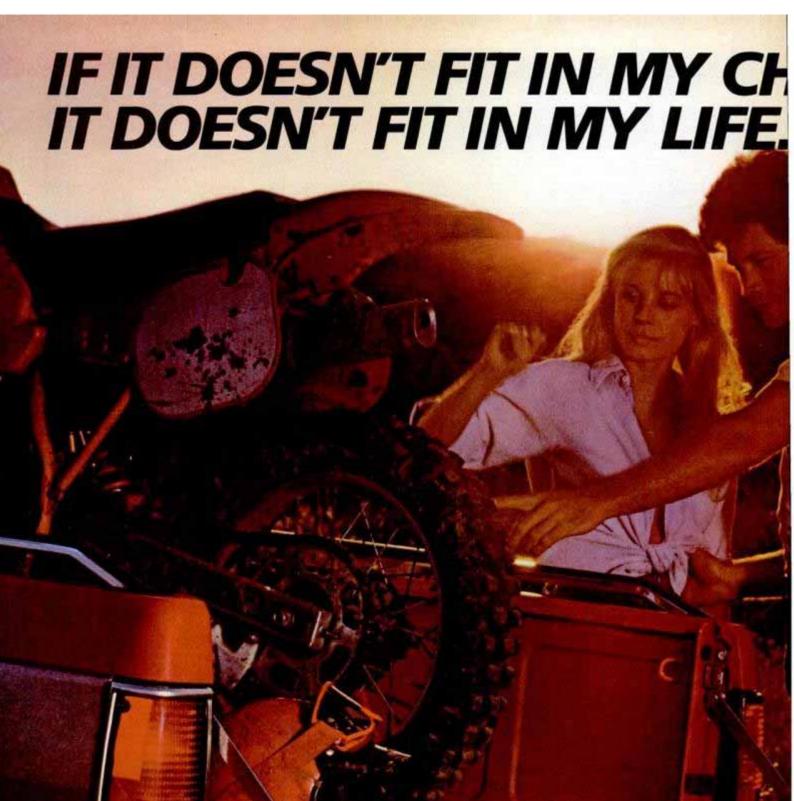
What does it take to get a cranky 76 year old across the country? A quality machine, a strong willed team, and a dependable Interstate battery. This year almost five million Americans will replace their old worn out batteries with new Interstate batteries at over 122,000 authorized Interstate dealers all across America. And for good reasons. Today's vehicles are loaded with more electronics and need deep reserve capacity, as well as dependable starting

power. Interstate Starts Great for you too. batteries have the best combination of both.

Even a toll free 800 number you can call if you ever have a problem.

It's nice to know you are a part of the Interstate Battery system.





CHEVEY

Материал: зашишенный автороком право



"A man's got to have rules, and my #1 rule is if it doesn't fit in my Chevy S-10, it doesn't fit in my life. That means I'm always ready to load up my S-10 and move on to a new adventure. I equipped my S-10 to haul a whole bunch and even tow a lot so I'm never really roughing it. And with the available fuel-injected 2.8 Liter V6 and five-speed overdrive tranny, this baby eats up the miles. If you're a 4x4 man like me, shift-on-the-fly Insta-Trac's standard on all S-10 four-bys. You can even order a beefy off-road suspension and gas shocks so 'anywhere you want' really means anywhere. Hey, if it doesn't fit in my Chevy S-10, it doesn't fit in my life."

Light bar shown can be purchased through outside suppliers. This is not a safety device.



# TRISLIKE A TRACEMENT

### INSIDE DETROIT

(Continued from page 20)

### Olds LTS

Not to be left out of the race for specialty car supremacy, Oldsmobile will have its own sporty coupe within a year after the Cadillac Allante and Buick Reatta make their appearance.

But instead of a 2-seater, Oldsmobile will put a full-size, 4-passenger coupe on the market. It's code-named the LTS, for Luxury Touring Sedan. The LTS will be more sporty than the Toronado, says Olds chief Bill Lane: "And we want a bigger car than a 2-seater. There are too

many of those in the works."

While details remain secret, it is known that the car will be among the first to have the Olds-developed, 2.3-liter, double-overhead-cam, 16-valve 4-cylinder engine, which is scheduled to go into production just in time for the 1986 model year. Look for a price tag in the \$20,000 range, a notch or two below the flagship of the line, Toronado.

# 'Out-inch' the rest

Dodge's new midsize Dakota pickup will be slightly bigger than the compacts it competes against and that's just the way Dodge wants it. "We may be last, but we'll out-inch anything on the market," one Dodge designer boasted last year. Details on the Dakota show that it is indeed bigger than the competition. Two engines are offered, the workhorse 2.2-liter Four that Chrysler uses in most of its sedans and small vans, and a brandnew 3.9-liter V6 that Chrysler made out of its husky 318-cu.-in. V8. The 90° V6,



Dodge's Dakota pickup is the biggest little compact around; has 3.9-liter V6.

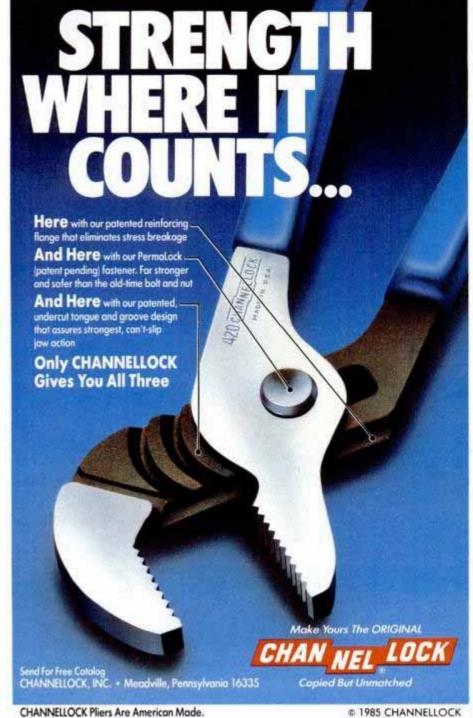
with standard 2-barrel carburetor, develops an impressive 133 hp, and Dodge claims it will pull a 5500-pound trailer easily. Standard transmission is a Chrysler-made 5-speed manual, while a 3-speed automatic is the extra-cost option. Two cargo boxes with double-wall construction are available, a 6½-ft. standard and an 8-ft. option. Wheelbases for the two are 111.9 and 123.9 in., both the longest in the compact truck field.

# Hog the wagon market?

Mercury's plans for the Sable station wagon indicate that this model may outsell just about any other wagon on the market. "We'll build 40 percent wagons, 60 percent sedans," is the word from Ford's Lou Lataif, vice president of sales. That's well above the industry average for wagon share of a model's sales. The normal split between wagons and sedans is 20 percent/80 percent in favor of sedans.

### Ford to move faster

Along with completely new styling for the 1987 full-size Ford pickup line (see DLP, page 30, Oct. '85), you will see similar styling changes in the Ford Bronco utility truck. That will put Ford ahead of GMC and Chevrolet, which are also planning new styling for the 1987 pickups, but will not change the Blazer or Jimmy until 1988. Major difference in appearance of the Fords will be oversize headlights with an aero shape and a new grille. GM's pickups will stick with current style headlights, but the body shape will be greatly different, with the emphasis on aero lines, as far as possible in a pickup cab (see *DLP*, page 26, Nov. '85). GM will jump ahead of the light truck field in being the first to offer nonlocking rear brakes on its pickups next year, because these vehicles are notoriously skittish when unloaded.





# Radio Shack's affordable new radar detector with False Alert Suppression Technology

The more you drive, the more you need Radio Shack's hot new Road Patrol XK\* with FAST. It has a GaAs Schottky-barrier diode front-end and dual-superhet design for incredible sensitivity. Plus our exclusive FAST circuit that dramatically reduces interference from other detectors. The combination gives you reliable, long-range protection with a minimum of false alarms.

Road Patrol XK features Radio Shack's unique Triple Warning System. You can choose a tone, a light or both that pulse faster (or slower) to indicate the relative distance to radar.

Road Patrol XK is easy to install and easy to remove for use in another vehicle or storage. Its cigarette lighter plug and fully automatic polarity system assure trouble-free operation in any 12-volt car or truck.

For dependable and affordable "travel insurance" think FAST and get Radio Shack's new Road Patrol XK today. Ask for #22-1612. Only \$149.95 or as

low as \$20 per month with Radio Shack/CitiLine credit.

# Radio Shaek

A DIVISION OF TANDY CORPORATION

FREE 1	1986 CA	TALOG
Mail to: Radio 3 300 One Tandy	Shack, Dept. 86-A- Center, Fort Wort	-303. h. TX 76103
Name		

Not sold where prohibited. Use may be regulated by state or local law. Price applies at participating Radio Shack stores and dealers. CitiLine is an open-ended credit plan from Citibank. Payment may vary depending on balance.

Homeowners' Q&A

BY NORMAN BECKER, P.E.

# Save that garage!

I've bought an old house with a small detached garage. Rain runoff flows down my driveway and through the garage, and the sole plate has been repeatedly soaked. Both the sole plate and the bottoms of the wall studs have started to rot. The rest of the building is in good shape and I would like to save it for a workshop. I'd appreciate any help.—John Crawford, Northport, AL

Before repairing the garage, you should eliminate the water penetration. Install a drain across the driveway in front of the garage to catch and deflect the runoff. Cut a small channel, about 8 in. wide across the driveway, fill it with gravel and cover it with a grate. Provide a free-flowing outlet using 3-or 4-in.-dia, pipe to direct the water downhill and

away from the garage.

If the driveway is not steep, you might simply divert the water with an asphalt lip across the driveway, 2- to 3-in. high. Diverted water should flow to a lower area in the lawn.

Before cutting away the rotted portions of wall, you must erect supporting braces. Working on one wall at a time, nail a 2×4 horizontally along the top inside edge of the wall with the wide face against the studs. Wedge a 2×4 under every other ceiling beam, between the horizontal 2×4 and the floor. This will relieve the pressure on the wall and allow the rotted framing to be cut away.

Remove the rotted sill and cut off the bottom of the studs 11% in. above the floor. Set a row of 8-in. concrete blocks (that actually measure about 7% in. high) in a ½-in. bed of mortar so that they align with the outside of the garage wall.

Mortar anchor bolts into the block cavities so they protrude 1½ in. above the top of the blocks. Use three anchor bolts per wâll. Bolt a 2×6 to the blocks with holes counterbored for washers and anchor nuts. Then, nail a 2×4 along the length of the 2×6 to form a sole plate. Finally, toe-nail the studs to the 2×4 with aalvanized 8d nails.

## Electrical service leaks water

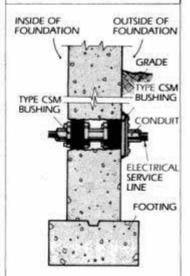
Rain water and snow melt leak through the foundation of my house where my electrical service enters. The electrical cable is enclosed in plastic conduit. The foundation is poured concrete. I've dug down to the cable and tarred around it from the outside, and sealed the conduit with silicone from the inside. Neither of these measures has stopped the leak. Please help.—Robert Shook, Westboro, WI

O-Z/Gedney Co., a division of General Signal, Main Street, Terryville, CT 06786, manufactures bushings for sealing pipe, conduit or tubing that passes through foundations below grade. The bushings can be used to retrofit an existing opening or in new construction. The bushings are available through electrical supply stores. You can contact the manufacturer for the name of your local distributor.

To order, give the size of the cable and the size of the conduit. The price of bushings vary, depending on the size and type. You will probably need two kinds of CSM bushings, one for the outside and one for the inside of the foundation wall.

If the hole through which the conduit passes is not large enough to accommodate a CSM bushing, it will have to be bored out. In this case, the inside of the hole should be sealed with concrete sealer to prevent moisture penetration from other points in the wall.

I would recommend that you have a licensed electrical contractor install the



Neoprene-seal bushings prevent leaks where electrical service enters below grade.

bushings. However, if you decide to do it yourself, be sure to have the electricity turned off from the street to the house.

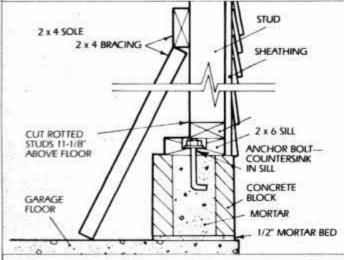
### SERVICE TIP

The National Roofing Contractor's Assn. (NRCA) has set up a toll-free hotline to help consumers select a roofing contractor. Too often, homeowners choose an unqualified roofer because he quotes a low bid. Untrained roofers can damage a roof and void the material warranty.

The NRCA will send you a listing of professional roofing contractors in your area. Call 1-800-USA-ROOF. In Illinois, call 312-693-0700.

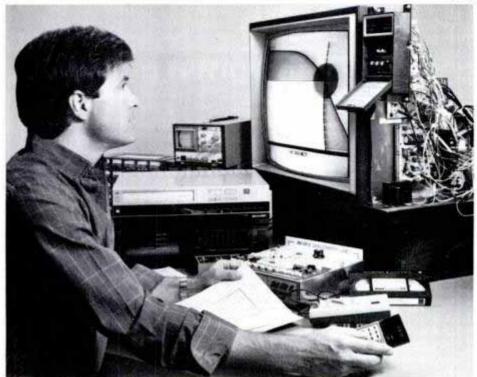
The association also recommends that you choose a roofing company that is bonded, has a business phone and permanent business address, and provides you with a written estimate. It should also offer an enforceable guarantee and warranty, and references of satisfied customers.

Do you have a home-maintenance or repair problem? Send it to Homeowners' Q & A. Popular Mechanics, 24; West 57th St., New York, NY 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in the column. For more home-repair and maintenance help, get PM's Home Care Guide, \$2,45 postpaid. Send your order(s) to Popular Mechanics, Box 1014, Radio City Station, New York, NY 10101.



To repair a garage with rotting wall bottoms, prop each wall with 2x4 bracing, then cut away the lower  $11\frac{1}{8}$  in. Replace with concrete block, 2x6 sill and 2x4 sole. Mortar anchors into block cavities.

# Only NRI gives you professional hands-on training and equipment to prepare you for today's high-tech video electronics servicing careers.



# Become One of America's Most Sought-After Technicians— Put Your Talents and Spare Time To Work for You in the "Explosive-Growth" World of Home Entertainment Electronics

Train in State-of-the-Art Video/Audio Servicing and become a fully qualified professional the uniquely successful NRI Way. It's hands-on training, at home... designed around the latest state-of-the-art electronic equipment you build as part of your training.

# The High-Tech Revolution in the Home Is Just Starting

Sweeping changes are taking place in our homes, changes brought about by the phenomenal growth of home entertainment electronics. Already available are high resolution TV, TVs with stereo sound, simultaneous multi-channel viewing, projection TV, Camcorders, 8 mm video cassettes, and compact disc players.

Soon, our TVs will become interactive computer terminals acting as both our entertainment and communication/information source, ushering in yet another revolution in the way we live.

Today the consumer electronics industry represents a whopping \$25 billion dollar opportunity for the new breed of consumer electronics technician.

# Join the Future Or Be Left Behind

Today's consumer electronics revolution is creating huge servicing and repair markets that are just starting to boom. Enormous opportunities for new jobs, new careers, and new businesses are there for those willing to seize them.

Here is your chance to become a fully qualified professional the way tens of thousands have trained with NRI's 4-way integrated training system. NRI's Video/ Audio Servicing Course is the only at-home training that combines videotapes, audio cassettes, vividly illustrated texts, and hands-on experiments into one complete, reinforced learning experience.



Only NRI's video training includes a state-of-the-art TV you build, the latest VCR, professional test equipment, and NRI Action Video tapes. All yours to keep as part of your training.

# Totally Integrated Hands-On Training

The secret of NRI's training success lies in the unique way multimedia instructions are fully integrated with the equipment you use. NRI's Action Audio and Action Video cassettes combine with brilliantly illustrated and well thought out lesson materials to give you a thoroughly stimulating and productive learning experience.

Only NRI trains you with Action Video tapes for step-by-step professional servicing skills reinforcement. You'll watch complicated troubleshooting techniques come to life!

Since NRI training is built around 
"learning by doing," right from the start 
you conduct important experiments and 
tests with your professional digital multimeter. You assemble the remarkable NRI 
Discovery Lab\* and perform a complete 
range of demonstrations and experiments 
in the process. You build your own 25" 
Heath/Zenith color TV and train with the 
latest model front-loading VCR, also included as part of your course.

NRI has purposely designed your training around equipment that has the same high-tech circuitry you'll encounter in commercial equipment. That means your training is real-world training.

# Your NRI Training Has Another Special Element

Also built into your NRI training is the enormous experience of our development specialists and instructors. Their long-proven training skills and personal guidance come to you on a one-to-one basis. They are always available for consultation and help.

# Step Into the Future Today

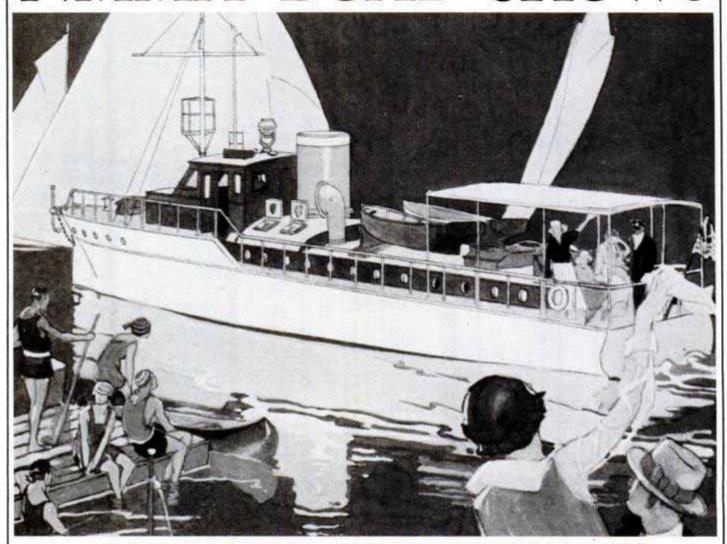
The richest reward gained from your NRI Video/Audio training is a firm grip on the future. But now is the time to act. Right now. Return the post-paid card to us today. You will receive our 100-page catalog free. It's filled with all the details you'll want to know about our training methods and materials and our more than 70 years of successful innovation in at-home, hands-on career training. (If someone has beaten you to the card, write to us at the address below.)

# NA Schools

McGraw-Hill Continuing Education Center 3939 Wisconsin Avenue, NW Washington, DC 20016



# OFFICIAL 1986 NMA BOAT SHOWS



# **NEW YORK NATIONAL BOAT SHOW**

NEW YORK COLISEUM, JANUARY 11-19, 1986

# MIAMI INTERNATIONAL BOAT SHOW

MIAMI BEACH CONVENTION CENTER, FEBRUARY 21-26, 1986

# MIAMI INTERNATIONAL SAILBOAT SHOW

MIAMI BEACH MARINA, FEBRUARY 21-26, 1986

C'mon aboard the biggest boat shows of 1986, sponsored by the National Marine Manufacturers Association. The greatest display of boats and accessories in history. C'mon aboard Motor Boating & Sailing magazine, too. The January and February issues preview the shows and are packed with information to make boating a pleasure for old salts and new.

MOTOR BOATING & SAILING is a publication of Hearst Magazines, a division of The Hearst Corporation.

© 1965 The Hearst Corporation





# Aviation



BY DENNIS ESKOW

# New push for homebuilts



Prescott Pusher combines fuel efficiency with high performance.

Raw power and fuel efficiency make an exciting compromise in America's newest homebuilt plane, the Prescott Pusher. The 4-place single engine pusher gets its name from its aft-mounted propeller. The configuration gives the craft higher fuel efficiency than a plane with a forward-mounted prop since the pusher-type doesn't subject the plane's fuselage to the high velocity of its propeller wash. The Prescott is not the first pusher. The Avtec, Gates Piaggio and Starship already have made their mark with this technology. But the Prescott is up to date with design and control technologies to make most pilots sit up and take notice. The kit comes in versions ranging from \$19,600 (basic airframe) to \$36,500 (including a hydraulic gear and flap system). The Pusher cruises at 180 mph.

The pusher-prop technol-

ing number of aircraft and may dominate the smallplane market by the end of the decade.

### A Noble effort

Richard Noble is well-known as the builder of land-speed record cars. But he's taken off in a new direction. Noble has designed the 2-seater



Richard Noble's Super-2 is a lightweight for ultralight fans.

ARV Super-2, a lightweight plane you can build from a kit. Powered by a 2-stroke, 3-cylinder water-cooled engine, the Super-2 cruises at 100 mph on 77 hp. At under \$14,000, the kit is not cheap. But ultralight fans should enjoy taking a ride,

Most of the plane is made of "superplastic" aluminum that can stretch to 10 times its normal size and then return to its original shape.

### Float and fly

Canada has come up with a new entry in the international amphibian market. The Seawind International 4place plane cruises at 180 mph at 75 percent power. Its swept-wing design has a gentle stall that will make flying over marine thermals easier to handle. The powerhouse is a Lycoming 200-hp overhead prop. If your last experience with amphibious flight was on pontoons, you should take a flight on the

Seawind craft or one of the growing number of amphibians, then land without pontoons. Getting on and off the water is much smoother.

The fiberglass composite plane comes in kit form for \$20,000. It is assembled from 10 major premolded components. You provide your own prop, engine and instruments. With careful shopping, the total cost could be under \$30,000.

### New pilot category

The Federal Aviation Administration earlier this year proposed controversial new regulations for "recreational pilots." Under the new rules, you could be licensed to fly a 4-place craft within 50 miles of an airport. You could fly cross country in hops. And the amount of training would be far less than that required for private pilots. We'll have to wait and see if relaxed regulation will work.

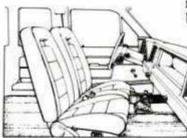


ogy is showing up on a grow- Canada's Seawind 4-place amphibian has smooth wing stall and goes 180 mph at 75 percent power.

# The Long Ranger. Tough Ford Ranger Supercab 4x4.

Ford's new Ranger SuperCab is here...with more room and comfort than ever! Ranger's new 2.9L V-6 engine is the most powerful in any small pickup, too. And new "Touch-Drive" option lets you shift to 4WD high on the fly!

Now there's a tough, small 4-wheeler that gives you more room for off-road roamin'!



Ford's new Ranger SuperCab has over 22 cu. ft. of space behind the split-back front seat more room than any Ranger ever.

With optional rear jump-seats, it's the only small pickup that can ride five.

# Most powerful V-6!

There's extra offroad power, too— 140 horses\* worth in Ford's new, bigger 2.9L V-6 option. It's the most powerful engine in any

small pickup!
Like the standard
2.3L Four, it's electronically fuel-injected for
quick response.

## New "Touch-Drive" system.

When the outback beckons, just touch and go for it! A button in Ford's new "Touch-Drive" console shifts electrically from 2WD to 4WD high and back at any speed. Nobody ever made it simpler! (Manual locking hubs are still standard for you traditional off-roaders.)

# Supertough Truck.

Above all, this Ranger 4x4 is one tough truck—built Ford tough, with a Twin-Traction beam indepen-

dent front suspension...
double-wall construction
...tough ladder-type frame.
And a payload of 1625 lbs.

## Special STX trim.

All this off-road room and toughness comes with all the "goodies," too, in the new Ranger STX optional package—sporty trim, Captain's Chairs, lower two-tone accent, the works. It's the look that says, "4-wheelin', you ain't seen nothin' yet!"

### Best-Built American Trucks.

At Ford, Quality is Job 1. A 1985 survey established that Ford makes the best-built American trucks. This is based on an average of problems reported by owners in the prior six months on 1981-1984 models designed and built in the U.S.

## Lifetime Service Guarantee.

Participating Ford
Dealers stand behind their
work, in writing, with
a free Lifetime Service
Guarantee good for as
long as you own your car
or light truck. Ask to see
this guarantee when you

visit your participating Ford Dealer.

### Buckle up together we can save lives.

\*Based on SAE Standard J1349.



# FORD RANGER

BEST-BUILT AMERICAN TRUCKS





# **Outdoors**



BY TIM COLE

# Options in fish finding

Most of the big names in electronic depth-sounding equipment—like Lowrance (pictured here), Humminbird and Vexilar—are taking a headlong plunge into LCD technology. But how do the state-of-the art units compare to the paper graph recorders of not so long ago? We wanted to know, so we invited Lowrance's Don Lain to our bass boats performance comparison test (see page 79) for a demonstration.

All three fish finders we tested—which included the inexpensive 2330 flasher-type (\$200)—were positioned over the same bottom structure, yielding the same depth readings.



Three generations of Lowrance fish finders: the LCD X-3, top; the 2330 flasher, below; and the workhorse X-16 paper graph recorder, right. The rectangle on the X-16 is equal to the entire area covered by the X-3,



Obviously, the flasher was limited to intermittent flashes between zero and the indicated depth when fish passed between the bottom and the boat's transducer.

OWRANCE L

The LCD X-3—which costs \$300 and draws .35 amps during daytime use—provided a very clear bottom profile, with random pixels indicating individual or schooling fish. The X-16,

on the other hand—which costs \$600 and draws a continuous 1.3 amps—provided significantly greater detail and was able to accurately discriminate rocks, wrecks, brush and trees. It was possible to make out individual, schooling, bottom or suspended fish—even to observe jigs descending to a desired depth on a downrigger. The X-16 also offered variable frequencies for shallow or deep-water penetration and beam angles up to 45° for wide-scale coverage. The rectangle imprinted on the X-16 delineates the same coverage offered

by the LCD X-3 model.

While there seem to be plenty of advantages offered by the "lower tech" paper graph recorders (if you exclude the high costs of replacement graph paper), LCD technology is catching up fast. New units that begin to approximate the definition found on paper graph units are just coming on the market. Watch for Lowrance's new X-5 LCD fish finder, which offers an amazing 2124 pixels per square inch, to the X-3's 470. The X-5 also features a 2-tone system that segregates bottom structure from bottom profile. Contact Lowrance Electronics, 12000 East Skelly Drive, Tulsa, OK 74128.

### Classics in Kevlar

Platt Monfort of Wiscasset. Maine, the distinguishedlooking fellow below, has developed a new boat-building system that uses high-tech Kevlar in low-tech hull shapes. His Geodesic Airolite building kit concept uses a rugged basket-like wooden framework reinforced with strands of Kevlar he calls triangulared tensile members. The resulting frame is covered with heat-shrink Dacron fabric. The Whitehall Jr. design, pictured here, is tough, superlight and can be rigged with electric power or fitted with a sliding seat and oarlocks. Contact Platt at Monfort Assoc., RFD 2, Box 1490, Wiscasset, ME 04578.



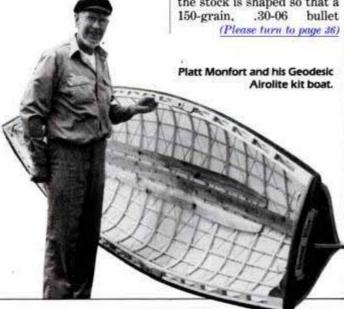
The downrigger advantage is now available for small boats.

# Mini downrigger

The downrigger advantage now extends to people who like to fish open water on small lakes. The Little Laker from Walker Downriggers attaches to the oarlock of your average Jon boat. It weighs less than 4 pounds and comes equipped with a hundred feet of cable. The \$85.50 unit also stows easily for the fisherman who likes real portability and will even fit in a suitcase for extended fishing trips. A rock-filled sock can stand in for the standard 10-pound weight. For more information, contact Walker Downriggers, 395 South Pitcher St., Kalamazoo, MI 49007.

# Lightweight mountain rifle

Browning's new A-bolt—named for the shape of its unique, 3-lug action—weighs just 6.5 pounds, but the stock is shaped so that a 150-grain, .30-06 bullet (Please turn to page 36)



# The most inflammatory question of our time.

"Hey, would you put out that cigarette?"

Just seven little words. But in today's over-heated climate of

opinion, they can make sparks fly.

For with all the rhetoric about "second-hand smoke," many non-smokers are beginning to feel not just bothered but threatened by cigarettes.

And with all the talk about anti-smoking legislation, many

smokers are beginning to feel threatened by non-smokers.

This is not exactly a recipe for social harmony. In fact, it's

practically a guarantee of further discord.

Since we have discussed scientific aspects of the "passive smoking" controversy in previous messages, we'd like to focus

here on the social questions.

Will more confrontation or more segregation produce less abrasion? Do we solve anything by creating yet another way to divide our society? Shouldn't all of us be wary of inviting government to involve itself further in our private lives?

At R.J. Reynolds, we see an alternative.

We think we should start not by raising barriers, but by lowering our voices. We think smokers and non-smokers can work out their differences together, in a spirit of tolerance and fairness and respect for each other's rights and feelings. We think common courtesy can succeed where coercion is bound to fail.

And maybe, after we have learned peaceful coexistence by talking to each other civilly and sensibly, we can apply the same

approach to our many other problems.

Because, after all, this is hardly the most inflammatory question of our time.

Brought to you in the interest of common courtesy by R. J. Revnolds Tobacco Company

# Free Catalog



Discover the newest in high tech ideas for your home, shop and in the office.

Browse through the colorful pages of our catalog, chock full of unique and fascinating values for the hobbyist, student and educator. Read about our many telescopes that will bring Halley's Comet in view for this once-in-a-lifetime event; microscopes that range from pocket-size to 4-objective; 8x10" color enlargements you can make from slides in less than 3 minutes in daylight; high-tech electronics plus an array of arcade-action toys. Also featured are products for health and physical fitness, and the unusual in hard-to-find useful tools designed to make jobs around the home and business easier and more enjoyable.

Write today for your FREE copy.

SERVING HOBBYISTS SINCE 1942

Edmund Scientific Co.

Dept. 2103, 6210 Edscorp Bldg., Barrington, NJ 08007

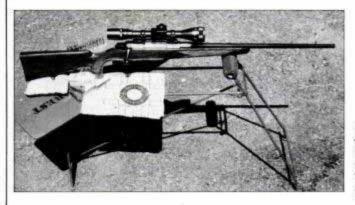
### AMAZING SCIENTIFIC AND ELECTRONIC DEVICES

LASERS, PHASERS for shock wave, weapons, burning, cutting, holography, cloud writing and visible light beam application. PLASMA TORNADO, FORCE FIELD, ION WIND, ION MOTORS, LIGHTNING GENERATION, TELSA COILS, ANTI-GRAVITY, MAGNETIC IMPULSE GUNS, INFRASONICS and ULTRASONIC DEVICES. SHOCK and STUN GUN PROJECTORS for personal protection SEE IN TOTAL DARKNESS, LONG RANGE VOICE TRANSMITTERS, DIRECTIONAL MICROPHONES, INTRUSION DETECTORS for security. SATELLITE TV, ENERGY and INSECT/RODENT KILLERS, REPELLORS for the home. SEND \$1.00 FOR CATALOG OF PLANS, KITS AND COMPELTED ITEMS TO

INFORMATION UNLIMITED BOX 716, DEPT M8 AMHERST, NH 03031







The 6.5-pound Browning A-bolt .30-06 fired respectable 100-yard groups right out of the box using 150grain ammo.

won't bruise the shooter. Fire a 180grain load, though, and you know it.

Accordingly, the highly finished Medallion .30-06 we test-fired (\$424.95) liked 150-grain Winchester-Western Super X factory ammo best, making %-in. by %-in. and %-in. by 1-in. 100-yard groups. That's exceptional for any untuned out-of-the-box rifle and spectacular for a lightweight hunter.

The A-bolt's action is the real standout. A 60° bolt turn and an oval bolt knob mean you can cycle rounds faster for rapid fire. The magazine loads through the open action or unclips when you drop the floorplate—handy when carrying a reserve magazine. In .30-06, the A-bolt Medallion holds four officially, but you can load five if you close the floorplate with the bolt open. Magnum calibers hold three. For more information, contact Browning, Route 1, Morgan, UT 84050.

# Lightweight, large-size pack tent

Kelty has eliminated unneeded sit-up room in its new, 3-season Apollo tent to create a commodious but lightweight outdoor shelter. A unique 2-tiered design concentrates most of the room in the front of the tent near the flap. The rest of the tent is comprised of leg space only. The Apollo is made of 1.9-ounce Ripstop and incorporates an integral fly on a 2.5-ounce nylon taffeta floor. A hood over the tent flap allows plenty of ventilation in the rain, as we discovered one summer evening. Setup is simple with two expandable tent poles and one small foot pole.

Kelty designer Dennis Brune says



The Kelty Apollo achieves 5.15-pound all-up weight by eliminating needless sit-up room.

the Apollo has endured sustained 100-mph winds from a DC-3 prop under test conditions. This 5.15-pound tent sells for \$150. For more information, contact Kelty, 704 Maupin Ave., New Haven, MO 63068.

# Dinghy towing whip

Mooring whips have become standard dockside additions around the nation's coasts, particularly on South Florida waterways, where tidal action and boat wakes habitually slam boats against piers. A line from a flexible fiberglass whip to the inboard side of a boat keeps



The towing whip keeps continuous tension on vessel being towed, avoiding transom damage on the mother ship.

the vessel safely out of harm's way. Now, Mooring Products Inc. has transferred this useful mooring whip concept to dingly towing.

Dinghies, small boats and other types of auxiliaries have a tendency to slam into the transom of their mother ship in big seas or during a sudden slowdown. The dinghy towing whip will keep continuous tension on the stern of the dinghy for added towing security. The towing whip is available for \$195 from Mooring Products Corp., 1554 North Federal Highway, Pompano Beach, FL 33062.

# Your home workshop

This One Low-Cost Power Tool-

SAWS to desired Width...

PLANES to desired Thickness...

MOLDS all popular Patterns...

All at once or separately. . . All By Power Feed!

The Only Complete Workshop Tool Of Its Kind In The World!

From the Day It Arrives ... the Planer will make and save you money. With shortages and inflation driving lumber prices skyhigh, this versatile power tool quickly pays for itself by easily converting low cost rough lumber into high value finished stock. In just one pass turn out your own quarter-round, door and window stop, casing, tongue-and-groove... all popular patterns. Other operators are making cases for grandfather clocks, furniture, picture frames, bee hives, bed slats, surveying stakes . . . all kinds of millwork

Built For Pros... Priced For Home Craftsmen... it is engineered and built to industrial standards, but factory-direct selling keeps the price low. Handles tough oak and walnut as easily as pine, and so simple to operate even beginners with no experience can

Start Your Own Business! Earn Extra Income Right At

With just this one low cost power-feed machine in a corner of your garage or basement, you're set up to supply lumberyards, cabinetmakers,

carpenters, remodelers, contractors and hobbyists in your area with custom-planed lumber, trim, molding . . . ALL of their millwork requirements. You can supply picture molding to art shops, hardware and department stores, or sell direct to framing shops. All standard patterns are available from stock, or we'll custom grind a knife to your own special design or sample.

## Does The Foley-Belsaw Pay? YOU BET! READ WHAT OWNERS SAY:

A Good Investment • Robert Sawyer, Roseburg, Oregon: "I believe that the Foley-Belsaw is the best investment I ever made. I've been a planer man for years and am now retired. The Foley-Belsaw has earned me \$60,000 extra income in the past eleven years."

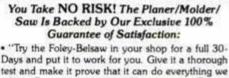
Pays For Itself: • R.S. Clark, Springfield, Ohio: "I bought a batch of walnut in the rough, and after planing it on the Foley-Belsaw I figured up the money I saved. It was enough to pay for two-thirds the cost of the Planer. It really does a

More Than Expected • Stephen Schultz, Orangeville, Penna.: "This machine pays for itself by making money out of scrap boards. It is a very well built machine and I confess it is more than I really expected for the price. It does everything you say it will.

... And Foley-Belsaw Is The Choice Of Professionals:

"I recommend Foley-Belsaw Planer-Molder-Saw as the most useful shop tool any craftsman could own. We use one every day in the Workbench model shop, and couldn't get along without it.'

JAY HEDDEN - Editor WORKBENCH Magazine



Days and put it to work for you. Give it a thorough test and make it prove that it can do everything we say it will . . . use it just as much as you want. Then if you are not completely satisfied, just send it back and we'll return every penny you sent. And YOU are the sole judge! There are no questions asked ... there are no fine print 'use' charges. Our flat guarantee is that YOU must be 100% satisfied or you get your money back."

BOOKLET! **Get FREE Book with** facts and full details .. RUSH COUPON TODAY!

**NO SALESMAN Calls!** 

Try The

Foley-Beisaw In Your Own Shop On Our

Mail Coupon Bel

For Complete

Details!

If coupon has been removed, just send postcard with name 90653 FIELD BLDG. KANSAS CITY, MO. 64111 and address to.

ACT NOW! Coupon Brings **Full Details!** 

Just Mail Coupon . . .

NO OBLIGATION and

/	I	Ī	П	1	Ţ	1
1	:	1	S	3	Ш	/

FOLEY-BELSAW CO 90653 FIELD BLDG KANSAS CITY, MO. 64111

YES, please send me the FREE Booklet that gives me complete facts about your Planer-Molder-Saw and full details on how I can qualify for a 30-Day Free Trial right in my own shop. I understand there is No Obligation and that No Salesman will call.



NAME		
ADDRESS		
CITY	STATE	ZIP

# Audio



BY TERRY SHEA

# Theater sound at home



NEC's AV-300E has Dolby circuitry, amp, audio/video switching.

If you enjoy watching movies at home on videotape, but miss the realism a Dolby Stereo-equipped theater brings to a movie's soundtrack, you'll be happy to know that such effects can be duplicated in your living room.

and components. Technics and Sony, for example, offer surround sound in their latest A/V packages.

Your ticket for admission to surround sound is a decoder mated with an extra speaker or two, and maybe



Sansul's DS-77 processor has 20-watt amp for extra speakers.

Dolby Stereo is a form of surround sound, a term that embraces several different techniques for adding greater depth and realism to recorded sound, Dolby Stereo is what immerses you in action, so that the helicopters in "Apocalypse Now" seem to zoom from the screen, over your head and out toward the theater lobby. If you'd like to send those same choppers through the den and out to the backyard, surround sound is for you.

Surround sound isn't new. But with many people now connecting their video gear to the hi-fi system, manufacturers are beginning to add surround-sound circuitry to their audio/video systems

an extra stereo amplifier. We'll assume you're already running the sound from your VCR or videodisc player through a component hi-fi system. The decoder extracts the surround-sound information from any movie soundtrack that's been Dolby Stereo encoded. There are more than 700 of these, and the surround information is there whether on videocassette, videodisc or 35-mm film.

In a theatrical Dolby Stereo system, left and right speakers face the audience and provide the normal stereo for music and most sound effects. A center speaker is used for dialogue, while rear speakers reproduce those True Dolby surround sound: Shure's Home Theater System.

special effects that add a lifelike sense of depth to the soundtrack. Finally, a subwoofer is often used to deliver gut-thumping bass, like the rumbling of rockets at lift-off in "The Right Stuff."

For home use, Dolby Laboratories developed a simplified version called Dolby Surround: Compared to the theater-type Dolby, what's usually missing

what's usually missing is the center dialogue channel and sometimes the subwoofer connection. To offer

true Dolby Surround, decoder manufacturers must be licensed by Dolby Laboratories, and such products carry the "Dolby Surround" logo. Decoders are available at present from Audionics, Fosgate, NEC, Shure, SSI and Teac. Prices range from about \$350 to \$600.

What complicates matters is that some surround sound decoders, while claiming to decode Dolby Stereo, do so with circuitry reminiscent of earlier 4-channel quadraphonic audio systems. Their proponents claim that these processors not only extract the Dolby Stereo signal from movie soundtracks, but also add surround effects to stereo LPs, cassettes or Compact Discs. Dolby argues that such double-duty processors do an inferior job decoding Dolby Stereo soundtracks. I've yet to be given a proper demonstration of one of these systems, so I'll reserve judgment. Yet, I've witnessed some very impressive demonstrations using true

Dolby Surround decoders.
All surround-sound systems require an extra speaker or two and a l

systems require an extra speaker or two and a lowpowered amplifier in addition to the sound system's main amp or receiver. To simplify matters, several manufacturers build a lowpowered amp into their decoders. Fosgate's 3601 and the SSI-36011 are two Dolby Surround decoders with built-in amps, while Yama-



SSI Model 360-II has Dolby Surround and built-in amplifier.

ha's SR-30 and Sansui's DS-77 are non-Dolby processors with built-in amplification. Some models offer even more flexibility, functioning as complete video control centers so you can switch among several video components, or easily dub from one cassette to another, or from videodisc to cassette. NEC's AV-300E and Teac's AV-500 are Dolby Surround decoders of this type, while Sansui's AV-C10 and Denon's AVC-500 are control centers/surround decoders that feature non-Dolby surround circuitry.

# Hands-on report: Technics SL-XP7

The Technics SL-XP7 portable Compact Disc player is one of those devices you just (Please turn to page 42)



Big sound out of a small size: Technics SL-XP7 CD player.

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

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

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

### Learn at Home in Spare Time

No need to quit your job or travel to night school. NRI trains you right at home. You learn with "bite-size" lessons that show you how to service almost everything that uses small motors. And you learn at your convenience.

### Includes 5 HP Engine, Power Generator

NRI's Master Course gives you a brand-new 5 HP Tecumseh engine to work on. Plus a power generator, which generates enough 120-volt AC to keep your house going during outages or give you portable power for weekends and vacations. You learn to troubleshoot, do tuneups, even tear down for valve and ring jobs. You learn using professional tools like a complete wrench set, inductive tachometer, volt-ohm-milliampmeter, overhaul equipment and more.

#### Choice of Two Courses

There's the 30-lesson Basic Course, concentrating on the lucrative lawn and garden equipment business. The 45-lesson Master Course has it all, adding lessons on chain saws, mopeds, outboards, light industrial equipment, snowmobiles, and even motorcycles.



Training includes 5 HP engine, all these professional tools.



A business you can start in your garage and watch grow



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



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

#### **Exclusive Factory Training**

Although not required for graduation, your Master Course includes five intensive days of optional training at the

Tecumseh Factory Service School. Here you'll work with master technicians, getting first-hand experience in subjects like solidstate ignitions, transmissions and transaxles, engine teardown, two and four cycle carburetors, troubleshooting, and more. All designed to prepare you for success.

# Free Catalog, No Salesman Will Call

Our big catalog tells all the facts, no salesman will ever bother you. Each lesson, each piece of equipment, each day of the factory service school is described in detail. Take the first step toward running your own life and send today. If coupon has been used, write NRI Schools, 3939 Wisconsin Ave., Washington, D.C. 20016.

McGraw-Hill Continui Education Center 3939 Wisconsin Ave. Washington, DC 2001	ing	For Career courses approved under G to theck for detail
We'll give you tomorro		
□ Small Engine Service & Repair     □ Air Conditioning, Refrigeration &     Heating Courses Including Solar     Technology  Pleases a such one the one for	Automotive Mechanics Course Appliance Servicing Course Communications Electronics Color TV/Audio/Video Servicing ree catalog I have checked.	
obligation. NO SALESMA		Turberstand there is no
Name	(Please print)	Age

# Finish Wood Like An Expert! WATCO

The Original and Still the Best

# DANISH OIL

One easy application primes, seals, hardens, protects, beautifies!

With Watco you just WET-WAIT-WIPE, and you have an elegant, extremely durable finish that would please the most critical professional.

Watco penetrates deeply — creates a tough finish INSIDE the wood — makes wood up to 25 percent harder. Can't chip, peel or wear away like a surface coating. Stains, scratches or minor burns usually are spot repairable.

WATCO DENNIS CORPORATION

1756 - 22nd St., Dept. PM-16 Santa Monica, California 90404

Send Free booklet "How to Beautifully Finish Wood."

Name

Street

City

State

Zip

# Why beat up your hands cleaning old paint and rust...





#### when you can sandblast it clean in minutes?

Now you can quickly sandblast clean auto parts, boats and furniture - most home projects on metal, wood, stone or hard plastics - with-

out harming the part.
Handy Vortex sandblast kits are made by one of the countries leading blast cabinet manufacturers, and are unavailable in stores. Kits feature a trigger control aluminum diecast gun, delivery hose and pick-up tube. Sim-

ply attach to air and media supply and you're ready to work. Kits are a low \$59.95 in-

Kits are a low \$59.95 including postage and handling.\* For more information, or to order, call 1-800-854-8544, or write: Industrial Equipment & Supplies, Inc., P.O. Box 540, 1908 Sunset Dr., St. Joseph, MI 49085. Enclose check, money order, or VISA or Mastercard number with your order.

\*Michigan residents add \$2.80 for state tax

# STOKES SEED CATALOG FREE

Select from 1500 varieties. Many exotic exclusives from England, Europe, Canada. Send for it today.

STOKES SEEDS, INC.

1376 Stokes Building, Buffalo, NY 14240

#### **AUDIO**

(Continued from page 40)

want to like. After all, how can anyone not be impressed by a CD player that's hardly bigger than the sliding drawer into which you load the disc on most home CD players?

Measuring about 5 inches square, the SL-XP7 is barely bigger than the Compact Disc itself, and at a mere 1½ inches deep, it's thinner than the average romance novel.

The SL-XP7 carries a suggested retail price of \$300, plus \$60 for the combination carrying case/battery pack, which is rechargeable and good for about three hours—enough to play four discs. For on-the-go use, the player is inserted into the metal case, creating a package that weighs not quite 3 pounds and is about an inch larger in each dimension.

The player's features are amazingly complete for a handheld portable unit, with bi-directional fast search, the ability to program the order of selection play and instant access to any track. A liquid-crystal display shows the total number of tracks, disc playing time, which track is playing, the elapsed time per track, number of tracks left and total disc time remaining.



Jamo's car speaker boasts 30 watts.

All the operating controls are easy to figure out, and are as accessible when the unit is in its case as when it's not. One exception is the side-mounted volume control—the case gets in the way when adjusting the volume.

The SL-XP7 sounds great, whether used as a portable and listened to through headphones (not included), or



Jensen's amp/speakers have 2-inch depth.

connected to a home audio system and played through loudspeakers (connecting cable included). Slung over your shoulder with the supplied strap, it feels lighter than many 35-mm cameras. Walking doesn't upset the tracking mechanism a bit, but when the strap slips down—as it inevitably does—the laser sometimes skips when you hoist it back up onto your shoulder. Accordingly, the SL-XP7 is not something to take jogging. Besides, it weighs nearly 3 pounds.

# Car audio upgrade

You've probably been told that the quickest, easiest way to upgrade the sound of your car stereo system is to replace the factory-supplied speakers with something better.

Well, you can take that advice one step further and install any of the recently available *powered* car stereo speakers. You'll thereby upgrade not only your speakers, but also boost your amplifier power and the quality of the signal—all without the hassle of mounting outboard power amps in the car's trunk or under the seat.

Designed to be used with lowpowered car radios or radio-cassette players, powered speakers connect to the same leads as conventional speakers, sense the voltage that's coming through, and then amplify that signal. The amount of power you get, though, is only whatever the speaker's amp is rated at—not the sum of your radio's power plus the speaker's power.

Powered speakers are available from Jamo, Jensen and Sparkomatic, among others. Jensen offers a pair of round models—4½- and 6½-inches in diameter. Each has an amp rated at 20 watts. Mounting depth is 2 inches, and suggested retail prices are \$169.95 and \$199.95 per pair, respectively. Jamo's single powered car speaker, Model 305 Electronic (\$224 per pair), has a 5-inch woofer and 1-inch tweeter, each powered by its own internal amp—20 watts for the woofer, 10 watts for the tweeter. They can be door- or shelfmounted, with a depth of 1.7 inches.

Sparkomatic offers a trio of 2-way powered speaker systems, plus a powered subwoofer in its ASK-3000 Series. All three systems offer a 4-inch woofer and 2-inch tweeter, with each woofer powered by a 20-watt amp and each tweeter by a 5-watt amp. There's a door-mount system with a separate surface-mount tweeter (ASK 3000, \$100 a pair), a 2-way flush-mount rear deck system with dual woofers and separate tweeter (ASK 3010, \$130 a pair), an enclosed surface-mount system (ASK 3015, \$120 a pair) and a 50watt dual-subwoofer system (ASK 3030, \$60) designed for flush mounting on the rear deck.

# Save Gas, Save Engine with "POLY"

The following introduces one of the most fully tested and proven gas saving, friction-reducing engine treatments ever to reach the market!

#### The Secret is "Poly"

"Poly" is short for polytetrafluoroethylene (TFE), the slipperiest substance known to man. (1981 Guiness Book of World Records). Petrolon Corporation, makers of Slick 50, invented a way to permanently bind this slippery chemical to your engine with one treatment. Just one quart of Slick 50 can reduce engine friction, increase gas mileage and horsepower and reduce engine operating temperature, causing your oil and engine to last longer. . . plus it reduces metal wear, defraying costly overhauls.

#### Years of Testing and Use Have Proved it True!

Slick 50 has been thoroughly tested in independent laboratories and out on the road:

The March/April 1982, p. 35 issue of "Consumer Digest" magazine stated, "Slick 50 does reduce engine heat and ordinary wear, and our informal tests indicate that it will improve gas mileage by about 2 or 3 miles per gallon."

One of the country's most respected research institutes reported applying a powerful ultrasonic cleaning process to a Slick 50 treated engine and were surprised at its permanence. "We actually expected the Petrolon Slick 50 TFE Resin coating to also be removed, but later found it was still there."

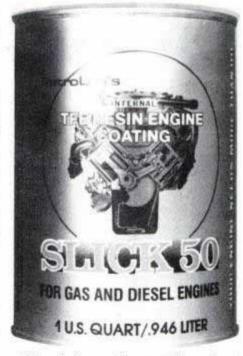
"Dune Buggies & Hot VWs" magazine April 1983 issue records the results of their one year testing of Slick 50. "We can indeed say scientifically that Slick 50 does work, and that it does reduce engine wear! . . . for the price of one treatment when compared to engine rebuild, we feel that you'd be money ahead using Slick 50."

The 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 showed almost zero engine wear!

The senior engineering researcher at a leading southern California university stated, "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 Pennsylvania and shown on WTVE television. Three cars with 75,000 to 129,000 miles on them were treated with Slick 50. Six months later the oil was drained from each vehicle, and the cars driven without the oil plugs for about a half hour. The water temperature never rose and the engines sustained no apparent damage.



There isn't room here to tell you about the dozens of other tests proving that Slick 50 is everything we say. However, if you're still skeptical, send \$2.00 to cover printing and postage costs, and we'll send you detailed test results plus actual letters from users who report how Slick 50 saved their engines and saved them money!

#### It's Easy to Treat Your Engine

A few minutes before oil and filter change, add the engine flush you get free with each order to clean out the engine. Let the engine idle for 5 minutes. Then drain the oil, change the filter and add the proper amount of oil, less one quart. Add one quart of Slick 50, drive for 30 minutes, and leave it in the crankcase for at least 3,000 miles. As the engine operates, the oil carries the "poly" between the parts where it is burnished into the pores of the metal.

# **Only One Treatment Necessary**

It's 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.

#### **Works with Most Oils**

Slick 50 will work with all petroleumbased oils and all synthetics compatible with petroleum-based oils with the exception of graphite oils. However, once an engine is treated, you can go back to a graphite type if desired.

# 4 Ways Slick 50 Saves You Money

Your actual percentages may vary depending on your driving, vehicle condition, weather and geographic location, but no matter what your conditions, Slick 50 can:

- 1. Increase mileage
- Increase horsepower (small economy cars and large RV's really need this)

- Reduce operating temperatures, thus increasing the lubrication and life of the oil and engine
- Minimize or eliminate costly overhauls by reducing engine wear

Up to 90% of the engine wear on a car can be caused by lubrication starvation cars experience when first started before the oil begins to circulate, Slick 50 can eliminate this problem for less than the cost of two tanks of gas.

#### Slick 50 Will Not Affect Your Warranty

Slick 50 is suspended in an excellent grade of petroleum oil which meets or exceeds every manufacturer's engine warranty requirements. In addition, this oil carries an American Petroleum Institute service classification SF-CC-CD.

### There's No Risk with Our Money Back Guarantee

Use Slick 50 for 3000 miles. If you don't notice an improvement in engine performance, return your invoice with a short note telling why, for a prompt full refund — no questions asked.

#### Profit from Selling Slick 50 Yourself

Here's an opportunity to make handsome profits. Having such solid test results from major institutions make Slick 50 easier to sell than many other products. Free dealership 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 1-800-525-8624, ext. 13 (in Colorado call 1-303-762-1385) or send to: Progressive Energy Corp., 3148 S. York St., Dept. PM186, Englewood, CO 80110.

	to improve in ny engine —		
☐ One Slid and han	ck 50 at \$39 adding.	.95 + \$4.0	0 shipping
	free shippin 2 or more a		
☐ Check	☐ C.O.D.	☐ Visa/	MasterCard
Card # _			
Exp. Date			
Name			
Address (Give street a	address if pos	sible for UPS	G delivery)
City	St	ate Z	ip
-		احد	

3148 South York, #PM186, Englewood, CO 80110 TOLL FREE 1-800-525-8624. In Co 303-762-1385 ©1985 Progressive Energy Corp.

# TOOL TESTS

# **Shopsmith Planer**

Shopsmith enjoys a reputation for excellent machinery. thanks mainly to its fine Mark V multipurpose woodworking tool. So I was impressed, but not surprised, by the quality and performance of Shopsmith's recently introduced 12-in. Professional Planer. Unlike two other Shopsmith planers that mount on the Mark V. this is an independent, selfpowered machine. It weighs a manageable 150 pounds and is moved easily about the shop. Retractable casters are available. The planer plugs into any 110-volt outlet. The throat handles stock up to 12 in. wide, and from 4 in, thick down to a minimum of 1/12 in.—ample capacity for the home workshop and small professional shops.

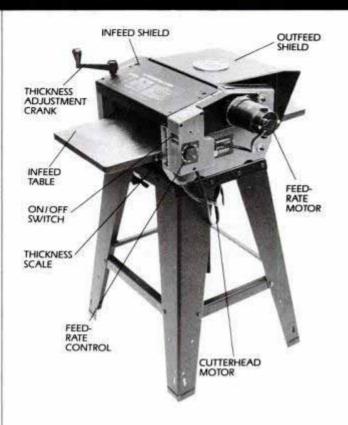
Instead of the typical single-motor drive, this planer has two motors—one for the cutterhead and another.

with variable speed, for the feed rollers. This translates into top performance because the feed rate is infinitely variable from 7 to 20 feet per minute, while the 3-knife cutterhead operates at a constant 5750 rpm. Thus, it's possible to obtain from 72 to 205 knife cuts per inch.

Fast feed permits rapid stock removal while slow feed gives a smooth surface, even on difficult wood grains. By making the final pass on various woods with a shallow depth of cut at the slowest feed, I obtained a surface comparable to one sanded with 120-grit sandpaper, and without millmarks.

The 12-in. Professional Planer lists for \$999, but the manufacturer indicates that some promotional prices may be lower. Contact Shopsmith Inc., 6640 Poe Ave., Dayton, OH 45414.

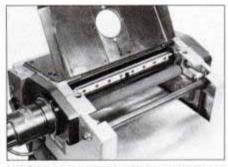
-Rosario Capotosto



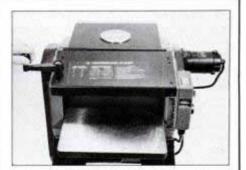
Shopsmith's 12-in. Professional Planer has separate motors for cutterhead and variable-speed feed rollers. It runs on 110 volts.



Antikickback fingers prevent stock from being thrown out of infeed opening. Knurled-steel infeed roller grips wood.



Cutterhead has three knives. Rubber outfeed roller moves the finished board away from cutterhead without marring surface.



Thickness adjustment crank moves table up or down in small, precise increments, with each complete turn accounting for 1/14 in.



Safety power switch requires key to unlock it. Recess prevents unintentional turn-on. Button above switch is for fast turn-off.



Maximum depth of cut for stock up to 4 in. wide is 1/6 in. using fast speed for softwood and medium speed for most hardwood.



Maximum depth of cut for boards that are more than 8 in. wide is  $\frac{1}{32}$  in. per pass. Stock can be planed down to a mere  $\frac{3}{32}$  in.

# New Players Lights 25's

# Count em-25 for the price of 20.

Kings & 100's

Kings: 10 mg "tar;" 0.8 mg nicotine — 100's: 12 mg "tar;" 0.9 mg nicotine av. per cigarette by FTC method.



Count em.

25
quality cigarettes for the price of 20.

SURGEON GENERAL'S WARNING: Quitting Smoking Now Greatly Reduces Serious Risks to Your Health.

Mfr's, suggested pricing based on full-price brands. Not available in all areas.

# **Photography**



BY STEPHEN A. BOOTH

# Kodachrome at 50



The 1940 Kodachrome picture shows inventors Godowsky (left) and Mannes.

It's a classic American success story of the type so often documented in these pages. A rank amateur hobbyist, fiddling around in the basement, garage or kitchen, comes up with a benchmark invention that somehow or other improves the quality of life. In this story, the rank amateurs were two professional musicians who liked to tinker with photography, and the product they midwifed makes it possible for millions to take color snapshots today. That product is Kodachrome, and it's 50 years old this year.

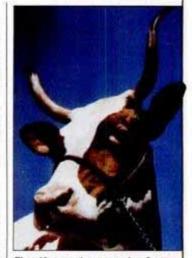
There was color photography before Kodak introduced its breakthrough, but not for everyday use. The process was expensive, difficult to achieve, what was achieved wasn't very good, and it had to be projected on a screen—color prints



Price of early Kodachrome included developing by Kodak. In 1936, sending back the return mailer only took a 11/24 stamp.

just weren't possible.

Color was produced optically in the predecessor to Kodachrome. The company explains that a set of color filters had to be placed in front of the camera lens before exposure. After developing, the same filters were mounted on the lens of a projector, and something approximating true colors would show up on a screen. Trouble was, extremely bright light was required in picture taking. Definition was poor and focus was shallow. To retain enough light to project the image, screen size had to be small. Any movement in the picture left colorful trailers behind the object. Reproduction of the color blue was impossible.



First Kotavachrome print from a transparency, circa 1939.

According to Kodak's annals, the process leading to Kodachrome film was the brain child of Leopold Mannes and Leopold Godowsky Jr. Mannes's father was head of the Mannes School of Music in New York; his uncle, Walter Damrosch, was the noted conductor of the New York Symphony for whom Damrosch Park at Lincoln Center is named. Godowsky's musical heritage was equally impressive: His father was a noted musician and composer, and his brother-in-law was George Gershwin.

In 1916, a magic-lantern color film titled "Our Navy" inspired the boys—not to enlist but to pursue a hobby in photography. Five years later, at age 21, they were professional musicians. They'd also dumped the optical approach to color photography

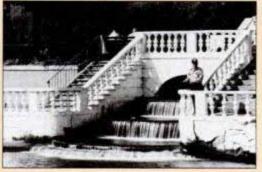
(Please turn to page 50)

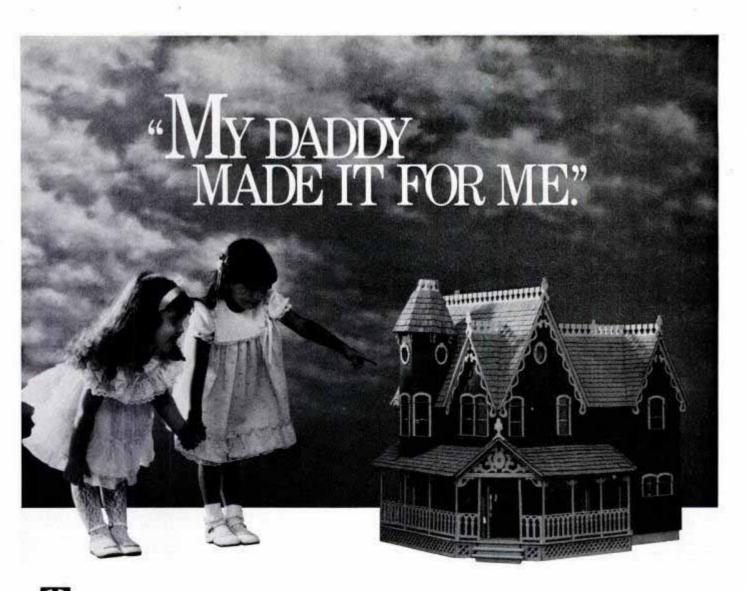
# PM PHOTO ALBUM— TIPS FOR BETTER PICTURES

Pictures of water falls, streams or fountains can become illusions of fantasy simply by using slower shutter speeds. Instead of freezing water with fast shutters, use time exposures to blur it. The longer the better: Speeds below 1/8 sec. will fatten-up and soften moving water. The photo at left was taken at 1/250 sec., f/2.8, while the one at right was exposed for 1/8 sec. at f/16.

It's not always easy to make lengthy exposures in daylight. For best results, use slow-speed films, such as ASA-25. Neutral density and polarizing filters help considerably. A steady support for the camera is a must. With manually metered and aperture-priority auto cameras, use the smallest aperture (such as f/16). For shutter-priority auto types use the slowest speed allowable for a good exposure. Even the shutter on most auto-everything 35-mm compacts can be slowed to its minimum (1/8 to ½ sec.) by using filters or low-ASA films.—Armand Ensanian







There's a lifetime of magic moments waiting for you to discover. Like the day you hand your daughter the key to her own little dream house. When you've built this clever wooden keepsake yourself, those moments and memories become even more special.

Whether you're making a doll house for your daughter or a custom wooden deck for your own house, Shopsmith can help you build it right. With the Shopsmith MARK V, you get the five most-needed woodworking power tools in a compact unit the size of a bicycle. You can saw, drill, sand, bore and shape lumber into projects you'll treasure forever.

And you don't have to be a woodworking wizard to get started. The MARK V is easy to operate. And Shopsmith offers the instruc-

tion and educational programs you need to become the best woodworker you can be.

You can order a MARK V by mail, by phone, at one of our Shopsmith stores, or when you attend a Free Shopsmith demonstration in your area. But no matter how you choose to buy a MARK V, once you do, you'll have the tools and the know-how to build a dream come true.

# Free Information Kit and Magazine Subscription!

Send in the coupon below and receive a Free MARK V Information Kit, including a copy of "How To Determine Your Best Power Tool Buy." Act now and you'll also receive a Free one-year subscription to "Hands On," the famous Home Workshop Magazine.

Call Toll-Free 1-800-228-2233 In Nebraska – 1-800-642-8788



 Shopsmith, Inc. 1985
 Shopsmith<sup>®</sup> is a registered trademark of Shopsmith, Inc. Available in the U.S.A. and Canada only.

me a Free MARK V Information he informative booklet, "How four Best Power Tool Buy", and one-year subscription to "Hands nd I am under no obligation.
Control in Manager Day Carlot Control
Zip
a Shopsmith woodworking power tool.
Shopsmith Inc.  For better woodworkers And those who want to be 6640 Poe Avenue Dayton, OH 45414-2591





# 24 Page

Satellite TV Buver's Guide

The new SATMAN Buyer's Guide is a necessity for any homeowner who wants to learn more about affor-dable, legal, and value packed 100 channel satellite TV. It's a better value than Cable TV, a VCR, or going to the movies. Buy direct, Do-It-Yourself and save with SATMAN. GUARANTEED LOWEST PRICES ON ALL MAJOR BRANDS. CALL NOW FOR YOUR FREE 24 PAGE BUYER'S GUIDE.

1-800-4-SATMAN 1-309-692-9582 Illinoi



--- Call Now! ----PHONE LISTENING DEVICE

Oty discounts available



Controlled Energy Corp. Fiddler's Green Box 15016 Waitsfield, VT 05673

Yes! Please send more information right away!

Name Address	
City	7in
Otato	

# ENDLESS HOT WATER!

# Woman Takes 18-Hour Steaming Hot Shower!

world record? We don't know. We did it to prove how you can get

endless hot water with an AquaStar Tankless Water and cut your water bill Heater . in half too!

AquaStar heats your water only as you use it, as long as you use it. Enjoy instant, endless hot water at the exact temperature you want it. No bulky tank. No running out of hot water. No more wasting energy. Millions of AquaStar tankless water heaters are in use today!

AquaStar is the ideal replacement for the tank. Designed to last a lifetime so AquaStar may be the last water heater you ever buy! Read what Popular Science, New Shelter, Mechanix Illustrated and others say about these amazing, economical tankless heaters.

Send coupon today for free information!

Minicolor prints arrived, late in 1941. The prints came in 21/4 x 31/4 and 5 x 71/2-inch sizes, and were conversions from Kodachrome slides. The process, called Kotavachrome, involved transferring an emulsion to an opaque baseat first, white cellulose acetate. Though the first successful Kotavachrome print-the perplexed-looking steer shown on the preceding page-was made in 1939, it took two years to ready

PHOTOGRAPHY (Continued from page 46)

and that year came up with a successful chemical process for putting part of the color spectrum on a photographic plate. They were still working out of their families' kitchens and bathrooms. But the higher-ups at Kodak sold them equipment and supplies at cost in return for getting peeks at their work. By 1930, the "boys" were on Father Yellow's payroll and working at the

new research center in Rochester, New

York. In 1933, they were close to their

and Kodak's goal: A single film that

would contain the photo-sensitive

emulsions necessary to reproduce true

color, with no need for external filters.

So close, in fact, that Kodak threw all

its technical resources behind the ef-

fort. Before long, experimentation ad-

vanced from plates to film, and on April

15, 1935, Kodachrome made its debut

as a 16-mm movie film. Slide film for

still cameras came in September 1936,

The color film that Mannes and Godowsky brought into the world was

really three black-and-white films

rolled into one—until it was processed.

Kodak explains that the original Koda-

chrome had no dyes or color couplers. Instead, the base film was coated with

three black-and-white emulsion layers, each sensitive to certain parts of the

color spectrum. Color dyes were added, layer by layer, in the still-complex pro-

cessing procedure. Even today's Koda-

chrome is basically a black-and-white

to have amateur color movies and slides

in 1936, it wasn't easy to display them.

Most cameras owners were accustomed

to the portability and convenience of

prints. They'd been around in blackand-white for some time before Kodak

As exhilarating as it might have been

film until it's developed.

and five years later, the color print.

The innovation caught on. Three months later, Kodak unveiled its Kodacolor print film. Unlike Kodachrome. this film includes color couplers in its emulsion layers, to simplify processing. This meant lower prices, enabling even more people to take and enjoy color pictures. How many people? No one knows, but according to Kodak, some 12 billion pictures were taken in the U.S. alone in 1984.

the process for commercialization.

POPULAR MECHANICS • JANUARY 1986

# Car Clınıc



BY MORT SCHULTZ

# Surge purge urged

My 1984 Ford Thunderbird surges without warning when I take my foot off the accelerator. The dealer acknowledges that the problem exists, but he claims it cannot be corrected. Is this true?—Karen J. Schroeder, Milton, MA

Ford acknowledges that a surging condition exists in 1984 and 1985 cars equipped with fuel-injected 3.8-liter engines. These are Thunderbird, LTD, Crown Victoria, Mustang, Cougar, Marquis, Grand Marquis, Capri and Colony Park. The company defines surge as a momentary variation in engine power which occurs while driving at a steady speed or when accelerating or decelerating.

As matters now stand, the National Highway Traffic Safety Administration is investigating, and Ford has issued the following technical service bulletins, which may lessen or eliminate the condition:

- TSB 84-19-12 calls for installing a new exhaust valve position sensor (part No. E43Z-9G428-B) in some cars.
- TSB 85-3-7 recommends increasing sparkplug gap to .054 in. and installing a new EGR valve (part E5SZ-9H473-A) in all cars.
- TSB 85-12-14 tells dealers to inspect wire harness connections for corrosion and lubricate them with Lubriplate DS-ES grease. It also recommends dealers see that the idle speed control

motor is adjusted correctly.

TSB 85-13-8 calls for repairing a short circuit in a wire harness, which causes the air conditioner clutch to engage when it shouldn't. This causes the idle speed control motor to kick in at the wrong time.

Some surge may always be present. It could be caused by the way the fuel system is calibrated, momentary driving conditions that the computer has not been programmed to cover and the operation of a lock-up torque converter. Sometimes, surging is caused by a partially restricted fuel-system component or additives in the fuel.

# Tip sheet

I haven't been able to find out why my 1978 Plymouth Volare station wagon gobbles ignition system electronic control units (ECUs). It's now on the fourth one. The engine dies, and a new control unit is the only thing that gets it going again. Any tips?—Roy Colston, East Point, GA

Several. First, make sure the replacement ECUs are original equipment or quality brand-name units.

The problem may also be in the dual-ballast resistor, which contains two resistors—compensating and auxiliary. The compensating resistor allows constant primary current to be maintained regardless of variations in engine speed.

This resistor is supposed to be bypassed as the engine is started, so full battery voltage is applied to the ignition coil—not to the ECU. The auxiliary side of the dual-ballast resistor also acts to protect the ECU by limiting the amount of voltage the ECU handles. If either resistor is bad, voltage can damage the ECU.

In 1980 models, the compensating resistor was changed from a 0.5-ohm rating to one with a rating of 1.2 ohms. In other words, the electronic control unit in your car may be working with a resistor of the wrong rating.

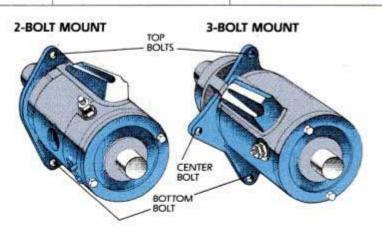
Test the dual-ballast resistor by disconnecting wires from it. With the ignition switch off, connect an ohmmeter across two of the terminals that have the same wiring in common. You should get readings of 0.5 to 0.6 ohm in one direction and 4.75 to 5.75 ohms in the other. If you don't, the resistor is either shot or the wrong one. In any case, get a new dual-ballast resistor.

Pull wire harness plugs from the connector on the firewall and from the ECU. If there's corrosion on terminals, clean them with carburetor cleaner and a soft brush. Make sure terminals aren't bent. If they are, straighten them. Then, pack terminals with nonconductive grease.

If these two tips get you nowhere, the ECU could be failing because of excessive heat. You can reduce the heat by removing the ECU from the fender well and smearing heat sink compound on the bottom of the ECU and on the fender well. Get the compound at Radio Shack by asking for part No. 276-1372. Cooling

(Please turn to page 52)





#### To catch a crook

It's important when installing a starter to make sure it's mounted evenly. If you mount one crooked, its drive gear will bind against the flywheel. Hard starting and damage to one or both parts can result. Here's the right way to do the installation.

1. First, install the top bolt, but don't tighten it.

Run it up just enough to hold the starter to its mounting pad.

- 2. Install and tighten the bottom bolt.
- If the starter uses a bolt in a center ear, install and tighten this one next.
- Finally, go back to the top bolt and then tighten that.

# CAR CLINIC

(Continued from page 51)

system neglect, incorrect ignition timing or a faulty thermostat could also raise engine temperatures and lead to ECU failures.

# Seal of approval

The power-steering pump in my son's 1983 Pontiac 6000 went from a sealed unit to instant pour-out overnight. The service manager at the local Pontiac dealership told us the pump had blown every one of its seals. He claims this is a common occurrence, and we have to expect it every 30,000 miles. Is he right?—S.L. Thomas, Springfield, MO

More GM power steering pumps are in use past 50,000 miles than fail at 30,000 miles. Blown seals usually result from a buildup of excessive pressure caused by a sticking flow control valve. Get in touch with the Pontiac zone office nearest you. Ask that a field rep meet with you. Don't be surprised if he offers to make a financial settlement.

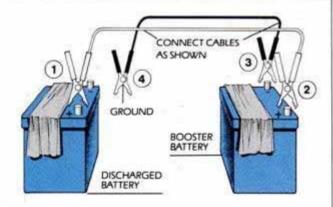
# Plugging along

I've been using AC R46TSX sparkplugs gapped at .060 in. in the 350 cuin. engine of my 1977 Buick Electra for all these years. Now my neighbor tells me they aren't the right plugs for the engine. He says I should use AC R45TS

# SERVICE TIPS

- Replacing the actuator solenoid valve of a 1982-'85 Honda Accord cruise control system will, in all probability, prevent the car from slowly gaining speed with the cruise control engaged when the ambient temperature is below 32"F. So says TSB 85-009. The new solenoid valve carries Honda Control No. 2047678. If the car is no longer under warranty, ask the dealer to check with the district service manager to find out if the cost of repair will be picked up by Honda.
- The reason for rough idle and hopskip-jump acceleration by a Pontiac Fiero which had been performing wonderfully until now may escape detection unless you check the No. 3 sparkplug cable. The cable, lying against the intake manifold core plug, may be frayed and shorting out. Replace it and wrap it with electrical tape where it hits the manifold.
- Ford's found a weak area between the roof panel and windshield pillar joint through which water can drip into a 1985 Escort, Tempo, Lynx or Topaz. TSB 85-18-1 tells how to seal the area with special vinyl sealer (part D6AZ-19562-A).
- Chrysler advises not to worry about a 1- to 3-second metallic knock heard just after starting a 2.6-liter engine in a 1983-'84 Conquest or Ram 50 that hasn't been started for four hours or longer. The noise is caused by the timing chain tensioner and isn't detrimental. If it bothers you, have a dampener (part No. MD084945) installed per TSB 09-09-85.





# Serious business

Every year, motorists and

would-be good Samaritans are injured or blinded when batteries explode while being jump-started. Try to avoid jump-starting if you can. When faced with a dead engine, remove the battery cables (ground first) clean the clamps and posts, then reattach the cables (ground last).

If the weather's been frigid, lay a lighted drop light near the battery for a half hour. It may warm the battery enough to start the car. If you must use jumper cables, make sure you do it this way:

Put on safety goggles. If you don't have them, don't jump.

If you're jumping from the battery of another car, make sure the two cars aren't touching.

If one or both batteries have vent caps,

lay a wet cloth across the caps to keep explosive hydrogen gas from escaping.

- Connect jumper cables in the 1-2-3-4 order shown in the illustration. Before making the fourth connection, be sure to recheck the others.
- See that jumper cables will not be hit by the fan and are not lying across the manifold.
- Try starting the engine of the dead car without starting the engine of the booster car. If this doesn't work, wiggle cable clamps to make sure they have a good bite and try again. As the last step, start the engine of the booster car, then start the dead car.
- Disconnect jumper cables in reverse order of hookup: 4-3-2-1.

gapped at .045 in. Is he right?—J.F. Flynn, Winston Salem, N.C.

He might be, but I doubt it since AC R46TSX plugs apparently haven't been giving you any grief. Three different sparkplug types are recommended for 1977 Buick 350-cu.in. engines—AC R46TSX gapped at .060 in., AC R45TS gapped at .060 in. For your car, the correct plug is determined by the fifth letter of the Vehicle Identification Number (VIN). If the letter is H or J, use AC R46TSX, if it's L, use AC R45TS, and if R, AC R46SZ.

# Muzzling a roving Ranger

The slow rate at which the engine speed of my 1984 Ford Ranger with the 2.8-liter V6 returns to idle is a hazard on icy roads. The engine is awfully slow throttling down when I pull my foot off the accelerator. The dealer says that's the way it's supposed to be. Please tell me that he's wrong.—Bill Wilson, Centennial, WY

Okay—he's wrong. Ford admits that the way in which 2.8-liter engines of 19831/2 and 1984 Rangers and

#### DO YOU HAVE A CAR PROBLEM?

Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, NY 10019, While letters cannot be answered individually, problems that are of general interest will be discussed in the column. Bronco IIs were originally set up has created the condition you describe. So to get the engine to throttle down more rapidly, Ford has issued a 4-step fast-idle cam (part No. E3TZ-9597-A) to replace the original 2-step cam. Installation instructions for the new cam are given in TSB 84-7-14. The dealer should also check TSB 84-8-25, which describes a new throttle-stop screw (part 382297-S), if a throttle-stop adjustment is necessary.

#### Stuck in fifth

The 5-speed transmission of my 1985 Dodge Omni is extremely hard to downshift from FIFTH to FOURTH. I almost have to pull the gearbox through the floor. There's no grinding and the clutch disengages the transmission fully. The car has been driven only 425 miles, and the dealer says with more mileage everything will loosen up. Can I believe him?—Tom Johnson, Ringgold, LA

Regardless of car mileage, transmissions either shift properly or they don't. The reason they don't shift properly is mechanical.

Ask your dealer to readjust the shift linkage. If it doesn't help, he should open up the shift control tower to remedy a defect, such as a burr on the shift rail. If this is not causing the condition, then the trouble is with the synchronizer.

Call 1-800-533-5545 today and . . .

These Brand Name Parts, 🖓 💥 & Equipment!

# **HEAVY DUTY LOG SPLITTER**

16 TON!

SALE!



24" Stroke! 32,000 Pounds of Splitting Force!

8 Ton Electric, (110 Volt), #1110.......\$459.00 12 Ton (High Speed Wheels), #1125....\$689.00 15 Ton (Vertical Splitter), #1160......\$1099.00 NEW! 16 Ton Splitter (Pictured), #1134.\$789.00 24 Ton (Blockbuster), #1142.....\$1329.00

(Some assembly may be required)



STANDARD KIT, Is 100% cast iron and will convert any 55 or 30 gallon barrel drum into an efficient and economical wood burning heater. A SUPER VALUE!

# 15056, Wt. 32 lbs., List \$49.95.. \$19.99 DOUBLE BARREL KIT, when used with above kit will convert it into a double barrel stove. The secondary gases are trapped and create greater efficiency as they travel through the top barrel.

#15057, Wt. 19 lbs, List \$39.95.. \$12.99



# GAS

\$789.00



5 HP Tecumseh, 1. Shaft #6051	\$139.95
5 HP Briggs, 3 Shaft #6052	\$141.95
5 HP Briggs I/C. 14 Shaft #6054	\$183.95
6 HP Tecumseh, 4" shaft, #6061	\$159.95
8 HP Briggs, 1 Shaft #6080	\$222.95
10 HP Tecumseh, 1"Shaft #6010	\$232.95
10 HPTec., (Elec Start), 1 Shaft, #60101	\$289.95
16 HPTecumseh, 1's shall #6016	\$462.95

3-20 HP Horizontal & Vertical gas engines available at Super Low Discount Prices!!!

# GENERATORS

4000 Watt, 8 HP Briggs 33 amps #16402 .\$425.00 4000 Watt | Electric Start), List S.

5000 Watt. 11 HP Brexis 47 ampr ts 21 amps = 240 v Li #16404 140 Bes \$639.00 5000 Watt (Electric Start), List S \$739.00 #16405

(Shipped truck freight collect)



heat cutput to 30. Adjustable Ship Wt 6 lbs. Lot \$87.95

tem= 1726.....\$39.95 MR. DOUBLE HEAT-IR

Two burners, 6,000 to 24,000 Btu Adjustable Ship Wt 14 hs List \$167.00

ttem# 1727 \$89.95

- PARTS

(tanks not included)



# LOG SPLITTER

# \$99.95 \$129.00 11 GPM 2 Stage Pump, #1012 ...... 13 GPM 2 Stage Pump, #1053

16 GPM 2 Stage Pump, #1056 ...... \$157.00

Standard 4-Way Control Valve, #2010.\$46.50 Auto-Detent Valve, #2020..... 4x24x2"Cylinder Welded Type: Item #902424 (Can ship UPS)......ONLY.....\$109.95 5x24x2"Cylinder (Tie Rod Type), Item# 9095 ON SALE NOW. \$222.00

Many Other In Stock at Low Discount Prices!

#### TARPS

Super strong approx 12 m waterproof polyethylene grommets every 3 feet. Won't not rust or militiew?

Item #	SIZE	Ship wt.	SALE
1770	6 × 8	3 lbs.	\$2.69
1771	B'x 10	4 lbs	\$4 95
1772	10'x 12'	4 lbs	\$5.95
1773	12'x 16'	B lbs.	\$9.95
1774	12'x 20'	11 lbs.	\$12.95
1775	16' * 20"	12 lbs	\$19.95

# COMPRESSORS

SANBORN\*

5 Hp. Single Stage

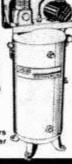
A great vertical 60 galon two cyl-inder single stage 12.7 Cfm ⊕ 40 Psi, 10.6 Cfm @ 90 Psi List \$1160

tem = 159545. \$497.00 5 HP, 60 GALLON

IMC 2 Stage, 17.3 Cfm #15975, \$1202 List.... \$879.00 (Full One Year Warranty!)

(Shipped truck freight collect)

We carry many other compressors and a full line of air tools at Super Low Discount Prices! Act Today!



801 East Cliff Road, Box 1219, Burnsville, MN 55337 Call our order dept. at 1-800-533-5545 In MN 612-894-8310

SALE EXPIRES JAN. 31, 1986

PHONE ORDERS:

M-Th: 8-7:30. Fri: 8-6:00 Saturdays: 8:00am-5:00pm

# (IO ORDER TOLL FREE 1-800-533-5545

Shipping & Handling not included unless stated otherwise.

Send for free catalog or send \$6.00 and receive catalog SiMail To I and splitter design booklet. Northern Name Address.



Hydraulics 801 E Cliff Rd Box 1219 Burnsville, MN 55337 # 9016

Please rush me my FREE

----------

Discount Catalog!

City State

VISA

Zip.

# Minicourse



BY ROSARIO CAPOTOSTO

# Barks approach to boring screw entry holes implies three steers:

Basic approach to boring screw entry holes involves three steps: pliot hole (left), shank clearance hole with masking tape depth gauge (middle) and countersink hole for screwhead.

# **Boring holes for screws**

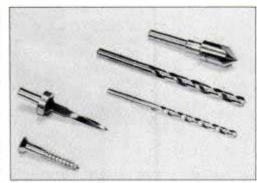
Screws are superior to nails for joining a wide variety of wood components, especially when extra holding power is required. They do, however, need clearance holes to make driving the screws possible, and to prevent the wood from splitting.

For the most common wood screws—the flathead type—three holes are required. The first is for the threaded portion of the screw. It's called the pilot hole and should equal the diameter of the screw body minus the threads. The second is called a clearance hole; it should match the diameter of the screw shank—the unthreaded section of the screw body.

The third hole is bevelled for the screwhead. It must be either countersunk flush with the wood surface or counterbored so the head can be driven below the surface and covered with wood filler or a wood plug.

This series of holes can be bored easily and accurately using three different drill bits. First you bore the pilot hole, then the shank clearance hole and finally the countersink hole if the head will be flush. However, if the screwhead requires a counterbore, this hole should be bored first for an accurate cut that will finish cleanly later.

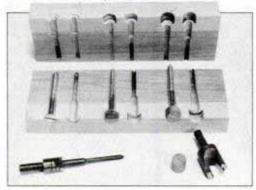
The steps mentioned above can also be performed in a single operation using various specialized bits shown in the photos here.



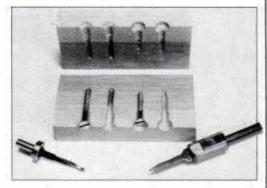
Countersink bit (left) matches size and shape of fh screw. It replaces three bits (right) because it bores all holes in one step.



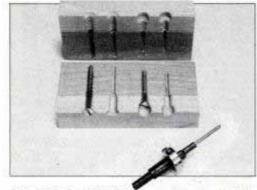
Adjustable length bit (left) has pilot, shank and countersink bits in one tool. Thin pilot bit does tend to break easily (right).



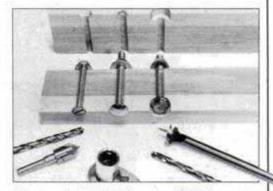
Screws can be installed three ways: flush (left), 1/8-in. counterbore for wood filler (middle), ¼-in. counterbore for wood plug.



Fixed collar on countersink (left) prevents bit from counterboring. But adjustable countersink (right) can sink and counterbore.



Adjustable length bit, however, is very versatile because it can sink and counterbore for same size screws of different lengths.



Other methods: Machine screw (left) is countersunk, carriage bolt (middle) has clearance hole only, bolt needs wide counterbore for washer.



In just a short time, you can be ready to join one of the fastest growing industries in America... an industry where qualified men are making from \$25.00 to \$30.00 per hour... and that's just for labor. Parts, engines and accessories add even more to the profits.



Because the small engine industry has grown so quickly, an acute shortage of qualified Small Engine Professionals exists throughout the country. In fact, it's not unusual for a good small engine man to be three to four weeks behind in the summer and at least a week behind in the winter. When you see how many small engines are in use today, it's easy to understand why qualified men command such high prices as much as \$49.95 for a simple tune-up that takes less than an hour!

# 65-million small engines are in service today!

That's right - there are over sixty-five million 2-cycle and 4-cycle small engines in service across the U.S.A. That's the official count from the Engine Service Assn., and new engines are being built at a rate of one-million per month! With accredited and approved Foley-Belsaw training, you can soon have the skill and knowledge to make top money servicing these engines. Homeowners and businessmen will seek you out and pay you well to service and repair their lawnmowers, tillers, edgers, power rakes, garden tractors, chain saws, mini-bikes, go-carts, snowmobiles, generators, snowblowers, paint sprayers . . . the list is almost endless.



No experience necessary.

You don't need to be a 'born mechanic' or have prior experience. If you can read, you can master this profitable trade right at home, in your sparetime, without missing a single paycheck. Lessons are fully illustrated - so clear you can't go wrong.

# **BEAT INFLATION!** Cash in on the

huge demand for small engine repair.

Work part time, full time right at home- we help you every step of the way.

# You receive trade secrets and business plans.

We guide you every step of the way, including tested and proven instructions on how to get business, what to charge, how to get free advertising, where to get supplies wholesale...all the "tricks of the trade"... all the inside facts you need to assure success right from the start.

#### Increased Income

"I've had about 8 years experience repairing small engines . . . but repairs were only minor . . . until I started the Foley-Belsaw Course!



Walter H. Strick Campbell, California

With our famous 'learn-by-doing' training method, you get practical 'hands-on' experience with specialized tools and equipment that you'll receive with your training plus a brand-new 4 HP engine all yours to keep!

# SEND FOR FREE FACTS!

You risk nothing by accepting this offer to find out how Foley-Belsaw training can give you the skills you need to increase your income in a high-profit, recession-proof business of your own.

Just fill in and mail coupon below (or send postcard) to receive full information and details by return mail. DO IT TODAY!

# FOLEY-BELSAW INSTITUTE of SMALL ENGINE REPAIR

50816 Field Bldg., Kansas City, MO. 64111

# NO SALFSMAN WIII Call



Send TODAY

for this

fact-filled

Tells how you quickly train to be your own boss in a profitable Sparetime or Fulltime business of your own PLUS complete details on our 30-Day NO RISK Trial Offer!

FOLEY-BELSAW INSTITUTE 50816 FIELD BUILDING KANSAS CITY, MISSOURI 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. Address



You get all this Professional equipment with your course, PLUS 4 H.P. Engine . . . ALL YOURS TO

KEEP.... All at NO EXTRA COST.

# **Cycles**



BY NORMAN MAYERSOHN

# Lady Liberty's ride



You've got to give the Harley-Davidson folks a pat on the back. First, the management rescues the company from the brink of extinction, then they reintroduce a much loved model at a genuinely competitive price. That 883-cc Sportster carries a \$3995 bottom line, and is especially attractive because it uses a downsized version of the thoroughly modern Evolution V-twin engine.

The latest news from Milwaukee is the release of an 1100-cc Liberty Edition Sportster, (XLH above) tarted up with metallie black paint, pinstriping and Liberty fender graphics. The Liberty Edition series, which will also include Low Rider and Electra Glide models, are H-D's salute to riders of all-American motorcycles. For each one sold, the company will donate \$100 toward the restoration

of the Statue of Liberty.

Beyond the patriotic reasons, there are some other items that make the XLH 1100 worth a close look. For starters, the 67-cu.-in. version Evolution engine offers a 25-percent power boost over the 54-cube (883-cc) en-The all-aluminum powerplant has a black paint treatment with highlighted edges, and pumps out 63 ft.lb. of torque. Service intervals have been stretched to 5000 miles for the new model, too. Most other engine details are adapted directly from the 1340-cc version of the Evolution engine, a unit we found ever so agreeable in the recently tested Low Glide (see Brute Bikes, page 106, Dec. '85).

The Sportster model originally appeared in 1957 as the first American Musclebike. Now, nearly 30 years later, the 1100-cc model goes a long way to re-establish Harley-Davidson's position of an image leader and producer of machines with a thoroughbred tradition. For \$5199, the big-inch Sportster makes more sense than anything we've seen in a long time from the venerable American bike builder.

# Waste no motion

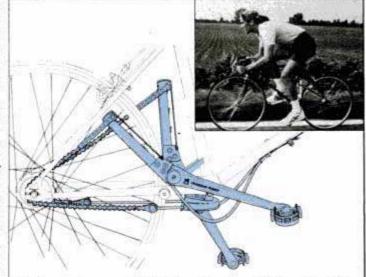
Cyclists of the humanpowered variety know that most of the work in pedaling occurs in the part of pedal rotation between the top of the pedal stroke and the point where the leg reaches full extension. Trouble is, the currently popular arrangement of chains and circular sprockets forces the rider to waste nearly 4% of his leg movement and a lot of energy.

A new approach comes from the Alenax company— a lever-action propulsion system. The only movement is up and down over a 100° arc, each downward stroke pulling the chain around a sprocket on the rear wheel. The chain also pulls the opposite pedal back up into the ready position.

The mechanical parts are different than a conventional bicycle, though not necessarily more complex. The chain itself is moved by transmission bars (called Transbars here) attached to the back end of the pedal levers. Gear ratio changes are accomplished by moving the drive chains up or down the Transbar, done with a single positive shift control. Finally, a seesaw idler changes the direction of the chain to allow up-and-down pedalling.

On the road, the Transbar bike's rider uses leg movements that are similar to walking and jogging. The long pedal lever dimension, along with the rider's option to vary stroke length, gives a drive ratio range that Alenax claims could only be duplicated by a 29-speed transmission in a conventional bicycle. Since the technology used is straightforward, anyone capable of maintaining a conventional 10-speed can do all his own upkeep on the Transbar bikes.

Alenax (50 Spencerport Rd., Rochester, NY 14606) will be marketing a variety of models, led off by the TRB 1000 at \$490 (see inset photo). There's also a Mountain Bike model, TRB 5000 at \$499, constructed of chromemoly butted tubing and carrying all the latest thinking in frame geometry. The Transbar System is certainly not the first, or last, new wrinkle in bicycle drives, but it's nice to know that the world's inventors are still at work improving a vehicle that's remained unchanged for so long.



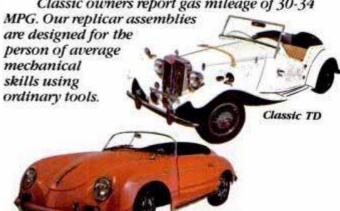
Transbar system propels the bike with a short 100° pedal stroke. Transmission bars, attached to pedal levers, pull the chain over twin sprockets mounted to freewheeling rear wheel hub.



# Assemble it yourself and drive a great bargain.

Classic Motor Carriages, the world's largest replicar assembly manufacturer, presents its classic line for the 80's. Millions of dollars have been spent in engineering research to enable Classic Motor Carriages to produce the finest replicar assemblies available. Gelcoat finish... no rusting ever! All replicar assemblies are fully warranteed by a company that cares.

Classic owners report gas mileage of 30-34

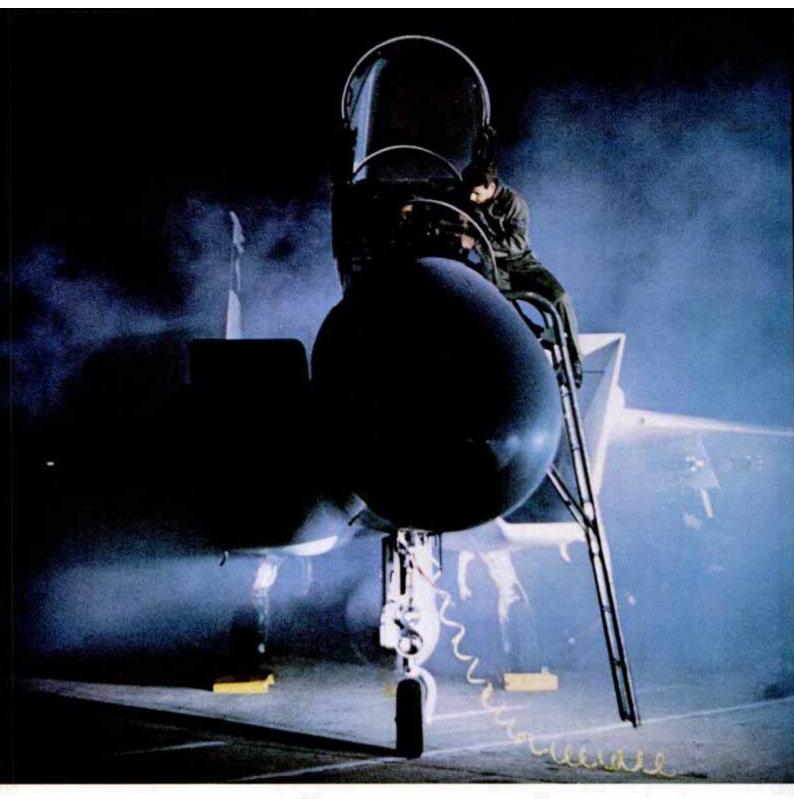


Speedster

Fill out the coupon below and begin the most rewarding experience of your life.

Miami.	W. 27tb Ace., P.O. Florida 33054. ( i. 9AM-9PM Sat.	305) 625-9700	
and co	ed is \$1 ea.fo insumer buyi bly: Gazelle _ TD	ng guide fo — Classic	r Replicar Speedster
Enclos	ed is \$5 ea. fo	r a full colo	or brochure on
tbe bai Gazell	ndcrafted, fa	ctory-finisb	ed:
tbe bai Gazell Name _	ndcrafted, fa e	ctory-finisb	ed:
tbe bai Gazell Name _ Addres	ndcrafted, fa e	ctory-finisb	70.324
tbe bai Gazell Name _ Addres	ndcrafted, fa e	_ State	ed: Zip
tbe bar Gazell Name _ Addres City Pbone	Home (see Code	_ State de)	Zip
the bar Gazell Name _ Addres City Pbone	Home (Area Code Bus. (Area Code Charge On my)	_ State <sub>de</sub> ) ) MasterCo	Zip
tbe bar Gazell Name _ Addres City Pbone	Home (Area Code Bus. (Area Code charge On my.	_ State do ) ) Master Ca ess	Zip

Look for our displays at airports in Amarillo, Baltimore|Wasbington International, Boston, Chicago, Cincinnati, Cleveland, Dallas|Love, Detroit, Grand Rapids, Gulf Port|Biloxt, Jacksonville, Kennedy, LaGuardia, Memphis, Miami, Minneapolis|St. Paul, Monterey, New Orleans, Palm Springs, Phoenix, Portland, Reno, San Jose, St. Louis, Tulsa. © 1984 Classic Motor Carriages, Inc. Some equipment depicted is optional.



# We'll pay you to take the most exciting classes anywhere.

You'll learn electronics, avionics, aircraft maintenance, health care sciences, management or logistics—the Air Force will train you in one of more than 200 technical specialties America needs today.

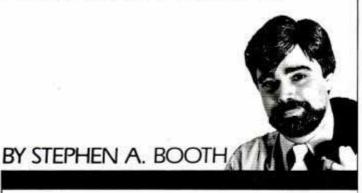
You'll get hands-on experience with the latest equipment, and we'll pay 75% of your tuition for off-duty college courses, to get you even further.

Whatever your goals, the Air Force will equip you with the skills to get where you want to be.

If you're looking seriously into your future, Aim High to a future in the Air Force. Visit your Air Force recruiter today or call toll-free 1-800-423-USAF

(in California 1-800-232-USAF).

# Electronics



# Shedding new light

The lightbulb isn't something many of us burn the midnight oil to think about, and little wonder. The basic design of the pedestrian incandescent hasn't changed much since Thomas Alva Edison invented it by gaslight in 1879. Stated simply, electrical current makes a filament glow white-hot. Thus

converted to heat, some of this electric energy is released as a visible light pleasing to the eye and flattering to skin tones.

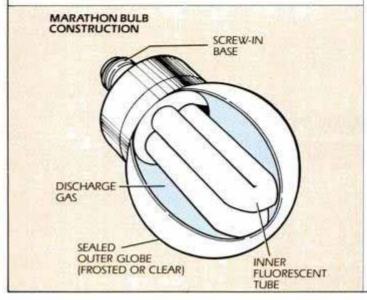
Compared to fluorescent lighting, incandescence is definitely inefficient. Much of the energy consumed is wasted as heat, which in turn wastes more energy because that other net-loss appliance-the air conditioner-has to work harder or longer. The incandescent self-destructs after about 1000 hours.

Despite its spendthrift performance, incandescence re- Above, Marathon Torch. Bulb choice for most households.

mains the illumination of construction diagrammed below.

Edison's brainstorm is small, costs less than a buck, and most of us have yet to take a shine to the color-draining effect of fluorescence on faces, clothing and furnishings.

This may be about to change. There's a new breed of



fluorescent lightbulb that screws into a lamp socket just like an incandescent, emits a similarly pleasing light, yet manages to retain the fluorescent's energy economy. Such bulbs are available from General Electric, Sylvania and North American Philips. The latest entry to the field of efficient illumination is the Marathon bulb from Japan's Mitsubishi.

What makes the new fluorescent so small and warm in tone is the rare-earth phosphors that coat the bulbs. In a conventional fluorescent-tube light, current passing from one end to the other vaporizes mercury to create an arc that emits invisible ultraviolet light. A phosphor coating on the tube turns the ultraviolet light into visible light.

With no filament to heat. the fluorescent uses less energy, runs cooler and lasts longer. Trouble is, the color tone of fluorescent light has never been a favorite at the makeup mirror. Moreover, fluorescent tubes have to be large because the phosphors deteriorate if they're too close to the arc. Rare-earth phosphors hold up better under current. And they convert ultraviolet into a warm tone that's close to that of incandescent bulbs. Mitsubishi, in fact, offers Marathon bulbs in two light temperatures. There's a 2800° Kelvin version that's close to incandescents, and a 5000° Kelvin bulb that simulates sunlight, for accurate reproduction of colors.

The bulbs are available frosted or clear, round or cylindrical, in two wattages. The 13-watt Marathon gives the light of a 50-watt incandescent; the 15-watt is equivalent to 60. Either costs \$18 and is rated to last 9000 hours-9 to 12 times longer than an incandescent, according to Mitsubishi. That might seem expensive but the company claims its Marathon uses 75 percent less energy and also runs cooler, thereby saving air-conditioning costs. To promote the bulb, Mitsubishi's packaging it with a fixture called the Marathon Torch (\$30). It comes in four colors, and may be wall- or ceiling-



WatchCam home security setup mates 4-in. TV and videocamera.

mounted, or used as a tabletop lamp. Also included is a half-price coupon for a replacement bulb.

# Better living through TV

Sony has taken the tuner out of its portable WatchMan TV, replaced the input source with a small videocamera and come up with a home security system called WatchCam.

The tiny, low-light videocamera has a built-in microphone, and comes with a fisheye lens and mounting rack for installation in standard door peepholes. The camera also may be wall-mounted for use, say, in a child's bedroom. A 67-foot coaxial cable comes with the \$500 package. Accessory cables extend that range up to 200 feet.

# Electronic phonebook

The little black book or whatever else you record phone numbers in might become obsolete if Mura's AP2002 telephone catches on.

Besides being a 2-line speakerphone, the AP2002 (\$140) stores up to 200 numbers in its memory. To dial, you simply spell the name of the party you're calling on the unit's alphanumeric key-board. Those numbers can be changed at will. In addition. the AP2002 provides three direct-access keys for onetouch dialing of emergency numbers.

Other features of the AP2002 include switchable TouchTone or rotary dialing, and a liquid-crystal dis-

# Hot ones for the cold.

# Tough Ford Bronco and Bronco II.

Bronco already leads its class in power. Now there's a powerful new V-6 in trim-size Bronco II. Plus new "Touch-Drive" option to shift to 4WD high at any speed. And Eddie Bauer luxury is offered in both!

Try a gripping experience this winter—in a big Bronco with optional seating for up to six—or a trim Bronco II that seats four. Both give you the 4-wheel toughness and security you want—to

power your way through snow or plow it aside.

# New 2.9L V-6 power!

Bronco II's big, new 2.9L engine churns out power that nothing in its class can match—140 surging horsepower.\* It's standard, at no extra cost.

## New "Touch-Drive."

Bronco II shifts electrically from 2WD to 4WD high at the touch of a button with Ford's new "Touch-Drive" option. That's at any speed, without stopping or getting out.

# Big Bronco power.

America's best seller in its class,\*\* Bronco comes with a high-torque 4.9L Six, standard. Or get a

5.0L V-8 with electronic fuel injection. There's a 5.8L V-8 with 4-barrel carb, too. It turns out a massive 210 horsepower.

considerably more than Blazer's biggest engine!\*

# Tough 4x4 suspensions.

Both Broncos offer independent front suspension, to absorb those off-road jars and jolts. And to keep wheels glued to the ground for solid traction.

Both give you a proven 4-wheel-drive system and manual locking hubs standard. (Automatic locking hubs are optional on big Bronco.)

And both offer the special look and luxury of Eddie Bauer editions!

#### Eddie Bauer Broncos.

Eddie Bauer models feature unique two-tone paint and trim. Highstyled interiors with dual Captain's Chairs, tilt wheel, cruise control and more. Plus Eddie Bauer tote and garment bags.

And Ford's Extended Maintenance and Limited Warranty coverage. Ask to see this warranty when you visit your dealer.

# Best-Built American Trucks.

At Ford, Quality is Job 1. A 1985 survey established that Ford makes the best-built American trucks. This is based on an average of problems reported by owners in the prior six months on 1981-1984 models designed and built in the U.S.

### Lifetime Service Guarantee.

Participating Ford
Dealers stand behind
their work, in writing,
with a <u>free</u> Lifetime
Service Guarantee for
as long as you own
your Ford car or light
truck. Ask to see this
guarantee when you
visit your participating
Ford Dealer.

### Buckle up together we can save lives.

- \*Horsepower based on SAE Standard J1349.
- \*\*Based on 1985 Model Year manufacturers' reported retail deliveries through July, 1985.







# Computers



BY RON SCIBILIA

# **Executive notepads**

or traveling companion. The ZP-150 offers a

16-line by 80-column

er into its 7.7 pounds by storing data in nonvolatile RAM (Random Access Memory) instead of a floppy disk drive. This practice, pioneered by Tandy, NEC and Hewlett-Packard, results in a lighter unit that, with no sensitive disk drive to get banged about, makes for a superi-

liquid-crystal display and comes standard with 32 kilobytes of RAM, enough for about 16 double-spaced typed pages. That memory is expandable to a whopping 416,000 bytes. The portable computer incorporates a 300-baud modem for telephone data communications. Also standard is a parallel printer port, RS-232C serial port (for printer or external high-speed modem), an audio cassette recorder port and a telephone jack for the built-in modem. Ten AA alkaline batteries power the ZP-150 for up to 10 hours; the unit also comes with an AC power converter.

What's most interesting





Sharp PC-2500: Color notepad.

about this new lap-top is its built-in applications programs "firmware," Microsoft Corp's WORKS.

It's installed in a hefty 224 kilobytes of instantly available ROM (Read-Only Memory) that executes directly from ROM without taking up precious RAM space to load programs. The WORKS package consists of six applications, including somewhat scaled-down versions of Microsoft's WordStar word processor, Multiplan spreadsheet and GW-BASIC, WORKS also includes a calendar/alarm

Heath Z-150: Programs in ROM save RAM for data storage.

program, database management filer and a telecommunications program. A Systems Manager overseer program lets you access programs, manage files and exchange information from one program to another.

Heath is offering the ZP-150-in fully assembled form only-at an introductory price of \$1195, after which the price jumps to \$1995.

NEC Home Electronics, meanwhile, is upgrading its PC-8401A Starlet portable by enhancing what's considered the Achilles' heel of virtually all lap-tops: the display. The new version, dubbed the PC-8401A-LS "Portable Office," keeps screen resolution unchanged at 480 by 128 dots and retains a 16-line by 80column text display, but uses a larger 91/2 by 3-inch LCD screen. The result, NEC says, is substantially larger characters and, the supplier also hopes, better readability. Weight on the larger-screen unit remains unchanged at under 6 pounds, as does the \$999 price tag. Battery life also stays the same, according to the supplier: eight hours of

continuous use with four alkali C cells.

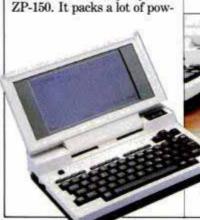
Tandy Corp. has a new wrinkle for fans of its TRS-80 Model 100 and Model 200 that helps answer the question: What do I do when I fill up the RAM with data files?

Newly available is a battery-powered disk drive that weighs only  $1\frac{3}{4}$  pounds and measures 2 by  $4\frac{5}{16}$  by  $6\frac{1}{8}$ inches. The unit runs on four AA batteries or AC. Operating software comes on a diskette supplied with the drive. To initialize the drive, the user types in a 3-line BASIC program. Displayed on the computer's menu are com-



mands for formatting disks, saving, loading and other disk functions. The drive transfers data to and from memory at 19,200 baud-fast enough to handle a typical 2000-word text file in about six seconds. Price is \$199.95.

Sharp Electronics also has unveiled a new under 3-pound computer, the PC-2500. It features a built-in 4-color plotter/printer. The \$395 computer measures 1111/16 inches wide, 125/32 inches high and 8% inches deep, and manages to offer a full-size typewriter keyboard with eight special function keys, a 4-line by 24-column liquid-crystal display with 150 by 32-dot graphics, a serial input/output port, and built-in software for spreadsheet building and graphic plotting. Standard memory for the Sharp portable is 5K-RAM, but optional credit card-size 8K or 16K RAM cards are available. The PC-2500 can run for up to 100 hours on its rechargeable Ni-Cad batteries.



NEC's Starlet: more eye-appeal,

The lap-top portable has yet

to explode the way industry

pundits were predicting, but

the computer manufacturers

haven't lost the faith. Sever-

al are working hard to make

portable personal computers

(PCs) more useful, as illus-

trated by some very recent

Systems subsidiary, has an-

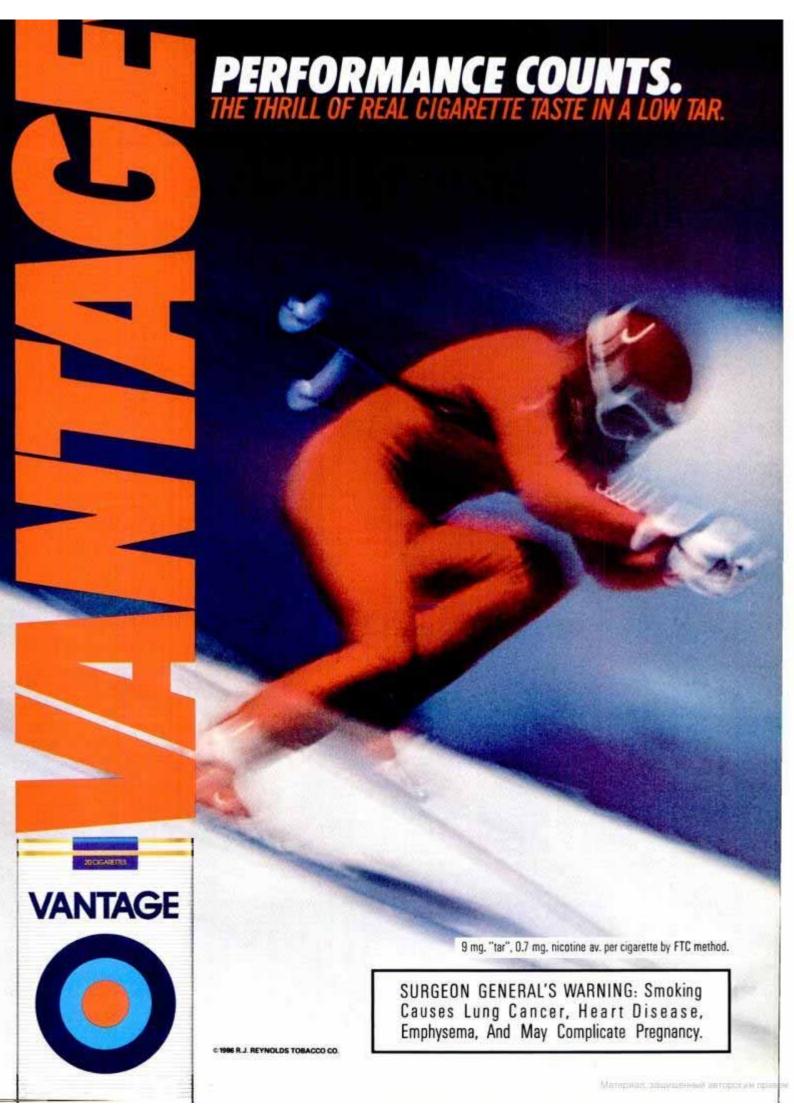
nounced a new lap-top, the

Heath Co., a Zenith Data

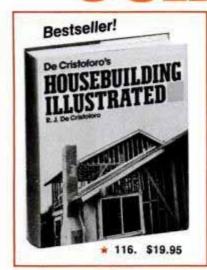
developments.

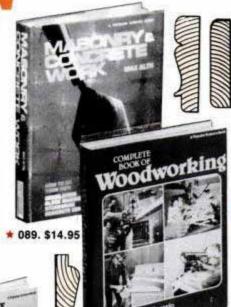
no gain in weight or price.

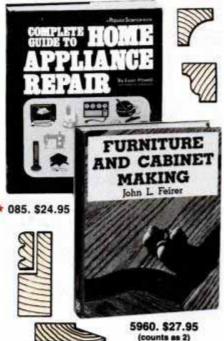
Tandy's portable disk drive (above) adds memory to TRS lap-top computers.



# JOIN the #1 Club for Today's











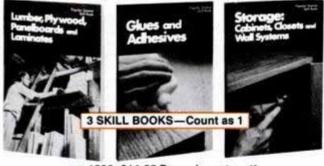
POPULAR SCIENCE BOOK CLUB—the #1 book club for today's do-it-yourselfer—invites you to take your pick of the best new, hard-to-find handyman books published today. Take any 3 for just \$3.95! Values up to \$95.85! Nearly 50 books to choose from! As a Club member, you get first choice of today's best new, hard-to-find handyman books: **Quality Books** from the top how-to publishers... **Authoritative books** by master builders,

105. \$17.95

ings...everything you need to do it yourself and do it right! You always choose from cream-of-the-crop homeowner-You always choose from cream-of-the-crop homeowner-handyman books on every important do-it-yourself subject: Home Repair & Improvement, Woodworking, Furniture Build-ing, House Building, Wiring, Plumbing, Masonry, Cars & Car Re-pair, Energy Savers, Home Remodeling...and much more. Club members may also select original custom-written "Popular Sci-ence Books" (see titles with \*). Each written on an important do-it-yourself subject...each published specifically for PSBC and offered nowhere else at Club discount!

woodworkers, home craftsmen, construction experts... Clear show-how books illustrated with step-by-step photos, draw-

NO-RISK GUARANTEE: If not completely satisfied with your three joining selections, after 10 days' free trial examination at home, simply return the books at our expense and your membership will be cancelled. Whatever you decide, the Shop Guide is yours to keep FREE!



\* 1208. \$14.85 Paper (count as 1)

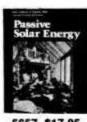
















5981. \$17.95

5829. \$19.95

**\* 160. \$22.50** 

**\* 097. \$13.95** 

233. \$16.95

5657. \$17.95

5943. \$19.95

BUILDING BETTER

5830. \$28.95



**\* 176. \$24.95** 



5862. \$24.95



5738. \$13.95



210. \$15.95



5838. \$25.95



5982. \$19.95 5569. \$17.95

5863. \$26.95 (counts as 2)

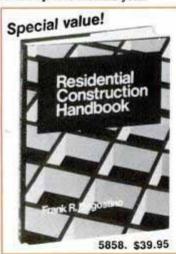
Do-It-Yourselfers!

with NO-RISK Free Trial Membership in POPULAR SCIENCE BOOK CLUB

You simply agree to buy just two more regular selections or alternates at regular Club prices within a year.







#### **HOW YOUR CLUB WORKS**

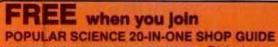
First, you choose any three do-it-yourself books shown here for just \$3.95 plus delivery and handling. Send no money now. Your books will be sent right away along with your **FREE SHOP GUIDE**.

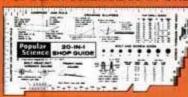
Then, about every four weeks (14 times a year), you'll receive a Club Member's bulletin describing the coming new Main Selection and Alternate Books also available. (In addition, up to 4 times a year, you may receive selected mailings on seasonal and annual products of special interest to the membership—many at giant bargains!) If you want the Main Selection only, do nothing. It will be sent automatically. If you don't want the Main Selection, or want an Alternate Book, or no books, simply indicate your wishes on the handy form that comes with the bulletin and return it by the date shown.

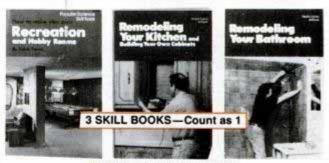
You will always have at least 10 days in which to do this. But in the unlikely event that you don't have 10 days, and you receive an unwanted selection, you may return it at our expense. Your only obliga-tion is to buy just two more selections or alternates at regular Club prices within a year. After that, your membership may be cancelled by either you or the Club.

Discounts! Club books are comparable in every way to the original publishers' editions, yet you may save up to 50% and sometimes more on many special bargains offered each year in the Club. To become eligible for these bargains, mail the postage-free card today!







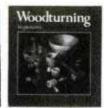


\* 1745. \$14.85 (count as 1)





5607. \$19.95



5852. \$17.95



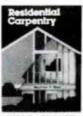
5853. \$15.95



**\* 119. \$10.95** 







**\* 113. \$15.95** 5522. \$28.95 (counts as 2)





HOMESTEADER'S











5872. \$21.95

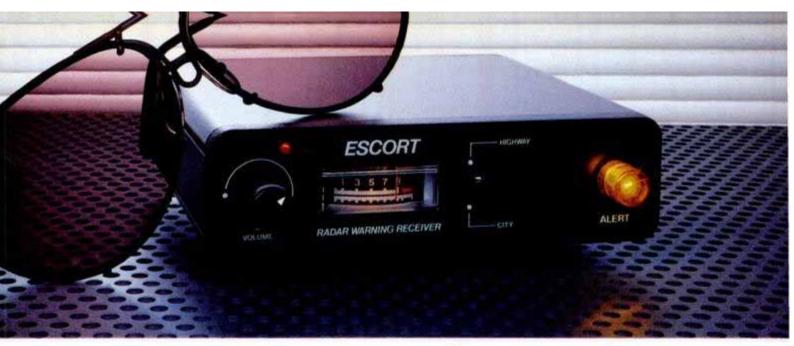
5986. \$22.95

5910, \$19.95

5881. \$16.95

\* 042. \$17.95 5857. \$21.95

5831.\$19.95



# It's Unanimous

# (Even the competition says ESCORT's the one to beat)

It's easy to see who sets the pace in radar warning. Just read all the detector ads. Most of them claim to be as good as ESCORT. A few say they're better.

At least they agree on one thing. ESCORT is the one they have to measure up to.

#### A modern classic

ESCORT was a radical piece of electronic engineering in 1978 when it was introduced, the first practical use of superheterodyne technology to warn of police radar. Car and Driver magazine said, "...the radar detector concept has finally lived up to its promise."

Since then, our engineers have never stopped refining that technology. ESCORT may look the same on the outside, but it never stops getting better on the inside.

#### Standard of comparison

Now, when experts refer to the high-water mark in radar protection, they automatically turn to ESCORT. In March of this year, Car and Driver published its latest detector test, this one comparing remote-mounted models. ESCORT is designed for dashtop or visor mounting. But the magazine included ESCORT in the test anyway, as the reference against which the performance of the others would be measured. ESCORT scored 412 points in the final rating, compared to 274 for the highest-finishing remote. You might say the comparison showed that there is no comparison.

#### A gilt-edged reputation

Seven years is a long time in the radar warning business, but there is no shortcut to a good reputation. Car and Driver said, "The ESCORT radar detector is clearly the leader in the field in value, customer service, and performance..."



These excerpts were taken entirely from advertisements for other radar detectors.

So it's easy to understand why other detectors would try to stand in our limelight. ESCORT has seven years worth of credibility, the one quality that money can't buy in this business.

#### **Check our references**

Credibility doesn't come from extravagant claims. It comes from satisfying customers. You probably know someone who owns an ESCORT (nearly a million have been sold). So ask about us.

ESCORT pioneered superheterodyne receiving circuitry. Ask if our radar warnings always come in time.

ESCORT's reporting system combines an alert lamp, a variable-rate beeper that distinguishes between X and K band, and an analog meter, all to give an instant indication of radar strength. Ask if our warning takes the panic out of radar.

ESCORT is sold in one place only, the factory that makes it. This lets you deal directly with experts. Any of our staff of over 60 sales people will be glad to answer any questions you may have, about ESCORT or about radar in general.

We've been solving people's radar problems since 1978. How can we help you?

#### Try ESCORT at no risk

Take the first 30 days with ESCORT as a test. If you're not completely satisfied return it for a full refund. You can't lose.

ESCORT is also backed with a one year warranty on both parts and labor.

ESCORT \$245 (OH res. add \$13.48 tax) TOLL FREE . . . . 800-543-1608



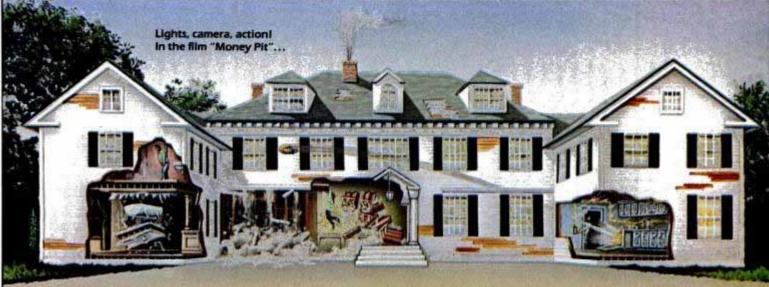


By mail send to address below. Credit cards, money orders, bank checks, certified checks, wire transfers processed immediately. Personal or company checks require 18 days.



Cincinnati Microwave Department 100-068-A13 One Microwave Plaza Cincinnati, Ohio 45296-0100

# TECHNOLOGY 1/86



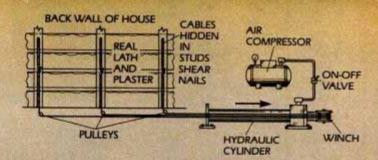
tub crashes through floor...

back wall of house falls out...

grand staircase collapses...

and kitchen wiring short circuits rocketing turkey out of the oven.

# How Spielberg makes a house fall apart



The special effects around your house are probably pretty run-of-the-mill: You watch as the paint lifts off, forming a blister that explodes and leaves peels hanging under your eaves. Things like that. But the special effects in Stephen Spielberg's movie "The Money Pit," directed by Richard Benjamin and being released now, look like the work



Shelley Long and Tom Hanks are bowled over thinking they got a deal on a house.



Do-it-yourself, hal it's going to take a lot more to keep this handyman's special together.

of a demolition team. Actually, the devastation is a sleight of hand performed by a magician of special effects, Mike Wood, and studio technicians and carpenters who possess the art of building something designed to fall down on cue. When we visited the Kaufman Astoria studios in New York, we watched the construction of a magnificent oak staircase. It looked like it would last for

generations, but in a few days it fell out from under Tom Hanks, almost leaving Shelley Long a widow. Tom and Shelley are the couple in "The Money Pit" who are suckered (by Maureen Stapleton) into buying a house that appears to be a steal. Well, they've been had. You'll recognize some of your own homeowning difficulties—but not, we



It's an easy job moving the tub downstairs from upstairs bathroom If you're in special effects.



We've got each other, but can't we call the super? The biggest commitment is owning a house.

would hope, a whole wall falling down. The drawing above shows how a little hidden hardware can be armed to shear all the nails in a wall's studs. Timber! Lath and laughs all over the place.

Editor: Dennis Eskow Assistant Editor: Ted Francis Contributors: Bill Hartford, Dick Greenhaus, Richard Schrader, Fran Golden, Paul E. Burd, John Rettie, Erne Johnston, Catherine Carlson, Steve Eskow, Chris Mitchell

# TECHNOLOGY

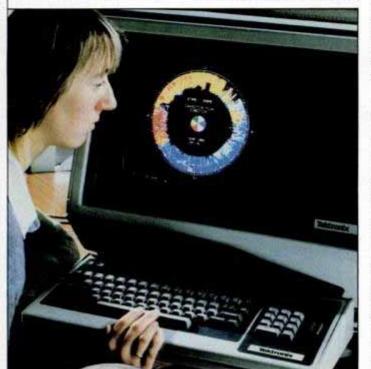
# UPDATE

1/86

WEATHER

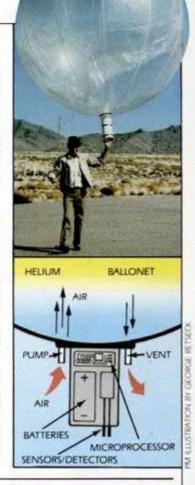
# Study teams track aurora

SABRE (Sweden And Britain Auroral Radar Experiment) is using sophisticated radar technology (below) to analyze the aurora borealis (northern lights). Comprised of two radar stations in northern Scotland and Sweden, SABRE teams are tracking lights created by charged solar particles striking atmospheric gas molecules. SABRE is tracking the aurora to improve highaltitude radio communication.



# Balloon traces acid rain

The Adjustable Buoyancy Balloon Tracer (above right) has the unique ability to follow both horizontal and vertical air motion. The 9-foot balloon envelope contains a helium-filled ballonet (drawing). A microprocessor-controlled pump and valve siphon air to lighten the balloon or make it more dense. The valve system is connected to sensors that follow vertical air and test for acid rain. It will aid in understanding the effects of acid rain.



Weather detection system nears final stages of development

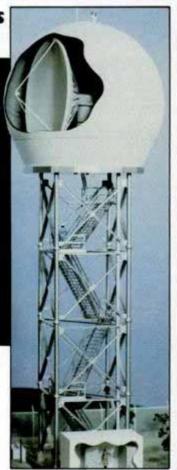


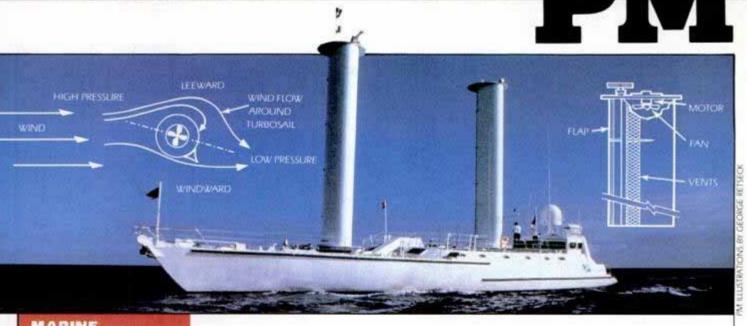


NEXRAD (Next Generation Weather Radar) will consist of a nationwide network of 160 S-band Doppler radar systems, which will warn airports, aircraft and civilians of hazardous weather. Competitive designs have been submitted by

SPERRY

Raytheon (right) and Sperry (left). The Sperry system converts data into computer graphics (above). Colors indicate extreme conditions. NEXRAD, by providing an 18-minute warning, should reduce the number of lives lost.





MARINE

# Yes, those really are sails

Foundation Cousteau has completed the Alcvone (above) with its cylindrical Turbosail propulsion system. The units are hollow, with suction vents on both sides. A fan on top of the cylinder draws air through the open leeward side to create a lift-pull effect. Windward vents are covered. Turbosail flaps are orientated by a shipboard computer.



# 'Phoenix' fireboat seeks to prevent creation of ashes

The world's first catamaran fireboat, the London Phoenix has assumed duty on the Thames River with the London Fire Brigade. Phoenix's twin hull draws only 51/2 feet of water despite a 51-ton displacement. The craft's wide

beam provides a level table for its hydraulic platform and its six water cannons, which deliver 4500 gallons per minute. Twin 317-hp diesels propel the Phoenix to 111/2 knots. It will be used to negotiate shallow tidal water.





date, page 80, Dec. '85), there were many technological winners. Following closely on Silver Arrow's heels was the Biel (below), fielded by a Swiss technical college, with 428 photovoltaic cells. First in

one winner (Mercedes' Silver Arrow, see Technology Up-

the hybrid category was the muscle-aided Globi (above), a pedal-solar craft weighing in at a lithe 186 pounds. It attained a speed of 21 mph. The technologies will find practical uses later.



AGRICULTURE

# Sun shines on winners

Although Europe's 5-day, 228-mile Tour del Sol rally for solar-powered vehicles had

# Less work for farmers

The Lightspray 1048 is lighter, faster and more fuel-efficient than a tractor of comparable proportions. Despite its large 230-gallon tank, the Britishbuilt vehicle exerts low, even pressure and can spray at

speeds up to 15 mph. Special suspension joints keep the 40foot stainless-steel booms steady. Lightspray is powered by a 1600-cc engine with an 8-speed gearbox and can also be used for applying microgranules and granular fertilizers. Farmers can treat crops and soil very quickly with only a minimum of ground damage to their land.

# TECHNOLOGY

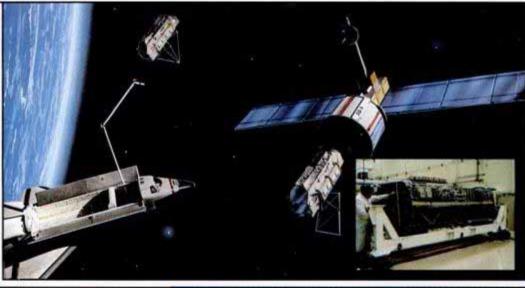
# UPDATE

1/86

### AEROSPACE

# Industry seeks home in space

McDonnell Douglas's Electrophoresis Operations in Space
(EOS) Program will move toward an operating space factory this summer when EOS-1
(photo, lower right) is deployed in the Shuttle's cargo
bay. The manufacturing unit
will have 24 times the capacity
to separate cells, hormones
and other proteins as the present unit. The corporation
hopes to deploy several
10,000-pound units.



# AVIATION

# Aircraft ice detector

Dataproducts of Connecticut is producing an ice detector that tells pilots when their aircraft need deicing. Through an electronic sensor like the one on the Cessna Citation (below, right), ice formations are recognized and a signal is sent to the cockpit. The deicers work automatically or by pilot control. It also warns of icing conditions ahead.



# Th is So up

# Comrade, there's room

The Antonov An-124 (above) is the latest addition to the Soviet cargo fleet. Its hinged, upward-opening nose section permits full vertical and horizontal loading. While the An-

124 is slightly heavier than the C-5, it can land on short runways. It's suited for unimproved runways at remote oil exploration sites, and heavy military airlift operations.

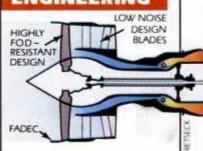
# Airlines begin stretching for passengers

Lightweight composite aircraft components and more powerful, fuel-efficient engines are leading to larger planes carrying more passengers. Airbus Industrie's A320 technology will be used in its proposed TA11 (right). McDonnell Douglas's MD-11x (below) will be 22 feet longer than its DC-10, can seat 60 more passengers, and fly 500 nautical miles farther. Both are expected to use CFM's 56-5 turbofan.





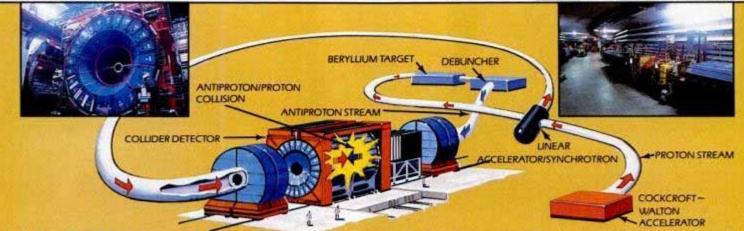
# ENGINEERING



# New engine

CFM International's latest turbofan jet engine is scheduled for use on several airlines. CFM56-5 offers 13 percent less fuel burn, fewer risks through high Foreign Object Damage Resistance, high/low engine control with Full Authority Digital Electronic Control and low-noise blades for FAA rule compliance. Airlines may save \$1.5 million per aircraft in maintenance.





PHYSICS

Prepare for the world of antimatter Fermilab's Tevatron I, the world's most powerful accelerator, will produce protonantiproton collisions emitting 2 trillion electron volts. Particles from a Cockcroft-Walton generator are propelled through a 10-mile linear accelerator (photo right). Antiprotons stored in a debuncher are accelerated toward protons and hit in the collider detector (photo left). Results will yield origin of universe information.

MILITARY

# Air/tank missile

Tanks and low-flying aircraft will face ADATS (Air Defense Antitank System) in 1988. ADATS fire units use autonomous radar to detect aircraft and armored vehicles. A supersonic missile is guided to the target with a CO<sub>2</sub> laser beam. A proximity fuse detonates the warhead and an impact fuse detonates a charge for armored targets.

# A real (fast) moving target

The Navy's BQM-74C target aircraft has been upgraded to meet new performance objectives. BQM-74C, with its new J400-WR-404 Williams Research turbojet, flies higher, faster and turns quicker than its lower powered brother. The boosted BQM-74C also will give a better simulation of incoming airborne threats.





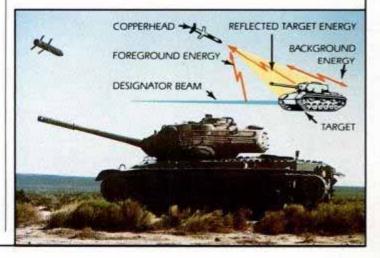
# Suited for gas warfare

In response to the Soviet's use of chemical warfare in areas such as Afghanistan, Boeing has designed a Tactical Life Support System (TLSS) g-suit. TLSS is woven with activated charcoal fibers. Along with an onboard oxygen-generating system, it protects pilots against dangerous chemicals. The garment will be effective at 9gs, 60,000 feet and 122° F. The helmet, visors and goggles protect against known laser and nuclear eve hazards. Plastic around boots seals access to legs where boots and suit meet. TLSS will allow pilots to use present and future aircraft regardless of environment.

# Copperhead bite is deadly

Copperhead is a laser-guided, howitzer-launched projectile that can destroy a stationary or moving target with a single round. A forward observer acquires the target and calls for a strike. After Copperhead is

fired, the observer fixes the target. Seconds before impact, the target is designated and the seeker locks onto reflected energy. Copperhead extends the area covered by battlefield artillery.



# Agripping story.

Once upon a time a group of automotive engineers sat down to design the perfect wagon. What they created was the roomy, handy, and fun-to-drive Honda Civic Wagon. Ah, but then one engineer asked the question all Honda engineers invariably ask: "How can we make it better?" The answer. Build a truly civilized four-wheel-drive version, too.

So the Honda engineers cleverly developed a drive train that magically could be transformed from practical front-wheel drive to versatile four-wheel drive. All with just a push of one button on

the dash. Without even stopping the car.

For getting going when the getting going is really tough, they built a six-speed transmission with a "special low" gear. And there are other standard features. Like All-Season steel-belted radials.

Now, about all that's needed to bring our story to a happy ending is for you to drive off into the rain or snow or sleet in your own Honda Civic 4WD Wagon.

The Civic 4WD Wagon



Popular Mechanics JANUARY 1986

# Lost And Found

The Titanic, lying 2 miles below the surface of the Atlantic, is about to surrender her mysteries.

BY CHRIS DAVIS

White Star Line. RMS Titanic.
This label must be given up when
the article is returned. The property
will be deported in the Purser's safe...
—Passenger receipt from the Titanic

he was the unsinkable flagship. Four city blocks long, she rose 11 stories high and displaced 66,000 tons, a spectacular steel city steaming through the icy North Atlantic at 26 mph.

It was a clear starlit night: Sunday, April 14, 1912. More than half the passengers and crew had gone to bed as midnight approached, but many were still awake. In the first-class smoking room, John Jacob Astor and a half-dozen friends enjoyed a cigan. In the purser's office on the same level, their gold and jewelry were safely tucked away. One passenger had stored an \$11,000 diamond necklace. A Philadelphia banker kept \$50,000 in gold coins and gold bullion in the purser's safes. Half the New York social

PMILLUSTRATION BY JEFF MANGIAT



The Argo/Angus submersible is checked before being put over the stern of the Knorr in the hunt for the Titanic.

register was aboard the *Titanic*. A few hours later, she lay 13,000 feet below the surface. The unsinkable ship had struck an iceberg and sunk. Lives and fortunes were lost—forever, it was once thought.

But last summer, the *Titanic* was rediscovered by a team from the Woods Hole Oceanographic Institute. This summer, funding permitting, the Woods Hole team will return for a closer inspection. A second team, funded by a millionaire adventurer, also will take a close look at the *Titanic*. And the race may have begun for the most exciting

salvage operation in history.

The Woods Hole operation, under the direction of oceanographer Bob Ballard, is more a labor of love than a search for riches and adventure. Last September 1, at one in the morning, Ballard was awakened by excited crewmembers of the research vessel Knorr. They had been dragging the submersible Argo/ Angus, searching for signs of the lost Titanic. Suddenly, a dim blue image appeared on a video screen picking up images from the Argo/Angus's 35-mm cameras, video equipment and sonar. The image now flickering on the screen was taken at a depth of over two miles. It was the unmistakable visage of a boiler. Not just any boiler. They had reference photos made in 1911, and there was no doubt they were watching images of a boiler from the Titanic.

Within days news spread around the world. The *Titanic* had been located. Two years earlier a team from Columbia University had come close to finding the wreck, but ran out of funds before it could complete the job. The mission was now accomplished. As quickly as word spread, comments were heard through-

SONAR SHIP ARGO/ANGUS Artist's rendering shows Titanic with stern split off as it was discovered

Photo taken by Argo/Angus shows Titanic's forward deck booms as they looked last September 1. last summer. A French sonar ship and the research vessel Knorr worked at the surface. The Knorr dragged the Argo/Angus submersible, which produced photos at more than 12,000 ft.

out the undersea exploration community: The *Titanic* is a worthy catch with salvage worth hundreds of millions of dollars. Perhaps more than a billion.

Within a month of the discovery, Ballard had gone to Congress and asked for a declaration that the *Titanic*'s grave is an International Monument, not open to salvage. He also asked the world court to declare it a monument. Such a double-barreled declaration might, he reasoned, bring a small naval flotilla to the area scaring off any adventurers.

As we went to press, no official status had been granted and there were plenty of would be salvagers preparing to make their own moves on the *Titanic*.

According to Columbia University

According to Columbia University marine scientist Michael Rawson, there are only a few vessels in the world capable of taking a man down to the *Titanic*. One of them, the *Alvin*, may be used by the Woods Hole team next summer.

The Alvin carries a crew of three and can submerge to 14,000 ft. putting it right on the decks of the *Titanic*. Alvin is equipped with three viewing ports and a pair of manipulator arms. But it costs over \$10,000 a day to operate, and its batteries hold only enough charge to give the Woods Hole crew two hours of visitation rights.

Ballard could use the two-man Navy submersible Seacliff, with a diving rate of 20,000 ft. But it doesn't have the camera capabilities or maneuvering ability of the Alvin. (The Trieste, a Navy submersible that dove over 35,000 ft. in 1960, is now retired and would cost millions to refit for the Titanic exploration.)

The French have a vessel called Nautille, which holds a crew of five or





The Aluminaut shown submerged and surfaced is being refitted for a visit to the Titanic next summer. A Texas oliman hopes to find booty two miles below.

more and can handle depths around 12,000 ft., which would bring it to the top of the *Titanic*. A Woods Hole spokesman says the ideal scenario would send the *Nautille* down with the *Alvin* to work as a team in doing closeup research. The two vessels, even working together, could not do extensive salvage work. They might be able to pick up a few loose pieces.

The only other sub known capable of reaching the *Titanic* is the *Aluminaut*, a vessel built by Reynolds International in the 1960s. Her active duty has included recovering an H-bomb off the

Spanish coast and exploring for mineral deposits. She also has recovered a small naval vessel. Skipper Art Markel says the *Aluminaut* has never gone deeper than 6500 ft. But insiders say she could be fitted for the journey within a matter of months.

Enter Texas geologist-explorer-oilman Jack Grimm, funder of three missions seeking the *Titanic* since 1980. Thwarted mostly by weather, he did come away from his last visit with a radar image of what he is sure is a blade from one of the *Titanic*'s propellers. He needs no help in finding the *Titanic*. "We're going down in the *Aluminaut* next summer." Grimm yows.

"We're going down in the Aluminaut next summer," Grimm vows.
Grimm already has put up \$1.5 million for the fourth mission. Most of it will go to refurbishing the Aluminaut. Captain Markel says the sub could be recertified by the Coast Guard by next summer.

Markel says the Aluminaut will be shortened from 52 to about 26 ft. and lightened from 80 to about 30 tons. That will make it easier for a salvage ship to tote her around. A floor viewport will be added, and a third mechanical arm may be installed to help fill the interior artifact basket to the brim.

The Aluminaut also is getting a new propulsion system. Markel is reluctant to discuss that in detail, but he says it would give the Aluminaut four times as much underwater loitering time as the Alvin. The Aluminaut's engines will employ a NASA-designed pump jet engine, which uses fuel at a very high efficiency level.

Markel's team is also working on a mini Remote Operated Vehicle (ROV)

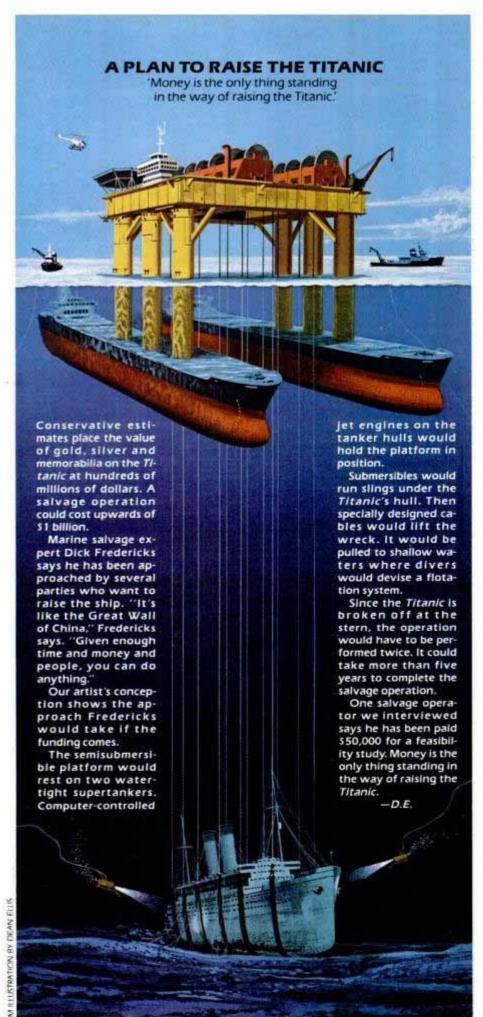
Nautille, which holds a crew of five or cluded recovering an H-bomb off the that would be tethered to the Alumic PURSER'S DEPOSITORY

FORWARD DECK BOOMS

SHIP'S SAFES

RIP IN HULL

PM ILLUSTRATION BY TOM FREEMAN



naut by an aluminum umbilical cord. Carrying a TV camera, lights, manipulator arm, some kind of collection basket and a power system similar to the Aluminaut's, the ROV will be controlled by the Aluminaut crew. If all goes right, Markel says, the ROV will be able to snake into parts of the wreckage where the larger sub—or the Alvin—can't go.

The entire apparatus is being tested in one of the Navy's model pressure tanks. Markel estimates the *Aluminaut's* crush depth at 22,000 ft., not nearly as far as she'd have to go to recover some valuable booty from the *Titanic*.

# Challenge of the deep

Aside from the obvious risk of finding a shallower crush depth on the way down (pressure at 12,500 is 6000 psi), what other hazards await the Grimm expedition to explore the wrecked *Titanic*? They range from the unpredictable to the downright frightening.

"First," says John Hollis, spokesman for the Titantic Historical Society, "the landscape down there is Alpine. Imagine a submerged Switzerland." Sharp, craggy mountains, cavernous valleys, a seascape where rock slides and seaquakes are not improbable. Hollis mentions the day the Titantic's sister ship, the Olympia, passed the spot where the tragedy happened. As they held ceremony, throwing a wreath into the water, a quake rumbled through the sea. Any descent vessel will have to be held in a tight "tunnel" from surface to bottom to prevent running into cliffs or having its lifeline snagged or snapped. This special problem of holding position, given the generally uncooperative disposition of the North Atlantic, has often been called one of Western man's greatest enemies.

Another major stumbling block could be cables—lines and ropes free-floating from the deck of the *Titanic*. The ship and all her gear was brand new when she went down and because of the temperature of the water at that depth, scientists expect very little corrosion. So, ropes from the deck should be abundant and intact. "Get tangled in one of those," says Markel, "and you're down there for good."

Markel, an Annapolis graduate, is personally interested in finding out if the wreck has become a haven for any forms of marine life. He points to the large fish that showed up in the Woods Hole video images and says there could be more down there. Giant squid, for instance, are known to inhabit these waters, he says. Although no fisherman's net or hook has ever landed one, the Smithsonian has a 50-footer that washed up on a North American beach.

(Please turn to page 110)



# BATTLE OF THE BASS BOATS

Five top fishing machines clash in a PM performance showdown.

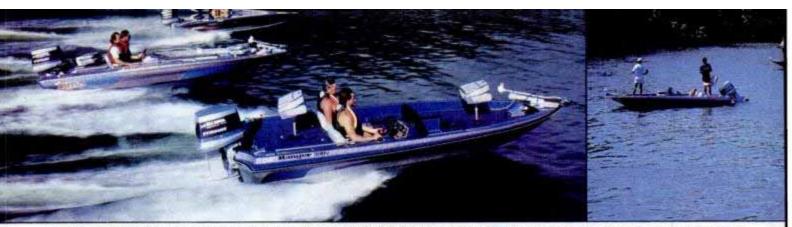
BY TIM COLE, Boating/Outdoors Editor; Photos by Skip Gandy

raft a low-speed trolling platform to a high-speed planing hull, pepper it with tackle stowage and aerator-equipped live wells, and you wind up with the modern bass boat, the schizophrenic answer to the science of catching fish.

Primarily a Southern creation, these utilitarian speedsters with multiple personalities were invented to meet a diverse medley of objectives on the bass fishing tournament trail. Sprint to the fishing hole at speeds approaching 60 mph. Deploy the trolling motor to creep along rocky shorelines and around heavy cover. At the same time, store mountains of artificial lures, plastic worms and dozens of rods. Keep your line in the water for as long as possible, then blast back to the tournament weigh-in with a live well full of bass. Sounds simple enough, but balancing each of these important functions without limiting any of the others could only be achieved through a process of evolution span-



Top, Cajun and Bass Nautique iron out the curves at our test site. Above, the PM crew goes over times and radar readings.



Designed by the necessities of bass fishing, Ranger (foreground), Skeeter and Stratos blast out for a quiet interlude at the fishing hole.

ning close to 15 years. Only serious fishermen could have fused bass fishing's disparate requirements into a boat of such exquisite form and function.

High-end performance—there are some 20-footers capable of speeds near 80 mph-is crucial to the success of a particular design. But if it is achieved at the expense of stowage space or trolling ability, speed alone is insufficient. By the same token, sluggards receive short shrift from bass fishing devotees, and thousands of dollars can be spent on engine modifications and transom retrofits to achieve an extra 5 mph.

Performing a head-on comparison of bass boats based

on the same concept-with vastly different levels of success-was an exhilarating 4-day exercise on Lake of the Ozarks, Missouri, in the heart of bass fishing country. We invited some of the leading names in bass boat building-Ranger, Cajun, Skeeter, Stratos and Correct Craft's new Bass Nautique. Evinrude kindly provided the power and their XP 150s performed magnificently right out of the box, absorbing heaps of full-throttle punishment. Identical Evinrude Scout trolling motors gave us a chance to judge how each hull performs under trolling conditions. The boats were rigged with care by the staff of Able Marine in Osage

# **CONCEPTS IN** COMPROMISE

A successful bass boat design is really a balancing act between high performance and utility-two diverse. philosophically opposed, objectives. Still, manufacturers have answered the demand for speed and usefulness with low-freeboard planing hulls, casting platforms fore and aft, trolling motors for close-in work and stowage space for gear. Within this general design, there's a wide variety in style.

Overall Ranking Make Model

LOA/Beam (in.) Weight (lb.)

Bow Casting Area (sq.ft.)

Stern Casting Area (sq.ft.)

Casting Seat Separation Cockpit Area (sq.ft.)

Stowage (sq.ft.): Lockers Under Seat Gunwales

Livewell Vol.(gal.) Hatch Size (sq.ft.)

Hull Construction (see key below)

Time (sec.) From 0 to 55 mph. (trim out)

Time (sec.) Through 180 Course (trim in)

Maneuverability Course (sec.; trim variable)

Trolling Performance Index (1-5)

Price As Tested, Less Motors Test Parameters



1. Skeeter Starfire 175

18'5"/87.5/1200

9.94 (spacious and stable; easy control access)

15.26 (takes some wash on deceleration)

11'5.75"/12.29 (tackle box stowage may be tough)

42.44/17.16/52.02 (adequate but not generous)

20 fwd., 24.5 aft. 1.14 fwd., 3.07 aft/Aerator

FG HLU, 4LY Mat, 3LY WR, B CO/ Spr. PU

Fastest-16.5, Slowest-17.8 (behaves well)

Fastest-43.57, Slowest-44.33 (consistent)

Fastest-1:10.47, Slowest-1:13.17 (no surprises)

5 (ultra stable in cross wind and chop)

\$8150



2. Stratos 179 V

17 8 /86/1250

9.78 (rocky; area unsupported by Vee hull)

21.40 (makes up for forward platform)

9'10.5"/11.35 (locker space compensates)

82.87/2.09/41.43 (unbalanced but ample)

18 fwd., 20 aft/.72 fwd., 1.13 aft/Aerator

FG HLU, 6LY Mat, 3LY WR, SS/ Spr. PU

Fastest-15.7, Slowest-16.1 (a joy)

Fastest-44.99, Slowest-45.40 (forgiving)

Fastest-1:11.69, Slowest 1:13.57 (full tilt)

3 (very rocky, tracking spotty)

\$6234



Skeeter's sports car feel is a plus. Trim gauge position is poor and dash lip is a knee-cruncher.



Wheel, throttle, gauges all balance for secure feeling in Stratos.

150 powerplants and Evinrude Scout trolling motors. They were fully fueled for each test and operated by the same driver (the author). Speeds were calculated by radar (courtesy of MPH Industries, Chanute, Kansas) and with a Heuer digital stopwatch. Stowage comparisons were developed by measuring "drop-in space only, though each boat has rod stowage extending below deck.

All boats were equipped with identical Evinrude XP

Hull Construction Key: PL-Pre-formed foam log flotation; PU-Polyurethane foam flotation; In; Injected.
Spr.-Sprayed; LY-Layer; CR-Chopped roving;
WR-Woven roving; Triax-Triaxiat; CO-Core; B-Balsa;
Cmt-Coremat; HLU-Hand lay up; SS-Stringer system; WdR=Wood reinforcement.



Bass Nautique (foreground) and Cajun follow suit. Each bass boat tested was marked by subtle variations in styling and approach.

Beach, Missouri, which also provided technical support in the trolling motor shootout we ran concurrently (see page 114). The overall rankings are a function of speed, trolling ability and static measurement, along with subjective evaluations of dash layout, cosmetics and handling. There were clear winners and clear losers in almost every test category, but the overall prize went to the boat that achieved the best balance in stowage area, trolling ability and high-end speed.

Skeeter Starfire 175

The remarkable thing about Coleman Industry's

entry in the bass boat market is the fact that it doesn't elicit any profound reactions—good or bad—in the primary performance categories. Space is sufficient, but hardly generous. Speed and maneuverability are sound, but scarcely memorable. The boat is rock stable while trolling, but offers no leap of performance. Indeed, the Skeeter performed well, but not brilliantly, possessing no bad habits or querulous quirks. At the same time, the bass boats we pitted the Skeeter against were often outstanding in certain categories—even surpassing the Skeeter—only to suffer seriously from

(Please turn to page 114)



3. Ranger 350 V 17 10 82/1050

11.22 (roomy, easy panel access)

19.20 (moderate space, very stable)

9'8.5"/17.72 (superb tackle box stowage)

46.72/11.60/25.74 (smart use of space)

11 fwd., 21 aft/.85 fwd , 1.12 aft/Aerator

FG 3LY CR. 1LY WR, WdR/Inj. PU

Fastest-18.1, Slowest-21.85 (average)

Fastest-43.17, Slowest-43.43 (very fast)

Fastest-1:09.67, Slowest-1:11.62 (steady)

4 (mild instability, but still able)

\$8522



4. Cajun Ricky Green

18'5"/88"/1,200

10' (wide area, easy control access)

23.7 (very roomy, ingenious pedestal stand holders)

9/16.50 (adequate but not generous)

28.44/8.25/59.11 (ditto)

16.8 aft, 16.8 aft/1.09 aft, 1.09 aft/Aerator

FG 3LY CR, 1LY Triax, 2LY WR, Coremat CO/ PL

Fastest-20, Slowest-20.5 (slow acceleration)

Fastest-47.96, Slowest-49.98 (blame it on the prop)

Fastest-1:02.76, Slowest-1:18.13 (clear winner here)

5 (stable in the chop, tracks well in crosswind) \$7995



5. Correctcraft Bass Nautique

17"7"/83"/1,200

9.36 (ample area but flat hull means instability)

10.24 (obviously not a priority)

10'4.25"/10.5 (cramped but workable)

6.67/none/28.28 (less than meager)

22 aft, 19 fwd /.83 aft, .83 fwd./Aerator

FG 3LY CR, 1LY WR, SS, WdR/Spr. PU Fastest-15.6, Slowest-16.7 (speed king)

Fastest-45.62, Slowest-46.55 (fast but unforgiving)

Fastest-1:11.26, Slowest-1:12.86 (wrestling match)

2 (rocky, hobby horse in chop)

\$6220



Wheel is a bit distant for true highspeed security on the Ranger.



Cajun's bold dash design falls flat. You can't see the gauges—even trim—at high speed.



Wheel, trim gauge and throttle work well on Bass Nautique, but are too far from driver.

# THE SIX BILLION DOLLAR MAN

Cybernetic technology is bringing the half-man/half-machine off the screen and into the real world.

the human body, arms outstretched, legs spread, describing a perfect square and circle, may be, as philosophers say, "the measure of all things." But man the machine is also, as Mark Twain says, "a rickety, poor sort of thing, always in need of repair."

To reconcile these two truths, man has for centuries dreamed of creating a half-man, half-machine, resulting in the 20th century science of cybernetics. The ultimate goal is to build the ultimate being, with human wisdom and grace and with mechanical strength and endurance. Such thinking has given rise to fictional figures like television's Six Million Dollar Man and the motion

picture villain called The Terminator. Each was a marriage of human skin and manufactured circuitry.

"Using machinery to make man more perfect is becoming more acceptable," acknowledges Uri Kantor, a State University of New York researcher working on a small motor to drive an artificial wrist joint. "But there are many moral constraints against a true cyborg, and technology for the Terminator-type character is still basically fictional."

Arnold Schwarzenegger played The Terminator, a cyborg that could repair itself as it was riddled with bullets. The Terminator had super strength, hearing, vision and intelligence. In an effort to reach that level of man/machine, science still has to come up with ways of replacing billions of nerve endings that make the system think and move. Along the way, cybernetic—more conventionally known as robotic—research has come up with ingenious body parts that



Steve Austin's strength (above) and The Terminator's electronics (facing page) are no longer pure fiction.

### BY CHRIS DAVIS

are already functioning in living human beings who would die or be totally disabled without them (see illustration on page 84).

How pricey has the catalog of replaceable human parts grown? While modern manufacturing techniques make devices more and more affordable (artificial hearts can now be made on vacuum molds like plastic drinking cups), no price tag can be put on the years of research that have led up to the miracles that are now fairly common.

In the past 20 years, research and development leading to artificial hearts, blood, bones and joints has cost an estimated \$6 billion, 1000 times greater than the fictional price tag on televi-

sion's most celebrated cyborg, Steve Austin.

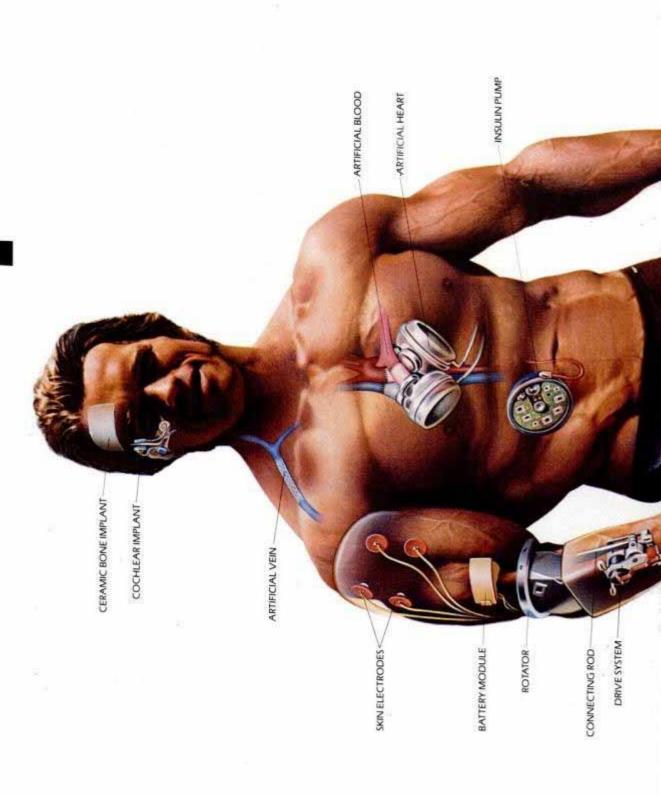
Approaches may vary, but most researchers seem guided by a common philosophy: as Dr. Ljubomir Djordjevich of the Rush-Presbyterian-St. Luke's Medical Center puts it, "Virtually no organ does not have a replacement."

### Blood

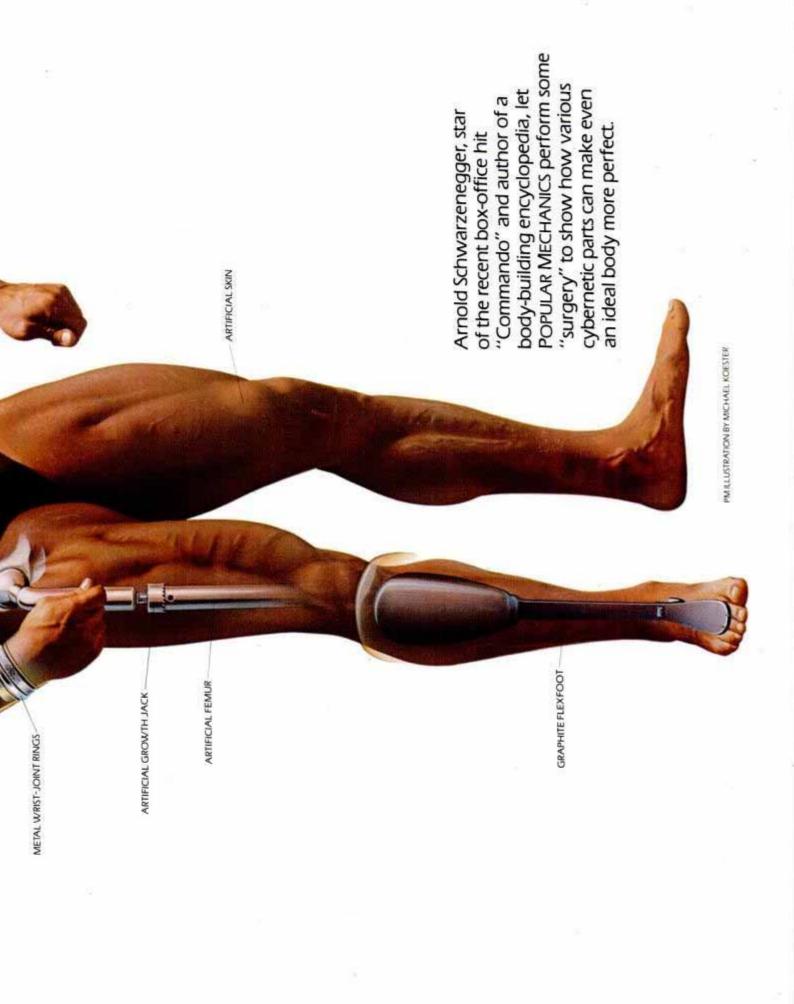
Dr. Djordjevich has been developing one of the smallest members of the new generation of replacement human parts. Artificial Erythrocytes (AE), that is, red blood cells. To appreciate the need for designer blood, it's important to understand what's wrong with blood as it is.

First, there's not enough of it. We have to share what we have and when we do, there's the risk of passing around viruses such as hepatitis and AIDS. Also, blood is typed by (See illustration on page 84; story continues on page 141)





Afternoon removement and according to



## PM COMPARISON TEST: 5 MINIVANS

# amily Affair



f your family is like most, even a simple trip to the grocery store becomes an exercise in tactical planning that would try the resources of the Joint Chiefs of Staff, As often as not, you'll end up with not only the 10 bags of groceries you started out to get, but selected items from the dry cleaners, the hardware store and Sneaks n' Cleats—not to mention Ja-

son's friend Marcia, Marcia's friend Jeffrey and Jeffrey's Irish setter. Jokes about the Family Taxi service

are only too true.

Which brings us to the question of the Family Taxi. In the old days, there was only one answer. Dad bought a full-size station wagon with woodgrain trim and tossed everything into the back-groceries, kids, pets and plywood. But the gas-guzzling big wagon has gone the way of a threemartini lunch at the country club, and most of today's miniaturized wagons just aren't up to serious family

hauling, especially when it involves towing a boat or camping trailer.

The world is obviously ready for a station wagon substitute. And the answer is the family van. There are five family vans on the market, led by Lee Iacocca's innovative Dodge Caravan and Plymouth Voyager. They've recently been joined by competing new vans from Ford, General Motors and

Toyota. And of course, the original miniyan, Volkswagen's Vanagon, is enjoying more interest than ever.

Unlike the full-size Sin Bins of the 70s, the new family vans are cute. comfortable and carlike. Your wife can drive one without looking or feeling like a trucker, yet the neighbors will think she's being daringly differ-ent. Kids—your kids and the neigh-



Toyota Van presents a space-age profile, but short wheelbase gives a choppy ride, midship engine has many drawbacks.



Chevy Astro is big, trucklike and pow erful. The Starcraft conversion doesn't make this family van better.



bors' kids—will think it's cool.

We abandoned our normal road-test procedure for this comparison, on the excellent theory that a dragstrip is not the proper milieu for a group of family vans. Instead, we invited five PM staffers and contributors to bring their wives and children on a 2-day family outing to upstate New York.

All 20 testers—ranging in age from 3

to "over 39"—had a chance to register their opinions. All 10 drivers, male and female, drove each van over the same 20-mile test loop in back-to-back runs, and also drove each van for at least 50 miles on divided highway. All driving was done en famille—a real-world test of how parents and children accommodated themselves to the differrent vans.

Family vans all look pretty similar on the specifications page. All of them are roughly 175 inches long on about a 110-inch wheelbase with a 1500-pound payload, 2- to 4.3-liter engine and seating for five to eight passengers. In actual fact, though, there's more diversity in appearance, layout and driving feel than in any other market segment. You wouldn't think a box on



Ford Aerostar combines slick styling with gobs of convenience and luxury features to win the hearts of our testers.



VW Vanagon with the camper package is a great single-purpose vehicle, but is more fun to camp in than to drive in.



Plymouth Voyager is still one of the best family vans. Front-drive, ease of service, overall comfort win points.





Chevy Astro features a plush dealer-installed custom package by Starcraft that includes velour upholstery, 2-tone paint job, a big luggage platform and lots of woodwork.





Ford Aerostar has an overhead console with reading lights and trip computer (left) plus rear radio controls with headphone jacks for the kids (center). Two 7-passenger seating designs are offered: two buckets plus two benches, or four buckets plus one bench.







Plymouth Voyager test unit is equipped with the rare Magic Camper package, which includes the Convert-A-Bed bench seat (above) and a custom pop tent that fits around the van's sliding side door (left).

wheels could be made in so many different variations.

### Plymouth Voyager

Our favorite family van is the frontwheel-drive Chrysler. Why? Mostly because it doesn't come across as a van at all, but as an engagingly offbeat station wagon with lots of room. The one comment that appeared on every rating sheet was "most carlike."

Perhaps that's because the chassis is made from front-drive K-car bits and pieces, and they all work well together. As one of our testers put it, "You feel like you're driving a sedan . . . smooth performance and solid handling."

Everyone agreed that the 3000-pound Voyager needs more power than Chrysler's small Fours have to offer. In another year, a new Mitsubishi-built V6 will solve that complaint. Our test Voyager averaged an outstanding 22.9 mpg

> Produced by the PM Auto Dept. Text by Rich Taylor Photos by Humphrey Sutton

around our course, the best in the group.

The Chrysler's interior is pleasantly plush. It's not luxury-car opulent, but it is as nice a place to be as the interior of most passenger cars in the Voyager's \$10,000 to \$15,000 price range. Our particular van had a \$1352 Magic Camper Tent Package that's a great addition.

The Magic Camper turns the rear bench into a Convert-A-Bed and adds a whole raft of heavy-duty equipment suspension, tires, battery, 20-gallon fuel tank, plus an 8x10 foot tent styled and



**Toyota Van's** most popular feature is the mini refrigerator between the front seats (above). Twin sunroofs (right) are another unusual feature. The long, narrow van seats up to seven people.







VW Vanagon's Westfalia camper package has a pop top with an upper berth for two (left). Dinette table swings out from galley (above). Rear bench folds down to create a second double bed.

FAMILY VANS									
VAN¹	GAS MILEAGE (EPA city/ PM test)	SPACE (cu. ft.)	BASE PRICE	PRICE AS TESTED	ENGINE <sup>3</sup>	WHEEL- BASE (in.)	LENGTH (in.)	WEIGHT (lb.)	OVERALL RATING
Chevrolet Astro	16 16.9	206	\$9037	\$18,911	155-hp OHV 4.3-liter V6	111.0	176.8	3500	5
Ford Aerostar	18/15.1	188	\$9064	\$15,178	115-hp OHV 2.8-liter V6	118.9	174.9	3600	2
Plymouth Voyager	18 22.9	182	\$9487	\$14,290	104-hp SOHC 2.6-liter inline-4	112.0	175.9	3100	1
Toyota Van	21/22.3	202	\$8498	\$15,308	105-hp OHV 2.2-liter inline-4	88.0	175.4	2950	3
Volkswagen Vanagon	18 17.7	295	\$12,290	\$17,190	95-hp OHV 2.1-liter flat-4	96.9	179.9	3600	4

All have 4-speed automatic transmissions except the Ptymouth Voyager, which has a 3-speed automatic, and the Volkswagen Vanagon, which has a 4-speed manual.
 Width between doors x height from floor to ceiling x length from dashboard to rear window.
 Specifications are for '86 models.

sized to the Voyager. Our resident outdoorsman took it on a week-long crosscountry trip, and swears by the accommodations and extra fuel capacity.

Any Chrysler van fairly bristles with clever convenience features. The standard rear seat pops out with two release levers to reveal a sizable load area with a convenient low floor. We especially appreciated the spacious glovebox hidden under the passenger seat, the cup holders in the dash, the map pockets in the seatbacks and the optional ceiling console, which has molded clips for sunglasses and garage door opener.

Let's face it. Dad may see himself as a macho trucker ready to take over an 18-wheeler anytime, but Mom and the kids want a smooth-riding, easy-handling pseudo-station wagon with a great radio. That's the Chrysler. The only drawback we can find is a towing capacity of only 1500 pounds, less than one-third of the Ford and GM competition.

If you don't need to tow things, this is without question the definitive family van. As one enthusiastic Mom put it, "This is the most useful car in the bunch for the way I live. It drives beautifully, it's practical and comfortable and easy to live with. And the extra seating height is great for driving in traffic or searching for parking spaces.

### Ford Aerostar

This is a truck, a Ford truck, that would look at home being driven by a model in Cosmopolitan. Underneath,

(Please turn to page 137)

# Voyager's Next Stop

Astronomers have set their collective knowledge aside for this month's Voyager 2 encounter. It is expected to yield revolutionary facts about the seventh planet.

BY DENNIS ESKOW, Science/Technology Editor; Illustrated by John Berkey

through the icy darkness of space at 40,000 mph. In the quiet-near-vacuum, hardly a sound is heard as the servomotors crank wide-angle, narrow-angle and infrared cameras into position. NASA has marked Jan. 24, 1986, for the closest encounter of the seventh planet from the sun, Uranus.

"The whole scientific community is excited," says Frank Bristow of NASA's Jet Propulsion Lab. "When Voyager 2 is finished, we expect to know details about the atmosphere of Uranus and have maps of its clouds and hazes." The Voyager 2 spacecraft and its twin, the Voyager 1, already have doubled our knowledge of Jupiter from earlier flyby

visits. The Voyager 2 Jupiter flyby of 1979 discovered a ring around the largest planet in our solar system. The visit this month will bring the craft to within 64,500 miles of Uranus's surface, measuring planetary wind speeds, mapping the rings around Uranus and charting its magnetic field.

The Voyager twins were launched in 1977. Voyager 1, after snapping pictures of Saturn in 1980, was sent out of the solar system carrying recordings and images of music and voices from Earth on the off chance that an advanced civilization might find the vessel. Voyager 2, when it completes its work at Uranus later this month, will fly on to an August 1989 close encounter with the eighth planet, Neptune.



The old boob-tube's getting a facelift. Some changes are more than skin-deep.

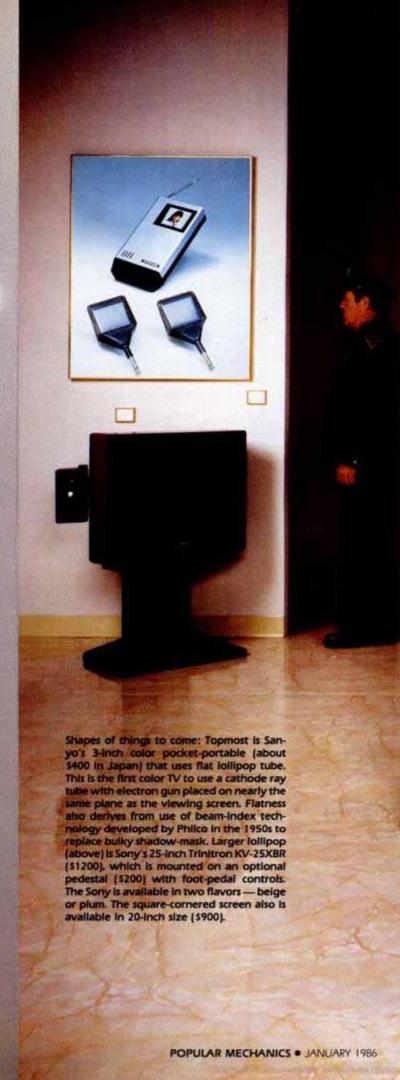
BY STEPHEN A. BOOTH, Electronics Editor PM photo by Bill Ashe

t's subtler than the switch from black and white to color, or from porthole screens to rectangles. Nonetheless, television is donning a new appearance, shedding its boxy image for a highly stylized contemporary look. If TV's no longer content to be just another piece of furniture, it's not merely a case of the emperor's new clothes. Some of the cosmetic changes reflect innovation deep within the guts of the sets.

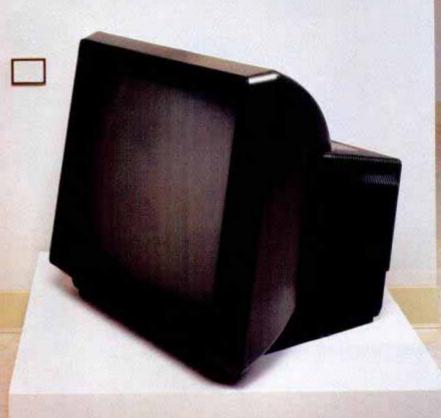
For example, squared screen corners not only represent improvements in glassmaking, but also in the technology that drives an electron gun to write crisp, undistorted images on the extreme edges of the screen. Given this precision, manufacturers no longer need to hide an inch or more at the periphery of the screen. This yields more viewing area, and explains why 26-, 20- and 14-inch sizes have joined the familiar 25-, 19- and 13-inch TVs.

A similar change, limited right now to RCA TVs, is the flat screen. The viewing surface of most tubes is slightly convex, but the screen center of RCA's new Square Planar Tube is nearly on the same plane as the 90°-square corners. This nets more viewing area (27 inches) and lets you see the whole screen from extreme offside angles.

Stereo sound has prompted a change in TVs you can see as well as hear. Stereo TV broadcasts and the hi-fi soundtracks of movies on cassette has spawned a need for multiple loudspeakers. The way they're incorporated often lends an attractive visual element to the sets. Meanwhile, the styling of the new TVs themselves reflects the diversity in the way people deploy them at home. There's more flexibility than the old crate design afforded. While you can place your TV on a pedestal and mount the speakers on a wall, still a ways off is the large-screen monitor you hang like a painting. Nonetheless, work is in progress on the cathode ray tube with an electron gun nearly parallel to the screen.











Larger screens, stereo sound and flexibility of placement are highlights of newest TV sets. Counterclockwise from top left is 27-inch Zenith SB2737 (\$1400). Hinged loud-speaker panels can be angled for best stereo effect, or even detached for greater separation. The 26-inch screen of Quasar's Delta TV (\$1500) is angled upward for comfortable viewing when placed on floor or low-profile platform, but vertical adjusters vary angle for more conventional placement on rack or table. Unique wedge-shape cabinet of General Electric's 25-inch SpaceStyler (\$840) permits easy placement in room corners. Floorstanding console also sports swivel base. RCA's beige GLR27908 (\$1350) doesn't swivel or pivot, but its flat 27-inch Square Planar Tube permits covenient viewing from extreme angles.



# PHONES ON A ROLL

here might come a day when we'll wear telephones the way we wear wristwatches. That day isn't here yet, but miniaturization has come to cellular telephones. They can now be carried in a jacket pocket or briefcase, truly making the user never more than a phone call away. Realistically, though, even the most portable cellular phone is still linked to the automobile—but the umbilical cord is being stretched to its longest.

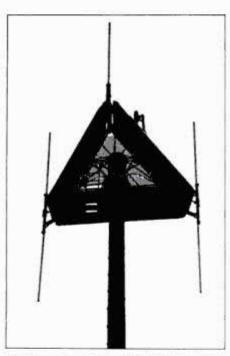
A cellular telephone call is transmitted to and from your dashboard or briefcase via radio waves in the neighborhood of 800 megahertz. The signal is picked up by an antenna at alternate cell sites, and relayed to the phone company's normal wire-line channels. The easiest way to envision a cellular phone system is to imagine the honeycomb structure of a beehive, with the hive being a metropolitan area. Cell sizes vary, but as the caller travels from one cell to the next, the signal is handed off from one antenna to another. The switching is handled by a computer, which monitors the strength of the radio signal to determine when to make the hand-off.

When this concept was first conceived, a car was perceived to be the object moving between cells. These days it might just as easily be a person. The portable cellular phone was pioneered by Motorola, and refinements have been added in recent months by Walker Telecommunications, General Electric and OKI.

Though cellular phones are in more hands than ever, they are hardly a mass-market product. Prices for the most basic car models hover around \$1000, while the phones with the most mobility are steepest—\$3000 or more.

Among the smallest and most mobile is the portable cellular phone from Walker. This phone weighs 15 ounces and measures only 7½ by 2 by ½ inches. Automobile, briefcase or pocket—cellular phones go where you go.

BY FRANK VIZARD



You'll be seeing more of these as you drive. Triangular structure atop mast is a cell antenna for mobile-phone common carriers.

Powered by a self contained, rechargeable battery that offers up to 30 minutes of talk time, the Walker phone sports a unique alpha-numeric memory that holds 99 names and numbers. When the user retrieves a number stored in memory, the liquid-crystal display screen shows the number, memory position and name of the person being called. And you can scroll through the stored numbers until you come to the number you're looking for.

The Walker phone has most of the standard features found on cellular phones of any type or brand. These include display of each number before the call is sent; an accumulative call timer that records the length of all calls made on the phone; alternate long-distance dialing, which lets you use a non-AT&T service; self-diagnostic testing; automatic last-number redial; an electronic security lock; and a scratch-pad memory that lets you put a phone number on the display during a call.

A somewhat different approach to the portable is taken by General Electric. Its GE\*MINI cellular phone weighs just under 2 pounds and measures 81/4 by 31/4 by 11/4 inches. What accounts for the extra bulk is a sidemounting battery that offers one hour of talk time. A quick-clip bayonet mount means the battery can be changed in seconds. Additional batteries are \$80 each. Also included in this and most portables is a recharging device that plugs into a car's cigaret lighter. Moreover, automotive adapters can make a part-time home for the portable in a car. In this case, the phone might take its power from the car's battery, and use an antenna mounted on the body.

Both portables and most new cellular car phones have a feature not seen on first-generation models. This feature, called an A/B switch, reflects one of the practical limitations of cellular telephone technology. Ideally, the antenna in each honeycomb cell should be located at its center for optimal performance. But local opposition and the realities of the real estate market often make this impossible. As a result, the original honeycomb design sometimes is transformed into a mass of differently shaped amoeba-like blobs.

In such a situation, a caller might find himself in a dead zone—that is, an area beyond the range of any antenna in the

system. This problem occurs mostly in densely populated areas. Cellular phones pack only 3 watts of power (1 watt for portables), so it's possible that a cell antenna might be out of range. Fortunately, the Federal Communications Commission requires there be at least two competing cellular phone ser-



Portable by Walker Telecommunications is 7/8 in. thick, 71/4 long by 2 wide. It holds 99

vices in every major market. By subscribing to both services, chances are you'll be in range of an antenna belonging to at least one service. This is the reason for the A/B switch.

### Other options

Because portables have only a single watt of power, not every manufacturer has rushed to offer one. The alternative, available from suppliers such as Audiovox, Advanced Cellular Systems and others, is a full-powered phone built into a briefcase with its own battery pack. Talk time is generally about an hour. A cigaret lighter adapter for the car and an AC adapter for the home are included. This package is heavy, often weighing as much as 30 pounds. List prices range from \$2200 to \$3000.

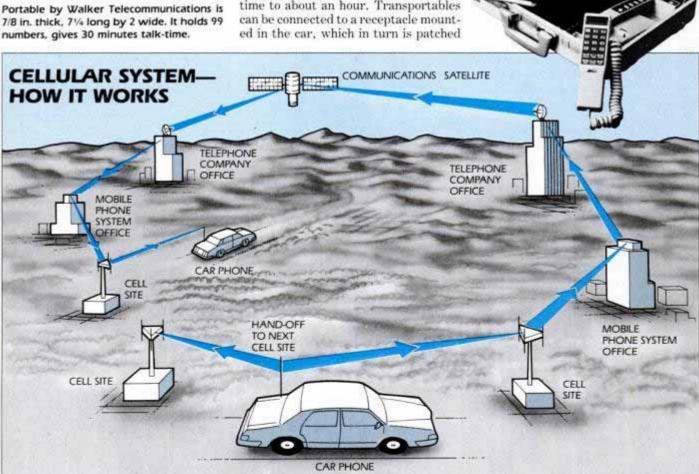
Another option is a class of cellular phones called transportables. Typical of the breed is NEC's offering. Reminiscent in appearance to the crank-up field telephones carried by infantrymen during World War II, transportables are cellular phones connected to a portable battery pack. Overall weight is about 71/2 pounds, 12 pounds with an optional battery pack that extends talk time to about an hour. Transportables

into the car's power supply and an external cellular antenna. The antennas used in car installations are considered superior to the stubbier versions on their more portable brethren.

Cellular technology is being extended to other areas. Specially designed marine antennas made by Audiovox, Antenna Specialists and others are making boat installations a reality. Products such as The Bridge and The

(Please turn to page 136)

Briefcase cellular phones, such as Audiovox model here, put out full 3 watts, give one hour of talk-time from built-in battery pack.



A cellular telephone system divides a metropolitan area into numerous cells, each one having a triangular-shaped antenna that relays conversations to and from the phone company's normal wire-line channels. As the phone user travels from one cell to the next, a computer measures signal strength and passes the call to the next nearest antenna. Once mobile service transfers a call to the phone company, the conversation may be relayed by microwave, fiber optics or conventional cable. If the party at the other end is using a mobile unit, the phone company transfers the call to a cellular service. Signal then passes between the cell antenna and the mobile phone via radio waves in the 800- to 900-megahertz band. Each cell handles 666 calls simultaneously.

# FAMMERS

PM looks at 22 champion striking tools—from bantamweights to heavyweights—each designed for a special purpose.

BY JOSEPH TRUINI Shop And Tools Editor Photos by Brian Kosoff

he tool we now know as the hammer was first developed around 7000 B.C. during the neolithic period (the New Stone Age). It was during this time that man first lashed a branch to a sharpened stone. With this act, known as hafting—fitting a handle to a tool otherwise held in the hand—the hammer was born.

Today, the hammer has evolved into a large family of specialized striking tools. As a sample of the various tools that are available, we've gathered together 22 hammers, each designed for a specific purpose. Note that the tools are made from a variety of materials including steel, wood, brass, fiberglass, leather, rubber and plastic. Despite the variety of hammers available, it's surprising to find that many homeowners own only one or two models. It's common to have several different sizes and styles of screwdrivers, handsaws or pliers to handle specific tasks. This same logic, though seldom practiced, applies to hammers, too.

How many hammers you should own depends on what kind of work and materials you are actively involved with. The typical do-it-yourselfer should own at least four or five hammers. Generally speaking, they should include a 16-oz. curved-claw hammer for nail driving, a 22-oz. rip hammer for

construction and remodeling work, a 12-oz. curved-claw hammer for finish carpentry, a cabinetmaker's hammer and a ball peen hammer for metalworking. Fortunately, high-quality hammers are relatively affordable. The 22 hammers shown range in price from about \$4 to \$70 each.

Proper use

Hammers are one of the most used and abused of all hand tools. Here are a few basic guidelines to follow when using any striking tool. Select a hammer for its intended use and use it only for those purposes. Always wear safety goggles to protect your eyes and never use a hammer that has a loose or damaged handle. Replace a damaged handle immediately with a new handle. Never strike one hammer with another. Discard a tool if its striking face is chipped, dented or mushroomed. Don't strike with the cheek, or side, of the hammer's head. Now let's take a close look at each of the hammers shown.

hammer-1. Framing Designed for use by house framers, this 28-oz. hammer features an extra long handle, a ripping (straight) claw and a milled, checker-boardpattern face that reduces glancing blows and flying nails. The nearly indestructible hammer is forged from a single piece of solid steel and is fitted with a long-lasting nylon/vinyl handgrip. The hammer, which is also available with a smooth, polished face, costs about \$29. Contact Estwing, 2647 Eighth St., Rockford, IL 61101.

2. Nail-holding hammer—Driving a nail in a tight corner while in an awkward position, say, upside down, is almost impossible when using two hands. However, this 20-oz. hammer allows you to accomplish such a feat easily while using just one hand. A magnet set into the head grips an iron or steel nail. One sharp strike starts the nail. The hammer has a hickory handle and will hold a 2- to 4½-in.-long nail.

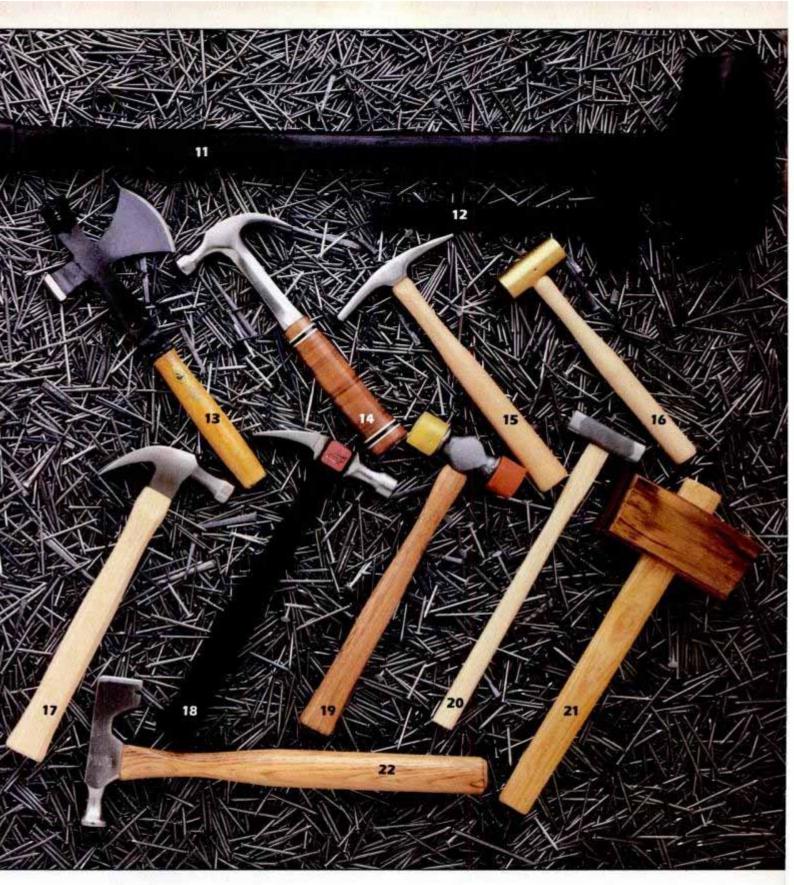


It's available for \$23.55 postpaid from Garrett Wade, 161 Ave. of the Americas, New York, NY 10013.

3. Plastic mallet—Use a plastic mallet to strike blows without damaging the work's surface. The 11%-in.-dia. x 6-in. plastic head weighs 16-oz. and is pinned

to a 13-in.-long wood handle. The mallet is useful for assembling and disassembling furniture parts and for setting wood dowel pins. It's available for about \$12.80 at hardware stores and home centers. It's made by Great Neck, 165 East 2nd St., Mineola, NY 11501.

4. Tack hammer—Driving small brads and tacks with a 16-oz. claw hammer can be a real pain—especially in the thumb and forefinger. This 7-oz. tack hammer (\$4.44) has a magnetized head that holds a tack for one-hand starting. Drive the tack with the opposite, non-

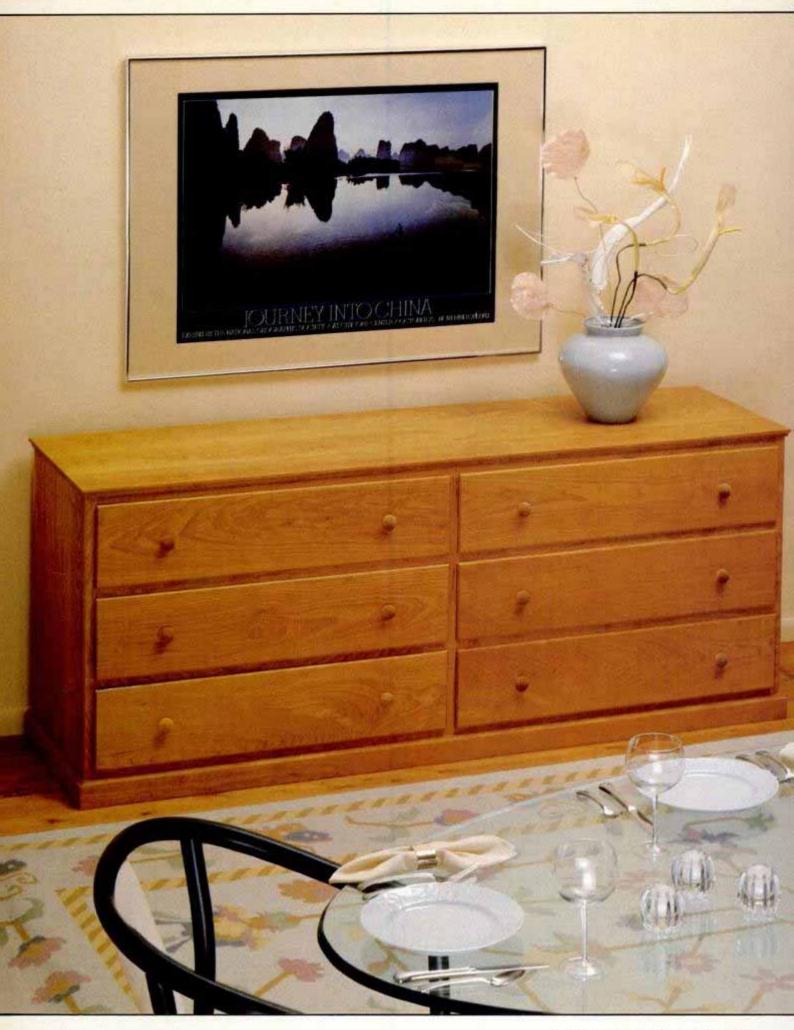


magnetic face. Contact | Great Neck, 165 East 2nd St., Mineola, NY 11501.

5. Bricklayer's hammer—An indispensible masonry tool, this hammer is designed exclusively for setting and splitting bricks, masonry tile and concrete block. The tool features a 16oz. forged-steel head that has a square striking face opposite a flat, sharp cutting edge. Never strike metal with a bricklayer's hammer, including a brickset or stone chisel. It costs about \$20 at most Sears stores. Contact Sears, Sears Tower, Dept. 703-PM, Chicago, IL 60684.

6. Warrington hammer—Considered to be the ultimate cabinetmaker's hammer, this perfectly balanced tool has a tapered cross-peen that allows you to start small nails and brads without striking your fingers. The forged steel head is attached to an ash handle. Warrington hammers are available in weights ranging from 3½ to 16 oz. The 6-oz. hammer shown costs \$13.90 postpaid from the Fine Tool Shops, 20 Backus Rd., Danbury, CT 06810.

7. Claw hammer with no-slip grip—The ash han-(Please turn to page 112)



# SHAKER SIMPLICITY

This solid cherry chest of drawers is as much at home in the dining room as it is in the bedroom.

### BY NEAL BARRETT

uild this elegant chest, styled in the functional Shaker tradition, to complement almost any room in your home. Each of its six drawers measures nearly 3 ft. wide by 7 in. high. They'll hold a storehouse of table linen, dining accessories, blankets or clothing.

If you have a surface planer and jointer, you can buy rough 4/4 lumber, surface it yourself to the required thicknesses, and true one edge of each board. Otherwise, you can buy dimensioned lumber or have the lumberyard mill the wood to your specifications.

Cut all the required boards to rough length, then the boards that will be edgejoined for the case sides, partition, top, bottom and for the drawer faces. Match the color and grain pattern of adjoining boards, making certain that you choose your best pieces for the top and drawer faces.

To begin construction, edge-glue the boards into panels for each of the case parts. Use 1/s-in.-dia. × 1-in. dowels, spaced 6 to 8 in. apart along the mating edges to help align the boards. Clamp each panel, placing the clamps alternately above and below the work to evenly distribute clamping pressure and to keep the panels flat.

Remove the squeezed-out glue with a sharp chisel before it hardens completely. After the glue dries, sand the surfaces smooth using a belt sander and 120-grit sanding belt. Then cut all

Black/white photos: Neal Barrett Technical art: Eugene Thompson Color photo: Harry Hartman Photo stylist: Gabe Herrick Tableware: Courtesy of Fortunoff, 681 Fifth Ave., New York, NY 10022 the panels to finished size.

Cut dadoes on the inside surface of the sides to receive the bottom. Use a router with an edge guide, as shown in the photo at right, and a 3/4-in.-dia. straight bit. Use the same bit to cut the dado in the case bottom that receives the center partition. Clamp a straightedge across the case bottom for a guide. Reset the edge guide, and cut the rabbets on the back edge of the case sides to receive the back.

Cut recesses in the top rear corner of the case sides to receive the back rail. Use a sharp chisel. Also, notch the top rear corner of the center partition.

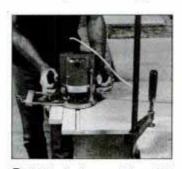
The face frame is attached to the case using ½ × ‰-in. hardwood splines to align and reinforce the joints. Cut grooves for the splines ¾ in. deep, centered in the front edges of the case sides, partition and bottom. Clamp the pieces securely to a workbench while making the cuts so you can guide the router with,both hands. Use a ¼-in. slotting cutter with a ball-bearing pilot.

### Assembling the case

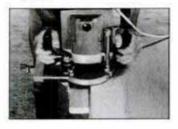
Begin the case assembly by gluing and clamping the center partition into the dado in the case bottom. Reinforce this joint with four 1½-in. No. 8 fh screws driven through the bottom into the partition. Next, glue the case sides to the bottom, and the back rail to the sides and the partition. Apply glue generously at each joint, and clamp. Before the



 Edge-join boards for case.
 Alternate clamps above and below to prevent bowing.



2 Cut dados in case sides with %-in.-dia. straight bit. Use edge guide on router base.



3 Reset router bit depth and edge guide for rabbets in the sides to house the case back.

### SHAKER SIMPLICITY

glue sets, check the assembly with a framing square. Readjust the clamps if necessary to square the case.

### Building the face frame

While the glue dries, cut the face frame parts to size and mark the mortise locations. Clamp a fence to the drill press table to center the mortises in the frame pieces, then bore overlapping 1/4-in.-dia. × 11/16-in.-deep holes to form each mortise. Use a sharp chisel to square the ends and smooth the sides of the mortises.

Use a dado blade in the table saw to cut the tenons on the rails and the center mullion. First, cut the tenons to proper thickness, then readjust the blade height to cut the shoulders. Note that the top shoulder of the top rail is ¼ in., and the bottom shoulder of the bottom rail is ½ in. All other tenon shoulders are ¼ in. Test-cut your first tenon on a piece of scrap to ensure a snug fit in the mortises.

Glue both mortises and tenons and assemble the frame on a flat surface. Use long bar clamps to bring the joints tight. Compare the frame's two diagonal measurements to check for squareness. Readjust the clamps if necessary and let the glue dry.

While the frame sets, cut the rear support leg. Bore pilot holes through the case bottom and mount the rear leg with glue and screws.

After the frame is thoroughly dry,

clamp it face down to a worktable and cut %-in.-deep spline grooves, as shown in the drawing. Use a router with an edge guide, and a ¼-in.-dia. straight bit. Note that the groove in the bottom rail is stopped at both ends.

Cut the ½ × ½-in. splines from scrap hardwood. The splines should slide easily into the grooves, but without play. Test-fit the face frame to the case with splines in place to be sure all grooves align correctly. Glue all mating surfaces and grooves, and assemble the face frame to the case. Clamp, then check that the frame is tight against the case at all adjoining points.

Rip the ½-in.-thick stock to width for the base molding. Use a ¾-in.-rad. cove bit in the router table to cut the cove in the top edge of the molding stock. Miter the two front corners of the molding. Then bore pilot holes for 1-in. brads and attach the molding to the case with glue and brads. Use a fine-point nailset to drive the brads below the wood surface. Fill the holes with cherry-colored wood filler or cherry sawdust mixed with clear lacquer.

### Drawer runners

Cut the runners and runner supports from hardwood stock. Join a runner to each support with glue and brads. Bore clearance holes in each runner assembly for screws to attach the runner to the case. Make the front clearance hole round. The two rear clearance holes are elongated slots. These slots allow seasonal wood movement in the case sides, unrestricted by the screws, and will prevent the sides from cracking. To cut the slots, bore two adjacent holes and remove the waste between them with a sharp chisel. Mark the runner locations on the case sides. Then attach them with flat washers and 1¾-in. rh wood screws. Do not use glue.

Cut the case back from 1/4-in.-thick (Please turn to page 111)

## MATERIALS LIST— CHEST OF DRAWERS No. Size and description (use)

Key No. Size and description (use) A  $2 \frac{1}{2} 4 \times 19 \frac{1}{4} \times 28 \frac{1}{4}$  cherry (case side) B  $1 \frac{1}{2} 4 \times 19 \times 26 \frac{1}{4}$  cherry (case partition) 1 % × 19 × 26%" cherry (case partition)
1 % × 19 × 71" cherry (case bottom)
1 % × 28% × 71%" plywood (case back)
1 % × 1½ × 71½" cherry (back rail)
2 % × 1½ × 23%" cherry (frame stile)
1 % × 1½ × 25%" cherry (frame mullion)
4 % × 1½ × 35%" cherry (frame rail)
1 % × 1½ × 35%" cherry (frame rail)
1 % × 1½ × 20" hardwood (back leg)
1 % × 2½ × 20" hardwood (back leg)
1 ½ × 2½ × 20%" cherry (base molding)
2 ½ × 2½ × 20%" cherry (base molding)
12 % × 2 × 19" hardwood (drawer runner support) K LMN 12 support) support)

2 % × % × 19" hardwood (drawer runner)

1 % × % × 12 × 73" cherry (case top)

14' % × %" hardwood (spline)

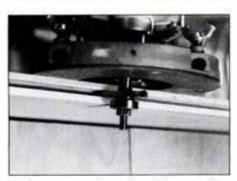
6 % × 17% × 33% maple plywood (drawer bottom)

12 % × 6 % × 18" maple (drawer side)

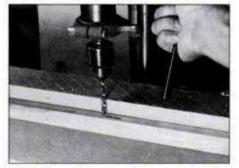
12 % × 6 % × 34 % maple (drawer face)

6 % × 7% × 34 % cherry (drawer face) 12 OP Q T 12 W X Y Z AA BB 8 1½" No. 8 fh screw 36 1¾" No. 8 rh screw, flat washer 24 1" No. 10 rh screw 30 %" No. 5 fh brass screw

Misc.: Carpenter's glue, 120-, 220- and 600-grit abrasive paper, 's'-dia. × 1" dowels (as required), Watco natural oil finish. \*As required.



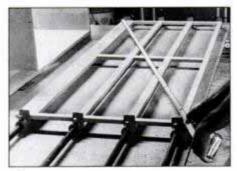
4 Rout grooves for splines in case edges using a ¼-in. slotting cutter. Clamp workpiece to a bench before routing.



5 Mark mortises, then bore overlapping 1/4-in.-dia. holes. Square with a chisel. Fence on drill press positions work.



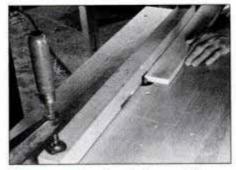
6 Cut ¼-in.-wide tenons with dado blade in a table saw. Clamp a stop block to the table to make identical repeat cuts.



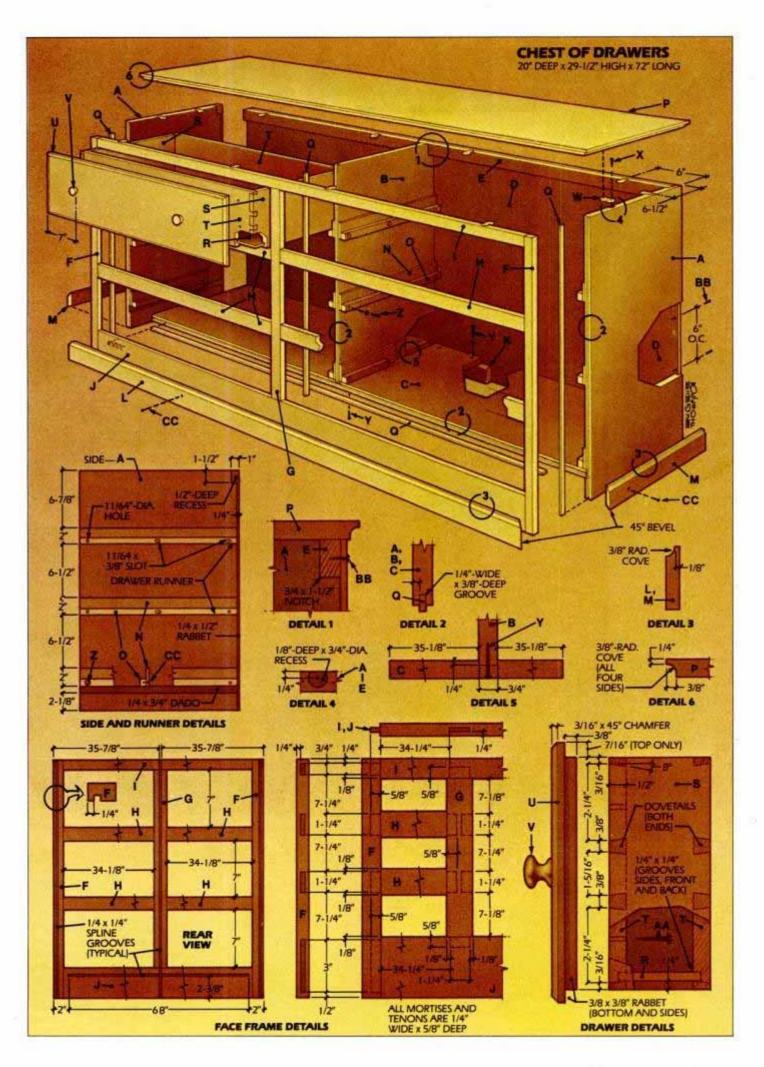
7 Glue and assemble face frame, and clamp. Measure both diagonals to check for square, and shift clamps if necessary.



8 Cut spline grooves in back side of face frame using ¼-in.-dia. straight bit. Stop groove in bottom rail 2 in. from edge.



9 Form top edge for the base molding on ½-in.-thick stock using a ½-in.-dia. cove bit on a router table.

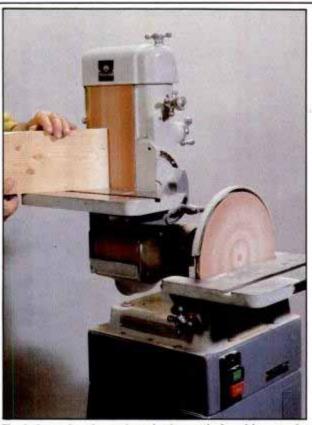


# SUPERSANDER

very woodworker knows
that sanding wood is a
necessary, if not glamorous, step toward the completion
of virtually all woodworking
projects. And although sanding
may never be fun, it can be
much less time-consuming and
tedious with the aid of a combination belt and disc sander.

The sander, also called a finishing machine, has a single, powerful motor that drives the sanding disc and the abrasive belt simultaneously. The sanding disc is simply a flat, circular metal plate that has an abrasive disc adhered to its surface. Disc sanders range in size from 6 in. dia. on small, benchtop models, up to 12 in. dia. on stationary, floor-standing units. Miniature 4-in.-dia. modelmaker's disc sanders are also available for lightweight handicraft work. The disc sander is generally used to square, shape and finish-sand the end grain of small workpieces and for shaping outside curves.

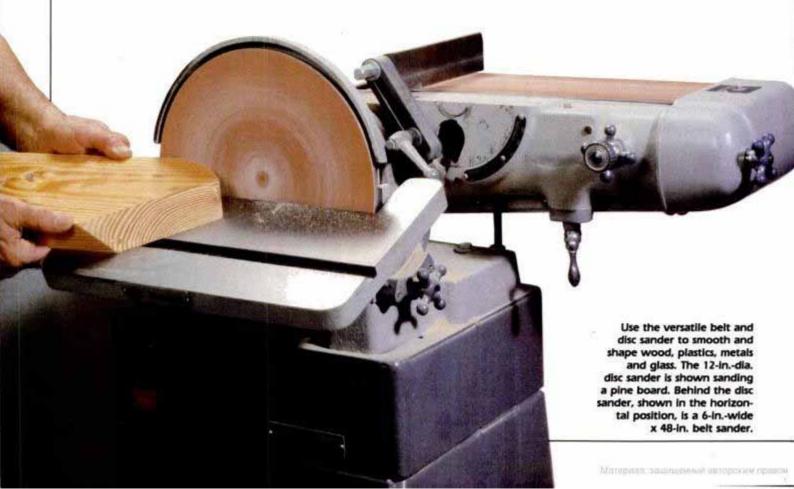
The belt sander operates a



The belt sander, shown here in the vertical position, can be adjusted and locked at any angle between 0 and 90°.

continuous abrasive belt that rides on two drums. A flat metal backup table, called a platen, is positioned between the drums to support the belt and the workpiece. Belt sanders are designated by the width of the belt they use, typically 4 or 6 in. wide. The sander's straight-line sanding action is particularly effective for sanding the surface and edges of boards. Sand inside curves by working the board against the end of the idler drum, as shown on page 120. The more expensive belt and disc sanders feature an adjustable-angle belt sander that permits positioning the belt horizontally, vertically or at any angle in between. This allows you to lock the belt sander at the most convenient working

Another desirable feature to look for on a belt and disc sander is a pair of tilting worktables. The tables on the Delta unit shown tilt out 45° and in toward the abrasive surface 20°. Tilting tables are invaluable for sand-



### An inside-out look at the most versatile sanding machine you can buy.

### TEXT AND PHOTOS BY ROSARIO CAPOTOSTO

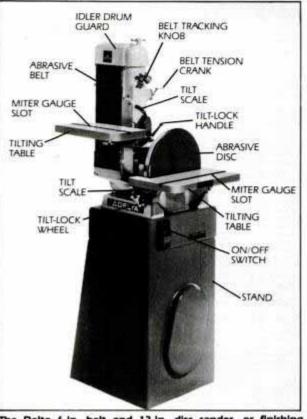
ing precise bevels and angles.

Sanding discs and abrasive belts are commonly available in two types of coatings: garnet and aluminum oxide, and in a variety of grit sizes ranging from 50 to 150 grit. Use garnetcoated abrasives for sanding all species of wood. Aluminum oxide abrasives work equally well on wood, metals and plastics.

### Mounting the disc

The first step is to clean the metal disc with lacquer thinner. Be sure to remove all foreign matter and residual glue left behind from the previous sanding disc. Then, mount the new disc to the plate using a specially formulated sanding disc cement. Don't use contact cement or any other permanent-bond adhesive that will make disc removal extremely difficult. Apply the cement to both the metal plate and to the back of the sanding disc. Wait about five minutes before pressing the disc onto the plate.

As an alternative to disc ce-



The Delta 6-in. belt and 12-in. disc sander, or finishing machine, is shown with its major parts identified.

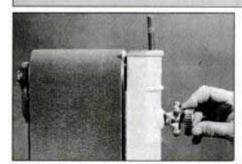
ment, try using peel-and-stick adhesive-backed discs or the new Velcro-backed sanding disc system. Both of these alternatives are quick, easy-to-use and, of course, more expensive than paper-backed discs.

### Disc sander

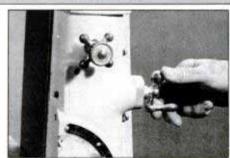
Disc sanding operations are always performed on the downward rotation half of the disc. Therefore, the machine's sanding capacity is slightly less than one-half the diameter of the disc (cutting action at the center is negligible). Hold the workpiece flat on the table and feed it lightly into the disc until the desired shape is formed or smoothness is achieved. Avoid pressing hard against the sanding disc. This will only clog the abrasive and cause burn marks on the wood. When precision sanding is required, such as when squaring an end or forming a miter, use a miter gauge to guide the workpiece.

Sanding perfectly round workpieces on the disc sander is

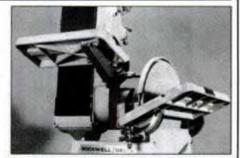
### **TOOL SETUP**



Move the belt to the left or right by adjusting the tracking knob. Then, tighten the star-shaped wheel to lock the belt in place.



To change the abrasive belt, simply rotate the tension crank until the belt loosens so that it can be slipped off the drums.



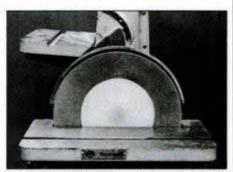
Delta sander features sturdy, ribbed worktables that tilt toward the abrasive surface 20°, as shown, and tilt out, or down, 45°.



Liquid sanding disc cement provides an easy way to mount the sanding disc. First, apply a thin, even cement coat to the metal plate.



Then, spread a thin cement coat onto the back of the sanding disc. Wait for about 5 minutes before pressing disc to plate.



Make a dual-grit sanding disc by cutting the centers out of two discs. Disc center is cut from fine grit; outside ring is coarse grit.

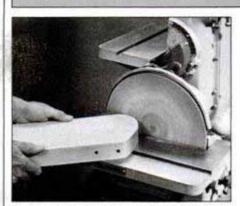
easy with the aid of the shopmade pivot jig shown below. The jig consists of a double ½-in. plywood table that houses a dovetail-shaped pivot bar. Rip the bar from ½-in. hardwood stock with the saw blade tilted 20°. Next, make a pivot pin by grinding a sharp point on the tip of a ¾-in. No. 6 flathead screw. Then, bore three or four holes in the pivot bar, spaced about 1 in. apart, for installing the pivot pin. Countersink the holes on the underside of the bar.

The adjustable pivot bar slides in a dovetail-shaped groove in the table and is locked in place with a cam-action locking lever. Form the dovetail groove in the table by simply cutting the top's upper plywood panel into two pieces with the saw blade tilted 20°. Bolt the locking lever to a mounting block that is glued and nailed to the table's underside. Locate the bolt off center, as shown, to create an eccentric, cam-action movement.

To use the pivot jig, first rough-cut the workpiece round on a band saw. Next, mark the workpiece center with an awl and place it on the pivot point. Then, slide the bar forward until the work makes contact with the sanding disc. Pull the locking lever up to lock the bar in position, turn on the sander and rotate the workpiece slowly until the entire edge is sanded. The pivot jig shown will accommodate workpieces up

(Please turn to page 120)

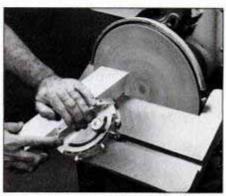
### DISC SANDING



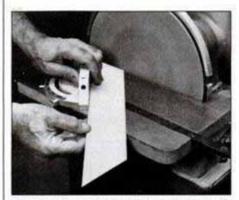
Sand outside curves on the disc sander freehand. Make light passes by swinging the work back and forth against the disc.



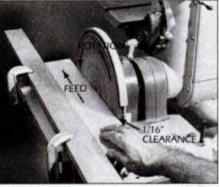
Use a miter gauge to sand precise miters. First, rough-cut the miters on a saw. Then, finish-sand the miters on the disc sander.



To sand a compound miter, tilt the table down and adjust miter gauge to the desired angle. Be sure to precut the miter first.



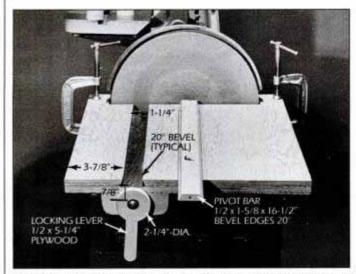
Disc sander is excellent for sanding plastic laminate and wood veneers. Use a fine-grit disc and keep the work's good side up.



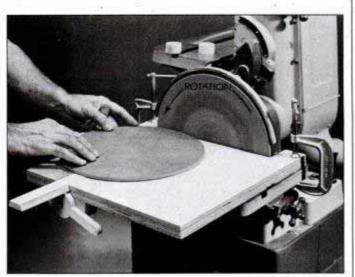
To sand long board edges, clamp a straightedge fence at a slight angle so that the work clears the upward rotation half of disc.



Form accurate, uniform chamfers easily by inserting a stop rod in the miter gauge. Adjust the rod to control the depth of cut.



Easy-to-build pivot jig clamps onto the sander's table. Pivot bar slides in the dovetall-shaped groove in the plywood top.



Place rough-cut circular workpiece on pivot point. Slide pivot bar forward and lock it in place with the cam-action lever.

# **EXPAND YOUR CAREER HORIZONS...**



# START WITH CIE.

Microprocessor Technology. Satellite Communications. Robotics. Wherever you want to go in electronics ... start first with CIE.

Why CIE? Because we're the leader in teaching electronics through independent study. Consider this. We teach over 25,000 students from all over the United States and in over 70 foreign countries. And we've been doing it for over 50 years, helping thousands of men and women get started in electronics careers.

We offer flexible training to meet your needs. You can start at the beginner level or, if you already know something about electronics, you may want to start at a higher level. But wherever you start, you can go as far as you like. You can even earn your Associate in Applied Science Degree in Electronics.

Let us get you started today. Just call toll-free 1-800-321-2155 (in Ohio, 1-800-362-2105) or mail in the handy reply coupon or card below to: Cleveland Institute of Electronics, 1776 East 17th Street, Cleveland, Ohio 44114.



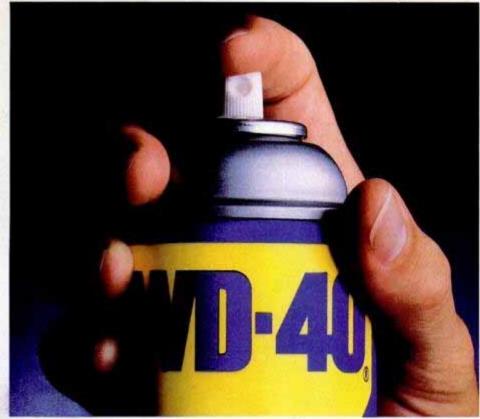
### Cleveland Institute of Electronics 1776 East 17th St., Cleveland, Ohio 44114

☐ Please send your free independent study	catalog.
For your convenience, CIE will try to have a	representative
contact you — there is no obligation.	

Address			Apt
City		State	Zip
Age	Area Code/Phone No		

MAIL TODAY!

Материал, зацишенный автороком приво



# If it moves, shoot it.

Take a shot at tools with moving parts, lawnmowers, sticky locks and squeaky hinges. Anything that moves. WD-40. America's troubleshooter.



To introduce you to the famous Junghans West German quartz mini-movements, Clockwerkes now offers you this precision clock movement at a very special introductory price . . . PLUS, if you order before 1/31/88, you'll receive a FREE GIFT CERTIFICATE worth \$3.95 on future orders for \$10 or more. It's like getting your first clock movement FREE! Hour & Minute Hands are included and accurate performance is guaranteed for 3 years! Order as many as you wish but remember this special price & FREE Gift Certificate are offered only on introductory orders. Major credit cards accepted. WRITE OR CALL TOLL-FREE.

in residents call (608) 755-1000 Out of state customers CALL TOLL-FREE

1-800-356-4011

DEPT. PM 1 Tempus Instrument Corporation 2419 Foster Avenue, Janesville, WI 53545 Save Time! Save Money! Mill Supply Sells Over 1,000 Different Top Quality

# STEEL REPLACEMENT

To Repair Rust or Collision Damage on Many American Cars, Pick-up Trucks and Vans and Most Imports



96-Page MILL U.S. Car, Truck and Van Catalog

\$300

\$200

Lists sheet metal parts available for most popular U.S. cars, vans and pickups. Tools and body shop accessories also are included (\$4.00 Canada, U.S. funds)

MILL Import Car & Truck Catalog

Lists steel replacement penels, tenders, hoods, grills, ruckers, risar quarters, etc. (\$3.00 Cenada, U.S. funds) (\$3,00 Canada, U.S. funds) Send check or money order, allow about 3 weeks for delivery, VISA or Mastercard accepted ON PARTS ORDERS ONLY:

Free Information Send self-addressed, stamped long envelope for free information on any ONE American or



3241 Superior Avenue • Cleveland, OH 44114 Phone (216) 241-5072

### TITANIC

(Continued from page 78)

When Capt. Markel told Jack Grimm that they might run into a 50-foot squid in their 25-foot sub, Grimm, according to Markel, responded with a Texas grin: "Be glad to meet 'em."

Grimm's grail

Grimm, whose last major quest was an expedition to Turkey in the 1970s that found ancient wooden beams on Mount Ararat, beams some believe to be from Noah's ark, plans to spend 30 days at the site, making one dive a day. With the Aluminaut costing some \$30,000 a day to support at the surface. and with refurbrishing the vessel costing \$1 million, it appears that Grimm is already over his \$1.5 million budget. So why the money? And the risk? What is Grimm after?

One of the ship's two bells, Grimm says, "possibly" to place in Philadelphia's Titanic museum. Otherwise, Grimm just wants to look around on the ocean floor and pick up whatever they can-mailbags, briefcases, luggage.... Capt. Markel says he wouldn't mind sampling a bottle of the wine preserved down there for so long.

Searching for clues

It's unlikely that any artifact will help solve the mysteries still surrounding the tragedy of the Titanic. Why, for instance, were there too few lifeboats and why did people refuse to get into the ones that were being lowered away? Was there a ship within sight and why did it ignore the volley of distress rockets fired by the sinking liner? Did the crew think that they were signals from fishermen trying to find their way to their mother ship?

One new mystery, however, has surfaced since the wreck was discovered: Why did the stern break off and the bow remain so pristine? Theories abound. Did the wreck settle first on an underwater mountainside and then, after a seaguake, tumble into a valley, breaking in two? Or did the mere weight of the water-filled bow drag the air-filled stern down before it could fill with water, causing a kind of implosion that snapped the section off? A closer look at the damage may tell.

### A Titan's treasure-trove

Grimm says the controversy over the Titanic is mainly over one question: whether or not it should be raised, and he says he's not interested in that. "But," he says, "there's nothing wrong with diving in the area and recovering memorabilia."

Diamond neckless and gold aside, the ship's bell from the Titanic, marine experts say, would be priceless.

(Continued from page 102)

plywood. Bore clearance holes and counterbore the holes slightly. Install the back with %-in. No. 5 fh brass screws, spaced 6 in. apart.

Mark locations for the %-in. × %-in.deep mortises for the tabletop fasteners in the top edges of the case. Bore the mortises with a %-in.-dia. Forstner bit, then install the fasteners with %-in. No. 8 fh screws.

Clamp the case top upside down to the worktable so that you can cut the cove detail on all four edges. Use the %in.-rad. cove bit in the router. Be sure to place the top on the case with equal overhang on all sides, and secure it with %-in. No. 8 rh screws through the tabletop fasteners.

### **Drawers**

Cut drawer sides, fronts and backs from ½-in,-thick maple stock. Lay out the dovetail joints as shown in the drawing and cut the joints using a dovetail saw and sharp chisel. Rout the groove for the drawer bottom with a ¼-in,-dia. straight bit in the router. Cut the drawer bottoms from ¼-in, maple plywood. Sand the inside drawer surfaces before assembly, first with 120-then 220-grit paper.

Assemble the drawers with glue and clamps, checking each for squareness. After the glue dries, sand the outside drawer surfaces and test-fit each drawer in its opening. If the fit is too tight, use a sharp plane or belt sander to trim



10 Apply base molding with 1-in. brads and glue. Fill nail holes with wood filler or cherry sawdust mixed with clear lacquer.



12 Mount the case back with %-in. No. 5 fh brass screws, set 6 in. apart. Counterbore screwholes to set heads flush.

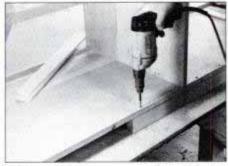
the drawer sides as necessary. Be sure to allow for seasonal swelling of the drawer when fitting.

Cut the drawer faces to size. Use a chamfer bit in the router to cut the 3/16in, bevel around the edge of each drawer face. Cut rabbets on the back side of each drawer face with a %-in, straight bit on the router table. The rabbets on the sides and bottoms are % in. wide; top rabbets are 7/16 in. wide. Bore clearance holes in the drawer fronts and attach the faces to the fronts with 1-in. No. 10 rh screws. Mount the wood knobs on the drawers. Although the knobs are maple, they are turned from end-grain wood, so they will finish quite dark and virtually indistinguishable from the cherry. Now you should finishsand the case and drawer fronts, first with 120- then 220-grit paper.

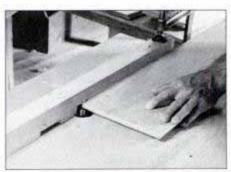
### Finishing

We applied three coats of Watco natural oil finish. Brush on the first coat of oil liberally, then sand with 600-grit wet or dry abrasive paper, wrapped around a padded sanding block. Wipe off the excess oil.

After three or four hours, apply a second coat. Let the oil soak into the wood for about 15 minutes before wiping it off. Allow the oil to dry overnight, then apply the third coat. Put a light coating of paraffin on the drawer sides and runners to ease the drawer movement and prevent sticking.



11 Install the rear support leg with glue and screws. Bore clearance holes in bottom, and countersink screwheads.



13 Cut rabbets on backs of drawer faces using  $\frac{3}{16}$ -in.-dia. straight bit. Top rabbets are  $\frac{7}{16}$  in. wide, others are  $\frac{3}{16}$  in. wide.







1-800-221-3085

IN NY 212 689-9018

### **HAMMERS**

(Continued from page 99)

dle of this 16-oz. hammer (\$13) features a dimpled, antislip surface. The striking face and curved claw are hardened individually to ensure strength and durability. It's also available in a 20-oz. model. Contact Sandvik, Box 1220, Scranton, PA 18501.

8. Ball-peen hammer—Featuring a hardened head, the ball-peen hammer is used for striking cold chisels and punches and for general metalwork. The ball-shaped peen was originally used to mushroom rivet heads. They are commonly available in sizes ranging from 8 to 32 oz. The 24-oz. model shown costs about \$19. Contact Estwing, 2647 Eighth St., Rockford, IL 61101.

9. Toolmaker's hammer—Here's an excellent example of just how specialized a hammer can be. This 4-oz. miniature ball-peen hammer has a magnifying lens built into its head. Use the lens to check centerline and intersection punch marks for accuracy. The chrome-plated tool costs about \$32. Contact Starrett Co., Consumer Products, 121 Crescent St., Athol, MA 01331.

10. Rip hammer—Great for rough carpentry, this 22-oz. hammer features a straight ripping claw, a fiberglass handle and a rubber handgrip. Many workers prefer fiberglass-handled tools because they are virtually unbreakable and are more shock absorbent than steel-handled tools. The hammer shown costs \$20.99 postpaid from U.S. General, 100 Commercial St., Plainview, NY 11803.

11. and 12. Dead-blow hammers—Use dead-blow hammers to strike blows without damaging the work's surface. The tools' hollow heads are partially filled with small metal shot, which reduces rebounding. Durable urethane completely encloses a solid steel handle that's welded to a cylindrical steel head. Dead-blow hammers are available in five styles ranging in size from 8 oz. to 14 lb. Shown are the 10-lb. (No. 11; \$70) and the 14-oz. (No. 12; \$18) hammers. Contact Stanley, 600 Myrtle St., New Britain, CT 06050.

13. Frontiersman's tool—This rugged 24-oz. tool is more than just a hammer, it's also a crowbar, nail puller and hatchet. You'll find this tool particularly useful on camping trips and for opening wooden crates. It's \$13.90 postpaid from Leichtung, 4944 Commerce Parkway, Cleveland, OH 44128.

14. Leather-grip claw hammer— Designed for finish carpentry and other light-duty nailing jobs, this 12-oz. (\$19) curved-claw hammer features an attractive, comfortable leather handgrip. The grip is a lamination of leather washers pressed and riveted to the solid steel handle. Contact Estwing, 2647 Eighth St., Rockford, IL 61101.

15. Upholsterer's hammer—The magnetic face of this 7-oz. hammer (\$20) makes it easy to start upholstery tacks and small nails. Use the nonmagnetic face to continue driving the tack. The curved, narrow head fits in restricted spaces. Contact Stanley, 600 Myrtle St., New Britain, CT 06050.

16. Brasshead hammer—Use this 16-oz. solid brass, wood-handled hammer during metalworking to avoid marring the work's surface. The tool has a 1-in.-dia. x 2½-in. head and is about 10 in. long. It's available for \$14.65 post-paid from Garrett Wade, 161 Ave. of the Americas, New York, NY 10013.

17. Claw hammer—Here's a fine example of a standard carpenter's nailing hammer. This 16-oz., hickory-handled hammer (\$18) is designed for general nailing. Its curved claw has two sharp, beveled edges for drawing out stubborn nails. Contact Stanley, 600 Myrtle St., New Britain, CT 06050.

18. Supertough hammer—If you're tough on tools, try this virtually indestructible rip hammer from Last Time Tool Co., Suite 415, 148 International Blvd., Atlanta, GA 30303. The handle is made of a super-resilient, shock-absorbent copolymer resin. The 14½-oz. hammer is available with a rip or curved claw for about \$18.

19. Plastic-tipped hammer—This 12-oz, steel-core hammer (\$12) features two replaceable plastic faces. One side has a hard plastic face, the opposite side has a soft face. Use the hammer for striking, without marring, various materials including wood, metals, plastic and stone. Contact Sears, Sears Tower, Dept. 703-PM, Chicago, IL 60684.

20. Japanese hammer—The square steel head of this hammer has one flat striking face opposite a slightly crowned face. Use this tool for both woodworking and metalworking. The 8-oz. hammer is \$12.55 postpaid from Garrett Wade, 161 Ave. of the Americas, New York, NY 10013.

21. Lignostone mallet—Use a wooden mallet to strike wood and plastic handled chisels and gouges, to install wood dowel pins and to assemble wood parts. This 25-oz. mallet is made of laminated beech veneers that is claimed to be five times harder than solid beech and twice as elastic. It's \$15.90 postpaid from the Fine Tool Shops, 20 Backus Ave., Danbury, CT 06810.

22. Drywall hammer—Designed for installing drywall, this 12-oz. hammer has a milled striking face opposite a hatchet blade. Use the hatchet blade to score the drywall to permit snapping it along the scored line of cut. It's about \$20 at most Sears stores. Contact Sears, Sears Tower, Dept. 703-PM, Chicago, IL 60684.

Now! NRI and SUN team up for training in professional auto servicing.

Includes famous Sun diagnostic equipment and Autocraft scope you keep to use on the job. It's the most in hands-on career training at home.

Only NRI trains you so thoroughly, so professionally for a career... even your own business... in auto servicing. Only NRI includes famous Sun and Autocraft equipment as part of your training. And only NRI does it all in your own home, at your convenience, with a program developed with the help of pros like Richard Petty, leading stock car driver and NRI consultant.

### Includes Sun Equipment, Choice of the Pros

NRI training is based on plenty of hands-on experience. And you get that experience using the real thing. You learn to use the famous Sun Gun\* inductive timing light, Sun compression tester, vacuum gauge, remote starter, and the Sun inductive diagnostic analyzer.

Finally, you get your own Autocraft ignition analyzer oscilloscope, the master mechanic's master instrument. Its electronic patterns let you "see" right into an engine, spot problems and make adjustments on 4,





6 or 8 cylinder engines, even racing and high-performance cars.

### **Training Covers the Complete Car**

You learn auto servicing from bumper to bumper, at home in your spare time. NRI starts you out with the high-demand underhood services... tuneups and diagnostic work. Then you move on to tire and brake work, alignments, transmissions, power steering, air conditioning, even engine rebuilding. It's 51 information and know-how packed lessons, with an extra bonus of special training in diesel engines plus 6 special texts covering body work, certifica-

tion, starting your own business, and more.

### Pro Training from the Pro Trainers

Nobody has more know-how in at-home technical training, nobody has more successful graduates. Only NRI/McGraw-Hill combines almost 70 years experience with the resources of the leading educational publisher to give you the training you need to become your own man. See for yourself. Mail the coupon today for your free catalog showing all the opportunities and describing lessons and equipment in detail. Train at home, train for the future with NRI and Sun.

If coupon has been removed, write to NRI Automotive School, 3939 Wisconsin Ave., Washington, DC 20016

### MAIL FOR FREE CATALOG

	ne free catalog only.		Building Construction Course		
Air Conditionin Heating and Sc Courses Small Engine F	The state of the s	☐ Telephone Servicing Cours ☐ Industrial Electronics ☐ TV/Audio/Video Servicing, ( cations Electronics, Micros Electronic Design Technology	Commun		
Appliance Sen	vicing Course (Please	tronics Courses	je .		

### **BASS BOATS**

(Continued from page 81)

some deficiency in another category.

In sum, we liked practically everything about the Skeeter's seating and dash layout. It's comfortable and offers superb sight lines from the helm. However, we contend that the distance between the driver and the steering wheel is an important security factor when you're driving at high speeds, and the Skeeter's wheel is just a touch farther away from the driver than we would have liked. Also, the dash cuts across the knees and is capable of delivering a nasty

bruise in rough water. We would have preferred to have seen the trim gauge located on the instrument panel close to eye level rather than on the side deck. While we found the stowage to be adequate, we particularly liked the door latches, which you can grab easily and quickly (unlike the flush-mounted pop-up handles on Ranger's lockers).

In high-speed handling, the Skeeter turned easily and well. The boat eases onto the after hull pads when trimmed out fully, while some boats, notably the Stratos, mount the pads with a kind of brisk authority. This "mushiness" in no way detracts from the way the boat feels flat out, and it takes really rough conditions to initiate a chine walk. A slight stiffness in steering was more than compensated for by the Skeeter's knack for counteracting moto-torque. Smooth water performance at speeds in excess of 60 mph was quite literally a breeze.



Earl Bentz-designed Stratos wraps around the course marker in one PM performance test.

The Skeeter's balanced characteristics—rather than flashy excellence in any particular category—made it a standout.

### Stratos 179

The Stratos very nearly eclipsed the Skeeter in our overall ranking. If the boat hadn't stumbled during the trolling performance test, its truly superlative abilities on the highend would have put it over the top. None of the boats we drove felt as good at speed as the Stratos. One indication of the boat's consistency and forgiveness at high speeds is in the margin between fastest and slowest times in our performance tests. A mere four-tenths of a second separated the Stratos times in the 0 to 55 test; five-tenths in the 180° test. In both instances, the throttle was resting comfortably on the lock and steering was accomplished with nonchalant aplomb. And when the Stratos was trimmed out, it sprang onto the pads

### Trolling: It's What's Up Front That Counts

We mounted four leading trolling motors to the bow of a Ranger 370V for our performance comparison The same operators were aboard the Ranger for each test and all voltages vere either set on 24 or for the Mercury Thruster HIGH Thrust, amp draw and weight were supplied by manufacturers

### Ranking/Make/Model

RT/AD/Weight (lb.)\* Times: Straight/Slalom Steering (1-5)/Noise (1-5)\*\*

Price As Tested



1. Evinrude Scout 31/29/27.5 1:06/3:09

4/5 \$533



2. Minn Kota Mag 40 41/24/41

1:06.30/3:04.31 5/4 \$571.57\*\*\*



3. Mercury Thruster

28/33/37 1:25.92/3:40.26 4/3

\$545



4. Motor Guide Brute

41/26/35 1:07.51/3:10.55 4/1

\$460\*\*\*

\*RT=Rated Thrust; AD=Amp Draw. \*\*Steering Index: 1=Difficult, 5=Smooth, Noise Index: 1=Very Noisy, 5=Very Quiet. "Prices obtained from dealerships

PM invited four major trolling motor manufacturers to participate in a mini shootout during our bass boats performance test. We compared static figures like rated thrust, amp draw, weight and price, then threw in some of our own criteria, like time through straight-line and slalom traps and subjective evaluations of steering authority and underwater noise emission.

### **Evinrude Scout**

This little unit has clean, pleasing lines and a bold directional indicator. All pluses. But we chose the Scout over the other trolling motors we tested on performance, not on looks. For the most part, the Scout has less rated thrust and amp draw, yet it performed superbly in our speed tests.

The Scout also has a bent-shaft leading to

its lower gear case, which was designed to counteract torque. This minor innovation manifests itself in greatly improved steering. I do have a complaint about the Scout's foot pedal though. It makes a radical backward angle in its max down position. Feet aren't designed to bend that way.

### Minn Kota Mag 40

There was an inconsistency between the Minn Kota's rated thrust and the amount of speed we were able to achieve. It seems that with 10 pounds more RT, the unit should have been a little bit faster. We also had minor complaints about the directional indicator (too small and shapeless.)

There's still plenty to like about the Minn Kota unit, though, like its very quiet underwater noise characteristics and the smoothness in the steering pedal action.

### Mercury Thruster

Deploying the thruster with the power cord instead of a string is mildly disconcerting. Also, the Mercury Thruster's steering pedal is covered by a flimsy piece of plastic, which feels like it's about to break away.

Still, the Thruster's underwater noise level rates a neutral 3-not bad, not good. It's abovewater noise level is indeed pretty high.

### Motor Guide Brute

As with the Minn Kota, the Brute's rated thrust wasn't consistent with its speed. And while the Brute has some good points (like the very clear directional indicator and brisk steering authority), its underwater noise level was exceedingly high.-T.C.

with no-nonsense determination, locking onto course and producing unmatched comfort and control. The Stratos was quite simply a joy to drive flat out.

This ability on the high end of the speed range and the boat's enormous locker space wasn't enough to compensate for some shortcomings in the trolling performance category. One reason the Stratos produces such a splendid rough-water ride is its fine hull entry forward, which splits the chop. That hull form means the boat's forward casting platform must pivot on a rather narrow fulcrum, so trolling performance in rough water is rocky. Although it's probably the kind of thing one can become accustomed to, it was just irritating enough to kick the boat out of first place.

### Ranger 350 V

Forrest Wood's Ranger is the granddaddy of the bass boating field, and it's reasonable to assume that most manufacturers have gone to school on Ranger's original blend of speed and practicality. The company is rightfully proud of the safety inherent in its foam-injected hull. Ranger concedes its boats may not be the fastest, but it'll stack its "fishability" against anyone's, insisting its boats supply durability and peace of mind in addition to easy stowage and a respectable performance.

Perhaps its strongest suit, the Ranger's stowage compartments are ample and designed with an eye toward balance (although, as mentioned, we disliked the locker door latches). There is sufficient space for rods, livewells, maps and PFDs with no one stowage area taking all the room at the expense of another. It's a nicely organized arrangement, in other words, and in some ways exceeds stowage concepts found on other boats.

Trolling was a bit rockier on the Ranger than on the Skeeter and Cajun, and while the boat turned in a middling performance in the 0 to 55 test, it trounced all comers in the 180° test with the engine trimmed in. Explain that!

At high speed, the Ranger feels a little less secure, and that's probably a function of the distance between console and driver (10 inches to Skeeter's 8). Still, some committed Ranger fans like that kind of separation because it makes it easier to get behind the wheel.

### Cajun Ricky Green

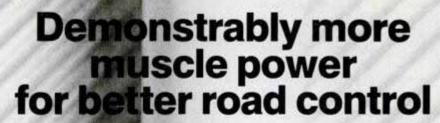
The Cajun followed the Ranger—but not by much. It's trolling performance is ultra stable, stowage is sufficient and maneuverability close to stellar. But the Cajun's 0 to 55 test results were soured by having the wrong prop installed (a Raker 24 instead of a Raker 22), which spoiled its acceleration from a standing start. Following a spectacular pass through our maneuverability course

(taking all honors on a running start), we were willing to forgive the Cajun's performance lapse out of the hole.

Nonetheless, we were intensely dissatisfied with Cajun's dash layout—crucial to high-speed peace of mind. The tach, speed and trim gauge are all positioned at knee level and to the right, which means you have to look into the bottom of the boat at high speed to ascertain the engine's trim angle. When you're trying to fire the boat out of the hole and onto the pads at high speed in rough water, the last thing you want to do is take your eyes off the waves to check the instruments. To its credit, the Cajun has some nice touches. The aft casting platform is enormous, and, again, its trolling ability is superb. We also liked the mini-windshield (which you can only appreciate at full speed on a rainy day) and, for all the shortcomings in the instrument layout, its ability to accommodate fish-finding electronics on the dash near the driver.

### Correct Craft Bass Nautique

First the good news. The Bass Nautique will burst onto the hull pads with smooth alacrity and create cheek-flutter-(Please turn to page 116)





### Here are the facts:

				Gas-a-just's Advantage		
	Gas-a-just	Monroe	Gabriel	Monroe	Gabriel	
Gas pressure!	280 psi+	100 psi*	200 psi*	+180%	+ 40%	
	Greater pre	essure means	quicker resp	onse.		
Bore diameter!	40.0 mm	34.9 mm	34.9 mm	+14.6%	+14.6%	
	Larger diar	neter means i	more dampin	g power.		
Monotube construction	yes	no	по	Gas-a-just eliminates aeration		
	Monotube construction eliminates aeration for better performance.					

Plus these other Gas-a-just features: 0-ring piston seal, chromed piston rod and patented divider piston mean better performance. Sintered iron piston means greater strength. Seamless eye-ring and cylinder mean greater durability.

'Source: Competitive advertising. 'Approximately.

No wonder America's best-selling

monotube gas shock is

for passenger cars, too.,

Uas-a-just from L Y LS 901 Oak Creek Drive, Lombard, IL 60148

Pioneers in gas shock technology.

If you can operate a garden tiller, vou can...

# be your own water well driller!

All the pure, fresh water you need for your home and garden - and never pay another water bill! Let your lawn sprinklers run all summer - the cost is only pennies per day when you drill a little 2-inch well in your backyard.

### "I can't believe how easy...!"

To drill your own water well takes a little time (usually a weekend), a little effort and a little machine called the HYDRA-DRILL, Since 1962, over 99,000 water wells have been drilled with this economical, easy-to-use machine - mostly by homeowners who'd never before drilled a well. Many tell us, "I can't believe how easy it was - a lot easier than operating a garden tiller!"

Imagine! No more water bills! No more water restrictions! Win total water independence just by drilling a 2-inch well in your backyard. Enjoy an endless supply of FREE WATER 365 days a year!

Interested? We'll be happy to send complete information, FREE, by mail. No obligation, of course. Write or call toll-free 1-800-821-7700 (Ask for Operator 5932).





Cross-country skiing is often cited by physiologists as the most perfect form of cardiovascular exercise for both men and women. Its smooth, fluid, total body motion uniformly exercises more muscles so higher heart rates seem easier to attain than when jogging or cycling. NordicTrack closely simulates the pleasant X-C skiing motion and provides the same cardiovascular endurance-building benefits-right in the convenience of your home, year 'round. Eliminates the usual barriers of time, weather, chance of injury, etc. Also highly effective for weight control

### More Complete Than Running

NordicTrack gives you a more complete work out-conditions both upper body and lower body muscles at the same time. Fluid, jarless motion does not cause joint or back problems

### More Effective Than Exercise Bikes

NordicTrack's stand-up skiing motion more uni-

Call or write for FREE BROCHURE

storage space.

exercises these muscles.

Toll Free 1-800-328-5888 Minnesota 612-448-6987

buttocks. When swimming, the body is supported

by the water, thus preventing these muscles from being effectively exercised. The stand up exercising

position on the NordicTrack much more effectively

A Proven, High Quality Durable Product

NordicTracks have been in production since 1976. NordicTrack is quiet, motorless and has separately adjustable arm and leg resistances. We manu-

facture and sell direct. Two year warrantee,

Folds and stands on end

to require only 15" x 17

30 day trial period with return privilege.

PSI, 141PM Jonathan Blvd., Chaska, MN 55318

### BASS BOATS

(Continued from page 115)

ing, eye-watering acceleration as it proceeds to a top-end well past 60.

But, as one of the technicians from Able Marine put it, "You really have to drive that thing." He meant that high torque and a flat, speedy hull form can put up a real fight at speed. Also, the boat likes to chine walk-often a real attention-getter. It's easy to learn how to make this boat go fast. Getting used to its eccentricities is another matter.

While the Bass Nautique was the unqualified speed king during our testing-with swift, consistent times-the boat fell totally flat in stowage area and trolling ability. Correct Craft is best known for its ski boats, and the Bass Nautique is an attempt at duplicating the company's skiing success in the bass market. Bass fishermen are a persnickety bunch, though, and rarely tolerate a design that fails to balance all the attributes of true fishability. Bass Nautique's domination in the speed category just wasn't sufficient to boost the boat higher in our ranking.

We're told we can expect stowage improvements in BN's '86 model.

### Conclusion

There's one highlight that all of these boats seem to share. They were all really well built and cosmetically superb. Some very tough, well-designed construction lurks beneath all that metal flake and astro turf, and, as one manufacturer put it, "The driver always gives out well before the boat on a really rough day."

Most of the performance and measurement differences, while very real, were also very subtle. But details-down to a fraction of an inch-can often spell the difference between a bass boat that works and one that doesn't.

There's also another point I failed to mention. While we had a few moments of sheer, blind terror (sparked no doubt by a dangerous mix of operator zeal and naiveté), driving these things is just plain fun. It seems those Southern boys know a thing or two about boats.

### BASS BOATS MANUFACTURERS

- Skeeter Products, 1 Skeeter Rd., Box 230, Kilgore, TX 75662; (214) 984-0541
- Ringure, 1A 75062; (214) 384-0841
  Stratos Boats Inc., 931 Industrial Rd., Old Hickory, TN 37138; (615) 847-4034
  Ranger Boats, Wood Manufacturing Co. Inc., Flippin, AR 72634; (501) 453-2222
  Cajun Boats, Mastercrafters Corp., Winnsboro, 1A 713055, (218) 425 0421
- LA 71295; (318) 435-9431
- Bass Nautique, Correct Craft Inc., P.O. Box 13389, Orlando, FL 32859-3389; (305) 855-4141

### TROLLING MOTOR MANUFACTURERS

- Evinrude Scout, Evinrude Outboards, P.O. Box 663, Milwaukee, WI 53201; (414) 447-5769
   Minn Kota, 1531 Madison Ave., Mankato, MN 56001; (507) 345-4623
   Mercury Thruster, Mercury Marine, 1939 Pioneer Rd., Fond du Lac, WI 54935, (414) 929-5009
- Motor Guide, P.O. Box 4345, Starkville, MS 39759; (601) 323-4345

# Now you can have Lifetime Security in a CASH business where you can easily make up to \$200.00 per day and more

Find out how ...

... send NOW for your

# FREE Lifetime Security Fact Kit

Your FREE Lifetime Security Fact Kit tells you how to make \$18.00 to \$30.00 an hour in your own Foley-Belsaw Full-Service Saw and Tool Sharpening Business. Your FREE Fact Kit explains how you can:

- be your own BOSS!
- work full time or part time, right at home.
- do work you enjoy and take pride in.
- operate a CASH business where 90¢ of every dollar you take in is clear cash profit.

And it is *so easy* to learn. Foley-Belsaw gives you all the facts and instructions. No previous experience or special training is necessary. All you need is the desire and ambition to be your own boss. Foley-Belsaw tells you everything you need to know to be successful.

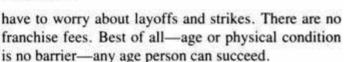
There's plenty of business where you live to keep you busy. It doesn't matter whether you live in a big city, small town or a small farm community.

You'll quickly be able to develop the skills necessary to earn a steady income. You'll be able to sharpen all types of saws, garden and shop tools for home, farm and industry.

Profits from your Foley-Belsaw Full-Service Sharpening Business can provide...

- ... CASH for future security or supplemental income
- ... CASH for travel, vacations, fishing trips
- ... CASH for the things you've always wanted!

And you'll be able to set your own hours and not



You can be like Steve Taylor of Brookville, Ohio, who told us:

"... the first year I grossed \$21,000.00."

Or James B. Jones, of Albuquerque, NM who reported:

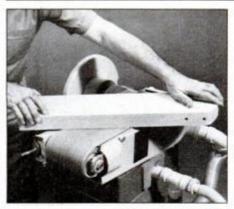
"This past summer my sales and service amounted to almost \$6,000.00 a month."

But you've got to get the FACTS before you can get started. So WRITE NOW for your FREE Lifetime Security Fact Kit. It's yours to keep with NO OBLIGATION. The Foley-Belsaw Company 60466 Field Building





### **BELT SANDER TECHNIQUES**



To sand a board that is wider than the belt, feed the board diagonally so that its entire surface makes contact with the belt.

to about 48 in. dia. When sanding work greater than 24 in. dia., support the pivot bar from underneath. Attach a scrap 1x3 from the bar to the floor.

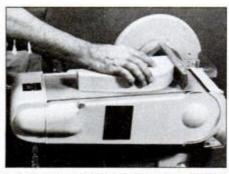
### Belt sander

As with disc sanding, many belt sanding operations can be performed freehand while other, more precise sanding tasks require the use of a guide to ensure accuracy.

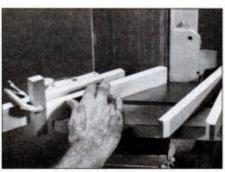
The most common freehand operations include sanding board edges, surfaces, inside and outside curves and square, inside corners. Sand the surface of a board with the belt in the horizontal position. Install an accessory backstop to the sander if the workpiece is shorter than the platen. Place the work on the moving belt with its end against the backstop. The backstop will prevent the work from shooting off the end of the sander. Apply light downward pressure until achieving the desired degree of smoothness.

To sand the surface of long boards, first remove the idler drum guard. Next, grip the work firmly and advance it slowly against the belt's rotation while applying downward pressure. If the board is wider than the belt, feed it at a slight diagonal so that the board's entire surface makes contact with the

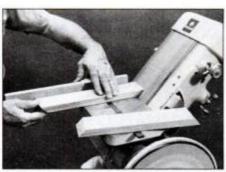
(Please turn to page 124)



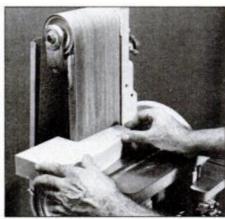
Install an accessory backstop when sanding small workpieces. Backstop prevents the work from shooting off the end of the belt.



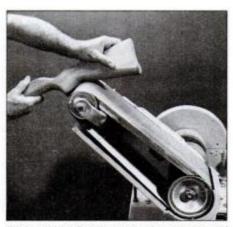
Use this setup to sand uniform end chamfers. Clamp a stop block to miter gauge fence, hold work to block and press into belt.



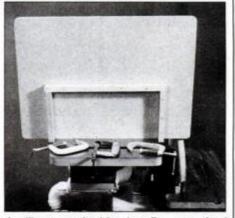
To obtain better control when sanding miters, tilt the belt sander to the desired angle. Now you can work on a level table.



Sand square, inside corners by positioning the belt flush with edge of platen. Side guard must be removed for this operation.



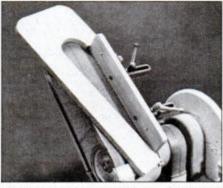
Remove the idler drum guard to expose end of the sander for contour sanding. Adjust the sander to a convenient working angle.



Auxiliary worktable handles oversized workpleces. Attach three cleats to the underside, then clamp the table in place.



The increased worktable surface provides greater stability for manipulating workpleces and, therefore, increases accuracy.



Make an auxiliary extension fence that wraps around the end of the belt sander. Attach by screwing through wood fence.



Keep work flat against extension fence to sand square, 90° edges on curved pieces. This isn't possible when sanding freehand.

# Why Are We Giving Away These Famous Nationally Advertised™ SWIFT 660/F™ Telescoping Spin Rods for only \$5?

Hard to believe, but true.

As part of its Anniversary Publicity Campaign, a leading New York firm will distribute one million (1,000,000) of its most expensive spin rods—the Famous Nationally Advertised™ SWIFT-660/F™ Telescoping WhisperCast™ WhamRod™—for the astonishing "Anniversary Price" of only \$5 each to the first one million persons who write to the company

address (below) before midnight, March 31, 1986.

This original Anniversary Ad must accompany your request. Copies or photostats are not acceptable.

These are the same famous SWIFT-660/F Telescoping WhisperCast WhamRods nationally advertised in leading media. A full standard 66 inches from base to tip, they spring to complete length in an eye-blinking 6/10ths of a second!... then telescope down to a mere 16 inches for easy storage in kit bag, glove compartment or attache case.

Crafted of aluminum, stainless steel and space-age fiberglass for extra strength and flexibility, they provide full response along the entire length of the rod, without "flat spots". And allow precise placement of small flies with a minimum of surface displacement.

Weighing a featherlight 3.75 ounces, they are the perfect ultralight rods for today's "compleat angler". Designed for casting powerfully over long distances, they're at home on virtually every lake, stream or waterway in America, and ideal for land-casting, general wading, and boat-fishing. Small wonder they are the fastest selling (and most expensive) spin rods ever offered by this giant multi-million-dollar New York firm.

Each rod is covered by the company's full one-year money-back guarantee. There is a limit of two (2) rods per address at this price. But if your order is mailed early enough (before March 25) you may request up to five. These Famous Nationally Advertised SWIFT-660/F Telescoping WhisperCast WhamRods will not be sold at this price by the company in any store.

To order, mail this *original* printed ad (no copies or photostats) together with your name and address and \$5 for each rod. Add only \$2 shipping and handling no matter how many rods you are requesting. (New York residents add sales tax.) Allow up to 6-8 weeks for shipment. *Make check payable to: A&C Company.* Mail to: A&C FISHING ROD OFFER, Dept. 114-107, Box 1736, Hicksville, N.Y. 11802. (A29380)

If you respond promptly

If you are able to reply before Mar. 25, we'll give away the famous top-of-the-line SWIFT-

ishing price of just \$2 a reel.

(And we'll even wind 250 feet of our best 6-lb-test monofilament line onto each reel!)

660/F ZoomCast

Spinning Reel with

every every rod you order...for the aston-

These nationally advertised reels perfectly match your rod in weight and balance, and give you fast "thumbs-off" (one-handed) casting over longer distances than you ever dreamed possible. You can cast even the lightest baits without backlash.

Compatible with virtually every plug or lure, the new high-speed gear ratio gives you fast "pop"-action, yet is powerful enough to reel in fish without "pumping". The new open-face design (and desirable skirted spool) eliminates friction and prevents tangles. The anti-reverse is "whisper" silent, and the Microdisc Surge-Free Drag System won't let your fish run away.

The most expensive reel sold by this huge firm, it is yours for only \$2 if you act before March 25. (A25166)

© 1985 PDM, Inc., 1200 Shames Dr., Westbury, N.Y. 11590



# HOME REBUILDER SPECIALS TOP NAME BRANDS

WE BUY DIRECT, WE SELL DIRECT THAT SAVES YOU MONEY.

RAPID COOL

**ELECTRIC FANS** 

S.B. CHEVY

WEIAND MANIFOLD

SPECIAL OPEN PLENIUM PPM RANGE 2000 — 6000

58 Chery \$69.95

ACCEL

ON SALE

BREAKERLESS

ELECTRONIC

IGNITION

chanical Advance try V8 89.95 id 289.302 99.95 id 3510-400 99.95

DISTRIBUTORS

d 429-460 99.95 par 318-360-360 99.95

uum Advance

# 289-302 # 351C-400

d 429 460 par 316 560 360

TRANSPARENT

DISTRIBUTOR OF THE

CAPS AVAILABLE FOR Ford/GM/Moper V8 YOUR CHOICE OF

CLEAR/RED/BLUE/YELLOW

YOUR LOW \$8.95

SUPER COILS

e Coll & Bracket

Mallory Pro-Maste

O E M. Linwersal

\$28.5

\$14.9

35.9

\$49.95

\$59.95

#### STOCK & HIGH PERFORMANCE PARTS FOR THE SHOP & HOME REBUILDER

# MASTER REBUILD KIT

BRAND NEW OUTRIGHT -NO EXCHANGE REQUIRED LIFETIME WARRANTY

**GENUINE BENDIX** 

SEMI-METALLIC

FRICTION KING II

**DISC BRAKE PADS** 

FOR MOST DOMESTIC & FOREIGN CARS & LIGHT TRUCKS (UP TO 1/2 TON)

STATE MAKE / MODEL / YEAR & FRONT/REAR AXLE

PRICE IS FOR 2 WHEELS

ON SALE

CARTER PERFORMANCE FUEL PUMPS

-

MECHANICAL STREET & OFF ROAD \$24 St. Produces 6 psi 80 GHP

ON SALE

ENGINE IS WARMED UP USES WATER ONLY AS VEEDED WAY!

MAXIMUM RELIABILITY

AT LOWER COST

RACE

\$29.95 BIC GHP

\$39.95

**HOLLEY WATER** 

INJECTION KITS

LOW PRICE \$19.95

\$24.95

3 Amminimine HAM Your Low Price ALLES \$299.00 Forged \$344.00

0 90

BRAND NEW OUTRIGHT -NO EXCHANGE REQUIRED

LIFETIME WARRANTS

**GENUINE BENDIX** 

**BRAKE SHOES** 

FOR MOST DOMESTIC & FOREIGN CARS & LIGHT TRUCKS (UP TO 14 TON). WE HAVE SHOES FOR HEAVY DUTY TRUCKS (OVER %) TON), & HEAVY DUTY BRAKE OPTIONS. PRICES START AT \$38.96. PHONE FOR LOW PRICE.

STATE MAKE / MODEL / YR & FRONT OR REAR AXLE

PRICE IS FOR 2 WHEELS

CARTER AFB CARBS

CARTER

THERMO-QUAD

CARBURETORS

SAVE OVER 50%

SAVE OVER 50%

\$19.95

Your Low

ON SALE

HIGH QUALITY CHROME VALVE COVERS



AMC 290-401 VS		
Buick 231 VB	19449	\$24.95
Chery VS	19201	\$24.95
Chevy SB Short	19196	\$18.95
Chevy SB Tall	19195	\$19.95
Chevy 58 Short	19333	\$28.95
Chevy SB Tall	19238	\$29.9
Mopar SB	19330	\$24.9
Mopar BB	19547	\$29.95
	19331	524.95
Ford 351C		
351M-400	19332	\$26.95
Error State State with	1400 60	

Ford SB Ford 361C	19331	\$24.95
351M-400	19332	\$26.95
Ford 360-390-429	19543	\$26.95
Ford 429-460	19542	\$29.05
Oldsmobile VIII	19544	\$28.95
Pontiac V8	19625	\$24.95

BRAND NEW OUTRIGHT -NO EXCHANGE REQUIRED LIFETIME WARRANTY

**GENUINE BENDIX** 

PREMIUM QUALITY

DISC BRAKE PADS

AVAILABLE FOR MOST DOMESTIC & FOREIGN CARS & LIGHT TRUCKS

STATE MAKE / MODEL / YR & FRONT OR REAR AXLE

PRICE IS FOR 2 WHEELS

HOLLEY

PERFORMANCE

CARBURETORS

Your Low Price

\$10.95

ON SALE

# HURST SHIFTERS

# AUTOMATIC

safterettck	\$129.95
MANUAL	
per Shifter (4 Sed )	\$129.95
fy 3 5pd	\$42.95
by Pick up 14 Spd.:	\$42.05
ty (4 Said ) Performance	\$79.95
per III (# Spa)	7.611.

#### ACCEL® MALLORY DUAL-POINT DISTRIBUTORS (YOUR CHOICE)

RECHANICAL ADVANCE EVY VS RO 269-302 RO 351 W\* RD 351C-400 RD 429-460 PAR 318-340-360 \$54.95 3PAR 383-440 \$54.95

UM ADVANCE V V8 569.95 289-302 599.95 351 W\* 599.95 351C-400 579.95 429-460 579.95

318-340-360 \$79.95 DPAR 383-440 \$79.96

#### MALLORY UNILITE

rvs VB d 289-302 18-340-360

#### EDELBROCK PERFORMER MANIFOLD



58	4.95
Small Bi	ock Cherry
2131 AMC V8 70	134.95
2101 SB Chevi	64.95
2161-45 BB Chery	139.95
21/6 58 Mogar	134 99
2191 A40 Modar	129.95
2121 SEFort	129.95
2581 351W First	179.95
2121 3519 400	139.95
2166 460 Ford	139.95
2105 390-428 Ford	184.95

#### \$ 6.0 ISKENDARIAN SUPER CAMS

Economy/Hi-Torque/RV

BOOKS

#### STAINLESS STEEL **FLEX-A-LITE FANS** UNIVERSAL FIT

8000 RPM RATING

#1070 17 DIAMETER #1080 18 DIAMETER YOUR LOW PRICE \$10.95

# WIRES

#### AUTOMETER AUTOGAGE PERFORMANCE STREET

TACH'S \$27.95

\$29.95

#### AUTO-GAGE'S

#### Pressure #2321 ate: Temp. #2331 south #2371

#### FRAM OIL & AIR FILTER SPECIAL \$8.95

PERFORMANCE V BELT & RADIATOR HUSE SPECIAL

Your Low Price \$14.95 Most Domestic Cars 1960—198

TUNE-UP SPECIAL

\$29.95

#### KONI DJUSTABLE

PERFORMANCE SHOCKS

\$49.95

We have Kon replace

#### RAPID COOL TRANSMISSION **OIL COOLERS**

ISSE CARSOMEDIU DURLOW PRICE \$19.95

1522 CARS, TRUCKS & TOWING (MEDIUM DUTY DURLOWPHICE \$29.95

1526 MOTORHOMES, TRUCKS & ALL HEAVY TOWNS

HLOWPHCE \$34.95

#### RAPID COOL **FAN CLUTCHES**

\$22.00

\$59.95

RAPID COOL **ENGINE OIL** COOLERS

8080 FORD-MOPA \$39.95 O.E.M. REPLACEMENT

#### **IGNITION PARTS ELECTRONIC**

#### **IGNITION KITS** 6 CYL & V8 Eng

KIT INCLUDES ROTOR & CAP 3 79-84 79-85 \$ 8.95

6 CYL 79-83 VB 72-84 \$ 3.95 VE 83-84 VB 74-84

TOP QUALITY TUNE-UP KITS FOR POINT TYPE IGNITION



atic 8 CY & V8 Eng & DISTRIBUTOR CAP

AMC 6 CYL

57-74 G.M. 5 CYL 63-73 57-74 6 CYL 52-72 66-72 5 CYL 56-65

MOPAR ORD YOUR \$5.95

#### DON'T REBUILD ENGINE CHECKING OUR PRICES. YOUR

THE HOLLEY SYSTEM COMES COMPLETE WITH STEP BY STEP INSTRUCTIONS AND ALL MOUNTING HARDWARE **NEW TRW FUEL PUMPS** OW COMPRESSION #19-1 IIGH COMPRESSION #19-2 IVS/MOTORHOMES #19-3

\$12.95 S.B. CHEVY

REPLACEMENTS

ERFORMER PLUS RIMINATURAL KITS CHEVY SPREAD BORE

AMC 304-401 Buick V6 79 up 231

**EDELBROCK** CAMSHAFT

KIT INCLUDES

The International

Camshafts-Lifters-Spring \$139.95

California residents: Items in this ad are: Not legal for sale or use on pollution controlled motor vehicles in California, Legal in California only for racing vehicles which may not be used on highways

#### WE CARRY A COMPLETE LINE OF MECHANICAL ENGINE PARTS FOR ALL APPLICATIONS, STOCK REPLACEMENT, HI-PERFORMANCE & RACING.



INCREASES LOAD CAPACITY FOR U.S.
CARS OR TRUCKS. HEAVY DUTY
SHOCK & SPRING COMBINATION
FOR FRONT & REAR APPLICATIONS AIR SHOCKS INFLATES TO 150 IBS WITH VEHICAL LOADED FOR HAULING THOSE HEAVY LOADS FOR ALL U.S. CARS 5 TRUCKS

#### CHROME MOLLY **PUSH RODS**

\$36.95 \$39.95

#### MANLEY O.E.M. REPLACE MENT VALVES LEGAL N.H.R. .

_	40	Ye	ser Law
5.8. C	HEVY		Price
1:72	Intake	1078	1.75
1.94	Intake	1476	2.65
2:02	Intake	1650	4.50
1:50	Exhaust		2.65
1:60	Exhaust	1649	5.95
BIG BI	OCK CHEV	*	9933
2.06	Intake	1852	3.55
2.19	Intake	1654	6.35
1:72	Exhaust	1651	4.45
5.8. W	OPAR		1000
1.88	Intake	1778	3.55
1.60	Exhuast	1721	3.55
8.8. M	OPAR IWED	(3.D)	37.5
2:08	Intake	1316	3.35
1:60	Exhaust	1265	3.85
1.74	Exhaust	1717	4.55
S.B. F	ORD 288 (No	on Rail	
1:78	Intake	1628	3.35
1:46	Exhaust		3.85
5.8. F	ORD 302 (Re		2.50
1.78	Intake		2.95
1:46	Exhaust		4.50

Exhaust RD 69-74 1830 3.85

**ENGINE** OVERHAUL SPECIAL



Kit Include CL77 Rod Bearle CL77 Main Bearle STD-010-20-030 Piston Rings STD-030-040-060 Buy All Three

8 Save 6 Cyl. Engines \$69.95 \$79.95

#### HI-PERFORMANCE **TIMING CHAIN** SETS

\$18.95 \$24.95

GASKET SETS SB Chevy SB Chevy SB Ford SB Ford

BB Ford eland OUCO вв Мора Your Low Price SB Chev

\$14.95 \$19.95 Bathtub Intake Gasket not included on SB Small Block BB Big Block

#### ON SALE

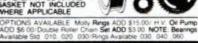
#### **SB CHEVY DELUX** ENGINE REBUILD KIT

\$99.95

OT INCLUDES:
PISTON RINGS
CL77 ROD BEARINGS
CL77 RAIN BEARINGS
ENGINE GASKET SET
OIL PUMP

CHAIN SET

NOTE BATH TUB INTAKE GASKET NOT INCLUDED WHERE APPLICABLE



HI PERFORMANCE HOCKER

ROCKER ARMS

8 Ford 289 302 351W \$69.95 Set Of 16 State Year, Rail or Non Rail 351C-Boss-429

divatable Kit w/ Arm. Ball. Nul

390-427-428 \$82.00 Set Of 16 Adjustable Rockers

PONTIAC

Set Of 16 B.B. Mopar Adjustable \$112.00 Set Of 16

NEW STOCK REPLACEMENT CAMSHAFT-LIFTERS SPRINGS

Available for most VB & 6 cyl.
Domestic engines
Ford—Chavrolet—Mopar
Your Low Price

\$119.95

TRW FORGED FLAT TOP PISTON & RING SPECIAL

440 283-327-350 Mopar 289-302 118 / 318-340 163.00 351C 1541 383 169.00 390 1441

HI-PERFORMANCE CHAIN SETS

\$19.95 S8 Chevy

BB Chevy SB Mopar SB Ford 351C-400 Ford 429-460 390-428

SUPER STOCK

REMANUFACTURED \$8.95

For Bushed Factory Rods (e. S.B. Moger, B.B. Ford)

PERFORMANCE SPA LIFTERS \$36.95

OTHERS \$39.95

TRW WATER.

PUMPS 1		e Price
CHEVROLET	-	
Small Block	trom	\$29.95
Big Block	from	\$54.95
FORD		
289-302-351W	trant	\$39.95
351C-400-351M	from	\$42.95
429-460	from	\$46.95
390-428	from	\$49.95
CHRYSLER		
Small Block	morn	\$29.95
Big Block	from	\$29.95
We have Water	Pump	a for all
domestic model		

SUPER STOCK



oil horse shamfered SEARNES The quanty the many beginning for perfect THING CHAIN SET. She

HOR STOLE, MY UP

YOUR LOW PRICE CAST FORGED PISTONS PISTONS 766.00 850.00 898.00 950.00 FORD 302-301W 886 DO 940.00 MOPAR 839.00 879.00 999.00 1099.00

ALL OF THE ABOVE PLUS

GASKETS Company Gasket set TOUR LOW PRICE CAST PORICED CA FORD

PERFORMANCE 一种出

Custom ground on Rod & Mains Journals. Con Rod & Main Bearings supplied for perfect fit. Available for menus

\$158.00

### ON SALE



OR FRONT OR REAR SPRINGS FITS MOST DOMESTIC TRUCKS

YOUR LOW \$44.95 PAIR

#### FLAT TOP PISTON SPECIALS WITH RINGS

302-351W 99.00 351C-351M-400 114.00 Mpnar 318-340-360 99.00 OS ADD \$15.00

HIGH VOLUME OIL PUMPS

S.B. CHEVY \$19.95 OTHERS \$24.95

California residents: Items in this ad are: Not legal for sale or use on poliution controlled motor vehicles in California; Legal in California only for racing vehicles which may not be used on highways

SUPER STOCK



PISTON RINGS COMMECTING HODS ROD & MAIN BEARINGS CRANKSHAFT CARSHAFT — LIFTERS — SPRINGS TIMING CHAIN SET

458.00 509.00 579.00

SUPER STOCK



CADILLAC 390 429 472 500 423.00 344.00 344.00 344.00 369.00 429.00 344.00 368.00 379.00 419.00 539 00 559 00 OLDSMOBILE 250 294 400 425 455 379.00 230-250 104-350-389-400-455 298 00 349 00 344.00

SUPER STOCK PISTON KIT



CAST FORGED PISTONS PISTONS 204.00 274.00 263 00 CHEVROLET 194 230 250 2 265 293 327 305 307 350 396 400 402 427 454 154.00 154.00 209.00 234.00 204.00 279.00

### \$15.00 \$60.00

#### **PAW T-SHIRTS & HATS**

The Fabulous PAW Blown Motor Logo in 3 Colors on both Front & Back of a Quality Hanes Beefy T Shirt. Available SM, M, L & XL **ONLY \$6.50** State Your Size

PAW Hat with Logo - fits all **ONLY \$4.50** 



GET OUR GIANT **NEW 1985** CATALOG FREE with an order from this advertisment

or send \$4.00

P.A.W. MONEY BACK GUARANTEE
BUY WITH CONFIDENCE FROM P.A.W.: IF FOR ANY REASON YOU ARE NOT
SATISFIED WITH OUR PRODUCTS, JUST RETURN THEM WITHIN 90 DAYS FROM DATE OF RECEIPT AND WE WILL REFUND YOUR MONEY.

NOTE: NO REFUND ON SHIPPING CHARGES. PRODUCTS MUST BE IN NEW AND UNUSED CONDITION IN ORIGINAL PACKAGE, INSTALLED ITEMS CAN-NOT BE REFUNDED, CALL 818-998-3641 FOR RETURN AUTHORIZATION.

> WE SHIP COD. NO DEPOSIT REQUIRED ON MOST ITEMS IN STOCK **WE ACCEPT MASTERCARD & VISA**

TECH LINE &

8:30 AM to 5:30 PM Pacific Time Monday thru Friday

CUSTOMER SERVICE: For Return Information and Inquiries Regarding Previ-

#### MAIL

PERFORMANCE AUTOMOTIVE WHOLESALE, INC. 21122 Lassen Street, Chatsworth, CA 91311

**HOW TO ORDER** 

State Make, Model, Year & Engine Size. Send at least 50% deposit by Cashiers Check or Money Order, no personal checks accepted or use your Mastercard or VISA. All Overseas & Canadian orders must be paid in full. No C.O.D. on truck freight shipments. C.O.D. on UPS only. All Engines & Master Kits must be paid in full. Customer responsible for all shipping charges.

**Print Name** Phone # ( Address\_ City Make \_ NOTE: P.A.W. is not responsible for typographical errors in pricing or app all contents of this advertising.

YOUR LOW YOU DON'T SEE PHONE FOR PRICE

#### SUPERSANDER

(Continued from page 120)

abrasive belt. Use a fine-grit belt for this procedure to minimize the effects of cross-grain scratches.

With the idler drum guard removed, use the exposed end of the belt sander to sand inside curves. Adjust the angle of the belt sander and lock it at the most comfortable working position. Sand irregular-shaped workpieces freehand over the end of the belt. To sand precise, square edges on inside curves, install an auxiliary fence to the sander's wood fence. Cut the auxiliary fence so that it wraps around the idler drum to provide maximum support for the workpiece. Install the auxiliary fence with 1/2-in. clearance over the belt.

Most end-grain sanding is performed with the belt in the vertical position. Use a miter gauge to ensure square ends and accurate miters. To sand miters on moldings, however, replace the miter gauge with a shopmade miter guide, as shown below. Make the guide by nailing together two 90° triangular pieces of ¾ x 10¼ x 10¼-in. particle-board or plywood. Next, nail a 22-in.

long hardwood strip to the triangular guide. Cut the strip to fit into the worktable's miter gauge slot. The guide will allow you to sand both right- and left-hand miters quickly and easily by simply sliding the guide on the worktable. This eliminates timely and inaccurate readjustments that are necessary when using a miter gauge.

Sanding square, inside corners is possible by adjusting the tracking knob so that the belt rides flush with the edge of the platen. Lock the belt in the vertical position and use the worktable to support the workpiece. Be certain to return the belt to its original position when finished.

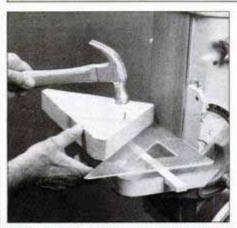
The sander's tilting worktable provides adequate support for small to medium workpieces, but it's outmatched when handling larger pieces. The solution is to build an oversized auxiliary worktable out of ¾-in. particleboard or plywood. The oversized table is simply an 18 x 24-in.-wide panel with three cleats nailed to its underside. Position the cleats so that they fit snugly against the sander's metal worktable. Use three small C-clamps to hold the auxiliary table in place during use.

Here's a unique, easy to execute technique for belt-sanding perfectly round, tapered legs. Start by cutting a square, tapered blank on a band saw or jointer. Next, nail a 4 x 4-in., L-shaped corner bracket to each end of the square blank. Be certain that the nails are centered and that the blank can spin freely on the nails. Now, with the belt sander in the horizontal position, clamp the brackets to the wood fence, as shown. Note that 1/s-in.-thick spacer strips are placed under the blank until the clamps are tightened. Remove the strips before turning on the sander.

With the sander running, rock the blank back and forth until enough stock has been removed from the corner to clear the belt. Repeat this procedure for the remaining three corners. Loosen the clamps and lower the partially rounded blank slightly and repeat the procedure described above until the blank is completely round.

A faster way to sand a round, tapered blank is to start with an octagonal blank instead of a square one. Also, use a 50-grit abrasive belt for the initial shaping and then switch to a 100-grit belt for the final finishing.

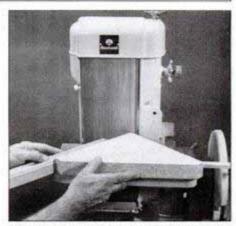
#### **BELT SANDER JIGS**



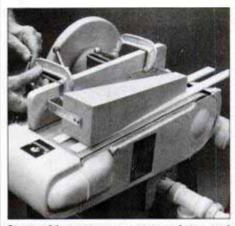
Make a 45° mitering guide for sanding moldings. Attach triangular block to hardwood strip that rides in the miter gauge slot.



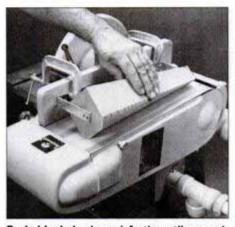
After miter-cutting molding slightly longer than needed, sand one end on belt sander. Fixed angle miter guide ensures accuracy.



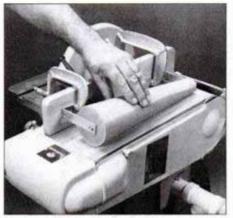
Slide the guide over and sand the opposite end miter. This eliminates readjustments that are necessary with a miter gauge.



Start with square or octagonal tapered blank. Nail brackets to blank ends and clamp to fence. Then remove spacer strips.



Rock blank back and forth until enough stock has been removed to allow the corner to clear belt. Repeat on remaining corners.



Once the four corners have been rounded, lower the blank slightly and repeat the sanding procedure until the blank is round.

Start your own money making busin

Train FAST

Get into this booming high-profit business that's Easy to learn - Easy to do - Easy on You!

Never 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!

#### Start Collecting CASH PROFITS Right Away

You're in "business" ready to earn \$10 to \$26.00 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 fulltime in a high-profit business of your own. Hundreds we've trained have done it. So can YOU! All tools plus professional Key Machine given you with course. These plus practice materials and equipment plus simple, illustrated lessons, plus expert supervision, plus business building guidance will enable you the KEEP THE MONEY COMING IN! Ideal for retirement - good jobs, too.

#### SEND FOR EXCITING FACTS-No Obligation

Discover what's in Locksmithing for you — how Foley-Beisaw's Master Locksmith-approved training can give you the skill you can depend on to EARN MORE — ENJOY LIFE MORE.

No Extra Included With Your Cost! Locksmith Training BURGLAR



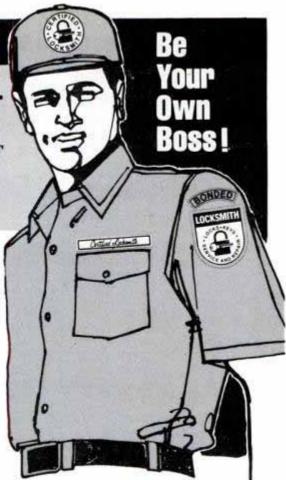
ALARM training Covers all phases of Burglar, Hold-Up and Fire Alarm

servicing and in-stallation. This valuable and

timely instruction includes all special tools and supplies ONLY Foley-Belsaw offers such extensive training in this rapidly expanding field as a part of your Locksmith training.

**ADVANCED Locksmithing!** 

How to change combinations, in-stall and service Safe, Vault and Bank Safe-Deposit Box locks. You'll find it fascinating and high-



Hundreds of Foley-Belsaw trained men have succeeded in this fascinating and highly profitable field . .

"Before enrolling I checked other courses and also asked for advice from several locksmiths in my area. They all said yours was tops and has the most versatile Key Machine.

"I always wanted to be in business for myself and now I am . . thanks to Foley-Belsat Institute

David Fairbrother-Dave's Locksmith Service Milwaukee, Wisconsin 53209



"I opened my own business, spare time, seven months after I enrolled and made a profit of \$329 for the first week." B. A. Deberry Littleton, Colorado

"No more hard, nasty work for me. Now I have my own business and with hardly any effort I average around \$50 a day. Thanks for my new start in life.' Sam Walker Prichard, Alabama



details!

THIS PRO KEY YOURS TO KEEP! EREE month to your income ...

This Pro Key Machine can alone

Find out all about it! Send for FREE Facts TODAY!

Just fill in and mail coupon below (or send postcard) to receive full information and details by return mail. DO IT TODAY!

RUSH COUPON!

State

occeenas

ALL SPECIAL TOOLS AND EQUIPMENT INCLUDED!

FOLEY-BELSAW INSTITUTE 10824 Field Bldg., Kansas City, Mo. 64111

#### NO SALESMAN WIII Gall Ihere 18

RUSH COUPON TODAY FOR THIS FACT-FILLED

Tells how you quickly train to be your own boss in a profitable Sparetime or Fulltime business of your own PLUS complete details on our 30-Day NO RISK Trial Offer!



Send for your copy today!

FOLEY-BELSAW INSTITUTE 10824 FIELD BUILDING KANSAS CITY, MISSOURI 64111



Zio

YES, please send me the FREE booklet that gives full details about starting my own business in Locksmithing. I understand there is no obligation and that no salesman will call.

Name				
777 (190)				
Address	 			
2000				

# 30 Ways To Help You Qualify For A Job That Pays More Money!

GET YOUR SPECIALIZED ASSOCIATE DEGREE IN BUSINESS OR TECHNOLOGY OR A CAREER DIPLOMA AT HOME IN SPARE TIME

ASB DEGREE CAREER DIPLOMA CAREER DIPLOMA CAREER DIPLOMA ASB DEGREE CAREER DIPLOMA Small Engir Repair Business Management with cotion in Marketin CAREER DIPLOMA ASS DECREE CAREER DIPLOMA CAREER DIPLOMA CAREER DIPLOMA CAREER DIPLOMA Air Conditioning & Refrigeration CAREER DIPLOMA AST DEGREE CAREER DIPLOMA CAREER DIPLOMA CAREER DIPLOMA AST DEGREE in Civil Engineering strial Electron Technician rtel/Restaura Management Catering/Gourmet Cooking anical Engineering CAREER DIPLOMA AST DEGREE CAREER DIPLOMA CAREER DIPLOMA CAREER DIPLOMA Electrical Engineer CAREER DIPLOMA CAREER DIPLOMA CAREER DIPLOMA CAREER DIPLOMA CAREER DIPLOMA

Send for free facts and color brochure to find out what career training in the field of your choice might do for you—no obligation to buy anything now or ever. Now at home in your spare time, you can train for a money-making career...even get a Specialized Associate Degree if you want...to help you get a better job. Find out everything you need to know about any one of these career programs—with no obligation to buy anything, now or ever, and no salesman will visit you. Just check the one program that interests you most. You will receive free facts, color brochure and information on employment opportunities in the field you choose. Mail the postage-paid reply card today and see how easy it is to train at home for a great new career or advancement on your present job.

Open Book Exams...Adult Training

Your Diploma or Degree is given to you for what you learn—not what you memorize. We send lessons and training material to your home. You decide when you are ready to take each "Open Book" exam. Then mail it to your instructor. You will receive your grades with comments when needed to tell you how to correct your wrong answers. "Open Book" exams have proven so successful for adults, they are now used in many colleges. Our graduates tell us they like our method of independent study because it's so convenient and easy to do. You choose your own study hours in the privacy of your own home. You move ahead one step at a time, as fast or as slow as you want. And every Diploma or Degree is fully accredited.

An Ideal Way to Learn

You waste no time traveling to and from class. And you never have to miss a paycheck. Skilled instructors are ready to help you at any time.

You get the same high-quality training that ICS has been known for since 1891... the same kind of training system that's offered by giant companies to their employees...corporations like Ford, Mobil, International Paper, General Electric, United States Steel, etc. And if you wish, ICS will keep

your employer informed of your progress if you feel it can help you toward a better job, or an increase

No one can promise success but if you want more security, more day-to-day satisfaction and more of a future, send for free facts and the color brochure of your choice. There is no obligation and no salesman will visit you.

#### Could a Career Diploma Help You Earn \$25,000 to \$100,000 More in Your Lifetime?

Compare your present salary with the amount of money you could be making in any one of the careers listed here. Electricians average \$11.25 an hour, auto mechanics over \$8.00 an hour. And it's not only the money, but the fun of working in a job you like.

Could a Degree Be Worth Thousands of Dollars to You?

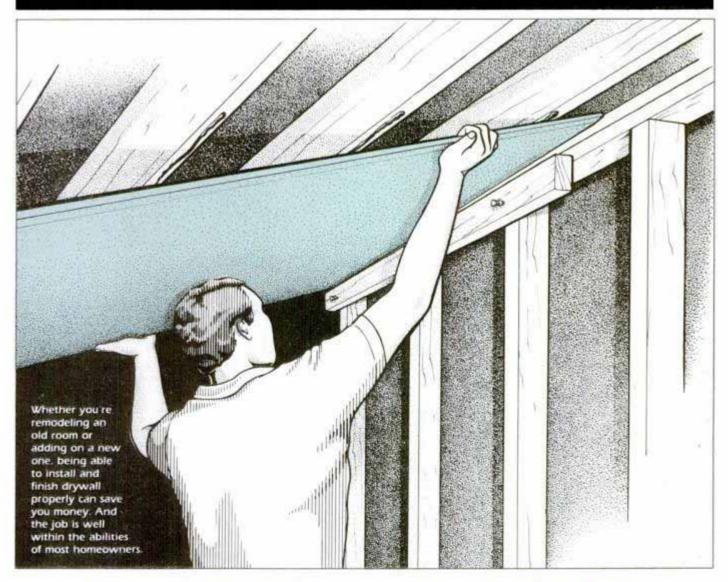
An Associate in Specialized Business or Specialized Technology Degree could make a giant difference in your lifetime earnings compared to the average earnings of a high school graduate. Check the degree or career course you are most interested in and mail the postage-paid reply card today!





North American and International Correspondence Schools Dept. PBSC5 925 Oak Street, Scranton, Pennsylvania 18508-9989

# THE BETTER FEBRUE



# How To Hang And Finish DRYWALL

rywall—also called wallboard, gypsum board or plaster-board—is probably the most versatile and forgiving wall surface available today. It's inexpensive, comes in a wide variety of sizes, and is much easier and less costly to apply than plaster. However, working with it can be extremely frustrating—especially in the finishing stages—because it does require real facility with at least three different compound knives. These and other basic

BY STEVEN WILLSON Home And Shop Editor Drawings by George Retseck

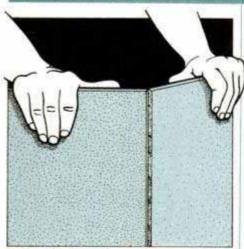
tools are shown on page 131. With a minor investment, these simple tools will provide excellent results at a fraction of what a professional would invest.

The individual drywall panels—or boards as professionals call them—come

in a variety of sizes. The common width is 4 ft., but the length varies by 2-ft. increments from 8 ft. to 16 ft. The thickness of the boards also varies: beginning at ¼ in. and progressing in ¼-in. increments to ¾ in. By far the most common size is ½ in. thick by 4 ft. wide by 8 ft. long.

Each board consists of a gypsum core covered with heavy-duty paper on both sides. The ends of the boards, are cut off square with the gypsum core exposed.

# THE BETTER



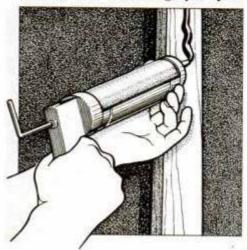
1 To cut the boards, score the paper surface with a utility knife, then snap from behind using your thumbs and one knee.

The long edges, however, have a built-in tapered depression that's about 1½ in. wide. These depressions are designed to accommodate the paper tape and joint compound that seals the joint between boards and creates a seamless surface.

It's very important to keep these edge differences in mind. Because the butt ends have no depression, the tape and compound that cover them will sit exclusively on the surface, which creates a slight bulge. For this reason, you should plan your installation to minimize or eliminate the butt joints. You can do this by ordering various length boards to do specific areas of a room. Of course, larger boards are heavier and more unwieldy, particularly when working on the ceiling. But with a little help from a friend, you can handle the job.

#### **Cutting the boards**

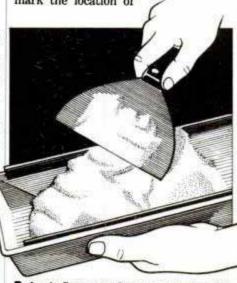
Starting with the ceiling, plan your



2 Using a caulking gun, apply panel adhesive to the edges of underlying framing members before the board is installed.

boards so the length runs across the joists. If your ceiling joists are on 24-in. centers, it's best to use %-in.-thick boards. But if the joists are on 16-in. centers—which is much more likely to be the case—½-in.-thick boards are the standard. The same is true for the walls. Make sure that you have nailing surfaces at the end (or ends) of the board where it intersects the room walls.

Cut the board to length using a utility knife and metal straightedge. Once you've cut the surface paper, break the board from the back as shown in drawing No.1. If this edge is ragged, you can sand it flat using 60-grit sandpaper. It does not have to be perfectly smooth; your goal is simply to make the board fit. Also mark the location of



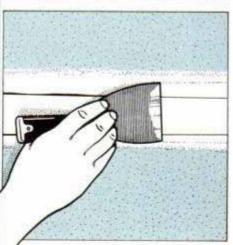
3 Apply first coat of compound using 6-in. knife. For better control, be sure to scrape compound off both corners of knife.

any electrical light boxes in the ceiling and cut out a matching hole in the board using a compass saw.

Before raising the board, apply panel adhesive to the bottom edges of the joists using a caulking gun. The adhesive improves the bond and reduces the number of nails that are required.

#### Hanging the boards

To help hold the board in place, it's a good idea to tack-nail a 40-in.-long 2 x 4 to the wall as shown on page 129. When positioned just 1 in. below the ceiling, it helps support one end of the board, which takes much of the strain out of the job. (Once the board is nailed, simply move the cleat to support the next board.) Attach the board with 1%-in.-long drywall nails. Drive these nails 8 in. apart around the perimeter—and across the face of the board—into every joist



4 Press tape Into first layer of compound using your fingertips. Then smooth tape across length of joint with a 3-in. knife.

that the board covers. Dimple—or slightly recess—the nail heads into the surface paper. This will create a depression that can be filled with joint compound later.

#### Walls

Use the same technique to hang the wall boards, making sure to plan your material to minimize butt joints. Areas over a door or window are good places for such joints because they're less noticeable. One way to avoid butt joints completely is to install the boards vertically. But, I strongly recommend you run your boards horizontally. It makes finishing easier because much of the tape and compound are applied horizontally, near your waist level. By doing the joints vertically, you have to move up and down a ladder continually, which makes using the knives much more awkward and less controllable.

Be sure to push the upper wall board tight against the underside of the ceiling boards. When the ceiling boards bear directly on the wall boards, the chance of cracks appearing later is drastically reduced. Complete the walls by installing the lower boards. If your ceiling height is 8 ft. or less, a second board around the perimeter of the room will do the job. But if your ceilings are higher, as is the case in many older homes, a third partial board will be required. Install it the same way as the others.

#### Knives and compound

The finishing process is basically a 4-step endeavor. First, apply a layer of joint compound. Next, imbed paper tape in the compound, directly over the joint line. Then the tape is covered with another coat of compound. And once this coat

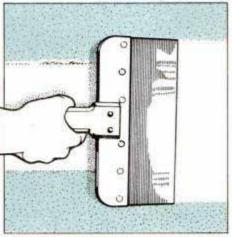


5 After tape is smooth, apply another layer of compound using 6-in. knife. Use just enough compound to cover tape.

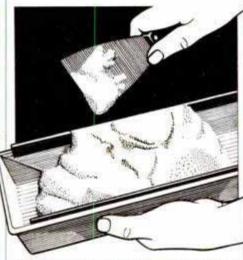
is dry, the joint is skimmed with a final-very thin-layer of compound. That said, you should know that there are probably as many ways to do this as there are professional drywall installers. But the 3-knife method-3-in., 6-in. and 10-in.-wide blades-shown here, is a good one for the beginner.

When buying these knives, look for blades that are extremely flexible. Stiff blades may work well for scraping off old wallpaper, but they are inappropriate for applying compound. You should be able to push the flat side of the blade against the palm of your hand and have the blade bend easily under pressure. When pressure is released it should return to its former straight shape. If the knives are not flexible you'll have quite a struggle on your hands.

The best joint compound is the premixed variety that comes in plastic pails-usually in 1-gal., 21/2-gal. and 5gal. sizes. Dry compound, that you mix with water, is also available and often



6 When second coat of compound is dry and sanded smooth, apply final-very thin-skim coat using a 10-in. knife.



7 Apply first coat to inside corners using 3in. knife. For better control, scrape compound off outboard corner of knife.

less expensive than the premixed variety. But it is extremely difficult to mix to a smooth texture without the proper

equipment. And, smooth joint compound is absolutely crucial to the properly performed finishing process.

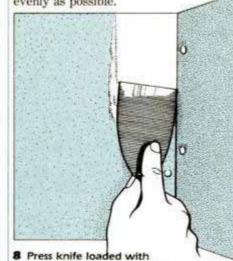
The best way to carry the compound from joint to joint is with a plastic or metal pan like the one shown. Each time you load the pan with compound, be sure to mix the compound slightly with a knife to obtain a uniform consistency.

These pans have a sharp blade on both sides for keeping the knives clean. Every time you remove your knife from the wall, whether to deposit excess compound in the pan or to get a new load, always scrape off both sides of the knife blade on the pan blades.

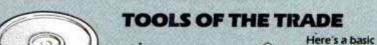
#### Joint sequence

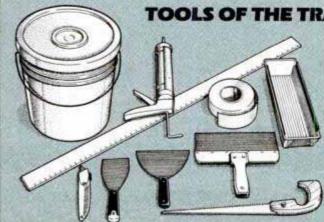
Begin on the ceiling and do all the ta-pered joints first. Then move to the tapered joints on the walls. Return to the ceiling and do any butt joints, followed by the butt joints on the walls. Then tape the corner joints between the walls and the ceiling followed by the corner joints between the walls. And finally, cover all the nail heads with compound only.

To begin a tapered joint, use a 6-in. knife and put a generous amount of joint compound on the blade. Then, clean off each corner of the knife slightly as shown in drawing No. 3. This cleaning step is important—especially when working on the ceiling—because it allows some room for the compound to spread across the knife without falling off which, when working on the ceiling, means falling on you. Hold the knife at a 30° to 45° angle to the surface and run it down the middle of the joint, pressing the compound into the depression. Work in smooth, steady strokes. Remember that your goal is to apply the compound as smoothly and evenly as possible.



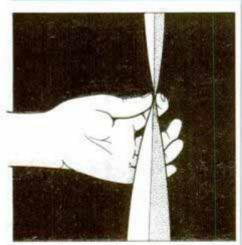
compound into corner and then pull down length of joint. Use surface of adjacent wall as guide.





assortment of tools for doing drywall work: metal straightedge and utility knife for cutting boards; caulking gun for panel adhesive: compass saw for making cutouts in boards; pail of joint compound and roll of joint tape; 3-in., 6-in. and 10-in. taping knives; and a metal or plastic compound pan.

# THE BETTER

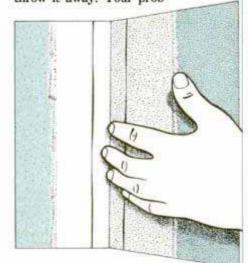


9 Cut joint tape to match length of corner, then fold tape in half. Tape has depression in middle to make precise folding easy.

Once the whole joint is covered, go back to the beginning and wipe off the excess using the same 6-in. knife. Do not press so hard that you scrape all the compound out of the depression.

Pull out a length of tape equal to the joint length and tear it off the roll. Then carefully press the tape into the compound with your fingertips. Once the entire joint is covered, go back to the beginning of the joint and carefully smooth the tape into the compound using light pressure on the 3-in. knife. Once the paper is imbedded, go back over the joint with the 6-in. knife to completely smooth the tape and remove the slight ridges that often result when the tape is imbedded. Again, clean the knife every time before you put it back on the wall.

If, after the tape is smooth, you notice a bubble underneath the tape, stop, remove the tape from the whole joint and throw it away. Your prob-



10 Carefully imbed folded tape into compound. Do not try to smooth with fingers, just make sure that tape will not fall.

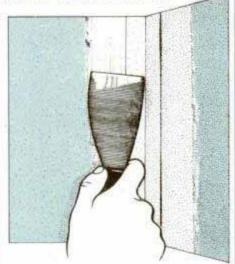
lem is too little compound under the tape for the tape to stick properly. Do not try to lift the tape and put more compound underneath it; you'll spoil the whole joint. It's better to simply start the procedure over.

Once the tape is smoothly imbedded, cover it with another layer of compound using the 6-in. knife. Then smooth the joint with the 10-in. knife. Leave just enough compound to completely cover the tape. Move onto the remaining tapered joints and when they're done stop for the day. Let the joints dry overnight, then smooth them by sanding lightly with 120-grit sandpaper. If you've done a reasonably good job, the sanding will be minimal. Remember, your goal is to achieve the smoothest surface possible before adding more compound.

Professionals will often omit this sanding stage. But for the beginner, it's well worth the effort because each ensuing coat of compound will be easier to apply. Whenever sanding the compound, be sure to wear safety goggles and a respirator. The dust is very fine and very irritating.

#### **Butt joints**

The second day, finish all the butt joints. This takes considerably more finesse because the built-in taper is not available. Begin in the same way as before. Apply the underlying compound using the 6-in. knife. Then smooth the compound with a 10-in. knife. Imbed the tape as before, directly over the joint line. Smooth it in place with a 3-in. knife, followed by a 6-in. knife. Add a layer of compound and again, smooth it with the 10-in. knife. For this step, the wider knife is crucial because the



11 Smooth tape into compound using 3-in. knife and adjacent wall surface as guide. Smooth one side and then the other.

compound must be feathered at least 5 in. away from the joint on both sides. As mentioned, you are creating a surface bulge with a butt joint, and so it should be as smooth and gradual as possible. Once all the butt joints are taped, wait overnight and sand smooth.

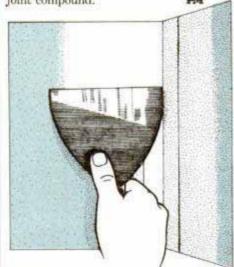
#### Corner joints

In many ways, corner joints are the less crucial because they don't show as much irregularity as a flat surface. The biggest problem is that when working on one side of the joint, your knife will often foul the adjacent surface.

Begin by applying the compound to both sides of the joint with a 3-in. knife as shown in drawing No. 8. Smooth it with a 6-in. knife. Then cut off a piece of tape the length of the joint and fold it as shown in drawing No. 9. Press it into the corner with your fingertips. Then smooth each side with the 3-in. followed by a 6-in. knife. At this point, top coat only one side of the corner. Do the remaining corner joints in a similar fashion and let them dry overnight. The next day, top coat the other side of each joint, and let these dry overnight.

#### Skim coat

Lightly sand the whole job. Now using the 10-in. knife, apply a very thin skim coat of compound to each joint. Clean the knife every time you return it to the pan. If you ever see the knife dragging anything in its wake, be sure to stop and remove the debris immediately. Once the entire surface is skimmed, wait a day for it to dry, then carefully sand the whole job with 180-grit paper and touch up any imperfections you find with fresh joint compound.



12 Apply second layer of compound over tape using 6-in. knife. Let dry and sand first side before coating second side.



# MACHOW-TO BOOK CLUB

Discover the Troubleshooting and Repair Secrets of Skilled Auto Mechanics and Home Craftsmen

- Repairing
- Restoring
- Customizing

- Refinishing
- Remodeling
- Renovating

with the Book Club that Makes it Easy

# Select 5 Books for Only 5

























1792 1244P List \$19.95 List \$14.95 (paper)























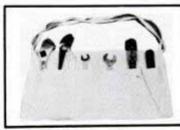




1122 List \$18.95







**FREE Shop Apron** 

#### 7 very good reasons to join the How-To Book Club

 Big Savings. Save 20% to 75% on books sure to increase your how-to know-how

 No-Risk Guarantee. All books returnable within 10 days without obligation

 Club News Bulletins. All about current selections. mains, alternates, extras-plus bonus offers. Comes 13 times a year with hundreds of up-to-the-minute titles to pick from

Automatic Order. Do nothing, and the Main selection will be shipped automatically! But . . . if you want an Alternate selection—or no books at all—we'll follow the instructions you give on the reply form provided with every News Bulletin

 Bonus Books. Immediately get Dividend Certificates with every book purchased and qualify for big discounts of 60% to 80%

 Extra Bonuses. Take advantage of added-value promotions, plus special discounts

 Exceptional Quality. All books are first-rate publisher's editions selected by our Editorial Board and filled with useful up-to-the-minute information

### HOW-TO BOOK CLUB

P.O. Box 8, Blue Ridge Summit, PA 17214

Please accept my membership in the How-To Book Club and send the 5 volumes circled below, plus, my FREE shop apron billing me \$2.95 plus shipping and handling charges. If not satisfied, I may return the books within ten days without obligation and have my membership canceled. I agree to purchase 4 or more books at regular Club prices (plus shipping/handling) during the next 12 months, and may resign any time thereafter. resign any time thereafter.

1046P 1122 1128 1160 1244P 1245P 1415 1465 1472 1515P 1530P 1569 1654 1655 1667 1680 1687 1761 1763 1779 1784 1790 1792 1868 1909 1915 1995 1998

Name			
Address			
City			
State	Zip	Phone	
Valid for new members only. Fore remit in U.S. currency. This orde	ign applicants will rece r subject to acceptance	eive ordering instructions. se by the How-To Book C	Canada mus lub. PM-18

BUILD YOUR OWN GRANDFATHER CLOCK



Under I (including movement and dial)

- · Do-it-yourself case
- kit, parts pre-cut Finished clocks · Solid 3/4" hard-
- woods: black walnut, cherry, oak Heirloom quality
- Factory direct prices Solid brass West German chiming
- movements Money back
- guarantee Prompt shipment No woodworking

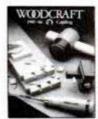
experience

WRITE FOR FREE COLOR CATALOG



WORLD'S LARGEST MANUFACTURER OF GRANDFATHER CLOCKS Dept. 1620 Emperor Industrial Park pe. Alabama 36532 • Phone 1-205-928-2316 I am interested in Do-It-Yourself Kits

Street	
City	



#### FREE Tool Catalog

Quality **Products For** Woodworkers

Send today for your FREE copy of our new colorful catalog. It's fully illustrated with the finest quality tools, supplies, books, components, hardware, and much more. Satisfaction Guaranteed Write today for your FREE catalog.



WODCRAFT SUPPLY CORP. Dept. PM16 41 Atlantic Avenue, Box 4000

#### WHAT'S HE DOING!

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

Make and sell your own Ornamental Concrete items. Rush \$5.00 for Book about Aluminum Molds

with prices and production trade secrets direct from world's largest mold manufacturer. Over 350 designs to select from.

Today To >

Send \$5.00 CONCRETE MACHINERY COMPANY P. O. BOX A99 - HICKORY, N. C. 28601

#### PHONES ON A ROLL

(Continued from page 96)

Span-computer modems made by Spectrum Cellular-are opening the way toward data communications via cellular phones, providing new versatility for lap-top portable computers.

#### Practical limitations

While cellular telephone technology has pushed mobile communications to new frontiers, the technology itself is still evolving. For the present, the



Transportables can be carried in hand, briefcase, or mounted in car. Seen here and in lead color photo is NEC's EZ-1401-A.

cellular telephone is primarily a business tool sold and installed by specialty retailers and car dealers-both of whom are usually agents of either the phone company or an alternative cellular service. Its future as an off-theshelf, do-it-yourself product is constrained by the need for expensive installation and testing equipment.

Additionally, each cellular unit must have its phone number, local access codes, serial number and lockout codes "burned" onto a microprocessor chip by the dealer, who inserts the chip into the phone. This equipment, plus necessary testing gear, can cost upward of \$3000-hardly worth the 1-time expenditure by an average customer.

On the carrier's side, problems such as dead zones remain to be solved. And as the service becomes more popular, call volume might be greater than what an individual cell can handle-thereby delaying the placing or reception of calls. Today, cell size in densely populated areas is limited in practice to a 2mile radius. Further cell-splitting requires complex signal switching (and high cost). At this point, the switching equipment often isn't up to the task. The result is interference, and sometimes inadvertent disconnection.

Back at the lab, Motorola is developing digital communication techniques to permit a single telephone channel to carry several conversations simultaneously. The new technology is not likely to see daylight before the 1990sthough it might be needed sooner. Industry experts predict phones and installation will become less expensive. In fact, they claim a \$500 cellular phone could hit the market this year. That kind of price is likely to make the cellular phone an attractive option to carmakers. Factory-installed phones already are offered as optional equipment in selected luxury cars. Meanwhile, competition between the various common carriers is expected to reduce monthly charges and tolls. Service charges vary across the nation, but \$45 a month is not uncommon. Tolls run 15 to 45 cents per minute.

#### The human factor

If cellular technology still has a way to go, so do the people who use it. While accident data is inconclusive so far, cellular phones already have sparked debate as to whether a talking driver is a safe driver. Police in some localities will invite you to use the shoulder for calling if they see you chatting at the wheel. Insurance companies are beginning to worry about their liabilitiesfrom both the risk of accidents and from thefts of cellular phones. Telephone manufacturers urge customers to pull over when placing or taking calls.

Right now, some of the latest phones provide hands-free operation, and future use of voice-activation might help alleviate safety concerns. But technology can't keep your mind on the road for you nor can it conduct your conversations. Making a sensible choice between the two is up to you. PM



Pictured in home battery recharger is portable GE\*MINI by General Electric. Clip-on battery on unit's left gives 1-hour talk-time.

#### A FAMILY AFFAIR

(Continued from page 89)

however, the Aerostar uses primarily Ranger pickup parts. The Ranger's engineering is big-truck tough, but it's no match for the slickly cerebral bodywork.

A fully-optioned Aerostar can weigh 3600 pounds, so the 115-hp 2.8-liter V6 doesn't have much power to spare. Ours also returned the worst fuel economy of this group-15.1 mpg. But the reardrive V6 does have enough torque to give the Aerostar a 5000-pound tow rating. A 145-hp version of the 3-liter Taurus V6 will be offered soon.

Our high-line Aerostar was trimmed out impeccably. The blue/silver paint scheme accents the swoopy, aerodynamic lines, and the overall effect is striking. As one Dad wrote, "The styling is fabulous . . . breaks new ground."

The Aerostar interior is like nothing you've ever seen. The seats are extremely plush, the digital dash is more elaborate than you get in a Lincoln Town Car,

#### Who Invented The Minivan, Anyway?



PHOTO COURTESY MARGUS KUUSE

RAF-2203, as it appeared before the '76 Moscow show: Aerostar prototype?

While Chrysler likes to take credit for inventing the minivan with its 1984 introduction of the Dodge Caravan and Plymouth Voyager, almost any van built in Europe or Asia is a mini by U.S. standards.

In 1950, Volkswagen introduced its famous Microbus, Kombi and Commercial vans. By 1954, 100,000 VW buses had been built, and even the U.S.S.R. was getting into the act. The Riga Auto Factory in Soviet-occupied Latvia had begun to build minivan prototypes. Since RAF's main business was rebuilding and recycling old automobiles, its first minis were built with running gear from Russian Pobeda and Volga cars. By 1976, the all-new RAF-2203 van was introduced at the Moscow auto show (photo).

Like the Ford Aerostar, the RAF mini features a droop snoot, 2.45-liter Four with up to 95 hp, 4-speed transmission and rear-wheel drive. Available with 2, 8 or 11 seats, it's used in light commercial service, as a shuttle bus and as an ambulance. Virtually all of them are owned by state-run agencies-there is no private RV market in the Soviet Union .- W.H.

and the detailing of the controls is thoroughly Eurostyle. Imagine a Merkur XR4Ti van and you'll get the idea. Ford is obviously aiming at the upscale, foreign car-oriented family, not the traditional American van buyer.

There were only a couple of things we didn't like. The sloping nose creates a dashboard 2 feet deep, and it's all wasted space. The same sloping hood makes maintenance a nightmare. Plugs, carb and valve covers are impossible to get at. The Chrysler is much easier for routine maintenance or heavy mechanical work. This is one Ford that rivals Mercedes in degree of difficulty.

Our overall impression? Well, as one perceptive Dad put it, "This is the quietest, most comfortable vehicle in this group. It's also very European in its style and very advanced in its electronics. Compared to the Plymouth, the Aerostar feels big and bulky, though it's actually shorter. It just takes some getting used to."

#### Toyota Van

The Plymouth Voyager and Ford Aerostar, different as they are, were rated about equally desirable by our families. Then there was a sizable gap to the third-ranked Toyota Van. In our view, the Toyota has some significant shortcomings. The most objectionable stems from the basic layout: The engine sits between the front seats, while the driver and passenger are cantilevered out in front of the wheels.

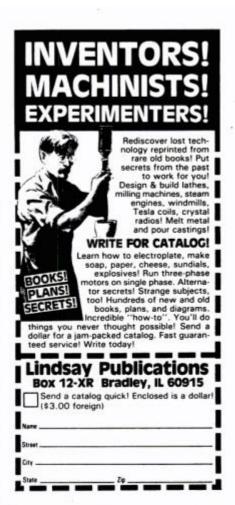
This means there's a big step over the dirty tire to get in. You can't walk through between the seats. The driving position is bizarre-set low and forward, with your feet seemingly the only things between you and an accident, it's not a confident place to be. The short 88-in. wheelbase makes for a choppy ride.

Other complaints were the too-narrow seats, noisy engine, lack of power-"accelerates in a burst of noise"-inconvenient controls and "1961 Econoline" handling. Servicing the engine is an absolute impossibility-all work must be done from the interior after the seats and floor are lifted up, unless of course, you want to drop the engine out the bottom. Change sparkplugs? Forget it. The Van uses expensive platinum-tipped plugs with an alleged 60,000-mile service life.

Things we liked about the Toyota were its typically Japanese quality throughout, pleasant styling and cute gimmicks like a 6-pack-size refrigerator in the console, separate front and rear airconditioning controls, two sunroofs, sliding side door window, power mirrors and pushbutton overdrive for the automatic transmission.

As one Dad neatly summed up, "This is a compromise vehicle-a number of attractive gadgets grafted onto the Lite

(Please turn to page 138)





#### MEN PAST 40

Troubled With Getting Up Nights Pains In Back, Hips, Legs Nervousness, Tiredness

If you are disturbed by these symptoms, your

If you are disturbed by these symptoms, your troubles may be caused by glandular inflammation of your prostate. Methods that merely give temporary relief for this condition cannot be expected to remove the cause of your trouble.

The Excelsior Institute Clinic, devoted to the NON-SURGICAL methods of treatment for diseases peculiar to older men, has a new FREE BOOK that tells how these troubles may be corrected. The NON-SURGICAL treatments described in this book require no surgery, hospitalization or long period of convalescence. Treatments take but a short time and the cost is reasonable. Write today. This book may prove of utmost importance to you. No obligation.

portance to you. No obligation. Excelsior Institute Clinic, Dept. 1288 110 E. Broadway, Excelsior Springs, Mo. 64024





Send for your FREE copy of our 56-page color catalogue featuring clock and other reproduction kits, dials, movements, tools, hardware, books, and much, much more. Satisfaction Guaranteed,

#### Mason & Sullivan

"Fine Clockmakers Since 1947"

586 Higgins Crowell Road Dept. 1138, W. Yarmouth, MA. 02673



#### A FAMILY AFFAIR

(Continued from page 137)

Ace commercial delivery vehicle. It's a well-made truck for what it is, but not well-suited for family use." Mom was more direct: "I wouldn't like to travel any distance in this—I just don't like it." How can you argue with that?

#### Volkswagen Vanagon

Keep in mind what we're talking about here—a box first popped onto a stretched Volkswagen Beetle chassis over three decades ago. The layout is still rear-engine/rear-drive, though nowadays the VW flat-Four is water-cooled. Both front and rear suspensions are independent, unlike any of the other family vans. The engine works hard, flatout most of the time, so our Vanagon returned a very unBeetleish 17.7 mpg.

The tall, boxy Vanagon is no longer on the outside than the Ford or Chrysler, but inside it has an extra 100 cubic feet of space. Despite the high liftover at the tailgate caused by the rear engine, there's a tremendous amount of luggage and passenger room. In a regular Vanagon, you get two Recaro-copy front buckets, plus bench seats for up to seven more in the back. This gives seemingly unlimited leg and head room.

Our test Vanagon had the famous poptop Westfalia GL Camper conversion. This adds \$4900 to the price, but provides unequalled versatility. A family of four could live in a GL Camper indefinitely without suffering any ill effects. Tucked away are a stove, refrigerator, sink, dining table, cabinets, two double beds and swiveling bucket seats. All you need to add is the Porta Potti.

Our families didn't much like the '85 Vanagon, though. They complained about the lack of performance ("needs a heart transplant") the high step into the driver's seat ("more aerobic exercise than chin-ups") the driving position ("Greyhound bus") and the controls ("confusing, unlabelled and spread all over"). Handling was especially criticized in comments like: "Handling? Some, but not much."

Summing up was easy. Said one Dad, "The Vanagon looks like the box the Aerostar was shipped in, but it has more room than a Manhattan apartment. It's not much fun to drive, but you could live in it pretty comfortably. It's a singlepurpose vehicle—great for camping, but not a practical grocery-getter, kid-hauler or family van. Only seats four."

Our test van was an '85 model. By midyear, VW was offering a less expensive (\$14,700) Camper model that eliminates the sink and stove, but has six seats and a removable 110-volt/12-volt refrigerator.

The '86 Vanagon gets new rectangular headlights and a bigger 2.1-liter, 95-hp engine that reduces 0 to 60 times from an agonizing 17.3 seconds to a more reasonable 14.4 seconds. This spring, a \$2100 4-wheel-drive Syncro option will be available on both the Vanagon and Camper. It will make an outdoor fan's heart go pitter-pat, but its dismal 22.6-second 0-to-60 time will give you time to plant flowers along the roadside as you steam away from a traffic light!

#### Chevrolet Astro

What a disappointment! General Motors' all-new Astro had the same gestation period as Ford's Aerostar, yet the Aerostar is a tour de force, the Astro is a bomb. Just as the Aerostar is built off the Ranger pickup, the Astro is built off the S-10. However, something got lost along the way. A new 4.3-liter V6 helps give the Astro a 5000-pound tow rating, but that's about the only good news.

Our families thought the Astro was ugly. For some reason, General Motors chose to supply us with a van tarted up with a \$5823 aftermarket package by Starcraft. The less said about it, the better, except to note that the Starcraft seats and accommodations were even worse than the stock Astro's.

The Astro falls down on basic design compromises. Rear visibility is very poor. There's no passenger foot room, the engine intrudes into the interior, the instrument panel is awkward, the driving position is uncomfortable, the step into the side door is too high for most people, and the list goes on and on.

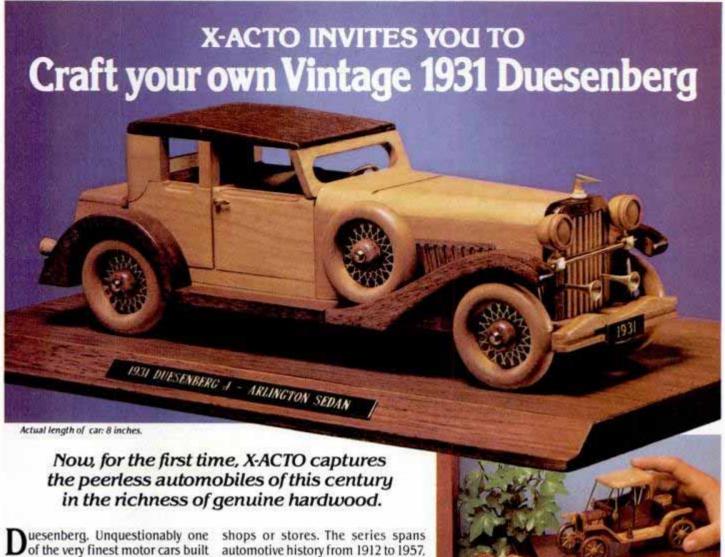
Mechanically, too, the Astro disappoints. The ride is choppy, the steering is numb and the slow-shifting automatic transmission makes the big, powerful V6 seem to be struggling.

The shame of it is that, with the marketing clout of Chevrolet, the Astro could easily turn out to be the best-selling family van. But as our families summed up, "This truck needs a complete rethink—a lot more engineering work and new styling. It's very old-fashioned, oafish and truck-like to drive. GM would have done better to have just copied Chrysler."

#### Conclusion

If you want versatile everyday transportation plus a basic camper you could take cross-country with the kids, buy a Plymouth Voyager or Dodge Caravan. They represent the class of family vans. If you need towing ability, and don't mind being whistled at, get yourself one of Ford's stylish Aerostars.

If you want to take a year off and camp your way through the National Parks, Volkswagen's Westfalia makes more sense than a full-size RV. And if you're thinking of buying a Toyota or Chevrolet Astro/GMC Safari, do yourself a favor and drive a Chrysler or Ford before you sign the papers. You just might find that your family agrees with our families.



Duesenberg. Unquestionably one of the very finest motor cars built in the 1930's. A car of such beauty and refinement that, for more than half of a century, it has been a source of supreme pride for the few who could afford to own one.

Today you can share in the Duesenberg legend and experience the personal satisfaction of crafting this vintage car with your very own hands. Because now, the makers of X-ACTO® brand precision tools and hobby products, bring you the incomparable Duesenberg in a wood kit you build yourself.

#### Meticulously Designed and Detailed

Perfect for beginning craft enthusiasts, yet challenging enough for experienced woodcrafters, the Duesenberg Vintage Car kit features over 60 pieces, including precision-cut hardwood parts and handsome brass details, and complete instructions for assembling and staining. You'll also receive FREE finishing materials and a history card detailing the specifications and unique personality of this classic automobile.

#### Available Exclusively by Mail

The 1931 Duesenberg J-Arlington Sedan is the first in a series of Vintage Car kits and will not be sold in hobby shops or stores. The series spans automotive history from 1912 to 1957, including distinguished models such as the 1931 Rolls Royce Phantom and the 1955 Thunderbird (as well as models pictured here).

#### Complete Satisfaction Guaranteed

Send for your Duesenberg kit now for only \$19.95.\* If not completely satisfied, you may return it for a full refund. Keep the Duesenberg, and you will become a certified member of the Vintage Car Club of America, which entitles you to examine other Vintage Car kits in the series, with no obligation to buy.

To get your Duesenberg kit, mail the coupon today.

FREE This Vintage Car Club Map Case holds your history cards, which come with each kit, and your Club Membership Certificate. Perfect for storing road maps in your glove compartment. Yours to keep, even

if you return your Duesenberg kit.

Each Vintage Car comes with hardwood base and brass name plate. Top: 1912 Ford Model T Touring Car. Bottom: 1929 Mercedes SSK Roadster.

### Vintage Ca 80 Newbridge I

#### Vintage Car Club of America 80 Newbridge Road, Bergenfield, NJ 07621

Please send me the Duesenberg Vintage Car kit by X-ACTO for only \$19.95.\* If I am not completely satisfied, I may return it for a full refund. If I decide to keep the Duesenberg, I will become a certified member of the Vintage Car Club of America and receive one Vintage Car kit per month for the same low price of \$19.95.\* However, I am under no obligation to buy any additional kits—ever, and I may cancel my membership at any time.

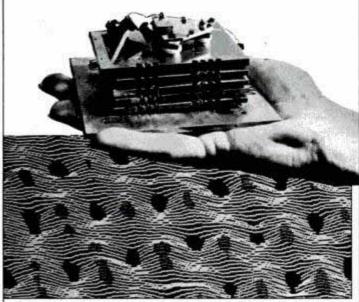
The Map Case is my PREE Gif	T even if I return the Duesent	erg Kit.
I prefer to pay as follows:  Check or Money Order enclosed Or charge to my credit card:  MasterCard (INTERBANK NO		PD-09 ners Club
ACCOUNT NO.	EXP. DATE	

ACCOUNT NO.	3	EXP. DATE
SIGNATURE		
Mic O Mrs. () Mins () Ms. ()		
NAME		
ADDRESS		
спу	STATE	ZIP
*Plus state sales tay and t	22 05 shipping and handlin	a.

# Science



### **Tunnel to land of atoms**



IBM's Scanning Tunneling Microscope fits into a hand. It takes images of individual atoms, shown as light splotches above.

Scientists who want to look at individual atoms are able to reach the submicroscopic particles by "tunnel."

IBM's scanning Tunneling Microscope can produce images of gold, silicon and graphite atoms as they actually appear at the surface of a sample of the material.

Just five years ago, it was impossible to look at an individual atom. But the new IBM device, which actually serves as a zoom on any electron microscope, imparts a charge to a surface where two atoms meet, driving the electrons of each in opposite directions and separating the atoms.

The tiny device then makes an image of the surface. Dark spaces alternate with lighter splotchy atoms. It looks like a microscopic revolution has begun.

#### Comet lab

Reports are being prepared on last October's encounter of a NASA satellite with the comet Giacobini-Zinner. The major studies in progress now are centered on images sent back of the comet's tail. They show very turbulent clouds of space dust. Physicists are studying the images for information on the strength and direction of the solar wind. The wind may one day be the power source for giant sailing spaceships.

Voyager's stop

This month, NASA's Jet Propulsion Laboratory (JPL) will get man's first closeup view of the planet

Uranus when the Voyager 2 spacecraft enters the seventh planet's gravity field (see Voyager's Next Stop on page 90). While scientists are excited about that, they are just as excited at recent findings from Voyager 1's encounter with Jupiter in 1979. Studying photos from that mission, astronomers have now confirmed the existence of a "gossamer" ring, an extremely thin gathering of space dust and rocks. Using computer enhancement, JPL researchers found the gossamer ring just outside the already identified bright ring of Jupiter. The new discovery indicates there was a lot more matter in the forming of the solar system than originally thought.

#### In control

My quest for the first journalist seat aboard the Space Shuttle is progressing nicely. I've just begun studying the Shuttle's propulsion system as part of my NASA extension course. In orbit, the Shuttle can't use standard aviation equipment to roll, pitch and yaw. Moving around is done with the Reaction Control System-44 tiny thrusters fired at once for forward propulsion or alternately to give the Shuttle a push in one direction or another. The thrusters are very responsive and require only a light touch at the controls. Speaking of light, I've lost my first 20 pounds. More on that next month.

**Burst of light** 

New light is being shedliterally-on the cause of epilepsy, a disease in which there is an interruption of nerve function. It causes victims to black out for a few seconds. And in severe cases, it causes seizures. Now Barry Connors and his team at the Stanford School of Medicine have pinpointed what may be a major cause of epilepsy. Using radiographic imaging techniques and a special dye called Lucifer Yellow, Connors and his associates have found "bursting cells" in epileptic patients. In such nerve cells,



Radiographic image of a "bursting" nerve is clue to epilepsy.

the body's electric current builds up and bursts out, instead of flowing through the cell as it is supposed to do. The sudden burst of energy disrupts the normal flow of information from nerve to nerve. Further studies are in progress, and scientists believe the work may eventually lead to the use of a chemical to smooth the electric flow in bursters, ending some forms of epilepsy.

# Shuttle's children

Some think the Space Shuttle program has been a waste of tax dollars. But they're not looking at the big picture. Cordless power tools are the result of the Space Shuttle program. Advanced heat pipes for the auto and other industries come from Shuttle rocket research. Ceramic engines in race cars are the offspring of ceramic experiments done during the Shuttle design phase.

The contributions Shuttle has made to industry are so impressive that the Society of Manufacturing Engineers has compiled a series of articles from trade magazines and professional journals outlining the breakthroughs. The collection of articles has a good reading pace that changes often enough to hold the interest of even a nontechnical reader. The book, Space Shuttle: A Triumph In Manufacturing (\$35, Society of Manufacturing Engineers, Dearborn, MI), is worth it.

(Continued from page 82)

certain proteins, so it cannot be offered and accepted by just anyone. And the design of its cells could also be improved. The average corpuscle, at 8 microns in diameter, is twice the width of capillaries it must pass through.

Dr. Djordjevich's AE could better nature on all of these shortcomings. The oxygen-carrier hemoglobin, taken from any number of sources (including expired human blood or animal blood), is enclosed in lecithin/cholesterol bubbles. Using a technique called high-pressure extrusion, he can vary the size of AE down to half, a tenth, a thousandth of the original. The blood does not carry viruses, could be transfused to people of all blood types and, if mass-produced, it could be made available for a tenth the price of donor blood.

What better to carry AE than a set of Dacron and Teflon vessels? Thousands of people have these today. Some, with severe atherosclerosis, have had more than 80 percent of their major arteries replaced. Researchers have found a way to get cells to grow a natural inner lining within the artificial vessel, minimizing the risk of clotting.

With human blood circulation, the heart of the matter is the heart itself. While the Jarvic-7 artificial heart has demonstrated remarkable success, it is still a long way from the ideal replacement part. At Penn State, for instance, researchers have developed a pneumatic device that weighs only a pound (the same weight as the human heart and nearly half the weight of the Jarvic-7). According to its developers, the pump responds automatically to the body's changing needs for blood flow, increasing it, for example, when a patient sits up, walks, grows angry or afraid. This system still leaves the patient tethered to an air compressor the size of a washing machine.

A power source as implantable as the pump is the sought-after grail of research today. Dr. William Pierce at Penn State has built a small, implantable motor that has kept a calf alive for a week. University of Utah researcher Wilhelm Kolff and his colleagues have also pioneered the WAK, or wearable artificial kidney. Designed for travel, the device offers hope of new mobility for the 70,000 kidney disease patients in the U.S. alone who are strapped to dialysis treatments-usually three, 4hour sessions a week. The WAK is basically an 8-pound, battery-powered filtration factory.

Eyes

While most organs may be replaceable—by artifice or transplant—the eye poses staggering problems. In fact, says Yale ophthalmologist Dr. Scot Sollaway, "you can't think of the eye as a separate organ—it's an extension of the brain." When blind patients ask about transplants, he tells them there are about 2 million nerve fibers joining each eye to the brain. Even if a surgeon could connect one fiber a minute, finishing one eye would take a lifetime.

There have been some fascinating attempts to bypass the eye and create vision without it. Dr. William Dobelle, working at Columbia University in New York, placed a miniature camera in the eye socket of a blind person. The camera was hooked up to a plastic sheet, which held 64 electrodes and was placed over the visual cortex of the brain. The information from the camera would be "painted" on the sheet much the same way as points of light make images on a scoreboard.

#### Ears

It's not known how many people in the U.S. are affected by hearing loss. Estimates range from 2 million to 3 million. It is, however, fairly certain that by the age of 70, one out of three Americans has significant hearing loss.

Now a new device—the cochlea implant—translates sound into electricity, activating bipolar contacts laced along a wire in the inner ear and directly stimulating the auditory nerve. Even though the 500 patients who have tested the device cannot distinguish between tonal qualities of various noises (it all sounds like radio static), they can still hear a door close, horn honk, or tell if someone in the room—someone they don't happen to be looking at—has started talking to them.

#### Skin

Artificial skin has been developed in the laboratories of M.I.T. Designed to aid burn victims, the product is as thin as a paper napkin and relatively easy to produce. Based on the construction of natural skin, it's made of two layers: an inner one of collagen (taken from cowhide and shark cartilage) and an outer layer of silicone. As the burn heals, the patient's skin uses the collagen as a kind of trellis. Meanwhile, the silicone shields the vulnerable tissue from bacterial attack. After about three weeks, the silicone is simply peeled away.

#### Limbs and joints

Structural problems are no simpler. Limbs are awesome marvels of engineering. When you consider that with each stride, hip and knee joints take three to five times the weight of the entire body (and the average sedentary person takes about a million steps per year), it's amazing that things don't go wrong more often.

(Please turn to page 142)



of Veneers.
Wood Parts.
Specialty
Hardware.
Tools.
Knobs.
Pulls.
Finishing
Supplies.
Books,
Kits & Plans

### NEW CATALOG

See the 1985/86 Catalog Great **NEW** Ideas & Products

Enclosed S1.00 (3rd Class)
S2.00 (1st Class)

Name

Address

City/State/Zip

#### The Woodworkers' Store

21801 Industrial Blvd. Dept. J701 Rogers, MN 55374



#### TANDY LEATHER CO.

Send check or money order plus \$2.00 pstg./hdlg. to: Tandy Leather Co., Dept. PM186, P.O. Box 2934, Ft. Worth, TX 76113. Limit 2 per customer. Offer ends 7/31/86. Net available in stores. (TX residents add 5% sales tax.) Valuable Coupon—Clip and Mail Today



CALL TOLL-FREE TODAY 1 (800) 251-4888 WOODMASTER TOOLS, INC. Dept. RP4, 2908 Oak, Kansas City, MO 64108

#### **6 BILLION DOLLAR MAN**

(Continued from page 141)

Today some 190,000 joints are replaced annually in the U.S. alone. Most of these are hips. The FDA registers 49 generic types of artificial joints, including 12 hips, 12 knees, five shoulders and four elbows. The basic principle is a metal (chrome-cobalt or titanium alloy) surface meeting with a tough plastic (usually polyethylene).

Up until only recently, the weak link in joint replacement has been the cement that joins prosthesis to bone. Today, by creating a textured, porous surface where the prosthesis touches bone, physicians are able to stimulate biologic ingrowth-bone grows into and around the artificial bone.

For younger patients needing a complete femur, or thigh bone replaced, Dr. Michael Lewis of New York has developed an artificial bone that "grows." The metal pipe-within-a-pipe, telescopes with a simple screw mechanism. Every year or so, X-rays are taken of both legs: the "bionic" leg is compared with its normal counterpart. The physician decides how much growth is required, opens the leg, and, using a kind of Allen wrench, makes the necessary extension adjustment.

The ideal bionic arm or leg would look

I really enjoyed the Locksmithing course. Am

telling my friends about the course, as it is well worth

Frank R. Bishop,

Holt, Mich.

the tuition.

natural and function normally. That happy marriage of appearance and appliance is a ways off, but there have been major strides beyond peg legs.

The FlexFoot, for instance, is soft, natural-looking plastic formed around a carbon fiber J that replaces the shin, ankle and foot. Rather than jamming against the pavement, the FlexFoot absorbs the body's weight and springs back, giving the amputee a slight push and a more normal stride. The leg replacement is expensive (up to \$7000) but, according to one of its developers, as long as the user stays within 20 pounds of body weight at the time of fitting, the FlexFoot has a virtually infinite fatigue life.

The main problem with developing a leg that is powered is finding a small enough power source. As one expert puts it, you'd need a shopping cart full of batteries to run a set of powered mechanical legs. But a prototype has been tested with some success.

Powered arms and hands, however, are becoming fairly common. Notable is the Utah Arm, developed by Stephen Jacobsen. The device is myoelectrically controlled. That is, instead of depending on the cables and straps of older hook prosthesis, the motors of the elbow and hand are triggered by a slight flex of muscle in the amputee's stump. Options make the arm tailorable to a patient's needs. In Canada, a myoelectric arm was modified to allow a patient to play the saxophone.

But the main limitation down the road in powered prosthesis is the rotation motor. Gears, weight, friction, noise-all kinds of design complications are centered in the motor, says one of Jacobsen's colleagues. Creating the perfect motor would start a whole new ball game.

Arnold Schwarzenegger, who played The Terminator and starred in the more recent high-tech film hit "Commando," did considerable research into proposed improvements in the human body. He drew the conclusion that human bodies are still getting stronger, faster and longer-lived at a pace too fast to be passed by cyborgs. In his Encyclopedia Of Modern Body Building (Simon and Schuster, \$35), Schwarzenegger noted that each succeeding generation of body-builder has exceeded the feats of its predecessors by 25 percent or more.

Still, no man will ever see in the dark or leap over 20-story buildings without the assistance of machines. And in the recesses of the world's greatest bioengineering labs, the goal is still to one day build a cyborg like the character Schwarzenegger portrayed.



portunity Booklet and

sample lesson mate-

rials. No obligation, No

salesman will call.

ADDRESS\_

CITY

STATE

see my locksmith course is practically paid for! I was never so enthused with les-

Adelindo Orsi, Jr., Azusa, Calif.

sons in my entire life!"

☐ Check here if Veteran

### WORTH WRITING FOR LOOKING FOR IDEAS ON TOOLS, HOME IMPROVEMENTS, HOBBIES & MORE? CHECK THESE LISTINGS, THEN USE THE COUPON BELOW.

148 WORKSHOP WONDER

Woodmaster describes the advantages of their new variable feed-rate planer that converts into a molder, jointer or sander. Also provides the answers to some frequently asked questions about the 4-in-1 planers. Free

149 THE ART OF WATERFOWL CARVING

Stackpole Books' brochure describes their new book on waterfowl carving. Learn first hand the start-to-finish carving and painting techniques from a world class carver. Free

150 FIREPLACE WITH VIEW

Jotul USA's brochure describes its new System 18 fireplace. This unit produces 55,000 BTU's; has glass door for fireview and will burn overnight. Cast iron stoves included. Free

151 THINGS YOU NEVER KNEW EXISTED

Fun-filled catalog where the unusual is the usual. 1,800 hard-to-find novelties, hobby and sports equipment, jokes, tricks, science and electronic items. Free

152 PROTECT YOUR FAMILY'S HEALTH

Have your medical history recorded on microfilm chips. This brochure gives details on what the VITAL card is and how it works. Can be read by hospitals, pharmacies and libraries everywhere. From Medical Information Systems. 50¢

153 TIPS FOR THE GOLDEN YEARS

National Home Life Assurance's 24-page booklet offers tips on living an active life in retirement. It's full of money-saving information and helpful tips - from tax breaks and money management to exercise and real estate. Free

154 MACHINERY MAGIC

Delta International offers a 44-page machinery catalog for building trades and home shops for the do-it-yourselfer and professional craftsman. A complete line of saws, drill presses, grinders, jointers, lathes, shapers and accessories. Free

155 PERFORMANCE PARTS

Brand new 80-page catalog available from GM Parts featuring "performance parts", part numbers which are available through GM dealers. Separate sections on Chevrolet, Buick, Pontiac and Oldsmobile. \$4.50

**156 KITCHEN SPECIALISTS** 

The National Kitchen and Bath Association's 84-page directory contains names and business addresses of qualified kitchen dealers throughout the U.S. who have subscribed to the association's standards of fair pricing and professionalism. Free

157 UNCOMMON WOODWORKING HARDWARE

New 48-page catalog features hard-to-find woodworkers' hardware. Including wood turnings, toy wood wheels with rubber treads, original project plans, jewelry box hardware, country-look projects and stenciling supplies. \$1.00

158 MAYBE THE CAR OF YOUR DREAMS IS A TRUCK

Find out about the 1986 Mazda B2000 truck experience in their 26-page full-color catalog. There are six different models to choose from — including a low-price extended cab truck. Free

159 AMERICAN ADVENTURE

Rediscover America on a steamboat vacation. The 1986 Delta Queen Steamboat brochure details their steamboatin' journeys on the Mississippi. Free

160 FLY LIKE AN EAGLE

Cessna answers the most commonly asked questions about learning to fly. Explains the Cessna Pilot Center training program, including learning procedures and financing programs. Free

161 HOME ON THE RANGE

Rio Grande Ranches explains how you can own a ranch in Colorado. Package includes photos of sites, recreation areas of the San Luis Valley and a property report. Free

162 GO FOR THE GOLD

Alabama Metals Company's flyer explains how their manual can teach you to recycle and reclaim precious metals from "scrap." \$1.00 (Refundable upon order.)

163 THE WORLD OF SAWS

Jonsered Chain Saws offers a new 28-page color brochure that takes you on a pictorial tour of various wood cutting operations in 10 countries around the world. Includes technical data on 10 different chain saws.

**164 A REAL WORKHORSE** 

Taylor M'g's pamphlet explains the benefits of their Fold-A-Leg Sawhorse bracket. Made from steel, this bracket allows you to store the sawhorse easily. For carpenters, painters, paper hangers. Free

165 COMPONENTS CATALOG

Brand new 48-page catalog is available from American Design Components, a distributor of electronic and computer-related parts and components. Lists IC's, semiconductors, blowers and fans, motors for the hobbyist, teacher, or design engineer. Free

166 THE CUTTING EDGE

Forrest Manufacturing Co. gives the complete story of their carbidetipped saw blades. Includes testing procedures and explains the difference between table and radial saws. Free

167 ALL ABOARD

Get the full story on Cobalt boats in their new 1986 brochure. Includes background, corporate ethic and model-by-model information. Free

Popular Mechanics 1/86 Box 1718, Sandusky, Ohio 44870	This Coupon Expires March 31, 1986
Please see that I receive the items checked below	
□ 148 □ 152 50¢ □ 156 □ 159 □ 162 \$1.00 □ 165	Total money for priced items \$
□ 149 □ 153 □ 157 \$1.00 □ 160 □ 163 □ 166 □ 150 □ 154 □ 158 □ 161 □ 164 □ 167	Service Charge \$50
□ 151 □ 155 \$4.50	Total money enclosed \$
	Total items requested \$
Name (Please Print)	
Address	
TownState	Zip Code

(Please send cash, check or money order made out to POPULAR MECHANICS. NO stamps, please)

Note: Popular Mechanics processes your requests for the above information and forwards these inquiries to the organization making the offer. Each company mails the material directly. Your order will be on its way to you within 90 days.

# NT PRINTER S

Premium Quality

10" Comstar 10X - This Bi-directional prints Tractor/Friction Printer standard sheet 8½"x11" paper and continuous forms or labels. High image resolution bit graphics, underlining, horizontal tab setting, true lower descenders, with super scripts and subscripts, prints standard pica. compressed, expanded, block graphics, etc. Fantastic value. (Centronics parallel interface.) List \$399.00. Sale \$179.00.



151/2" Comstar 15X - Has all the features of the 10" Comstar 10X plus a wider 15½" carriage and more powerful electronics to handle large ledger business forms! (Better than FX-100). The 151/2" Comstar 15X also prints on standard size paper and continuous forms and labels. Fantastic value. (Centronics parallel interface.) List \$599.00. Sale \$239.00.

List \$499.00

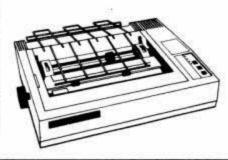
10" Printer

10" Comstar 160 + High Speed - This Bi-directional Tractor/Friction Printer combines the above features of the 10" Comstar 10X with speed (150-170 cps) and durability. Plus you get a 2K buffer, 96 user definable characters, super density bit image graphics, and square print pins for clearer, more legible print (near letter quality). This is the best value for a rugged dependable printer. (Centronics parallel interface.) List \$499.00. Sale \$229.00.

1 Year Warranty

High Speed

151/2" Printer List \$699.00



151/2" Comstar 160 + High Speed - This Bi-directional Tractor/Friction Printer has all the features of the 10" Comstar 160+ High Speed plus a wider 15½" carriage and the heavy duty electronics required for today's business loads. You can use large ledger business forms as well as standard sheets and continuous forms and labels. This is the best wide printer carriage in the U.S.A. (Centronics parallel interface.) List \$699.00. Sale \$289.00.

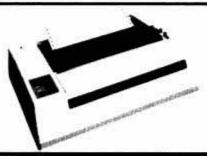
ist \$599.00

10" Printer

10" Comstar 2000 — The ultimate printer has arrived! This Bi-directional has arrived! This Bi-directional Tractor/Friction Printer gives you all the features of the Comstar 160 plus higher speed (165-185 cps), downloadable characters, proportional setting, external dark printing mode and a \*lifetime printhead warranty. PLUS ...

Lifetime warranty\*

High Speed & Letter Quality



List \$599.00

With the flip of a switch you can go into the letter quality mode which makes all your printing look like it came off a typewriter. Turn in term papers, do articles or just print programs. Have the best of letter quality and speed in one package. Fantastic printer (Centronics parallel interface.) List \$599.00. Sale \$259.00.

 15 Day Free Trial — 1 Year Immediate Replacement Warranty Parallel Interfaces

Commodore-64, VIC 20 - \$39.00

Atari - \$59.00

Apple II, II + IIe = \$59.00

Add \$10.00 (\$14.50 for 151%" Printers) for shipping, handling and insurance. Illinois residents please add 6% tax. Add \$20.00 for CANADA, PUERTO RICO, HAWAII, ALASKA, APO-FPO orders. Canadian orders must be in U.S. dollars. WE DO NOT EXPORT TO OTHER COUNTRIES, EXCEPT CANADA.

Enclose Cashiers Check, Money Order or Personal Check, Allow 14 days for delivery, 2 to 7 days for phone orders, 1 day express mail!

VISA - MASTER CARD - C.O.D. No C.O.D. to Canada, APO-FPO.

PROT

We Love Our Customers 22292 N. Pepper Rd., Barrington, Illinois 60010

312/382-5244 to order

Commodore 64 COMPUTER



LIMITED QUANTITIES

Deal 1 Commodore 64 Com. 1541 Bisk Drive Com. 803 Printer

PLUS FREE \$49.95 OH Barrons Adventure

Commodore 64 1541 Bisk Drive 13" Zewith Color Monitor

PLUS FREE \$49.95 OIL Barrons Adventure

Commodore C128 Computer \$289.00 \*

> C128 1571 Disk Drive \$259.00 \*

# FREE SOFTWARE COUPO

SUPER OFFER

(Expires 1-1-86)

SUPER OFFER

To introduce you to the C128 computer, we are offering you YOUR FIRST \$30 OF SOFTWARE from our 64 page catalog FREE when you buy a 
C128 Computer from Protecto. Just send this coupon along with your order. Choose software worth \$30 or more at sale prices from our 64 page catalog and subtract \$30 from the total.

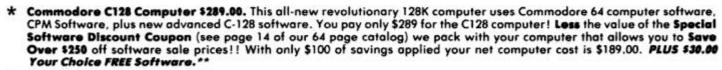
\$30

(1 Coupon per family)

CHANN WHIS

Software From Protecto's 64 Page Catalog Only \$30

40 1114



HELL THE

340K 1571 Commodore Disk Drive \$259.00. Double Sided, Single Disk Drive for C-128 allows you to use C-128 mode plus CPM mode. 17 times faster than the 1541, plus runs Commodore 64 software. You pay only \$259.00 for the 340K 1571 Commodore Disk Drive. Less the value of the Special Software Discount Coupon (see page 14 of our 64 page catalog) we pack with your Disk Drive that allows you to Save Over \$250 off software sale prices! With only \$100 of savings applied your net Disk Drive cost is only \$159.00.

Add \$10.00 for shipping, handling and insurance. Illinois residents please add 6% tax. Add \$20.00 for CANADA, PUERTO RICO, HAWAII, ALASKA, APO-FPO orders. Canadian orders must be in U.S. dollars. WE DO NOT EXPORT TO OTHER COUNTRIES, EXCEPT CANADA.

Enclose Cashiers Check, Money Order or Personal Check, Allow 14 days for delivery, 2 to 7 days for phone orders, 1 day express mail! VISA - MASTER CARD - C.O.D.

No C.O.D. to Canada, APO-FPO

### **PROTECTO**

We Love Our Customers 22292 N. Pepper Rd., Barrington, Illinois 60010 312/382-5244 to order

Материал: зашишенный авторским прак

# **Home Video**



BY JAMES B. MEIGS

### Get set: VCR hookups



The video revolution reached a major milestone last month when my parents bought a VCR. Then they got it home and discovered what more than 20 million other Americans already know: These television-age toys can be infernally complicated to set up and use.

Like my parents, most people manage to get their VCR working sooner or later. But I'll bet a sizable number never get far enough into the owner's manual to find out just how much their VCRs can do.

Setting up a VCR shouldn't be an exercise in frustration. For anyone who's just starting out in video, or for those who suspect they aren't taking full advantage of the VCR they already own, here's a quick tour through some of the hook-up fundamentals.

Though sometimes poorly written, the owner's manual is still the first thing you should check when you take your VCR out of the boxeven if it's your second or third recorder. Read it, then unpack all the cables and accessories that came with your VCR. Take a good look at the back of the VCR and TV, and any antenna wires or cable TV connectors.

If you have a rooftop antenna, check to see which type of cable it uses. The most primitive type is the flat, 2-lead wire known as 300-ohm cable. This connects to your TV using two screws, one to make contact with the flange at the end of each strand. Another type of antenna connection is the 75ohm coaxial cable, a round, shielded wire that is superior for long cable runs. This type should be familiar to anyone with cable TVthat's what comes into the house. Normally, 75-ohm cable terminates in a screw-on fitting that attaches to a protruding screw mount called an F-connector.

If you are using 300-ohm cable to get the signal from a rooftop antenna (or if you use an indoors antenna, which also usually has a 300-ohm output) you'll need a 300- to 75-ohm converter to connect it to your VCR's antenna input F-connector. This is a very simple gadget, but don't count on it being included with your VCR.

Once your VCR is hooked up to an antenna, take a look at the back of your TV set. If it has an F-connector input on the back (it will probably be labelled Antenna In), this will make hooking up the VCR quite simple. A short length of 75-ohm cable should have been included with your VCR. Plug one end into your VCR's Antenna Out F-connector, and the other to the TV's Antenna In, and you're in business.

If your TV set has nothing but two pairs of screws (one pair for VHF reception, the other for UHF), you'll need a 75- to 300-ohm connector to feed VCR pictures and sound to your TV. Again, this is a simple device, but it's not always included.

Both 300- and 75-ohm cables carry TV signals just as they are broadcast, as RF (radio frequency) signals with picture and sound combined. Though convenient, RF cable is not the best way to send sound and pictures from the VCR to your set.

The reason is simple: Before a TV set can reproduce an RF signal on the screen and through its speaker, its tuner has to separate the audio signal from the video. The tuner in the VCR does the same thing before recording the sound and picture on tape. In order to send that sound and picture to the TV set through RF cable, the VCR has to recombine the video and audio signals as if they were about to be broadcast again. The whole roundabout process degrades audio and video quality substantially below what the audio and video signal could be if sent to the TV set separately.

Fortunately, this is easy to do-if you have the right kind of TV set. The ability to accept these separate (or direct) audio and video inputs is one of the most important features of the sophisticated TV sets known as monitor/ receivers. Check the back of your set: If it has round phono plug inputs (like the jacks on a hi-fi amp or receiver), you're in luck. Most recent TVs do. Any standard audio cable with phono plug (also called RCA plug) tips can be used to make the direct video and audio connection. These cables are available in varying lengths at most electronics stores.

If you have cable television, the VCR hookup is more complicated. In next month's column, we'll show you how to make this complex connection.

#### The medium is the message

Though owner's manuals traditionally have been almost useless for helping people cope with real problems of setting up a VCR, at least a few manufacturers are trying to do something about the problem. In particular, Zenith has done an excellent job helping new owners get acquainted with the company's new VR3200 VCR. It's a good thing, too: The 3200 is not only a hi-fi stereo model. it also includes an MTS (multichannel TV sound) decoder for receiving stereo TV broadcasts. Both are complicated features that could baffle neophytes and old video hands alike.

When I opened the box, the first thing I saw was a bold red and black folder that said "Read this first!" Inside were simple—and I mean simple—pictures showing the easiest way to



Zenith's addressing the problems of VCR setup. Models VR3200-(shown) and VR3100 come with easy lessons on videocassette. connect the VCR to a TV and turn it on. The box also held a prerecorded cassette labeled "Video Operating Guide." The instructions told me to insert the cassette and press play.

For the next half hour, I sat and watched a pleasant how-to videotape covering all the basics on setting up and using the VCR (it also covers the slightly less expensive model 3100). The cassette includes 10 chapters, color-coded to make it easy to find them by fast scanning. Everything is covered-from playing a cassette to recording TV shows in stereo.

While the Video Operating Guide is not a substitute for the owner's manual (which is far better than most, by the way), it's a good way to get familiar with most of what the Zenith VR3200 VCR can do. If more manufacturers would follow Zenith's lead, buyers could spend a lot less time trying to decipher the operating instructions and more time using their VCRs the way they're supposed to be used.

Despite its high level of video and audio sophistication, the VR3200 (\$800) is refreshingly simple to program and use. The unit's liquid-crystal display leads you through the programming; commands are entered through a welllayed-out touchpad panel on the VCR's front. This panel flips down to reveal less-frequently used controls. The VR3200's wireless remote control operates most VCR functions, and doubles as a remote for Zenith TVs.

#### Looking ahead

If you're waiting to buy a VCR (or to buy your next VCR) because you think prices will continue to plunge, you should think again. With some very basic recorders selling for under \$200 in some cities now, it's not clear how much lower they can go. Even if prices fall 10 percent this year, that's only 20 bucks off a \$200 deck.

Digital TV sets will explode in numbers and features during 1986. Toshiba's is here already, and Panasonic should have its 20-inch digital model in stores soon. Mitsubishi has shown a digital set able to display still-frame images from nine channels at once.

Expect the 8-mm video format to gain ground in 1986. Several additional companies will join Canon, Fuji, Kodak, Kyocera, Pioneer, Polaroid, Sanyo and Sony with 8-mm equipment. On tap for 8-mm camcorders is autofocus. Also coming is a sophisticated modular home/portable system from Kodak.

Speaking of which, 1986 might be best remembered as the beginning of the end for film-based still photography. Kodak's just announced a videobased system that represents the first steps toward totally electronic photography. Stay tuned.

# **FAMILY OF SEVEN CUTS** HOT WATER BILLS IN HA

Tankless Heater Provides Endless Hot Water



The Hughson family just took 7 showers in a row — the 7th was as hot as the first and they're saving hundreds on their hot water bills too.

The Hughson family of Pennsylvania

### Sound, Simple, Money-Saving Idea

Did you know that much of the energy used to heat your basement tank of water is dissipated right through the walls of the tank itself and into your storage or crawl

#### The Perfect Answer-New Thermar™ Tankless Instant Hot Water Heaters

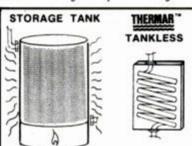
If heat losses are created by the need to keep large volumes of water standing in a tank, why not eliminate the tank? And, that's just what Thermar' has done. In its place we have developed a tiny, super powerful instantaneous heating unit which ACTUALLY CREATES HOT WATER AS YOU USE IT. A microswitch on the unit automatically turns on the moment hot water is needed. Then a continuous stream of delightful, sparkling hot water flows from the tap for shower or wash basin. IMAGINE as much hot water as you want produced in a never-ending stream as long as you need it.

The ordinary Tank-Type Hot Water Heater is the most "Energy Costly" appliance in your home. In this day of rising



- America's Leader in Tankless Heaters
- Featured in Popular Science Magazine
- Seen on Television!
- Member Gas Appliance Manufacturer's Association Inc.

costs and energy consciousness, a new THERMAR' TANKLESS INSTANT HEATER should be considered by everyone interested in saving money and saving energy.



Storage tanks keep large volumes of water heated ... all the time. Tank cycles on and off 24 hrs. a day — even when you're away. Tank can also run out" of heated water when peeded water when needed.

Tankless design small in size, does esn't but creates it on de-mand. Uses no energy until you need hot water. Can produce 120 gallons and more an hourf

#### **U.L. Listed Electric** and AGA Certified Gas Models Thousands in Use Around the World

You'll recover the initial costs many times over in fuel savings as the years pass. And, you'll enjoy a lifetime of hot water shower after shower after shower!

Savings will depend upon local cost of fuel, type of fuel used, condition, age and type of present healer equipm

FOR RUSH DELIVERY OF FREE ENERGY CATALOG AND FULL DETAILS **USE COUPON BELOW** 



#### JOHNSON POWER TECH

THERMAR CENTER

TRUMBULL, CT 06611-0398

**Call Toll Free** 1-800-854-8679

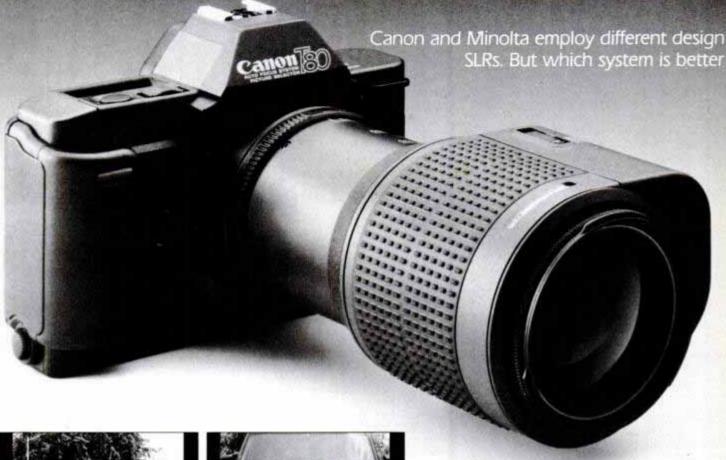
Connecticut Residents Call 452-0055

would like to cut my hot water heating bills in half! Please RUSH your FREE catalog of THERMAR™ INSTANT, TANKLESS HEATERS. Include details of the absolutely unique 10 year guarantee and lifetime rebuilding option. I understand that I am under no obligation to buy.

NAME	please print		
ADDRESS	5.WX5.K 0.23		
CITY	STATE	ZIP	
Canadian Residents send to: 56 Bramsteele Rd., Suite 8, Bramston, Ontario L6W3N4			PMO186

# Canon T80AF vs.

# 35-mm CAMERA







Canon T80AF with 75-200mm zoom photographed van approaching at 20 mph. Shooting continuously, T80AF fired 8 shots in the 7 seconds it took van to cover 180 feet. Shown here is every other exposure, working backward from frame-filling final shot. Compared to first frame of Minolta sequence at far right, van in first frame above is larger because it has approached closer to camera. Reason: T80AF autofocus takes slightly longer to fix on target.

# BY STEPHEN A. BOOTH Electronics Editor

all them "camputers." That's what you get when you cross a camera with a microprocessor, and it describes this new breed of 35-mm SLRs that are programmed not only to compute exposure, but even focus the subject for you.

Focus automatically they do—and a lot faster than you could do it yourself. Sound too good to be true? To find out, PM tested Minolta's Maxxum 7000 and Canon's T80AF, the first and second autofocus program cameras to hit the market. It seemed to us that when fitted with zoom lenses, these point-and-shoot cameras would be ideal for fast-action photography—sports in particular.

Before describing the differences between the T80AF and the 7000, it's worth noting that basically they share the same autofocusing principle.

POPULAR MECHANICS . JANUARY 1986

# Minolta Maxxum

# SHOOTOUT!



Unlike simpler autofocus 35-mm compact cameras, which use an active, infrared beam to gauge camera-to-subject distance, Canon and Minolta employ a passive through-the-lens system that achieves focus by comparing contrast.

Within the camera body is a charge-coupled device (CCD) imager composed of hundreds of light-sensitive cells, which measures contrast. When you sight a subject through the targeted area in the view-finder, the CCD compares the subject's contrast to that of everything else seen in the viewfinder. Compared to these, the out-of-focus subject will show less contrast, thereby appearing soft or fuzzy.

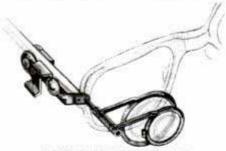
The CCD sends its contrast measurements to a microprocessor in the camera's body, which converts these to electrical signals that tell the lens motor how much

(Please turn to page 150)



Minolta Maxxum 7000 with 70-210-mm zoom proved about 25 percent faster than Canon shooting van. Autofocus Maxxum, positioned beside T80AF, took 10 shots in 7 seconds. Shown is every other frame, ending with last.





#### LOUPE MAGNIFIERS

Used by jewelers and craftsmen for inspection and assembly. Crown glass lenses pivot for 4X-7X magnification! Sturdy loupe attaches to either temple. Precision craftsmanship! Money-back guarantee. Send only \$19.95 + \$1 hdlg. Precision Optical, 132M Rochelle, IL 61068



Computer Verified; Learn How To Build Your Own High Mileage Carburetor, Too. Send 22¢ Stamp For Free Brochure! H & A INDUSTRIES - DEPT PM-1 #2 BOX 35E BOWLING GREEN, MO 63334



AMDECADIMO

Learn Landscap growing of plan opportunities. S LIFETIME CAREE	ing, Gardening, and the its at home! Excellent lend for Free Booklet. R SCHOOLS Dept. A-199	Name and Address of
2251 Barry Ave. L	os Angeles, CA 90064	JAN-MAN
Name		
Address		
1 cm	Ctata 76	N

#### 35-MM CAMERA SHOOTOUT

(Continued from page 149)

and which way to move to adjust the camera's focus.

When the CCD and microprocessor determine that the subject has achieved maximum contrast or sharpness, the lens motor stops and the camera flashes and beeps to tell you it's in focus.

If Canon and Minolta share the same autofocusing system, they certainly couldn't employ it more differently.

Minolta chose to build its microprocessors and lens motor into the Maxxum 7000's body. A dozen new lenses are designed to work with the system, but they can't be used with any other camera, and non-Maxxum lenses—by Minolta or anybody else won't work with the Maxxum 7000.

Canon, on the other hand, has taken a roll-your-own approach. The basic T80 only becomes a T80AF when you snap on one of three special autofocus lenses. That's because Canon puts the lens motor in the lens, which accounts for its binocular-like shape. The reasoning behind this is that it allows T80 owners to use other Canon or Canoncompatible manual lenses. If you want to upgrade to autofocus, you can, because the CCD imager and autofocus microprocessor are built into the camera body.

Despite the differences in configuration, the Canon and Minolta bodies weigh about the same—21 ounces with their four AAA batteries that power everything. Because the camera bodies are widely discounted, suggested retail prices are close enough to ignore: \$390 for the Canon, \$421 for the Minolta. Lenses are another matter. The Minolta AF 70-210-mm f/4 zoom we used lists at \$263. The equivalent Canon zoom, AC 75-200-mm f/4.5, has a \$380 suggested retail price. Minolta's basic AF 50-mm f/1.7 lens is \$88; Canon's AC 50-mm f/1.8 optic costs \$130.

#### Dial-less photography

There are other similarities and differences in the features each camera offers. The first thing you'll notice about the Maxxum or T80 is the lack of dials and rings for setting lens aperture and shutter speed. That's because they're program cameras: A microprocessor sets all the parameters for proper exposure, according to which program you choose.

Basically, each camera offers three programmed exposure modes, plus manual operation. The standard program in each camera is for basic point-and-shoot operation—either for spur-of-the-moment, once-in-a-lifetime shots or for when you're not concerned about creative composition. The microprocessor computes film speed and available

light, then chooses the best aperture/ shutter speed combination for the shot. If you want to freeze action, or depict speed by blurring the background, you use the shutter-priority program. The microprocessor automatically sets lens aperture to match shutter speed. It's just the opposite with the aperture program: Once the aperture is set for deep or shallow focus, the computer picks a corresponding shutter speed. Overall, Canon's programs are more automated than Minolta's and therefore more easily used by neophytes who don't know or care about f-stops or focal lengths.

Other similarities between the two cameras include automated film loading and rewinding, and motorized advance. The latter lets you take single shots and advances the film to the next frame. It also permits continuous shooting. Minolta claims two frames per second (fps) for its Maxxum 7000. Canon states a more leisurely 1.2 fps for the T80. We'll see shortly just what these motor drive ratings mean when the cameras are used for automatic focusing.

Another feature common to the Maxxum and T80 is a system of lights and beeps that alert you to focus status and other conditions. The beeps are defeatable, but helpful if your vision isn't 20/20 or you have difficulty deciding whether or not you're in focus. The T80 has an especially nice touch: The system works even with nonautofocus Canon FD lenses.

The two cameras differ in what their dedicated flash units (optional) will do for you. Minolta's flash sends out a near-infrared beam that helps the camera focus automatically when a lens of short focal length is used. Canon's infrared flash will instruct the camera how to set aperture and shutter speed, but won't focus the lens automatically.

#### Autofocus field tests

Most people probably can focus on a still subject pretty quickly and accurately. What's tough even for pros is drawing a bead on a moving target—and pursuing it. Accordingly, we were eager to learn how quickly and accurately these autofocus SLRs could track and capture live prey. Because the liveliest subjects most often must be shot from a distance, we chose the largest telephoto zooms available for each camera.

In trial runs to become familiar with the cameras, we braved strafing by vintage warbirds at the Oshkosh airshow, and even a stampede of thoroughbreds at the racetrack. The cameras acquitted themselves well under both circumstances, with a variety of films and program modes. But to really try these camputers to their limits, we

(Please turn to page 158)



o you have to sit in the driveway warming you car every morning? Does your engine stumble, buck and hesitate if you try to drive the car immediately after startup? Although you may have learned to accept the inconvenience, you shouldn't have to. Today's automobiles are designed to be driven immediately after starting, even in cold weather. In the following pages we'll provide some hints on where to look for the problem and how to fix it. The information is restricted to carbureted cars, both with and without computer control systems.

Cold driveability problems are usually due to the failure of your car's cold-start systems. But there are also other systems that enter into the picture. EGR valves are usually temperature controlled so they don't open until the engine warms up. Many vehicles built in the last

#### BY PAUL STENQUIST

10 years have thermal devices that control spark advance when the engine is

Almost all cold driveability problems produce similar symptoms. That's because in most cases, the failure involved causes a lean air/fuel mix.

You might, however, experience other related cold operating problems, including idle speed settings which are too low or too high. A too-rich mixture problem can result if the choke remains tightly closed even after the engine has started and begun to warm slightly. This would be characterized by high fuel consumption, chugging, plug fouling and misfire after startup.

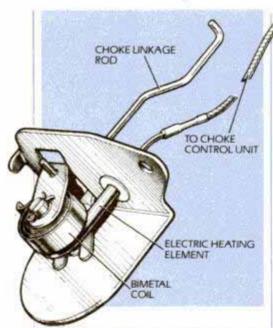
#### Carburetor choke problems

Three types of choke systems are used

Proper operation of the heated-air inlet flap is checked by applying vacuum to diaphragm.

on carbureted vehicles built in the last 10 years: those that use exhaust heat to warm the metallic coil that opens the choke flap as the engine warms, those that use an electric heating device to warm a thermostat that opens the choke, and those that use a combination of both electric and exhaust heat. A cold driveability stumble will result if the choke flap fails to close to the cold position or if it opens too soon.

Choke system faults can be the cause of cold driveability problems on both carbureted cars without computer con-



1 An electric element is used on some Chryslers to heat the choke actuating coil.

trol systems and those that are equipped with computers. The only variation in troubleshooting would be that for cars with computer controls, the on-board diagnostic system should be checked for trouble codes.

Most systems vary spark timing, fuel mix and EGR depending on engine temperature. If a coolant-temperature sensor fails, a nasty cold driveability problem can result.

#### Choke cleanup

The first step in checking any choke is to make sure it closes when the engine is cold. Remove the air cleaner from the cold engine, open the throttle and watch the choke flap. It should snap shut. If it doesn't, corrosion and dirt may be holding it open. Get a can of carb cleaner and, using a small solvent brush, clean all linkage parts and the choke flap.

Most chokes have an adjustment mechanism that allows you to preset the tension that the thermostat or coil applies to the flap when the engine is cold. If tension is insufficient to close the choke when the engine is cold, driveability and starting problems will result.

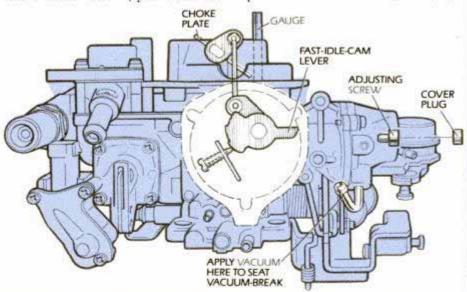
On some carbs, adjustment is simply a matter of rotating the choke housing cover until a pointer on the carb aligns with an index mark on the cover. You may find that the housing is held on with rivets or screws that have no slots. To remove rivets, drill them out. For most carburetors, you'll need an 1/-in. bit. To remove slotless screws, you should cut

made by gauging the height of the linkage rod with the engine cold and the rod disconnected from the choke flap.

#### Choke thermostat failure

If after cleaning and adjusting the choke flap, it still won't close or closes but won't open as the engine warms, the thermal device that controls it is broken, missing or incorrectly positioned.

To check, remove the carb's choke housing and look for the thermostat unit or metallic coil. Electrically heated chokes have a thermostat with a wire connected to it. Most exhaust-heated chokes have a metallic coil or similar device. In either case, the thermostat or coil should push the choke plate closed when the engine is cold. If it doesn't, replace it. If the thermal device is mount-



3 Adjustment of Chevette vacuum break requires applying vacuum to diaphragm.

slots in them with a hacksaw blade.

On many late-model GM cars with adjustable chokes, a plug gauge is used to check the position of the choke flap lever with the choke housing cover removed. On some cars, including late-model Chevettes with electric chokes, no

provision for adjustment is provided, and the choke thermostat must be replaced if the choke doesn't operate correctly.

If your carburetor doesn't have a choke housing, you'll probably find that the choke flap linkage is connected to a little metal box that sits on the intake or exhaust manifold. The thermal coil that opens and closes the choke is located in the box. You'll find it on rysler V8s and a lot of early GM

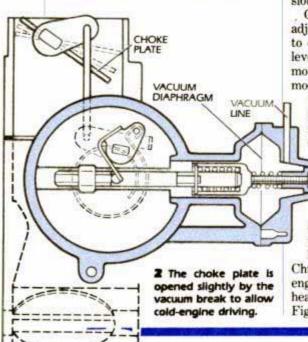
Chrysler V8s and a lot of early GM engines. On some Chryslers, an electric heater helps warm the bimetal coil (see Fig. 1). In most cases adjustment is

ed in a box on the intake or exhaust manifold, replace the entire assembly.

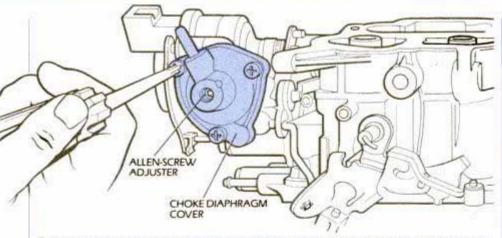
#### Vacuum break failure

All choke systems use a vacuum-break device that pulls the choke open a little bit after the engine starts. Mounted on the outside of the carb body, it consists of a vacuum diaphragm and a linkage that joins it to the choke flap. When the engine starts and develops intake manifold vacuum, vacuum is applied to the diaphragm, which tugs on the linkage and opens the choke flap a bit (Fig. 2). On some carbs, an adjustment screw limits the travel of the diaphragm, preventing it from opening the choke too far. This provides the right air/fuel mix and velocity for cold driving.

Most vacuum breaks can be adjusted to control how much the break pulls the choke flap open when the engine starts. Two different adjustment methods are







4 Faulty vacuum break diaphragm on Holley carbs can be replaced by removing cover.

used, depending on whether or not the break has an adjusting screw.

If you don't see a screw on the diaphragm housing, look for a screw plug or an expansion cup plug. If you see either, the adjusting screw is probably under it.

Instructions and spees for adjusting the vacuum break vary, so you'll have to consult your service manual, but the method for late-model Chevettes with a 2-barrel carb is typical (Fig. 3). Once you've gained access to the adjusting screw, use a hand vacuum pump to apply 15 or more inches of vacuum to the break diaphragm. Push the fast-idle-cam lever down to close the choke (with vacuum applied). Take the slack out of the linkage by pushing it in the open choke direction, and insert the specified gauge between the lower edge of the choke valve and the inside air horn wall. A drill bit, incidentally, makes a fine gauge. If the opening is not at spec, correct it by turning the adjustment screw.

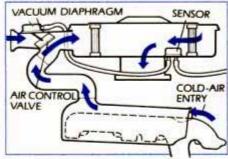
Instructions for checking the vacuum break on Chrysler K-cars with the 5220 Holley 2-barrel carb are similar. Chrysler calls the device a choke vacuum kick, and instructs the mechanic to disconnect the vacuum hose, open the throttle, close the choke and apply external vacuum. Then, while pushing hard enough against the choke to keep it fully closed, measure between the top of the choke valve and the air horn wall at the primary barrel end of the carb. An Allen-screw adjuster is provided in the center of the diaphragm housing (Fig. 4).

GM instructions for vacuum-break adjustment on most 2- and 4-barrel Rochester carbs call for the use of a choke-valve angle gauge to check the degree of opening. An angle gauge, available at better auto parts stores, is like a protractor with a bubble level attached. Rather than measuring the choke flap opening, it checks the angle of inclination.

To adjust the break on the popular E4ME 4-barrel, attach a rubber band to the green tang of the intermediate choke shaft and open the throttle, allowing the choke to close. Set the angle gauge scale to the specified figure and attach the gauge's magnetic base to the choke flap. Apply at least 18 in. of vacuum to the break diaphragm. If air bleed holes prevent the break from retracting, plug them temporarily. Make sure the airvalve rod does not restrict the plunger from retracting fully. If necessary, bend the air-valve linkage rod. With the plunger fully retracted, turn the screw on the diaphragm housing until the angle gauge's bubble level is centered.

Vacuum breaks without adjustment screws are gauged in a manner similar to those described above. However, to correct the size of the opening, one of the linkage rods is bent.

Once the vacuum break and choke have been adjusted, fast-idle speed should be set. In most cases, the fast-idle adjustment screw is positioned on a specified step of the fast-idle cam and a tachometer is used to gauge engine speed (Fig. 5).



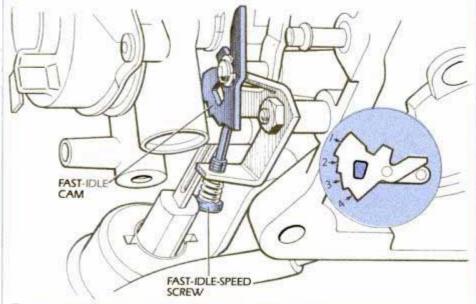
6 Inlet air heated by routing it over the exhaust manifold improves cold driving.

#### Heated inlet air system

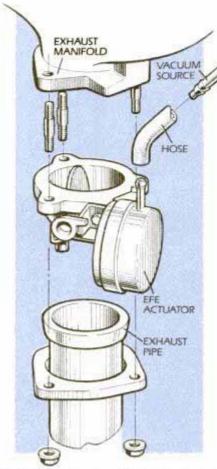
The various carmakers have their own name for this device, but in most cases operation and diagnostic procedures are the same. To avoid carburetor icing, fuel puddling and extended warmup, heated inlet air must be provided when only cold air is available at the air cleaner snorkel. This is accomplished by a simple vacuum-motor-controlled damper door in the air cleaner snorkel and a hose that joins a heat stove on the exhaust manifold to the snorkel (Fig. 6).

Most heated inlet air systems are calibrated to switch to outside air when the temperature of air entering the outer end of the snorkel reaches approximately 90° F. When the engine is hot, the door in the air cleaner snorkel should be in the down, or HEAT OFF, position. When the engine is cold, the door in the snorkel should be in the up, or HEAT ON, position. Of course the large duct hose that joins the heat stove on the exhaust manifold to the snorkel must be in place.

If the system doesn't operate, remove the air cleaner, cool it down to 50°F or



5 Adjust fast idle speed after setting screw on the specified step of the cam.



7 GM EFE system diverts hot exhaust gases to warm up intake manifold passages.

less and apply 20 in. of vacuum to the temperature sensor, leaving the sensor connected to the vacuum diaphragm that opens the door. The door should be in the HEAT ON position with vacuum applied.

If the door doesn't rise to the HEATON position, apply vacuum directly to the diaphragm with a hand vacuum pump and check to see if it bleeds down more than 10 in. in five minutes (see illustration on page 151).

If the door wouldn't move when vacuum was applied to the sensor but it moves when vacuum is applied directly to the diaphragm, then the sensor is defective and must be replaced.

#### Intake manifold heaters

In addition to heated inlet air, GM and Ford engines supply exhaust or electric heat to the bottom of the intake manifold during warmup to help prevent fuel puddling. If the heat is turned off, stumble and hesitation can occur.

Three types of manifold heaters are used: a ceramic grid that is electrically heated when the engine is cold, a valve in the exhaust stream that is closed by a bimetal coil when the engine is cold, or a valve that is held closed by a spring when the engine is cold, and is opened by a

vacuum motor when the engine warms. GM calls the device early fuel evaporation, or EFE; Ford has named it the exhaust heat control valve. Valves operated by a bimetal coil should be checked for freedom of movement and lubed with a high-temperature graphite lubricant.

Instructions for checking vacuum-controlled valves begin with inspection and lubrication of the valve. Next, check to make sure vacuum is available at the valve. If the vacuum supply is okay, apply more than 10 in. of vacuum to the valve's diaphragm using a hand vacuum pump. The valve must close and should hold vacuum well enough to remain closed for about a minute without applying additional vacuum. It must also reopen when vacuum is released (Fig. 7).

If you found that there was no vacuum available at the valve, the coolant temperature vacuum switch that controls it must be checked. With the engine at 70° or colder, apply vacuum at the inlet slide of the switch and check to make sure it's delivered to the outlet side. If not, the vacuum switch must be replaced.

Many GM cars use an electrically heated grid, sandwiched under the carb, to provide manifold heat. The simpler systems, like that used on late-model Chevettes, use a temperature-controlled switch, mounted in one of the engine's coolant passages that turns the heater on when the engine is cold and switches it off when it warms up. A second, less common type, like that used on the 3.8-liter Buick turbo engines, draws a lot of amps so a relay is used to switch the grid on and off. The relay is triggered by the temperature-controlled vacuum switch.

To check the electric EFE system on late-model Chevettes, turn the ignition switch on with the engine cold. Then, touch each of the two terminals on the heater switch connecter with one probe of a test light. The other probe of the test light should be connected to ground. If you find voltage at only one terminal, replace the control switch. If neither terminal has voltage, the circuit to the vehicle's ignition switch is faulty.

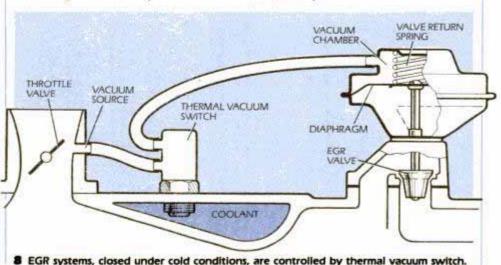
If you find voltage at both terminals, probe the pink wire at the heater connector near the base of the carb. If no voltage is available, the problem is in the wire between the heater switch and the connecter. If voltage is available, disconnect the heater connector and touch one probe of the test light to each of the two harness terminals. If it doesn't light, there's an open in the ground wire. If it does, get your ohmmeter out and check the resistance of the heater itself.

If you find that heater-grid resistance is over 3 ohms, replace the heater. If it's under 3 ohms, reconnect the wiring and probe the pink wire at the heater connecter with the other probe of the test light touching ground. With the engine at operating temperature, no voltage should be available. If you do find voltage, the heater switch is defective.

#### Other potential problems

As mentioned earlier, an EGR system that doesn't shut off when the engine is cold can cause cold driveability problems. Most EGR valves are vacuum controlled and a thermal vacuum switch is responsible for keeping the valve closed when the engine is cold (Fig. 8). In most cases, you can check the switch by making sure no vacuum is supplied to the EGR valve when the engine is cold. If vacuum is supplied when the engine is cold, replace the thermal vacuum switch.

If you have a cold driveability problem and other solutions have failed, check the emission controls chapter of the manufacturer's service manual to see if your vehicle is equipped with some kind of vacuum switching device that retards or advances spark.



# Homeing h!

At Last! A Rear-Tine Tiller Especially for Small Gardens!

the 3½HP TROY-BILT "JUNIOR"

If your garden is 30'x50' or less, here's why it will pay you to get the full story about the Newest, Greatest Breakthrough in rear-tine tillers in over 50 years!...

HALF THE PRICE OF OUR LARGEST MODEL

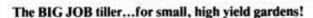
- SAVES YOU MONEY! Goes for half the price of larger reartine tillers—which you don't need for your small-sized garden.
- SAVES YOUR BACK! Forget spading and raking! The "JUNIOR" prepares your garden in a fraction of the time!
- SAVES HAND WEEDING! It's adjustable to shallow depth perfect for chopping, uprooting and burying weed seeds killing them. Simply guide the "JUNIOR" up and down the row.
- SAVES GARDEN SPACE! Narrow 14" tilling width allows you to plant your rows closer together. Grow more in less space!
- EASY TO USE! With its tines in the rear and engine out front, the "JUNIOR" is so well balanced you can handle it with JUST ONE HAND. Won't shake you to pieces like front-end tillers do!
- EASY TO TURN & MANEUVER! Because the "JUNIOR" is light and compact (but strong!) you can turn it and maneuver it in tight places with wonderful ease!

There's much more to know about this wonderfully different and better idea in small garden tillers...like how you can use it to build super rich soil, no matter what your soil conditions...or, how it can help you grow two, even three crops of vegetables where you could only grow one before!

So why not mail the coupon TODAY and get all the exciting facts about the amazing TROY-BILT "JUNIOR"... Plus our mid-sized PONY and large garden HORSE Models. We'll include prices, attachments and complete information about our special "OFF-SEASON" Savings discount now in effect!



WHY, for heaven's sake suffer any longer with a tines-in-front type of tiller that has no power to the wheels and shakes you to pieces? And why break your back with hoeing, raking and shovelling? The TROY-BILT "JUNIOR" makes all your gardening chores faster and easier — increasing your gardening JOY! Send for full details TODAY!





"Grow more in less space!"



"No more hand weeding!"



"Turns on a dime!"

Mail this coupon today!

TROY-BILT® Roto Tiller-Power Composter Dept. A2523 102nd St. & 9th Ave., Troy, N.Y. 12180

YES! Please send me complete information on the newest JUNIOR and all other TROY-BILT Tiller Models ranging from the 5 HP PONY to the 8 HP "PROFESSIONAL" including details on prices and big "OFF-SEASON Savings now in effect!

Name		
Address	-	
City		
State	Zip	



Yes, if you're needing good, high-quality lumber don't let today's inflated lumber prices stop your important building projects. Take the Foley-Belsaw right to the trees and turn out foot-after-foot of smooth, true-cut lumber. even beginners get excellent results. For power use your tractor PTO or other gas, diesel or electric unit as small as 25-HP. Our factory-direct selling keeps the price low, and convenient time payments may be arranged.



#### Send TODAY for FREE BOOKLET!

Just mail coupon for "How To Saw Lumber" Booklet and complete facts on the One-Man Sawmill. Send to:

One-Man Sawmill . Foley-Belsaw Co. 0575 Field Bidg. ensas City, Mo. 64111

Allu The Fully-belsaw Gall CANN	
Just one man (no crew needed)	
enough on weekends to SAVE	
dollars over high lumberyard pr	ices. But you
can also Custom-Saw for other	rs or sell the
lumber produced from your time	ber and EARN
excellent Cash Income - with a	
the choice is YOURS. And when	
Boss YOU pick the hours to wor	
Profits go in YOUR pockets	A dilu ALL III
Froms go in Took pockets.	Branch Comment

HOW TO

There is NO obligation and NO salesman will call! ONE-MAN SAWMILL Foley-Belsaw Co. 30575 Field Building

Kansas City, Mo. 64111

Please send all facts and details PLUS FREE.
'How To Saw Lumber' Booklet. I understand there is No Obligation and that No Salesman will call on me.

NAME	
ADDRESS	

CITY \_\_\_\_\_

STATE ZIP ZIP



Why pay \$600, \$1000 or more for an inflatable boat? Sea Eagle inflatable boats last for years, go almost anywhere and cost as little as \$60. Fishing platform, motor runabout, river raft, camp boat, yacht tender and now a true speedboat! Lakes, rivers, ponds, bays and oceans. Sea Eagles give you real value for your money!

#### FREE COLOR CATALOG!

Write: Sea Eagle, Dept. PM61B PO. Box 944, Smithtown, NY 11787

Or telephone: 516-724-8900 8:30 AM-4:30 PM, Monday-Friday, EST



#### 3:-MM CAMERA SHOOTOUT

(C .ntinued from page 150)

positioned them side by side to fire point-blank into a head-on charge by PM's Chevy van. Each was set to its standard program to take its best shot.

Suffice it to say that the Maxxum proved faster on the draw—but only slightly. In repeated tests, it fixed focus about 25 'ercent faster, and got that many more photographs as the van approached. It lidn't seem to matter much if we altered the van's speed over the 180-foot course, swapped the camera's positions or varied the focal lengths of their lenses. The results were pretty consistent. For example, the Minolta got 10 exposures to the Canon's 8 in the nearly 7 seconds it took the van to cover the course at 20 mph. That's about 29 feet per second!

Though these results seem to indicate that the T80AF's autofocusing speed corresponds closely to Canon's motordrive rating of 1.2 fps, there's more to autofocus speed than film-advance speed. Minolta rates the Maxxum at 2 fps. Yet our trial shows the Maxxum shot a frame every 7/10-second (three frames every two seconds) with the van moving at 20 mph.

This leads us to suspect that autofocusing speed is determined by camerato-subject distance, lens aperture and focal length, light conditions, how quickly the camera's microprocessor can compute this information and how quickly the lens motor can drive it into position. Our test was conducted in bright sunshine. Other conditions might produce different results.

Keep in mind that these still film cameras do not follow a subject in continuous focus the way a videocamera does. Instead, a slight pressure on the shutter release focuses the subject and locks the focus until increased pressure exposes the frame. The cycle then is repeated, and if the subject has moved, the camera must refocus. If you were to lock focus and the subject moved before you shot, the original focus is what you'd get. We were surprised to learn how quickly these cameras recycle in the continuous exposure mode as our van closed in on them. All the more so since Canon modestly states its T80AF servo-focus mechanism is only fast enough to follow a subject walking at normal speed.

We've told how quickly the Maxxum and T80AF focus. They also focused accurately in our van test, but this isn't always so, as other hands-on experience proved.

It would be misleading to say that the Maxxum doesn't focus accurately. It either focuses or it doesn't let you take a picture at all. Until the microprocessor has locked on the subject in the viewfinder's target area, it won't release the shutter. You cannot take a bad picture—at least one out of focus.

The Canon T80AF will let you make a fool of yourself if you don't learn patience. You can release the shutter while the lens is raking back and forth to find focus—but you shouldn't until the in-focus signal flashes and beeps. We blew a lot of frames before learning just how much pressure the shutter release button will bear.

That raking back and forth, by the way, is one thing that makes the T80AF's autofocusing slower. The Canon lens searches: It overshoots the subject then scurries back to perfect focus. Maxxum pitches strikes from the stretch: Its microprocessor computes the exact direction of focus and sends the lens directly home.

Though we used zoom lenses for chasing internal-combustion vehicles, the basic 50-mm lenses proved fine for chasing kids and pets around the house. Which brand of camera should you choose if you're interested in autofocus? The Canon's flexibility makes it a logical choice if you've already got a lot invested in lenses. If you don't, you can invest in a Maxxum.

# NEW/WORKSHOP

### Dial-a-speed scroll saw



Delta's scroll saw is designed for intricate cutting jobs.

Delta's new variable-speed scroll saw lets you dial the correct speed for the cutting job at hand. A control knob on the saw's front turns it on and off and adjusts its speed from 40 to 2000 cutting strokes per minute. Its speed and torque are electronically monitored while cutting. Strokes per minute read out on a digital display on the front of the saw.

The scroll saw can handle stock up to 2 in. thick and can cut a 1/64-in.-dia. hole when using an extra-fine blade.



The scroll saw's strokes per minute read out on the digital screen, left of the control knob.

Features include an 18-in. cutting depth and a 16-in.-dia. table that tilts left to right, front to back and rotates 90°. The saw measures 17¼ in. deep x 30 in. wide x 47 in. high.

Included with the saw are a locking bar and a wrench to tighten or release the blade, a sheet-steel stand and 96 assorted blades. The saw costs about \$1075 at Delta tool dealers. Write to Delta International Machinery Corp., 246 Alpha Dr., Pittsburgh, PA 15238.



The saw's 16-in.-dia. cast-iron table tilts and locks 30° left, 45° right, 15° up and 30° down.

#### Mini mill

Sherline's vertical milling machine is designed with the hobbyist in mind. It's meant for small-scale, light-duty work, such as model and jewelry making, yet it's built with many of the same features found on larger industrial metalworking machines—such as dovetailed slides and a permanently lubricated spindle. Its small size—12 in. deep x 14 in. wide x 17 in. high—makes it ideal for benchtop use.

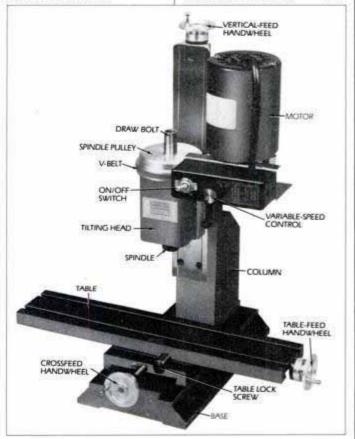
The mini metalworking mill is powered by a 1/5-hp 115-volt motor. A range of accessories and cutting tools, including end mills and speed attachments, outfit the unit for drilling, shaping and milling. It's \$380 postpaid from Sherline Products Inc., 170 Navajo St., San Marcos, CA 92069.

#### Center finder



The Bulls Eye gauge quickly and accurately marks a center point.

This easy-to-use gauge accurately marks the center of a piece of wood. Place the gauge on the workpiece and pivot it until the two pins contact the work. Tap the middle pin to mark center. The Bulls Eye is sold in 2-in. (\$10.45 postpaid) and 6-in. (\$16.45 postpaid) models by Ringmaster Inc., Box 8527A Orlando, FL 32856.



Sherline's vertical mill can expand the capacity of your shop to include light-duty metal drilling, shaping and milling.



# FORD SUPERVAN 2

PM takes a ride in a minivan that's faster than a Lamborghini Countach. How about 150 mph, plus 0 to 60 in 3.4 seconds?

#### BY JOHN RETTIE

■ ooking for a really fast delivery van?
Ford's Supervan 2 is the truck for you—a fiberglass replica of Ford of Europe's commercial Transit Van mounted on a race car chassis. Supervan 2 is, in reality, a one-of-a-kind 2-seater Ford C100 Group C sports racing car designed for long-distance endurance races like the LeMans 24-hours, so don't look for it at your local Ford dealer. It's powered

by a 3.9-liter Ford DFL V8 race engine developing 590 hp, which is a bored-out, nonturbocharged version of the unbeatable Ford-Cosworth DFX Indy engine.

Supervan 2 was the brainchild of Formula One race car designer Tony Southgate. Much of the design and styling work was done by engineers at Ford of

Ford's fastest van hunkers down the straight at the Donington racetrack in England (top). "Cargo" area is filled by the 590-hp V8. Britain's research and development department. In order to give the van a wedge shape and make it more aerodynamic, the overall height was lowered by chopping the van 3 in. below the waistline. Another band  $2\frac{1}{2}$  in. deep at the front, tapering to  $1\frac{1}{2}$  in. at the rear, was cut out above the waistline.

Supervan 2 is not the sort of vehicle one can just jump into, turn the key and drive away. It needs special care and a little coaxing in order to work at its best. The first chore is to fill the gas tank, but there's no filler on the outside. Instead, a mechanic has to clamber into the back of the van, over the engine, and pour fuel into the 50-gallon tank from several cans.

Starting a powerful race engine requires more juice than the small racing battery provides, so an external battery

is plugged in to help start the engine. The fuel pumps are switched on and, once pressure has reached the correct level on the fuel pressure gauge, the starter button can be pressed.

Amazingly, the engine fires to life immediately. The noise is deafening. The sound inside the cab reminds me of standing beside an old Cosworth-powered Formula One car on a street circuit, such as Detroit or Monaco, where the sound reverber-



ates off the walls of the surrounding buildings. A blip on the throttle and the revs shoot up immediately—it's very responsive.

Shifting the Supervan into gear

There's no synchromesh in the Hewland gearbox, so engaging first gear creates a heart-rending crunch—but not to worry, it's supposed to do that. To make it easier, the mechanics help the gears engage by gently pushing the vehicle. The umbilical cord to the external battery is unplugged and we gently let in the clutch. One doesn't just drop the clutch, otherwise the nose is likely to jump up.

The long-distance race motor has so much torque it is much easier to start off than usual for a race car. But wait a minute, we're already nearing the 9000-rpm rev limit. SECOND gear is grabbed. It's much easier to change gear now than it was to engage FIRST. Without even



Spartan driver's compartment features two racing bucket seats and little else.

#### THE PM REPORT CARD

FORD SUPERVAN 2	GRADE	COMMENTS
Acceleration	A+	One of the fastest vehicles in the world
Handling	A	Very good on a racetrack
Braking	A+	Couldn't be better
Steering	C	Far too heavy
Transmission	С	Difficult to engage FIRST gear
Ride	С	Not too bad as long as surface is smooth
Fuel economy	F	Very poor
Seating	В	Holds you in well
Vision	В	No worse than other vans
Gauges/ controls	A-	Well placed, but could do with a speedometer
Ventilation	D	Nonexistent except for two holes in side windows
Noise @ 55 mph	F	Ear plugs are a must
Cargo capacity	F	The whole cargo area is taken up by engine and transmission
Engine serviceability	С	Easy to get at but needs regular tuneups
Fit and finish	В	Good for a one-off



It's one of the few minivans with side radiators and full ground-effects skirting.

trying, we're already doing 70 mph and there are still four gears to go!

If you're into vibro massages, this vehicle's for you. You can feel the whole engine vibrating through the seat of your pants, wedged as you are in the hard racing bucket seat. The first corner comes up and the most difficult part becomes apparent. There's no power steering, and a tremendous amount of muscle is needed just to get around the corner. It has bags of power-induced understeer, but it's fun to drive in a straight line. Stopping is no problem either, the 4-wheel disc brakes work so well you can pull the van to a stop from 150 mph in no time.

Obviously, Supervan 2 has to be driven at its correct operating speed in order to show its true form.

Ford has a couple of professional race drivers who demonstrate Supervan 2, and they have managed to set lap times at various racetracks that would comfortably put the car on the pole position in races for modified sedans. When they're driving the vehicle to the limit, the steering becomes much easier in the turns.

Will there be more Supervan 2s in Ford's future? It's doubtful. After all, who needs a van that's quicker than a Lamborghini Countach, accelerates from 0 to 60 mph in 3.4 seconds, 0 to 100 in 7.1 seconds, will do the quarter-mile in 12.1 seconds and gets 5 mpg! But it's fun to watch and even more fun for those lucky few who have driven and ridden in it.



Driving position makes it hard to apply needed muscle to the tiny steering wheel.







1.9 to 2.7 GHz Frequency Range

20° Parabolic Dish. Preassembled Probe with Down Converter. Power Supply and Tuner Switch 53° of Coax Cable with Connector. Transformer for 75-300 Ohms. Mounting Hardware for Fast and Easy Installation

ORION ELECTRONICS P.O. Box 26420 Tempe. Arizona 85282





(602) 897-2321

Suggested Retail \$259

SPECIAL \$94.95







#### CHEAP HEAT Using your water heater

Don't waste money on another space heater. Let your gas or electric water heater give you continuous 90° heat <u>and</u> hot water. Do it yourself in an afternoon with easily obtained parts. Send \$10.50 for plans to Anderbo

Co., Box 5417, McAllen, TX 78502-5417.

• Inexpensive • Energy efficient • Maintenance Free

# NEW/AUTC

### Roller bed for loading



SLIDE - A-BED

Slide-A-Bed rolls in and out like a drawer in a pickup bed.

With loading access from one end only, an enclosed pickup truck bed can be double work to load and unload. Slide-A-

> PA 18976. It's also available directly from discount auto

when retracted. Decking is

not included, but %-in. ply-

wood is recommended. Slide-

A-Bed costs \$264 from the

Slide-A-Bed Co., P.O. Box

Besides

tect the bed floor, too.

The six ball bearings

of the frame will sup-

port 1500 pounds

allowing

parts stores.

#### Shaky business

66, Moraga, CA 94556.



Electric drill lets you shake that aerosol can for 3 minutes.

If you hate to shake aerosol or paint cans to mix the contents, a \$4 investment will get you the StirrCrazy, a gadget that attaches to your electric drill and uses a coil spring to hold the can. Center the can in the plastic frame, pull the drill trigger and it shakes the

can back and forth. It only holds cans up to one quart, but that's enough for car paint, aerosol tire inflators and undercoating.

The manufacturer is the Vermont-American Tool Co., Lincolnton, NC 28093, and you should be able to find the StirrCrazy in do-it-yourself centers as well as auto parts stores.

#### Squeeze action ratchet

Trying to swing a ratchet to tease nuts on or off in a tight



Squeezing action at handle translates into rotating ratchet.

spot usually leads to bruised knuckles. Why not squeeze the Crick-it ratchet instead? Eight squeezes allow a socket attached to the tool's drive unit to make one complete revolution.

In its standard state, the Crick-it ratchet takes 1/8-in. square sockets. With adapters, you can also use 1/4-in. or 1/2-in. square sockets. You can order Crick-it from the manufacturer, Davenport Tool Co., 320 Warren St., Davenport, IA 52802, for \$23.70.

#### Double duty brush for dirty parts

Cleaning gunked-up auto parts is one of the messiest jobs home mechanics have to tackle. You need a pan of cleaning solvent and a stiffbristled brush to be able to do the job well.

The Graymills 5D Double Brush combines a big end for easy-to-reach surfaces with a smaller end for tight places. And the brush will not ball up. flare out or become flabby. The 5D Double Brush is avail-



Double-ended brush handles ins and outs of parts washing.

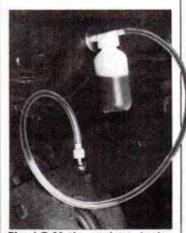
able for \$6.50 through auto parts jobbers or Graymills Corp., 3705 North Lincoln Ave., Chicago, IL 60613.

#### One-man bleeder for brakes

To bleed all of the air from a hydraulie brake system, you'll almost always need a helper. With the Bleed-O-Matic one-man kit, though, you can purge the system singlehanded.

A strong magnet holds the fluid catch bottle above the component to be bled. When the bleed screw is opened and the brake pedal pumped down, fluid is forced into the bottle. Next, the pedal is released, and only fluid will be drawn back into the system. A small amount of the fluid leaks past the loosened bleed screw, and acts as a seal against the re-entry of air.

Bleed-O-Matic The sells for \$8.95 and is available from Hepp Industries, 687 Kildare Crescent, Seaford, NY 11783.



Bleed-O-Matic makes brake bleeding a 1-man operation.

#### Righteous wrench for lug nuts

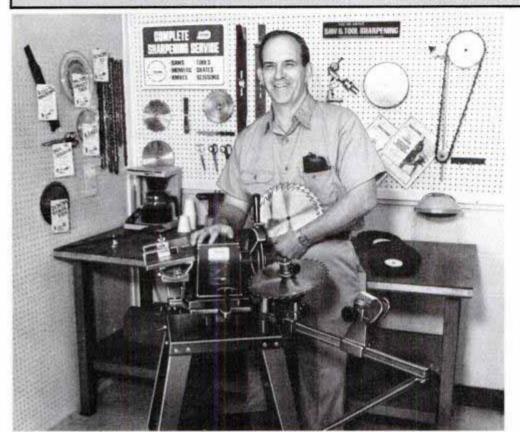
Flat tires are a nuisance, but they become a real pain when the lug nuts have been overtightened with a misadjusted impact wrench. Get the Lug-Buster and worry no morethe 18-in.-long ratchet and steel wrench support let you apply full force without fear of the socket slipping off the lug nut. And the ratchet's action means no more tedious removal and replacement of the wrench when you run out of travel.

Lug-Buster is available by mail order for \$19.99 from Reinhart Industries Inc., 908 Truman Court, Warrington,



Lug-Buster makes easy work of overtightened wheel nuts.

# **BE YOUR OWN BOSS EARN UP TO** \$20 AN HOUR IN A MONEY-MAKING BUSINESS OF YOUR OWN!



## NOW! **Use your SPARE TIME** to BEAT inflation and the high cost of living!

#### No Experience Needed

With Belsaw Sharp-All it's easy to start your own business. No selling is involved, no inventory. People bring in their work...
you take in year round CASH PROFITS and keep 90¢ out of every dollar you earn. Work spare time or full time right at home in your garage, basement or tool shed. Work the hours you want — FREE Book tells how to start your own business even while working at your regular job.

#### **BIG PROFITS** — Plenty of business waiting.

Every home and business has saws and tools that need periodic sharpening. There's plenty of business waiting for the man who can sharpen saws, planer knives, jointer blades, wood chisels, scissors, pinking shears, snips, lawn mowers, axes and other garden, shop and home tools. Belsaw Sharp-All does ALL these jobs and more . . . quickly, and at a big profit. You will be sharpening headquarters for carpenters, builders, lumberyards, factories, home workshops and hobbyists... hundreds of jobs right in your own neighborhood.

#### SEND FOR FREE FACTS TODAY!

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. Send coupon or mail postcard for full details on our exclusive 30-Day FREE Trial Offer?

#### 30-Day FREE Trial Offer!

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 your copy today. No obligation

BELSAW MACHINERY, DEPT. 60568, P.O. BOX 34620. N. KANSAS CITY, MO. 64116

## With the BELSAW SHARP-ALL It's Easy To Get Started!

You don't need to invest thousands of dollars to get started in business for yourself. Low cost Belsaw Sharp-All and our 50 years business for yourself. Low cost Belsaw Sharp-All and our 50 years of experience in helping sincere men to earn extra income, plus the desire to get ahead is all you need. Complete Operator's Manual gives clear, step-by-step instructions, shows exactly how to sharpen each tool, where to get the "tricks of the trade". And the Belsaw Sharp-All does the kind of precision job that brings customers back time after time.

There are NO tranchise eyes of any kind. With the Belsaw Sharp-All YOU are the boss... YOU set the hours YOU want to work... YOU put the PROFITS in YOUR pocket!

#### ACT NOW! Coupon

Brings

Full

Details:

BELSAW SHARP-ALL lets you sharpen saws... shop and garden tools for home and industry.

#### There is NO OBLIGATION!



BELSAW MACHINERY
DEPT 60568
P. O. BOX 2

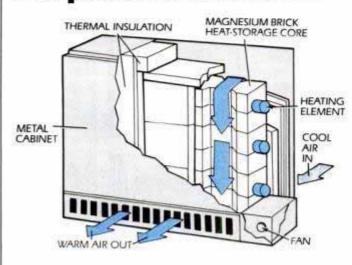
N. KANSAS CITY, MO. 64116
Please send my FREE copy of your book "LIFETIME SECURITY" and full details on your 30-Day Free Trial Offer!

Address

City

# **NEW/HOME**

### Off-peak electric heat

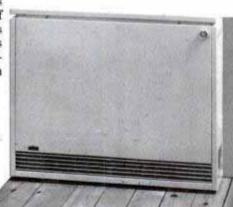


The Con-Elec Superslim heater converts electricity to heat when utility rates are lowest, during off-peak (low demand) hours. The unit stores the heat in ceramic bricks and heat loss through the sides of the heater is reduced by two layers of in-

sulation. Air enters through the back of the heater, is warmed and then is distributed on demand to the room

Con-Elec Superslim converts off-peak electricity into heat. by a small low-volume fan.

The heater shown, Model WSP 180, measures  $6\frac{1}{2}$  in. deep x  $25\frac{1}{2}$  in. high x 30 in. long. It sells for about \$400. For more information, write Con-Elec, 1610 Troy Ave., Fort Ethan Allen, Winooski, VT 05404.



#### Stain cover



Haltz II, a white acrylic latex sealer, was designed to hide stains from smoke and water damage. It can be used on interior or exterior surfaces. It's available from Finnaren and Haley Inc., 2320 Haverford Rd., Ardmore, PA 19003, in gallon (\$21) and quart (\$7.33) sizes. Shipping is extra.

Haltz II hides stains from smoke and water damage.

#### Tilt-open rack

Store your good knives safely and compactly with this tilt-open knife holder that fastens to the bottom of your kitchen cabinets. The Space Saver holds seven knives and a sharpening steel in angled slots. Its front and sides are oak with an oak veneer plywood bottom. It comes stained in oak or unfinished: the price is the same for both. When closed, it measures 4 in. high and pulls open to a 48° slant for easy access. Steel mounting hardware is provided with the holder. The unit costs about



Space Saver cutlery box stores knives under kitchen cabinets.

\$40. Write Chicago Cutlery, North County Rd. 18, PO Box 9494, Minneapolis, MN 55428.

#### Three-in-one light switch

The First Alert automatic light control combines a dimmer switch, light timer and quartz clock in one wallmounted unit.

To switch it on, press the brushed aluminum touch panel and keep pressure on it until the lights reach desired brightness. To turn off, press the panel again. Program the light control to turn on or dim indoor or outdoor lights at a preset time. Swing open the touch

panel to get to the light timer and clock mechanism.

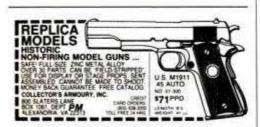
The light control comes in one color, an off-white. To install, remove the existing toggle switch and wire in the light control. A screwdriver is all that's needed, according to the manufacturer.

The automatic light control costs about \$27, hardware included. It's available at hardware stores and home centers. For more information, write to Pittway Corp., 780 McClure Rd., Aurora, IL 60504.





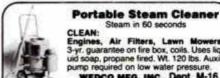




#### SAVE ON SAW BLADES!

You could pay 50% more and not get better blades. Band, scroll and fret, jewelers, spiral, coping, mini-hack, carbide tipped circular. Excellent quality and prices. Send for free catalogs.

THE OLSON SAW COMPANY Dept. 6, Bethel, CT 06801



Engines, Air Filters, Lawn Mowers.
3-yr. guarantee on fire box, coils. Uses liquid soap, propane fired. Wt. 120 lbs. Auxil. pump required on low water pressure.

WEDCO MFG. INC., Dept. M-16
P.O. Box D, 940 West Broadway,
Jackson, Wyoming 83001



#### MANUAL TIRE CHANGER

Fix your own flot tires. Changer breaks boad emounts and mounts tire on rim. \$199.00 pd., satisfaction guaranteed. Call or write.

#### WIKCO INDUSTRIES, INC.

At Last a New Amazingly Simple GAS TURBINE JET ENGINE





## PLEASURE PROFIT PRIDE FROM WOODWORKING

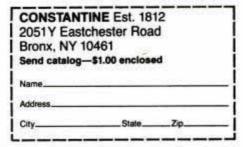
The world famous Constantine Catalog offers over 2,000 items to help you **BUILD, RESTORE, REPAIR, REFINISH** anything made of wood!

You can ruin an otherwise perfect job if you're missing the right tool, part, wood or finish. With Constantine's 116 page catalog as your reference guide, you'll be able to choose from over 2,000 unique and hard-to-find items-items that you need and won't find in your local hardware store or lumber supply!

Every item is top quality, reasonably priced and backed by CONSTANTINE'S MONEY BACK GUARANTEE! Choose from 150 kinds of veneer, 118 carving tools and chisels, 32 upholstery tools and essentials, 39 clamps, pages of brass hardware for furniture and cabinets, 72 lamp parts, 96 how-to books, 73 picture kits, 33 styles of prefinished picture molding, 200 sizes and kinds of

cabinet lumber, professional wood finishes, hundreds of plans for furniture, cabinets, shelves, toys...OVER 2,000 ITEMS IN ALL!

116 page catalog-Only \$1.00 SEND COUPON TODAY! \$2.00 refunded on 1st order.



# Homeowners!

## **Rid Your Property** of Unsightly Brush Piles!



into beautiful FREE mulch in less than one hour!



...with the Amazing New SUPER TOMAHAWK Chipper/ Shredder...exclusively from Garden Way!

- \*It's a powerful Chipper...handles big branches up to 3" in diameter with ease!
- \*It's an efficient Shredder...turns almost any organic matter into perfect mulch and compost instantly!
- Revolutionary New Compact Design... 7 ways better than bulky "old-style" chipper/
- \*Professional Quality...designed, sized and priced for the homeowner!

Send for FREE details today!

Exclusivate from the makers of the Troy-Bilt®Tiller

102nd St. & 9th Ave., Troy, N.Y. 12180	3	1
YES! I want to know more about the a SUPER TOMAHAWK Chipper/Shredde send me complete details including price and SPECIAL SAVINGS OFFER right a	er! Please ces, mod	
Name		

Garden Way Mfg. Co. Dept. A156

Name	
Address	
City	
State	Zip

## **BIG PROFITS** in Steel Frame Homes

OWN YOUR OWN SUCCESSFUL TRI-STEEL DISTRIBUTORSHIP!

We make it easy with:

- Low capital investment
- No inventory requirement
- Distributor training & support
- Substantial discounts
- Single & multi-family designs
- Low maintenance
- Tremendous energy efficiency (R-30)
   Unique patented designs



Select territories now available with a refundable \$4,950 investment.

For more information call [800] 433-5555 or in Texas [800] 772-5909.



€ 1986 All Rights Rese





## **Geodesic Home**

Beautiful, Efficient, Affordable.

Monterey Domes sells home kits for less than many new home down payments. Completely affordable...remarkably beautiful...our homes are designed for a lifetime of savings.

The most energy efficient homes on earth...up to 50% more than everyday homes. In addition, construction costs are cut dramatically using our patented building system...(our 1813 sq. ft.

Discover all the rewards of Monterey
Domes living with our 100 page Color
Catalog and Plans Book. ORDER TODAY
for just \$6.00. Unconditionally Guaranteed or your Money Back!

- Please rush my 180 page copy of Monterey Do Catalog and Plans Book. Enclosed is \$6.00.
- Also please send me the Monterey Domes B Dome Assembly Manual for an additional \$5

Address City/State/Zip

MONTEREY DOMES Dept. AQ-1 1760 Chicago Ave 714-684-2601

## Homeowners! **End Your Lawn Mowing** Frustrations Forever!

Garden Way's New TUFF-CUT is the perfect alternative to ordinary small-wheeled mowers and expensive "riders"!

 Easy to Handle — Big, easy-rolling, powered wheels handle slopes, obstacles and rough ground with ease.

 Extra Power — No more annoying hesitation or stalling in heavy grass.

· Faster - The wider mowing path and easy maneuvering help get your lawn done in record time.

From the makers of TROY-BILT® Roto Tillers





Never again struggle with cheaply built,

small-wheeled mowers that just can't handle tough jobs.

Send for FREE Details Today

1986 Garden Way Inc.

Garden Way Mfg. Co., Dept. A177 102nd St. & Ninth Ave., Troy, N.Y. 12180 YES! Please send all the exciting facts about the TUFF-CUT Mower, including details on your 5 models and Special Savings Offer now in effect.

## Popular Mechanics FILE BOXES SEPARATE INDEXES



No more untidu shelves or magazines stacked on top of each other.

POPULAR MECHANICS FILE BOXES will help you keep your magazines and bookshelves trim and orderly. PM is now offering a sturdy glossy lacquered File Box to keep a year's supply of PM issues neatly together.

With every order you will receive FREE self-adhesive labels covering the years 1975 through 1984. Peel off the year required and place on appropriate PM File Box and you'll have a very valuable, convenient and attractive reference library.

- 1 File Box, \$2.95
- 2 File Boxes, \$2.75 each
- 3 or more File Boxes, \$2.50 each

PM Indexes for the years 1975-1984 are here!

Find the answers to your shop, home and car problems faster than ever. Thousands of entries cross-reference the articles that have appeared in PM over these years.

ORDER BY YEAR! Price for each index is \$2.95

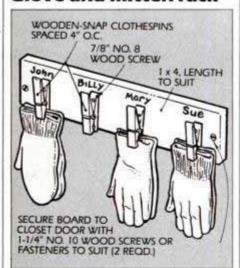
POPULAR MECHANICS

Box 1014, Radio City Station. New York, NY 10101

Popular Mechanics is a publication of Hearst Magazines. a Division of the Hearst Corporation

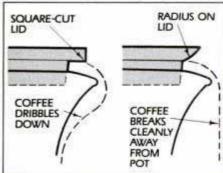
## HINTS FRON READERS

#### Glove and mitten rack



Children are less apt to misplace their gloves and mittens if they are kept in order on a rack in the closet. A board with snap clothespins fastened to it makes a handy rack for storing gloves and mittens and it allows air to circulate around them so they'll dry quicker. Fasten the board to the back of the closet door with two screws at a convenient height so your children can easily reach it .- Victor LaMoy

#### Dribbling coffee pot



Coffee often dribbled down the side of my coffee maker pot rather than into the cup. When I was about to toss the pot out, I came across an article in a scientific journal discussing the "teapot effect." I solved my problem by carving and sanding a radius on the square-cut lip of the pot's lid. The surface tension of the coffee, as it travels over the curved edge, pulls the stream upward and outward, away from the pot.

-Jerry D. Walter







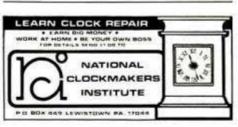
MAKE THIS SHADE FOR LESS THAN \$75.00

Send \$1.00 for our big catalog of stained glass supplies.

WHITTEMORE. Box 2065EM, HANOVER, MASS. 02339









B.L. MELLINGER, Famous World nternationally known Mail Order Expert. President, Mellinger Co. "I started only a few years ago, part time, in my garage with less than \$100. Today my tausiness empire spans the globe. I will help you succeed us ing my personal experience. Mail coupon for FREE REPORT."

START WITH 24,221 PRODUCTS!

PRODUCTS!

Many you can buy one at a time or order in quantity. Example, one 35 mm carriers with hot shoe and carry case \$13.00 ppd or 12 for \$7.41 ppd. Price drops to only \$5.80 in larger quantities. New government ruling makes thousands of imports free of any duty whatsoever. You deal direct my International Traders way. Out out greedy U.S. specialty mechanise middlemen. Really deal direct.

CLIP COUPON, MAIL TODAY PUT AD IN WALLET AS OF BIG

MEN-WOMEN...Turn Spare Hours or Full Time into INCOME! DISCOVER PROFITS OF IMPORT! My Home Mail Order Import Business Plan guides your every step . . . it is based totally on my personal success. Shows how to deal direct and cut out costly middlemen. . so you keep all the profits! I do the "hard work" for you . . by traveling the world to find dazzling "first time offered" new imports. The actual sample I will send you Free is typical of my import discoveries. You can pick and choose from more than 24,000 products. Deal in one product or 1000's. Buy below wholesale.

YOU CAN START IMMEDIATELY. I arrange free membership in exclusive International Traders organiration . . . instantly puts you in direct contact with suppliers abroad. I show how to operate anywhere. Age no barrier. Ideal for spare time husband/wife or retirement business. My report, "How to Import and Export" tells how to do it. No obligation. No salesman will call. Certificate brings your free gift sample import and everything else.

FICEE CATALOGS! New! Quick Double Profit

As a Member of Internation a a neember of international adders you also get free cata-gs of specialty merchandise order at rock-bottom priots om big U.S. Warehouse.

Products subject availab



1000's more dazzling products you can buy DIRECT!

PERSONAL GUIDANCE!

iving you my personal help! Regularly I meet a at regional closed door Seminars across the a will be invited to these meetings. THE MELLINGER CO., 6100 Variet Ave., Dept. 52251 Woodland Hills, CA 91367-3779

🗱 This Certificate Good for 🕏

ONE SAMPLE IMPORT - FREE

B. L. Mellinger/The Mellinger Co.
6100 Variel Ave., Dept. \$2251

Woodland Hills, CA 91367-3779

Send FREE REPORT, "How to Import and Export"... also actual Free Sample Import. Everything you send me is mine to keep without obligation. Show me how I can start a profitable home business of my own.

Name \_\_\_\_\_\_ Age\_\_\_ have not previously requested this Free sample. I am over 18 years of age. Initial here \_\_\_\_\_\_

# Exciting Breakthrough For Suburban Gardeners! At last!

Now there's a tiller/cultivator exclusively designed for small backyard

No longer do you have to choose between a yank-

gardens.

you-along front-tine tiller and a clumsy, hard-to-guide, expensive rear-tine tiller.

Now there's Mantis... the 20-pound wonder that makes every gardening job a breeze! Mantis starts with a flick of the wrist... turns on a dime... weeds an average garden in 20 minutes... and runs all day on a gallon of gas.

Mantis tills a full 8" deep, or delicately cultivates the surface for precision weeding. And, because it's so easy to maneuver, women love Mantis! And lots of older people (many of whom had almost given up gardening) find Mantis an absolute joy. "I'm 82 and I simply couldn't garden any more without it..." wrote W. R. of Russell, Kentucky (and it's a sentiment we find again and again in letters from Mantis owners).

The secret of Mantis' success is its exclusive "tine teeth" which spin at 240 revolutions per minute (twice the speed of most tillers). These tine teeth cut through soil, weeds and tough sod like a chain saw cuts through wood.





Mantis is so easy to guide that you can cultivate right around plants, along crop rows and up tight to fences... without worrying about running into your growing flowers and vegetables.

And, with its easy-on/easy-off precision attachments, Mantis quickly becomes a Planter/Furrower... a Border Edger... a Lawn De-Thatcher and Aerator... or a superb Trimmer for pruning shrubs and hedges.

Best of all, Mantis costs a fraction of what you'd pay for a big tiller!

Get the whole wonderful story on the remarkable Mantis...the little machine that has made gardening such a joy.

#### EARLY ORDER BONUS

Get a FREE \$41.00 Border/Edger! (If you hurry)

Cuts beautiful border edges along drives, walks, and gardens for professionallylandscaped finish.



## 3-WEEK HOME TRIAL MONEY BACK IF NOT DELIGHTED

Mantis

Mantis Manufacturing Co. 1458 County Line Rd., Dept. 821 Huntingdon Valley, PA 19006

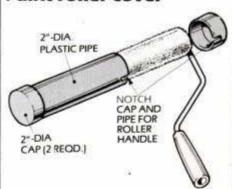
□ Please send me information on the Mantis Tiller/Cultivator and your Spring Bonus.

ADDRESS\_\_\_\_\_

STATE ZIP

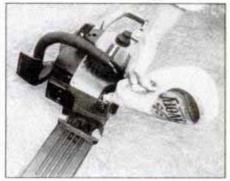
## HINTS FROM READERS

#### Paint roller cover



If you're working on a paint project that takes several days, using this roller cover eliminates the need to clean the roller after each day of work. Besides saving time and paint, the cover also eliminates the chance of the roller becoming oversaturated with water if you're cleaning off latex paint. Or it saves the expense of using solvent to clean oil-base paints. A length of 2-in.dia, plastic pipe serves as a cover for standard-sized paint rollers. Cut a section slightly longer than the roller, then cement a cap onto one end of the cover. Notch the other end of the cover and another cap to clear the handle of the roller. Slip on this cap after the cover is in place.—John D. Billings

#### Chain saw oil dispenser



Reduce the number of items you have to carry to the site when using your chain saw. Carry your oil in a liquid detergent container. You won't need a funnel or a rag for cleanup. To open the container, hook its spout over the lip of the saw's oil filler hole and pull. Close the container by bumping the spout against the other side of the hole.

-Al Marsinko

# AT BIG SAVINGS TO YOU! Interstate by FO

FACTORY NEW! FIRST QUALITY! Extremely sensitive SUPERHETERODYNE

circuitry! Proven in lab tests to be as good (or even BETTER) than models by Escort, Cobra and

So why pay up to TWICE as much for their units when you can buy our Interstate by FOX at such a low price?



One of the smallest, most sensitive and most selective radar detectors in the world! Superheterodyne system is superior to non-superhet units in seek-ing out and alerting you to police radar up to 5 miles away . . . around curves or over hills. It's very reliable for over-the-road protection!

What an opportunity! Our special arrangement with the manufacturer allows us to liquidate this Interstate Radar Detector by Fox at about half what you'd normally pay for an Escort, Whistler or Cobra with comparable sensitivity!

MORE RANGE! Superheterodyne detector is extremely sensitive! It detects fringe signals more reliably. It even picks up the signal from pulse radar hand guns!

COMPACT! Just 3%" x 1\" x 3\"

MORE SELECTIVE! False alarms are reduced by narrower bandwidth and video signal processing. Built-in dielectric lens for additional sensitivity and false alarm protection! Horn-shaped antenna aids in "pulling in" radar signals.

3-WAY SWITCH! For Off, City or long range highway use.

DOUBLE ALARMS! When radar signal is received the red LED will light, and remain "ON" until radar signal is below detectable levels. Buzzer is heard when radar signal is detected. At long ranges, the alarm sounds with a slow, lower tone which increases in rate as the radar source is approached.

LOUD ALARM! Warning signal can be heard even above noisy road traffic. And that's VERY important to you!

NOTE: The unit may either be clipped to your visor, or attached to the dash (hardware included). Also included are D.C. power (fused) cigarette lighter plug and instruction manual.

#### RADAR DETECTOR COMPARISON CHART

-106

-107

-107

-101

formational mensores in	mount and min
	K Band
Interstate (Highway)	103
Escort (Highway)	101
Whistler (Filter Off)	100
Cobra (Highway)	94

\*Tests conducted in accordance with industry standard procedures in the Fox Labs. Note that the higher the negative number, the greater is the unit's

4 hours a day, days a week VISA Nounco



Toll-Free: 1-800-328-0609 Your check is welcome! No delays in orders paid by check.

C.O.M.B. Direct Marketing Corp.

Authorized Liquidator 14605 28th Ave. N. ● Mpls., MN 55441-3397

#### **One Year Limited Factory Warranty!**

**PUBLIC NOTICE!** INVENTORY ADJUST-

MENT BY A MAJOR

RADAR DETECTOR MANUFACTURER **REQUIRES REDUC-**TION OF STOCK. C.O.M.B. now author-

ized to liquidate limited supply of Radar

#### WHY IS THIS RADAR DETECTOR SO GOOD?

Police radar devices are restricted to two frequencies: 10.525GH⊉ (X-band) and 24.150GH⊉ (K-band), both of which the Interstate by FOX alerts you to. But, there are at least alerts you to. But, there are at least four different types of radar guns in police use. Some are very easy to detect, as they emit a strong, continuous signal. Others are very difficult to detect with conventional radar detectors. These are the new hand-held radar guns used by police only when they are attempting to clock a suspected violator. This type of signal is registered on the Interstate by Fox by buzzer and LED indicator long before you are close enough to that radar.

#### Manufacturer's Suggested Retail

THEY GO AT ONLY

Item H-905-62999-00

Sales outside continental U.S. are subject to special conditions. Please call or write to inqui

Send Rader Detector(s) Item H-905- plus \$3.75 each for ship, handling. (Min sales tax. Allow 3-4 weeks for delivery. 5	nesota resider	nts add 6%
☐ My check or money order is enclosed. orders paid by check, thanks to TeleC Charge: ☐ MasterCard, ☐ VISA*	(No delays in heck.)	processing
Acct. No	Ехр	_
Name		
Address -		_
State	ZIP	
3 110.10		1

14605 28th Ave. N./Minneapolis, MN 55441-3397

C.O.M.B. Direct Marketing Corp.



#### **BUY ONE AND WE'LL** MAKE YOU AN EXCLUSIVE DEALER\*

6-wheel drive ATV



Amphibious 2 and 4 passenger models Call toll-free 1-800-255-2511

NY and Alaska 716-855-2226 Collect Canada toll-free 1-800-338-0012 Recreatives Industries, Inc.

60 Depot Street Buffalo, NY 14206

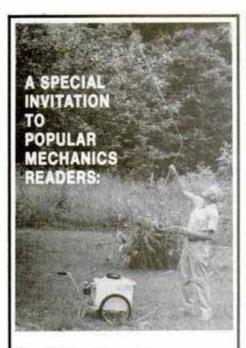
\*if the territory still is open.

#### Be a Legal INVESTIGATOR

Nationwide shortage of trained legal investigators, Many earn \$20,000 to \$50,000 a year. Men and women. Full or part-time, Earn while you learn at home. Send name, address for free opportunities booklet.

Commercial Technical Institute, Dept. 110-016-11 1500 Cardinal Drive, Little Falls, N.J. 07424





Try this all-new PORTABLE POWER SPRAYER at your home for 3 full weeks...FREE!

You'll find 1,001 uses for the versatile Spray Mate:

- Fertilize your lawn
- Eliminate backyard mosquitoes
- Spray fruit trees
- · Kill wasps and hornets
- Disinfect swimming areas
- Safely spray vegetables
- Control Japanese beetles
- Clean out gutters
- · And, lots more!

Spray Mate pulls along easily on its two big rubber-tired wheels. A pistol-grip wand shoots a jet up 30 feet! The big 12-gallon tank means fewer trips back and forth. The long-life battery and compact electric motor run silently for hours between charges.

This remarkable sprayer is available to Popular Mechanics readers on a FREE 3-Week Home Trial (for a limited time only!). Mail coupon today for the exciting details.

#### BONUS EXTRA: FREE BATTERY AND CHARGER

MANTIS SPRAY MATE	WC
1458 County Line Rd., Dept. P150 Huntingdon Valley, PA 19006-9976	1986
☐ Rush details on SPRAY MATE, FREE Trial, and FREE Bonus.	3-Week
Name	
Address	
City	
StateZip	

#### TURBO MOTOR OIL

Turbochargers work hard, run hot. Pennzoil PZL Turbo Motor Oil exceed API standards and every automotive engine manufacturers requirements worldwide.

Run cool with Pennzoil PZL Turbo Motor Oil.

#### TO SEA DENTAL MECHANIC



SECURITY PRESTIGE
Learn at home: in your spare time, to make
Crowns, Plates, Bridgework, etc. Dental Mechanics are employed by Dentists, Dental Laboratorice or open your own shop, full or spare
time, FULL EQUIPMENT OF TOOLS AND MATERIALS INCLUDED WITH COURSE, Law taRion, Easy Terms, Write for PIREE BOOK about
t's not affected by automation.

THE McCARRIE SCHOOLS INC. 215-L09-9155
132 N. 12th St., Dept. PM111 Phila., Pa. 19107

#### ADD TO YOUR INCOME

Earn a second income through Popular Mechanics Classified. \$1.00 booklet shows you how to start your own business with Classified advertising. (\$2.00 rebate with first order). Popular Mechanics, Dept. DN, 224 W. 57th St., New York, NY 10019.





From a tool box to a storage shed, a doll cradle to glass cabinets, our catalog has plans for you in these areas: • Fine Furniture • Storage Sheds • Kids' Stuff • For Your Workshop • Leisure Time • Outdoor Living

Plus, choose from hundreds of reprints and books on car care, home maintenance, boating and more. Send for your catalog today and experience the excitement that comes from building it yourself.

TO ORDER Send your name and address with check or money order, to: Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.

#### TOTAL LIQUIDATION YOUR CHOICE ANY ITEM ONLY \$14.95

\*\*\*\*\*\*\*\*\*\*\*\*\*\*



\$14.95

HIGH PRESSURE ENGINE CLEAN-ING GUN USE WITH SOLVENT, GUNK, SOAP ETC.



\$14.<sup>95</sup>

AIR OPERATED D-A SANDER DUAL ACTION WITH 6" PAD 1 YEAR WARRANTY



\$14.95

10 PIECE CROWFOOT WRENCH SET 36" DRIVE LIFETIME WARRANTY

## \$14.95

9 PIECE TORK DRIVER SET %
DRIVE WITH METAL CASE GREAT
FOR GM CARS & TRUCKS

BONUS ORDER ANY 2 ITEMS OR MORE AND RECEIVE THIS 2 PIECE SNAP RING PLIER SET FREE! RE-TAIL VALUE \$18.95



FOR REMOVAL AND INSTALLATION

does internal & external snap rings

TO ORDER CALL TOLL FREE OUT-SIDE CA. 1-800-423-7899 INSIDE CA. 1-800-826-7819 OR MAIL COUPON BELOW WITH

ENCLOSED CHECK, MONEY ORDER OR VISA OR M-C # ALL ORDERS SHIPPED WITHIN 24 HRS.

acct. #			_
expiration	on date		
Name .			
Address	i		
City	5.64		
State _	Zip _		
	# ()		
	descrip.	price	ext.
- Contract	engine gun	14.95	UAU.
	d-a sander	14.95	
	crowsfeet	14.95	
	tork set	14.95	
sub to	tal		
sub to	sidence add 61/2	2%	

TOOL CITY WAREHOUSE 14136 E. FIRESTONE BLVD. SANTE FE SPRINGS, CA. 90670

total

# CLASSIFIED ADVERTISEMENTS

Sophie Gronowicz, Classified Sales Manager Dorothy Nolan, Classified Service Manager Rate: \$6.70 per word payable in advance each insertion. Minimum insertion ten words. Bold face capitalized words—\$1.00 per word additional (First word set in Bold Face at no extra charge, Zip Code Free.) Centered Headlines in All Bold-Face Letters—\$45.00.

The next available issue to place an advertisement in America's No. 1 Classified Section is MARCH. The closing is JANUARY 3rd.

Send remittance payable and order to Popular Mechanics, Classified Department, 224 West 57th Street, New York, New York 10019.

Please indicate Heading under which ad is to appear. As a consumer service and in cooperation with our mail-order advertisers

who use post office box addresses for their convenience in handling your order, Popular Mechanics maintains a register of such mail-order advertisers containing their complete names and street addresses.

Advertisers using P.O. Box number must furnish complete name and street address for our records.

To avoid delay in the publication of your ad, please send samples and descriptive materials with your request.

#### PUBLISHER'S MART BOOKS & PUBLICATIONS

IF YOU liked the first book, you'll love the New TM Book. Cartoon illustrations explain the TM-Sidhi® Program. \$9.95. Seven Suns Publications, Dept TB11-2, P.O. Box 773, Fairfield, IA 52556.

HOW TO BUDGET. Easy. Efficient. Save money. Booklet \$2.00. Budgeting, P.O. Box 662, Beaconstield, Quebec, Canada H9W 5V3

FIREFIGHTERS Earn \$20,000+. Learn How. Send SASE: PFI, Box 402, Alpine, CA 92001

SAVE \$100's of dollars on your phone bill every year. Complete details on which phones to buy, phone services, long distance services and more! Fully illustrated book \$4.00. NOVA Enterprises, P.O. Box 9200, Trenton, N.J. 08650

SECRETS revealed in book "Grow Rich While You Sleep", send \$3.50, C & W Marketing, Dept. PM, 2825 Ventura, Abilene, TX 79605.

AT LASTI SECRETS REVEALED! Get rid of roaches quickly and save money. Brand new illustrated guide. "How To Eliminate Roaches Without Hiring An Exterminator," Written and illustrated by licensed, professional exterminator. Only \$10.00. Money-back guarantee. Order your copy now! Kruse, Dept. PM1, 136 Morrison Ave., Mt. Prospect, IL 60056

PUBLISH your book! Join our successful authors. All subjects invited. Publicity, advertising, beautiful books. Send for fact-filled booklet and free manuscript report. Carlton Press, Dept. PM.11 West 32 Street, New York 10001

PUBLISHERS' OVERSTOCKS, BARGAIN BOOKS 2,000 titles, all subjects! Free catalog: Hamilton, Box 15-A, Falls Village, CT 06031

SAVE on parts for Lawnmowers, Minibikes, Karts, Chainsaws, Small Engines, THOUSANDS OF PARTS, Send \$3.00 For Catalog, Sav-On Parts, P.O. Box 231, Somerville, Mass. 02145

AVOID RETIREMENT HEADACHES! Don't quit that job until problems which can make retirement miserable are settled. Just-published booklet lists problems, solutions. Send \$2.50 today. EC Publications, 500 Valleybook Drive, Silver Spring, Maryland 20904.

TECHNICAL BOOKS Many subjects. Catalog \$2.00. Keats & Company, Box 796 Station "A", Scarborough, Ontario, Canada M1K 5C8

BREAK AWAY FROM TWO FINGER TYPING! New method for PC, WP, and typewriter keyboards. FREE DETAILS. Send SASE: New Start, Box 7446P, Elmhurst, NY 11373

I EARNED \$40,000 yearly in free lance writing. For proof and my methods, send \$10 to: Ken Kelley, Box 2591C, Dearborn, MI 48123.

AMAZING offer. Be your own boss. Operate your own profitable business at home. Free details. Guaranteed. Write today. Les Fansier, Dept. PM-1, 180 Seabreeze Circle, Merritt Island, Fl. 32953

MAKE ONE MILLION DOLLARS in Real Estate starting with no cash. 228 pages. Send \$7.25. Royal Imports, 1608 Walden St., Teaneck, NJ 07666

POLICEMAN reveals how to beat traffic tickets. Contact J. Howard Associates, Route 2, Stouffville, Ontario. LOH 1L0. SAVE MONEY! Send \$5.95 for book describing 100's of ways to reduce energy costs. RBA, Box 231, Palos Park, IL 80464.

SELF-IMPROVEMENT BOOKS, FREE CATALOG. Steen Publications, 300A Hillcrest, Altoona, WI 54720

FREE CATALOG ON HOW-TO BOOKS: O'Neil's Mail Order, P.O. Box 173, Stone Ridge, N.Y. 12484

THINK AND GROW RICH: The secret to success. Order now, money back guaranteed, \$6.99 check/money order to: Gold Coast Gift, 125 Fayetteville Road, Decatur, Ga. 30030

POPULAR MECHANICS "PLANS AND IDEAS" CATA-LOG #1700 — Hundreds of ideas on workshop projects, plans for shop tools, storage houses, boats, furniture, toys just about everything! Send \$1.50 to: POPULAR MECHANICS P.O. BOX 1014, RADIO CITY STA., NEW YORK, N.Y. 1010!

#### CATALOGS

MINI CATALOG. Shop in comfort at home with this new unique gift items at LOW PRICES. Rush \$1.00. SGS, 6213 Chapel View Lane, Citrus Heights, CA 95621.

SHOP FROM HOME. HOUSEHOLD, PET, FROZEN FOODS, Gift items. Health, Beauty, Beverages, Laundry products. Catalog Send \$1.00. Blose, Box 1626, Fort Lee, NJ 07024

FREE tool catalog. Toolline, 817 New York Ave., Martinsburg, WV 25401

FREE CATALOG - BEST IN THE INDUSTRY A COMPLETE CAMERA STORE IN A CATALOG

ONE of the World's Great Catalogs, and it is photographic. Send to Porter's Camera Store, Inc., Box 628, Dept. PM, Cedar Falls, Iowa 50613 for your Free Copy (U.S. Only). 112 tabloid size pages filled with 4,000 items many of them exclusive and very unusual. Plus popular brand cameras, lenses, flash, etc., at discount prices. Huge inventory, fast service, great packaging. You must see it to believe it. Order your Free copy today.

#### **AUTOMOBILES**

FINE TUNE YOUR AUTOMOBILE! Increase Performance! East to follow manual \$10.00. THERMOTUNE, Box 1595, Cambridge, MA 02238.

STOW-A-TOW - Compact, retractable tow line, store in trunk or glove compartment, hooks in seconds, stronger than steel, can lift 2 tons, extends to 14', Ideal for emergencies. \$24.95. Pinebelt Distributors, 211 Noblesse Dr., Slidell, La 70460. Satisfaction guaranteed.

FREE AUTOMOTIVE SECURITY CATALOG: Largest selection available. Do-It-Yourself. Pagers, alarms, hood/locks, glass detectors. Allow 4 weeks. Immediate Delivery. Send \$1.00. Automotive Security Equipment, Dept. 2, P.O. Box 382, Plainview, New York 11803

FREE GAS MILEAGE! AT LAST! SECRET REVEALED! Send \$1.00 & self addressed stamped envelope to: Mileage, S-100, POB 563, Lake Charles, La. 70601 OLD CAR FANS - subscribe to HEMMINGS MOTOR NEWS, world's largest old car marketplace. Hemmings has over 600 pages of ads each month, crammed with thousands of old cars for sale—plus parts, literature, restoration supplies and more. Only \$16.75 for 12 giant issues. Subscribe to the bible of old car collectors today. Sent to: Hemmings Motor News, Dept. 6118, Box 100, Bennington, Vermont 05201

LEARN THE SECRETS of buying and selling cars from car dealer with 13 years experience! Finally available two valuable books: "How To Buy Your New Or Used Car Guide" and "How To Sell Your Used Car Guide." Absolutely guaranteed to put hundreds in your pocket! Rush \$4.95 for each exclusive book to: Neiman Enterprises, 8021-204 SW, Dept. PM1, Apt. 102, Lynnwood, Wa 90836

RADIATORS: Save by repairing at home, instruction booklet with ordering instructions for cores and supplies. \$5.95 to: AmRad, RFD 2, So. Paris, ME 04281.

200 MPG CARBURETORS: FACT or FRAUD? A 26 page SPECIAL REPORT. Fascinating! Informative! Only \$6.00. ORDER TODAY. Special Report. Dept. 186A, 304 San Miguel, St. Charles, Mo. 63303. FULL MONEYBACK GUARANTEE.

#### MIDGET CARS

SIDEWALK CLASSIC: Looks and drives like a real car, but travels at a sale 5mph. A black fabric top, leather dashboard straps and gas headlights give the look of an open roadster. Six volt auto generator serves as a motor and 12-volt electrical system with built in battery charger runs the accessories. Makes an excellent gift for child or grandchild. PL-1227-\$6.95. Send order to: Popular Mechanics, P.O. Box 1014, Radio City Station, New York, NY 10101

#### AUTO SUPPLIES & EQUIPMENT

ALTERNATOR Generator Rebuilding Book. Price: Hedelund Engineering, Box 26024, Las Vegas, NV 89126.

PARTS: Army Jeep and truck parts. Spare Parts & Equipment Co., P.O. Box 751, Lexington, Kentucky 40587-0751

IMPORT AUTO PARTS - New and Remanufactured at Bargain Prices. Send \$2.00 for catalog. State Year, Make & Model of Car. Same day service. Sech-A-Deal! Box 23621, Rochester, N.Y. 14623

CARPETS, top, shocks, suspension parts for all cars 1935-1980. Free catalogue. Kanter Auto Products, 76P Monroe, Boonton, NJ 07005. 800-526-1096.

LET'S Turn American Around Patriot license plates. David Roy, P.O. Box 106, Anderson, Indiana 46015

HEADLIGHT REMINDER. Warns You With A Loud Buzz! Avoid Costly Battery Drain. End Frustration! Easy, Screwdriver Installation. \$2.95. Bramble Co., 111 Downey, Brockton, Mass. 02402

BETTER MILEAGE with Plural Ignition Pulser for Chrysler Slant Six Engines 1973-1962, GMV 8 1975-1980. Guaranteed. \$22.50. DISCOVERIES, Box 190, Kailua, HI 96734

JUMPER Cables Piug In, Lighter To Lighter "So Easy" \$11.95 Ea. 3 For \$30.00. "Cables," Box 1389, Union, N.J. 07083

MOTALOY Ring Valve Job While Driving, Guaranteed. \$9.99 two \$17.50, postpaid. Andris, Box 34081, San Francisco, CA 94134. Dept. A.

#### **AUTO SUPPLIES & EQUIPMENT**

(Continued from preceding page)

ORIGINAL equipment manufacturer (OEM or "authorized dealer only") parts and accessories, at huge discounts for BMW, Honda, Mercedes, Porsche-Audi, Saab & Volvo. If your authorized dealer has it, then we do too, at prices up to 75% less! Hugh inventory; lowest prices. Call for quote, order by phone National Teleparts (408) 996-3278. M-F, 9-6:30 (Ca)

#### MOTORCYCLES, MOTORSCOOTERS & SUPPLIES

GO Karts, Minibikes, Atv's. Kits, Parts, Engines. Lowest Prices. Largest Selection. 72 Page Catalog \$3.00. Refundable. Kart World, Dept. C., 1488 Mentor Ave., Painesville, Ohio 44077

\$49-Mini-Bike Kit, Go-Karts, Frames, Engines, Wheels Clutches, Tires. Including Moped Parts and Accessories. More Parts-Lower Prices. 1985 Wholesale Catalog-\$2.00. Karts & Kits, P.O. Box 1028, Maywood, NJ 07607

CUSHMAN scooter obsolete parts catalog. \$1.00. Covert, 1106 Alpine, Dothan, Alabama 36301.

PLANS Build Your Own!! Go-Kart \$5.00, Mini-Bike \$4.00, Three Wheeler ATV \$7.50, Hydro-Plane \$4.00, Pedal-Boat \$6.00, UWP-Plans, 389 Ward, Burlington, Ontario L7R 3H8

#### **AVIATION, HANG GLIDING**

HOBBY HELICOPTER. "Choppy" Ultralight Single-Seat Helicopter, Simplified Construction.—Motorcycle Engine, Brochure \$3.00. Polynova, Box 670M, St. Remi, Quebec, Canada J0L 2L0

DESIGN-Build Airplanes, Hang Gliders, Simplified publications brochure 25c. McCoy Aircraft, Suite 243, Box J, Manhattan Beach, CA 90266

PILOTS Caps, T-Shirts, Polo Shirts, Large Selection, Free Brochure, Squadron Hat Co., 9373 W. Sample Rd., Suite 203, Coral Springs, Florida 33065

BOOMERANGS—WORLD'S BEST! Incredible returns, exciting sport. FREE illustrated catalog . . . 70 boomerangs, books, plans. Write today! BoomerangMan, 1806-1 N. 3rd., Monroe, Louisiana 71201-4222

#### **SPACE & ASTRONAUTS**

NASA emblems, toys, gifts, collectibles. Catalog \$1.25. Refundable. Collector Trends, Box 361, Dayton, Ohio 45409

#### HOVERCRAFT

FAN-TASTIC new hovercraft Plans. Free information. Palmer, Box 846M, Monroe, WA 98272.

HOVERCRAFT Plans All Sizes. Catalog \$1.00. Universal Hovercraft. Box 281. Cordova. Illinois 61242

AERO-CAR Amazing Hovercraft built easily with ordinary tools. Lawnmower engine power. Carries one man plus. Howers, flies forward, backward. Sideways over land snow-water. Complete constructions plans and brochure. \$9.95. Aero-Projects, Box 5118PM, Clinton, New Jersey 08809.

#### CB'S, RADIO & HAM EQUIPMENT

LINEAR PARTS — Tubes, Transistors, Modifications, MRF455 \$12, MRF454 \$16, MRF477 \$11. Catalog, RFPC, Box 700, San Marcos, CA 92059, (619) 744-0728

POLICE Scanners, Bearcat, Regency, HPR, Box 19224, Denver, CO. 80219.

CB MODIFICATIONS, Linear Planbook, Kits \$1.00 refundable, APS, POB 263, Newport, RI 02840, 401-846-5627

RADAR DETECTORS UP TO 50% OFF. We will meet or beat any advertised price on 8el, Whistler, Cobra, Fox, Uniden. CB's marine radios, scanners. FREE PRICE LIST 1-800-237-2897. Computronix 1-312-729-2897.

CB MODIFICATIONS1 Frequencies, sliders, FM, amplifiers, books, kits, repairs, high-performance accessories. Catalog \$2. CBCI, Box 31500M, Phoenix, AZ 85046

#### **ELECTRONICS**

BUGGED? WIRETAPPED? Find out fast. Countermeasures equipment catalog \$1. Capri Electronics, Route 1P. Canon, GA 30520. ELECTRONIC DEVICES for SECURITY, COUNTERSUR-VEILLANCE, and PERSONAL PROTECTION. Giant sixtyfour page catalogue \$1.00. HUNTEREX, Box 12922, Winston-Salem, NC 27117-2922.

SILENCE the phone whenever you like. Flick the switch and no more ringing. Flick it again and it's back to normal. Great for napping or just relaxing. Attaches in minutes. \$6.95. Gary's Gifts, 300 Woodrow Ave., Selma, Al. 36701

ADVENTUROUS Listening Device, Plans \$5.00. F&P Enterprises, Box 51272-A, Palo Alto, Calif 94303

ELECTRONIC products, Wholesale! Brochure \$1.00. OMC, Box 372, Northfield, N.J. 08225.

NIGHT VISION SCOPES, Reconditioned Military units. Both Starlight (Passive) and Infrared (Active). Catalogs \$4.00. STANO Components, P.O. Box 6274, San Bernardino, CA 92412, (714) 883-2728.

#### **COMPUTERS & SOFTWARE**

TI-99/4A Software Hardware bargains. Hard to find items. Huge selection. Fast Service. Free Catalog. Dynamic, Box 690, Hicksville, N.Y. 11801

SOFTWARE Savings Up To 77%, Send SASE, Softbyte, 3100 Hardin, Suite E, Soquel, CA 95073

COMMODORE Make EasyScript easy with quick reference checklist. Send \$1.00 to: Simple Solutions, P.O. Box 0452, Charleston. SC 29404

FINANCIAL AID FOR COLLEGE. Five sources guaranteed. Free information. Write: Computer Encounters, 401 Newcastle Rd., Syracuse, NY 13219

C64/128 owners. 63 programs, on D/S disk, 15c each. Games, Utilities, Business, Educational. Send \$9.45 plus \$1.50 s/h to: Softwaire Shack, Dept. 20, Box 133, Fresno, CA 93707

#### CALCULATORS

HEWLETT-PACKARD Calculators. Over 190 Accessories For Your HP-11. LOWEST PRICES For All HP Machines. Write For FREE 72 Page CATALOG: Educalc, 27953B Cabot Road, Laguna Niguel, CA 92677

#### STEREO, CASSETTE TAPES, ETC.

THOUSANDS OF OLDIES! Hard-to-find 45rpm hit records from the last 40 years including pop, country, rock, and soul. Send \$2.00 for catalog to: American Pie, P.O. Box 66455, Dept. PM, Los Angeles, CA 90066

#### TV & VIDEO EQUIPMENT

NOTICE: USE OF CERTAIN ITEMS IN THIS CLASSIFICATION REQUIRES STATION AUTHORIZATION

VIDEO MOVIES. Bargains! VHS. Beta. Catalog \$1.00. Tower, Dunkirk, MD 20754-0213

WORLDS Largest Satellite Distributor Can SAVE YOU HUNDREDS. All brands, we have everything, catalog \$4.00 refundable. Guaranteed. Technology, Box 18317, Knoxville, TN 37928-2317

"YELLOWSTONE," "YOSEMITE," "GRAND CANYON,"
"BIG SUR," VHS:Beta, Free Color Brochure, \$29.95 each,
Wilderness Video, P.O. Box 2175, Redondo Beach, CA
90278

BUILD Your Own Satellite TV Receiving System And Savel Instruction manuals, circuit boards, kits! Send stamped envelope for information: XANDI, Box 25647, Dept. 28P, Tempe, A7 8592.

SATELLITE System \$449. Information \$1. Starlink, 2603-16M Artie, Huntsville, AL 35805

THE NEXT GENERATION of satellite systems is here! Popular Echostar system, scramble-ready, \$599 Complete! With installation Guide. VISA/MasterCard. 2002 innovia, Inc., Box 2002. Gardnerville. NV 89410, (800) 628-2828 ext. 519.

HAVE EXCELLENT, NOT CHEAP SATELLITE SYSTEM UNDER \$600. MANY WAYS DEPENDING ON SKILLS AND OPPORTUNITIES. COMPLETE 60 PAGE BOOK \$11.95. CATALOG \$1. SHOJIKI ELECTRONICS CORP., 1327M NIAGARA ST., NIAGARA FALLS, N.Y. 14303. COD'S

CABLE TV CONVERTERS. Guaranteed lowest prices in U.S. Jerrold, Hamlin, Zenith—Many others! Lowest Dealer Pricest Orders shipped within 24 hours! Complete illustrated catalog, \$2.00. Pacific Cable Co., Inc., 73251/2 Reseda Blvd., #108. Reseda, CA 91335. (818) 716-5914

RARE POLITICAL & MILITARY films on videocassettes. Third Reich, Soviet, Eastern European and Vietnam era. Send \$1.00 for illustrated catalog. International Historic Films, Box 29035, Chicago, II, 60629

#### **CAMPERS & TRAILERS —KITS, PLANS**

BUILD YOUR OWN - Travel Trailer - Fifth Wheeler - Motorhome - Camper - Pickup Cover - Plans - Patterns - Kits -Catalog S1 - Glen-L R-V's, 9152PM Rosecrans, Box 756, Belflower, CA 90706.

PLANS, TENT & LUGGAGE TRAILERS for motorcycle or car. Free brochure. Creative Plans, 26615 - 16th S., Kent, WA 98032

COLEMAN RECREATIONAL VEHICLE AND MOBILE HOME FURNACE PARTS. Budget Heating, P.O. Box 146, Scottville, MI 49454, 616-757-9661.

#### BOATS, OUTBOARDS, TRAILERS, & KITS

BOAT KITS-PLANS-PATTERNS-FRAME KITS - 200 Designs - 40th year - 8:30 · Plywood - Fiberglass - Steel- POW-ERBOATS - Cruisers - Sportfishers - Houseboats - Hydroplanes - Runabouts - Duckboats (Canoes Kayaks) - SAIL-BOATS - Daysaiters - Trailersailers - Multihuits - SUPPLIES -Epoxies - Polyesters - Cloth - Foam - CATALOGUE \$3.00 (Book Amateur Boatbuilding \$6.00) CLARKCRAFT, 16-P Aqualane, Tonawanda, NY 14150

BOAT Plans - Patterns - Kits - Hundreds of designs - 7'/55' - Saiboats - Powerboats - Sportlishers - Houseboats - Row-boats - Duckboats - Bassboats - Canoes - Kayaks - Hydro-planes - Dories - Boatrailers - Simple construction - Proven instructions - Tremendous savings! Gigantic 160-page catalog \$3.00 (\$4.00 Airmail) - Includes Free "Boatbuilding Supplies" catalog - Fiberglass - Fastenings - Glues - Books. Revolutionary "Poxygrip Poxyshield" manual \$2.00. Giten-L., 9152 Rosecrans, Box 756MP, Betfllower, CA 90706

EVINRUDE - ALL BRANDS - 1984 Bargains ... all sizes ... \$2.00 handling ... Scott McCulloch parts ... Electra Marine, 610 Marrick Road, Lynbrook, New York 11563

BOAT KITS - SAILI - 16'-30'. FIBERGLASS. Save half. Anyone can assemble. FREE 48 page catalog. LUGER, Dept. BC-86 P.O. Box 1398, St. Joseph, MO 64502. 816-233-5116.

#### **CAMPING EQUIPMENT & TENTS**

CAMP COOKING: recipes, tips for "real meals" outdoors \$3.98. Camp Cooking, Box 613PM, Addison, TX 75001.

#### ATHLETIC EQUIPMENT AND BODY BUILDING COURSES

BIGGER, More Powerful Muscles - faster!! Free Booklet! Universal, Box 6694A, Detroit, Michigan 48240

SECRETS Of Powerful Muscles. Guaranteed. Free Booklet. John Associates, Box 1172, New Braunfels, Texas 78130

BEST Exercises To Flatter Abdomen! Free Details!! Cecere Enterprises, 277 Whitehall Rd. S., Garden City S., N.Y. 11530

KUNG-FU Free Lessons. Send \$1.00 for Postage. McLisa, Box 1755, Dept. PM86A, Honolulu, Hawaii 96806

#### FISHING, TACKLE, LURES

FREE Sinker Mold Catalog over 100 molds 25 shapes. Carmen's, Box 220PM, West Newton, PA 15089

CATCH Catfish Anytime. Secret Revealed \$18.00. Riley, 7802 Douglass, Wichita, KS 67208

#### BATTERY REBUILDING SCHOOL

REBUILDING and reconditioning information/prices. \$3.00 postage/handling. Sun Battery/Moore Tool, 10415 US 98, Sebring, Florida 33870.

Материал, зашищенный авторским правом

#### **ENGINES. MOTORS**

RUN three-phase electric motors on single-phase power. Use refrigerator and A/C relays, Build relays, Plans \$5.00, Electro, Box 4405, Lincoln, Nebraska 68504

#### **UPHOLSTERY SEWING MACHINES**

UPHOLSTERY Sewing Machines with Walking Feet, complete ready to use—only \$498.00. Thompson Model PW200-AVAILABLE FROM YOUR LOCAL DEALER, or order direct. (Master Charge-Visa). Datho Mfg., Inc., P.O. Box 12110, Lubbock, Texas 79452—Phone: (806) 744-6774

#### **MACHINERY, TOOLS & SUPPLIES**

4" METAL Cutting Lathe \$104.50. Taig. 15048 Proctor, Industry, CA 91746

BEST Prices, Woodworkers Machinery Catalog, Free. McKilligan, PMC86, Johnson City, N.Y. 13790

LATHES, Mills, Tools. Many manufacturers. Blue Ridge, Box 536V, Hurricane, WV 25526. 1-800-872-6500. WV: 1-562-3538. Catalog \$1.00.

SMALL FOUNDRY Furnaces, Supplies. Free literature. Pyramid Products, 3736 South 7th Avenue, Phoenix, Arizona 85041

BOLTS, SCREWS, TOOLS, WHOLESALE, DIRECT. Gueranteed. Catalog \$1.00 (Refundable). Camelot, Dept. 44, Box 65, Bristol, Wisconsin 53104

METALS for the machining hobbiest. Catalog \$2.00 refundable. R&J Metals, Rt 8, Box 755B, Huntsville, Tx. 77340

"SHARPENERS REPORT" Monthly Newsletter, Sharpening Guidebook, Angle Wall Chart, Free details. Skog Company, Dept. PM1, P.O. 22559, Minneapolis, MN 55422

WELDERS, new hands free speed-weld helmet, chin operated. Information: Tradewinds, P.O. Box 807, Pasco, Wa. 99301

STEEL, Aluminum, Brass-Sheet, Bar, Shop Supplies, Plans, Write: CEI, RR1, Box 163, Cameron, IL 61423.

BANDSAW BLADES, Any Size, Free literature. King Saw, 6641 Tidewater Drive, Norlolk, Virginia 23509

CARBIDE - TIPPED, Circular Saw Blades, Free Interature, Blades, 805 East Harrison, Seattle, WA 98102

#### **WELDING, SOLDERING, PLATING**

2-PART ARC WELDING training videotape contains 14 separate demos of different welding techniques. Runs 2 full hours+/\$300. For more information call 1(800) 443-9250 or write: AMP, Box 36, Riverton, WY 82501.

#### **ENERGY SAVING**

CUT HEATING COSTS 40%. Newly patented invention for Furnace. Thousands of satisfied users. \$1.00. CVS, Box 676, Beltsville, Md 20705

NON-ELECTRIC SUPER-BLANKET saves fuel costs. Discoveries, Box 190, Kailua, HI 96734

#### SOLAR, GREENHOUSE, AND ENERGY SAVING PRODUCTS CATALOG!

COMPLETE systems, components. Features famous Sun-Lite® products. 84 pages. Order from one expert source, America's largest energy saving mail order house! \$1.00 ppd. Solar Components Corporation, Dept. M, P.O. Box 237, Manchester, NH 03105.

#### **SOLAR & ALTERNATE ENERGY**

FREE HYDROGEN FUEL and Oxygen Generator uses Water and Solar Cells. Plans and Kit \$12.00. Prairie Power, Box 8291, Edmonton, Alberta, T6H OLO, Canada

SOLAR panel component 2x4 ft. instructions included \$14.95, \$5.00 postage. Box 769, Wylie, Texas 75098

SOLAR ROOM HEATER. Inexpensive window unit. Plans, booklet \$8.95. MS, Box 2108, Montgomery, Ala. 36102

#### HOME CRAFTSMAN

OVER 400 WOODWORKING DESIGNS! Create profitable toys, gifts, whirligigs, tolk art, household accessories and more! Brochure PLUS Sample Pattern only \$2.00. Accents (BP-16), Box 262, Danvers, MA 01923.

UNFINISHED picture frame moulding. Factory closeout. 50% discount. 200 styles. Write: Japs, 126-PF Seventh North, Hopkins, MN 55343 WOODCRAFTSMEN. NEW ideas. 40 page manual, illustrated. SASE for information. UNIQUE HANDCRAFTING, Box 383, Eustis, FL 32726

OVER 50 "FOLK ART" PATTERNS! Create profitable "Country Cut" woodworking designs. Hundreds of unique projects! Only \$6.00. Accents (CP-16), Box 262, Danvers, MA 01923

SET up home shop. Save money. Booklet tells how. \$2. Rustic Woods, 9330 Corporate #303, Schertz, TX 78154

WOODWORKERS, Hobbylists, 1986 catalog containing Chair Cane, Wooden Wheels, Lamp Parts, Tools, Finishing Materials, Hardware, Plans, etc. Send \$1.00 to: Barap Specialties, PM186, Bellows, Frankfort, MI 49635

MAKE PVC PIPE FURNITURE. Many preven plans. Profitable home business. FREE details. J&L Casual Furniture, Box 208, Tewksbury. MA 01876

WOODCRAFT PATTERNS, Windmills, Wishing Wells, Bird Houses, Feeders, Flying Duck, Pheasant, Outdoor Planters, Catalog \$1.00. Crafters, 11840 US. 27 North, DeWitt, Michigan 48820.

MAKE WOODEN TOYS - PROJECTS - 100's Plans, Kits, Hardwood Parts (toy, craft, furniture), Tools, Wood, Supplies. Color Catalog \$1.00. (614) 484-4363 - Cherry Tree Toys, Belmont, Ohio 43718 - 0369

HARDWARE CATALOG \$1.00 Refundable with first order. The Bever's, P.O. Box 12, Wills Point, Texas 75169

WORLD'S LARGEST CATALOG? Three pounds 704 pages. Every Tool, Supply. Machine Imaginable \$5.00. Refundable. McKilligan, PM-1-86, Johnson City, New York 13790.

BATTERY CLOCK MOVEMENTS. Below wholesale prices. Best Quality Catalog \$1.00 (refundable). Yankee, Box 26, Thompson, Connecticut 06277

WOODWORKERS Learn Fast Easy Method For Making Gilts, Toys, Novelties, Illustrated instructions \$6.00. C. Hastings, Box 488, Groves, Texas 77619

FAVORITE WOOD TOYS, Patterns, Parts, Wheels, Catalog \$1. Toys and Joys, Box 628M, Lynden, Wash. 98264

#### THREE WHEEL SLOT MACHINE

MADE from wood, fun for all without payoff, plans \$4.00. R. Mikels, 1142 Lee Rd., Troy, Ohio 45373

WOODWORKERS: \$100.00 profit EVERY Saturday with your shop scraps! Complete instructions \$5.00. Woodscenes, Box 744A, Oregon City, Oregon 97045

ELECTRIC Motor fits in the palm of your hand! Thousands of uses. 120V. \$4.95 Pius \$1.50 Postage and Handling. CLIK Ent., P.O. Box 9, Black River Falls, WI 54615

EASY TO BUILD, UNIQUE TOYS ..... Plans, Supplies Catalog, \$1.00, Refundable, ..... Phillips, Box 51802, Mount Pleasant, North Carolina 28124-0518

CATALOG FULL-SIZE FURNITURE PLANS - \$2.00. Refunded with first order. Traditional, Early American, over 180! Furniture Designs, 1425 Sherman, Dept. CP-86, Evanston, IL 60201.

BEST Country Furniture Plans. Catalog \$1.00 (refundable). Hammermark Associates, Box 201PM1, Floral Park, New York 11002.

CRAFTSMAN WORK CENTER: Build the MASTER CRAFTSMAN WORK CENTER. A portable tool center, two cabinets and deluxe assembly bench allows you to keep all your tools close at hand. A grid top makes clamping easier; covers with a sheet of plywood for other tasks. Swivel casters with brakes; drawers that open on either side and your choice of finish gives you a personalized work center. Plans and materials list. (PL-1760 \$6.95). Write: Popular Mechanics, P.O. Box 1014, Radio City Station, New York, NY 10101

BOOKCASE WALL.—A floor-to-celling bookcase with cabinet space on the bottom. Over 13 ft. long, but you can adjust shell width to lit any wall. (PM-1008—\$5.95) Order from: Popular Mechanics, Box 1014, Radio City Station, New York, NY 10101

#### WOOD, WOODWORKING

WOODWORKER'S supplies catalog!! ... Hundreds veneers, toymaking, turning squares, carving blocks, hardwoods, patterns, books, cane, dowels, pegs. spindles, more! Bargain offers included. Send \$1.00. Morgan, P01M29-D, 1123 Bardstown, Louisville, Kentucky 40204.

"WOODOFF" Dear Little Deer Plans \$5.00, DOEMOCO, P.O. Box 6448, Louisville, Ky. 40206

WOODWORKERS How we sell wood scraps for \$1200 MBF. Plan. Send \$6. Mitchell Sawmills, RT. 2, Box 172, Gladys, VA 24554

CHERRY, OAK, WALNUT, MAPLE Boards. Small Orders Our Specialty. Send \$1.00 for Listing (Refundable). Park Timber, P.O. Box 558P, Orchard Park, N.Y. 14127

WOODENTOY - Parts, Patterns - Catalog \$1.00. WOODENTOY, Box 40344PM, Grand Junction, CO 81504

BUTCHER'S BLOCK Coffee Table Plans! Three styles-\$3.00. Send check today! Andi's, Box 391, Cherry Valley, IL 61016

FREE WOODEN TOY PLAN \$4.00 Value. Send \$1.00 for postage. Toycraft, 601-PM1 East Main, Waynesboro, PA 17268

CEDAR OUTHOUSE, Dispenses Toilet Paper, Plans \$3.00 SASE, Secomb, 69865 E. 26, Rhododendron, Ore 97049

#### PLANS, BLUEPRINTS, PROJECTS

HOW TO BUILD YOUR OWN TANNING BOOTH, for complete plans and professional drawings send \$8.00 to: Best Enterprise. 515 North Third Avenue, Paden City, West Virginia. 26159

PLANS FOR 100+ TOOLS, Catalog \$1.00 Refundable. Wood-Met, 3314 Schoff, Peoria, II. 61604

WORLDS SMALLEST CLOTHES DRYER! Plans \$7.00 SASE. Carlos Trump, Box 69PM, McGraws, WV 25875

ROCKING Horse Pattern \$4.00. JML, P.O. Box 308, Lake Como, Fl. 32057

VIDEO Plans-Dutch Barn 8' ×12', instructions, VHS, Beta, \$29,00 Tax Included, Barns, Box 2037-Sequim, Wa 98382-2037

POPULAR MECHANICS TOOL CHEST. Compact, made from cherry wood. For handling ease, it's actually two boxes. Organized compartments for easy access. Expert construction protects tools from rust. Includes plan for dolly. Send for Plan PL-1745 + \$4.95 to: Popular Mechanics, Box 1014, Radio City Sta., New York, NY 10101

#### FOR THE HOME

BIRD-BEGONE! Rid public buildings, ledges, barns, roofs from messy damaging pigeons and birds. Save thousands in maintenance! Protect berries, orchards, gardens, crops! Absolutely amazing! Birds, unharmed, leave the area. No moving parts, electricity, noise, odors, poisons. Weather proof! Immediate refund guaranteed! \$14.95. "Bird-Begone", Box FD, Westminster, CA 92683

#### **HOME BUILDING & REMODELING**

BUILD 1350 sq. ft. Brick House for \$14,000 - 3 Bed Rooms -2 Baths - Fireplace - One Man Step-By-Step Instructions Only \$12. R. E. Whitehead, Rt. 3, Box 317, Vinton, VA 24179

SAVE THOUSANDS! Build your own home. Get the facts! Details free. Holder Construction Company, Route 1, Walnut Ridge, AR 72476

800 parts for WINDOWS-PATIO DOORS - STORM DOORS - DRAWERS. FREE PART IDENTIFICATION SERVICE. Repair instructions for double hung windows. Wood Snap-In window grilles. Catalog \$2.00 refunded with first order. Visa. Blaine Window Service, 1921 Blaine Dr. PM-16, Hagerstown, MD 21740. (301) 797-2510

#### 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 \$2.00. CASTOLITE, Dept. 66A/PM, Box 391, Woodstock, IL 60098.

#### DO IT YOURSELF

REPAIR just about anything in your home with our fact-filled guide! Fix cracked walls, restore a damaged roof, and more! Money-Saving Home Repair Guide, just \$7.00 postpaid. Infinite, Wrightstown-Cookstown Rd., Box 0125, Cookstown, N.J. 08511-0125.

ELECTROPLATING. Complete amateur's textbook. All metals Electroplate metallic/nonmetallic/items \$11.95. Details free. Tropic, Box 95-P3, Palm Bay, Florida 32905.

#### DO IT YOURSELF

(Continued from preceding page)

NEW! ... REPAIR ANY TV ... EASY. Write, Research, Rt. 3. Box 601BE, Colville, WA 99114

LIST of 3000 Mailorder CATALOGS. Fully described and alphabetically listed by product. \$5.00. Catmap, Box 17737, Washington, DC 20041

BELT BUCKLES for coins or stones, specialty buckles, ry mountings, cut stones, clock works. Wholesale cata log 25¢. Eloxite Corp., 8061/2 10th Street, Wheatland, Wyoming 82201

1600 VALUABLE CATALOGS! !! Every Subject Imagin-able! Directory \$3.00. Catalogs Galore, 7914-M1 Springfield Village, Springlield, VA 22152

PATIO Pipe Furniture, Complete Illustrated Plans. Save 75%. \$5.95. CGW Enterprises, P.O. Box 866114, Plano, Texas 75086

INSTALL YOUR OWN IN GROUND SWIMMING POOL for as low as \$1,695.00. Cheswick Pools, Rt. #28, Cheswick, Pa 15024, 412-274-6400

ELECTROPLATING kits, complete, \$17.95. Free details. Judsonco, 321 Charles, Cherokee, IA 51012.

1400 Catalogs listed and Described, Sources for Everything able \$4.00. Masterlog, Box 879-F, Fairfax, CA 94930

POWER metal hacksaw. Power woodsplitter. Make eithe for under \$100. Detailed plans \$11.00 each. Fletcher, 62785 Hamby Road, Bend, OR 97701

APPLIANCE REPAIR - Book written by Retired Service Technician shows SECRETS, FREE DETAILS. DLR Publications, 713 Silverstone, Richardson, Texas 75080PM

PLUMBING GUIDE. Complete, simple instructions, dis grams, photos. \$5.00. Order Now, Lal & Co., 192 Hubbard, Mt. Clemens, Michigan 48043

HOME APPLIANCE REPAIR GUIDE. Save repair shop costs. \$5.95 Satisfaction Guaranteed. Brown Associates, 326 Hillsdale Drive, Box 8275, Pittsburg, CA 94565-8275

HOT-TUB SPA, UNDER \$950. Innovative design, construction. Eight bathers, all electric. Plans \$15.00. More, RD#3, Box 489, Canastota, NY. 13032

BUILD and FLY YOURSELF! Thousands fiving since 1953 Voted No. 1 Homebuilt Aircraft Design! WORLD-FAMOUS BENSEN GYROCOPTER! Flies hands and feet off controls "QUICK-BUILD" KITS! 3-View Drawings, Flight-Test Reports, Design Details, FREE Catalog: \$10.00. Bensen Aircraft Corpora ation, Dept. PM186, P.O. Box 31047, Raleigh, N.C. 27622 ORDER NOW!

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-BE, Washington Crossing, Pennsylvania 18977. Creditcard Orders 24HRS. (215) 736-3979

PROFITABLE, Easy, Fun. Beautiful Furniture Made From 2×4's. Complete Plans - Photos Only \$4.95 Prepaid. DOIT-UR-SELF, Box 87P, Syracuse, 13205

4,321 Catalogs listed. Sources for Anything! \$5.00. Directory, Box 92452N, Atlanta, Georgia 30314

#### REPRODUCTION MOLDS

LEAD SOLDIER MOLDS, Scarce Civil, WWII, Cannon antasy. Illustrated Brochure \$1.00 (Refundable). Dunkens, Calvert, TX 77837

#### ARTS, CRAFTS, SUPPLIES

STAINED GLASS SUPPLIES Complete Catalog \$2.00 (reine Glassworks, 3690 Harlem, Dept CT, Buffalo, NY 14215

CLOCK WORKS. Wood clock blanks, rockhound supplies, belt buckles, cut stones, etc. Wholesale catalog 25c. Eloxite Corp., 8061/2 10th Street, Wheatland, Wyoming 82201

"GETTING Started in Stained Glass" \$1.00. Whittemore Box 2065T, Hanover, Mass. 02339.

STAINED GLASS SUPPLIES: EXCITING SUPER CATA-LOG-PM \$3.00. CORAN-SHOLES INDUSTRIES, 509 E. SECOND, BOSTON, MA 02127.

LEATHERCRAFT Supplies catalog, tools. \$1.00 (Refundable.) Crafter, Tom Bean, Tx 75489-0778.

#### CARTOONING, COMMERCIAL ARTS, SIGN PAINTING

CARTOON for Fun and Money!!! Free booklet!!? Cartoons, Box 40614A, Detroit, Michigan 48240

SIGN PAINTING —Easy method. Free catalogs. Kaulmann Company, Centertown, Missouri 65023

52 LESSON cartooning course. Cartoonist's Magazine, both \$5.00. Hartman, Box 30367, Lincoln, Nebraska

#### **MODELS, MODELS SUPPLIES**

FIRING CIVIL WAR 2' - NAPOLEAN Model CANNON PLANS, \$8.00: CATALOG \$1.00. Green-PM15, Box 892, Shalimar, FL 32579-0892

"WORKING STEAM MODELS"! KITS or ASSEMBLED. -Tractors, Locomotives, Limousine, Roadster, Truck, Engines. Two Steam Books total 59 Color pages \$4.95 (Refundable). Colored Circular \$1.00 Low Prices. Diamond Enterpris Dept PMN, Box 537, Alexandria Bay, NY 13607. (613)-475-1771

SHIP Models From America's Oldest Model Manufacturer. Send \$2.00 For Big Color Catalog Of Wood Kits And Modeling Supplies. Bluejacket, Box 617P, Shelton, Ct 06484

#### MAGIC TRICKS, JOKES, VENTRILOQUISM

PROFESSIONAL Magic! Huge catalog, over 1,000 Tricks and Books. \$4.50. Hank Lee's Magic Factory, Dept. PM1, 125 Lincoln Street, Boston, MA 02111

FREE Catalog! Things you never knew existed! 1600 Nov-Science, Hobbies Tricks Johnson-Smith, C-1013, Mt. Clemens, Mich. 48043

LEARN VENTRILOQUISM! Guaranteed Instruction, Supplies, DUMMIES. Information Free! Maher, Box 420-PM, Littleton, Colorado 80160.

#### **HOBBIES & COLLECTIONS**

NAZI & Historical Military Collectibles, FREE catalog, HMA, Box 1806PS, Lafayette, CA 94549.

MILITARY Medals Catalogue 50c. Yearly Subscription \$4.50. Vernon, Box 1387PM, Baldwin, NY 11510

NAZI - Collectors. Our Super 256 Page Fully Illustrated Catalog. \$3.00: W.W.#2 Ltd., Box 2063PM, St. Louis, Mo. 63158

#### **DECALS, EMBLEMS, PATCHES**

CUSTOM EMBROIDERED EMBLEMS, PINS, DECALS. atalog/Quotes. Rush Sketch. Stadri, 61P Jane, N.Y.C. 10014 (212) 929-2293

#### ANTIQUES, RELICS, INDIAN GOODS & CURIOS

FREE List to Serious Collectors. 30,000 Indian Artifacts, Pots, Spears, Axes, Slate, Beadwork. Caddo Trading, Box 669, Murfreesboro, AR 71958

INDIAN relics List 35¢, Identification Book \$10,00pp, Arrowheads, etc. samples \$16.50pp. Secrist's, Deerfield, Mo.

#### STAMP COLLECTING

50 YEARS Old fifteen different United States, over fifty ears old-25¢ with approvals. Jaxon, Box C11-P, New Rochelle, New York 10804

WOW! 50 All Different Germany 25¢! Super collection of genuine Germany Commemoratives, Definitives, Airmails, High Values. Free Big Catalog. Also fine stamps from our approval service. Buy what you like. Return balance promptly! Send 25¢ today! Thank you. Jamestown Stamp Co., Dept. A16PM, Jamestown, NY 14701

UNITED Nations 3 Complete Mint Sets 25¢, Approvals, Cornetta, POB 1509-M, Lake Placid, Florida 33852

BREATHTAKING Beautiful, 50 Different mint Monaco pic torials commemoratives only \$1.50 with mint complete set approvals. Pagoda, Box 132P, Sidney, Ohio 45365.

WORLD Wide Stamps mounted in books on approval 2¢ and up. TRUST STAMP COMPANY, P.O. Box 100-P. Jamaica, N.Y. 11435

FREE Surprise Collection with approvals. Gould, Box 2130, Petaluma, CA 94953

ONE! Two! Three! Cent Stamp Approvals! Regardless Cat-alog. Kloster, 4164 52nd, San Diego, CA. 92105

"WHOLESALE" U.S.—Foreign Pricelist and catalog Free! Everything Guaranteed. No Approvals. Schneider, Box 1240, Grand Rapids, Michigan 49501

"INVERTED ERROR" + 100 Different United States, 50e with approvals. Luray, P.O. Box 7088, Silver Spring, MD 20907

FREE U.S. Mint Set. Approvals. Hildebrand, Box 4867, Santa Clara, California 95054

101 Large Pictorials 50¢ when requesting approvals, Benat, P.O. Box 210244, Dallas, TX 75211.

50 RUSSIA 25¢ Worldwide Approvals. Birnell, 2304 Hancock #9P, Austin, Texas 78756

35 DIFFERENT Old U.S. Revenue Stamps \$1.00. Winchester Stamps, Box 3592, Mansfield, Ohio 44907

100 DIFFERENT US and British Commonwealth Com ves for one dollar with approvals. SSS, Box 208, Wales,

U.S. 6 commemorative plate blocks or 30 mint commemoratives \$1.00! Approvals. Gordon Davison, Nokomis, FL 33555

100 Different U.S. 25¢, Approvals. Bradley, Box 425P, Midlothian, VA 23113

FREE price list for Canadian stamps, Damel/Lighthouse ints and accessories. Ken's, Box 3318, Revelstoke, B.C., Canada VOE - 250

FIFTY FREE Stamps With Approvals, J&D Stamps, Box 747, Melbourne Beach, FL. 32951

ON APPROVAL QUALITY foreign stamps-reasonable prices. Isham McConnell, Box 47, Bedford, MA 01730

FREE 25 World Wide Stamps Plus Free Catalogue With Over 2,000,000 Stamps. No Approvals. Jefferies, 28311 Franklin, C334, Southfield, Michigan 48034.

PHILATELIC SPECTACULAR! Twenty Complete Sets. Mint, Used. Commemoratives, Topicals, Pictorials. \$1.00. Approvals. Abbott, Box 400A, Somers Point, New Jersey

BEAUTIFUL Collection for 50¢ When Requesting Quality Approvals at Bargain Prices. Myers, Box 858, Severn, MD

50 US Mostly Commemoratives 50c. No Approvals. Gibson, Box T. Williamstown, NJ 08094-0469.

SPECTACULAR! 300 BREATHTAKING STAMPS from 35 COUNTRIES, worth \$10.00. Only \$1.00 with Sensational Approvals. StampsPlus+, Dept.MA6, Box 982F, Toronto,

CANADA. 50 different 25c. Approvals. Oroszky, Box 1-C, Sarnia, Ontario, Canada N7T 7H8

FREE-\$2.00 packet. Approvals, 67% discounts! Gains, 716-S Sixteenth, Mattoon, IL 61938

FREE Disney Christmas issue. Request Approvals. Alpaugh, Box 225, Highbridge, NJ 08829

BARGAIN 100 World-wide Stamps 25¢. Quality Approvals. R. Parker, Box 143, West Brookfield, MA 01585

50 NEW ZEALAND FREE, WITH APPROVALS. Carmen, Box 6149, San Mateo, CA 94403

FREE 100 Canada with request of World Wide approvals. Briner's, P.O. Box 5607, San Mateo, Calif. 94402

50 DIFFERENT Old U.S. between 1861 and 1939 - \$1.00. Ed Roush, 423 Shepard, Mansfield, Ohio 44907.

FREE! 125 Different Foreign, \$10.00 Catalog Value. Approvals. Rick's, 520 South 23rd, Herrin, IL 62948.

125 DIFFERENT. Pictorials, definitives, airs, etc. \$.50. Low riced approvals. Loveland Stamp, Box 8224, Loveland, Colorado 80537

ISRAEL 15 Different 10e Approvals. Sam Chazen, Box 656, Delray Beach, Florida 33444

WORLDWIDE 100 Different Beauties, 25c. Approvals, J.D. Michael, P.O. Box 2273, Martinez, CA 94553

FIFTY U.S. 25¢, Approvals. Zanetich, P.O. Box 264P, Oaklyn, New Jersey 08107

CANADA starter packet including commemoratives 10c. approvals. Harley Boardman, Little Valley, New York 14755

FREE Gift With First Purchase. U.S. Approvals And Want List Service. 20c for Handling. The Stamp Boutique, P.O. Box 456, Madison, N.J. 07940

Материал, зашишенный авторским правом

#### COINS, TOKENS, CURRENCY

TEN Buffalo Nickets, Full dates, \$4.00. GEM, 1481 Clayton, Perryville, Md. 21903-2533.

FREE gift with worldwide currency approvals. Action, Box 44, Moose Jaw, Saskatchewan, Canada S6H 4N7.

#### **PHOTOS & PHOTO SUPPLIES**

PHOTOGRAPHY'S Finest Products At Nationally known low prices from a small town dealer you can trust. Free Catalog. Norman's, 3602 South Westnedge, Kalamazoo, Michigan 49008. Since 1957.

#### PLAYS, SONGS, MANUSCRIPTS

POEMS, Songs Wanted. Free Recording/Publishing. Broadway Music Productions, Box 7438PM, Sarasota, FL 33578

#### **MUSIC INSTRUCTIONS & INSTRUMENTS**

ACCORDIONS, NEW, USED. Electric, electronic, Cordovoxs, concertinas, Button Boxes, Hohners We Buy, Sell, Trade, Exchange, Repair, Tune, 50 Years Experience. If Dealers unavailable, Call or Write for Brochures, Mastercard And Visa Accepted. CASTIGLIONE ACCORDIAN, 12644 E. 7 Mile, Detroit, MI 48205. 313-527-1595

PIANOS, PLAYERS, PUMP ORGANS. Rebuild and repair. Catalog of "How-To" books, \$2.00 (refundable). Vestal Press, Vestal 11, New York 13850.

VIOLIN, GUITAR, etc., making materials, accessories, books. Catalog. \$1.00. International Luthiers Supply. Box 580397, Tulsa, OK 74158

ACCORDION Top Brands, Cordovox, Buy Direct. Tremendous Discounts. Trades accepted. Free brochure. PM, Accordion-O-Rama, 16 West 19th Street, New York, NY 10011

ELECTRIFY Player Planos, Pump Organs Quickly. Inexpensively with Lee Silent Suction Units. Write: Lee Music, P.O. Box 308F, Culver, Oregon 97734

HOME BUILT PEDAL STEEL GUITAR: plans \$8.00; Dobro plans \$5.00. Free Information, B. Adams, Box 22, Riner, Va. 24149

INTERNATIONAL VIOLIN COMPANY, Catalog for instrument makers, repairers. Imported tonewood, tools, varnishes, parts, accessories, strings, cases. European instruments, bows. Assemble yourself violin and guitar kits. Catalog \$1.00 includes 10% discount certificate. Dept. GA, 4026 W. Belvedere Ave., Baltimore, Md. 21215.

DEPENDABLE GUARANTEED GUITAR PLAYING method, songwriting instructions, for serious beginners. \$4.95.
MUSICMAKERS, Box 5082, Toms River, N.J., 08753

#### SELF IMPROVEMENT

COLON CANCER Home Test Free Information. Scientific Industries, Dept. P. 7447 South Harrison Way, Littleton, Colorado 80122

STOP SMOKING EASY WAY. Write: Chromo, Box 127, Oceanside. CA 92068

#### **EDUCATION & INSTRUCTIONS**

SUPER-INTELLIGENCE Amazing method sent Free! EDEMP, Box 1462, Glendora, CA 91740

TERMPAPER ASSISTANCE. 15,278 papers available! 306-page catalog—rush \$2.00. Research, 11322 Idaho, #206PS, Los Angeles 90025. OR, CALL 213-477-8226.

HIGHSCHOOL, COLLEGE, AWARD, Certificates blank. Parchment paper, Gold seats. Suitable for framing. Realistic (novelty). Not a Government Document. \$5.00 (all three \$10.00). Carroll Studios, Box 29001M, Chicago, IL 60629

LEARN Sewing Machine repairing. A profitable Trade. Easy to learn. Free details. Sewing Center, 187 FR, Rochelle, GA 31079.

"JET/GAS TURBINE CAREERS!" Homestudy courses — theory, maintenance, overhaul — Established 1957. AMERICAN JET SCHOOL, Department PM-3, Darby, Montans 59829. (406) 349-2100

HIGH SCHOOL DIPLOMA AT HOME. NO CLASSES. Low cost. Information FREE. Call toll free 1-800-228-5600 or write: American School, Dept. #345, 850 E. 58th St., Chicago, IL 60637

FREE Catalog. Learn Auctioneering. Nashville Auction School, Box 190, Lawrenceburg, Tennessee 38464

PIANO TUNING PAYS - Piano tuning - Electronic organ servicing. Learned easily at home. Free booklet. Niles Bryant School, P.O. Box 20153, Sacramento, CA 95820

L-EARN Clock Repair, State Approved. Free Catalog. School of Clock Repair, Rm M, Squire Village, 7 Cambridge Ct., Toms River, NJ 08753.

SUPERLEARNING! Triple learning speed through music! Develop Supermemory; control stress; access potentials. Free - book excerpt & catalog. Superlearning, 450-P1 Seventh Avenue, N.Y.C. 10123

AUTOSUGGESTION. Sleep-learning headquarters!Tapes, records, books, Gigantic catalog free. Research Association, Box 24PM Olympia, Washington 98501.

LEARN Asleep or awake, Records, tapes, equipment! Free catalog! Drawer PM-400, Ruidoso, New Mexico 88345

EXTENSION And Post-Graduate Awards in Philosophy, Art. Science, Botanic, Medicine, Homeopathy, Radionics, and others, 30 subjects Curricular free (airmail \$1.00 refundable). Registrar, Sussex College of Technology, Highlield, Danhill, Sussex, England.

LOCKSMITHING, Universal School of Master., Correspondence and Shop Training. Box 214652PM, Sacramento, CA 95821

RADIESTHESIA, Radionics, Dowsing E.S.P. Courses and Equipment Illustrated Catalog \$1.00 (refundable) Established 27 years. Dept. PM/R, Bruce Copen, Highfield, Danehill, Sussex, England RH17 7EX.

UNIVERSITY DEGREES By Mail. Accredited Bachelors, Masters, PhD's. Free Facts Revealed. Careers-PM1, Box 470886, Tulsa, OK 74147

WANTED - USED ICS CIVIL ENGINEER course. Box 8505, Stockton, CA 95208

LEARN REFRIGERATION AT HOME. Low cost monthly lessons. For free details write: REFRIGERATION SERVICE TRAINING, 757 Emory #129, Imperial Beach, CA 92032

UNIVERSITY DEGREES! Economical home study for Bachelor's, Master's, Doctorate. Prestigious faculty coursels for independent study and life experience credits. Free information - Richard Crews, M.D. (Harvard), President, Columbia Pacific University, 1415 Third St., Dept. 2E81, San Rafeel, CA 94901; Toll Free: 800/227-0119; California: 800/552-5522; or 415.450-15.600.

LOCKSMITHING. Free book. Locksmithing Institute, Dept. 310-016, Little Falls, NJ 07424

DETECTIVE training home-study program. Free information. Global, Box 191 PM, Hanover, Mass 02339

CAREERS In Trucking, Information \$3.00. Cameron, Box 90218, Hanahan, S.C. 29410

HOMEOWNERS - Save thousands in mortgage interest payments. Send \$2.00: RK Information Enterprise, P.O. Box 190, Dept. AA1, Plano, Texas 75086

#### **SCHOOLS**

WHY NOT INVESTIGATE COMMERCIAL DEEP SEA DIV-ING AS YOUR CAREER? Our Graduates are working worldwide making excellent money. Send \$5.00 (fully refundable upon enrollment) for catalog containing disclosures, credentials, course outline, employment statistics, instructor qualifications, progress standards, financial assistance to: Divers Institute of Technology, Inc., P.O. Box 70312, Dept. PM, Seattle, WA 98107

WORLD WIDE COLLEGE of Auctioneering, Inc. The original—50-yrs.—Worlds largest! Term soon. Approved for V.A. Free catalog. COL. GORDON E. TAYLOR, Box 949, Dept. 19, Mason City, IA 50401, 515/423-5242.

#### **EMPLOYMENT INFORMATION**

ROCKY MOUNTAIN EMPLOYMENT NEWSLETTER!!
Colorado, Idaho, Montana, Wyoming! Current openings - All
occupations! FREE INFORMATION!! Intermountain-L, 3115
N. Hancock, Colorado Springs, Colorado 80907.
1-303-630-7478 X112.

SHIPS, Tugs, Cruiseships, Riverboats. Women, Men. \$15,000-\$60,000 Work month, Home month. Experience unnecessary. U.S. 112 Countries. Free report. SASE. Marine Employment. Box 207. Central. IN 47110

LOOKING for sure professional ways to gain JOB RECOG-NITION, PROMOTIONS, or get that JOB on the FIRST INTERVIEW? New booklet can help you achieve these goals, even GOVERNMENT JOBS, without spending a lot of time ... or money! (MASTER KEY TO ADVANCEMENT). \$8.95. Career & Opportunity, Inc., Keystone Executive Plaza, 12555 Biscayne Blvd., Suite 920, Miami, Florida 33181

OVERSEAS Jobs \$20,000 to \$60,000. Free information. Doycorp, Box 697SZ, Pocatello, ID 83201

HOW to, where....\$50,000.00 Jobs....Easy Qualification Secrets....Free Details....Schwuchow, 672 N. Kenmore, Suite 304, Los Angeles, Ca. 90004

#### HELP WANTED

AN OHIO Oil Co. offers Plenty of Money plus cash bonuses, tringe benefits to mature individual in your area. Regardless of experience, write: T.C. Read, Pres., American Lubricants Co., Box 426, Dayton, Ohio 45401

AUSTRALIA — Openings Now! Top pay! Transportation. Plus Worldwide listings: \$2.00. Jobworld, Box 681E, Cypress, CA 90630.

OVERSEAS U.S. Jobs Available. Unlimited opportunities. Write for application. Employers, Box 3239-G, Gulf Shores, AL 36542 or call 205-968-2500.

AUSTRALIA WANTS YOU! Big Pay! Transportation! Newest Employment Handbook.—\$2.00. INTERNATIONAL, Box 19107-AM. WASHINGTON, DC 20036.

OVERSEAS . . . \$25,000 - \$65,000+. Free Report! Employment, Box 19760-AM, Indianapolis, IN 46219.

#### **FOR INVENTORS**

NONPROFIT Foundation helps inventors. Free recording forms. Free evaluation. Affiliated Inventors Foundation, 501-B lowa, Colorado Springs, CO 80909, Or Call 1-800-525-5885.

PATENT IT ECONOMICALLY! Free Details. N. Raner, 2008 Fondulac, Richmond, VA 23229

PATENT AND DEVELOP Your Invention. Registered Patent Agent and Licensed Professional Engineer. Send for FREE PATENT INFORMATION Every Inventor Should Have. Richard L. Miller, 12 Parkside Drive, Suite M, Dix Hills, NY 11746. (516) 499-4343

CUSTOM METAL WORK - NYC Area Small & Large Jobs -Reasonable Rates. Zelf Machine Shop, 44 Greene St., P-1 212/925-8586

LEARN how to offer your invention for sale or license. Free booklet outlines procedures, royalty rates, requirements. Kessier Sales Corporation, C-5-F1, Fremont, Ohio 43420

REGISTERED PATENT ATTORNEY Washington, D.C. Surburb. Donald A Kettlestrings, 414 Hungerford Drive, Rockville, Maryland 20850

PROTECT YOUR INVENTIONS AND TRADEMARKS.
Registered Patent Attorney. FREE Preliminary Review, 57
Pratt Street, Hartford, Ct. 06103

AFFORDABLE Patent Protection, Brochure: Chenpatents, 3013 Birchtree, Wheaton, MD 20906

#### INVENTIONS WANTED

NEW Idea? American Patent in Washington, D.C. Gets Results! Best References - Free Kit - 1-900-257-7880.

EARN ROYALTIES. NUPRODUX INTERNATIONAL, 1377 K STREET, #203, WASHINGTON, DC 20005

INVENTION MARKETING. FREE INFORMATION. REP-RESENTING MANUFACTURERS. Patmart, 77 Fulton, 26D, Financial District, New York, NY 10038

INVENTIONS: Free information on offering your invention for sale. Kessler Sales Corporation, C-5-1W, Fremont, Ohio 43420.

INVENTORS! Have an idea? Don't know what to do? Call AIM for free information kit. Toll Free 1-800-225-5800

#### **REAL ESTATE & FARMS**

NEW...FREE...CATALOG! Top real estate values coast to coast! Please specify type property and location desired. UNITED FARM AGENCY, 612-PM West 47th, Kansas City, Mo. 64112.

#### **REAL ESTATE & FARMS**

(Continued from preceding page

CANADIAN Country Properties. Our 70th year. Terms available. Catalogue airmailed \$1.00. Dignam Corporation, Suite 496, 85 Bloor East, Toronto, Ontario M4W 1B5.

CALIFORNIA, Lots. Acreage, \$40 Down, \$40 Monthly, Box 35291, Los Angeles, 90035.

#### **GOVERNMENT HOMES**

FROM \$1.00, You Repair. Also Delinquent Tax Property And Forclosure Lists. For Info. Call Refundable 1-312-888-0123

HOW To Find And Purchase Good Country Land . . . Fact Filled Guide Tells How, \$4.50 (Refundable). Charest Enterprises, Box 1691PM, Lewiston, ME 04240

MONTANA LAND NEW OFFERING, 20 Acres (or more) starting at \$6950, with \$150, down, \$96,58 mo. Near Beautiful Yellowstone Park and National Forests. In the heart of trophy elk, deer, moose, antelope and turkey hunting. Blue ribbon ms. Guaranteed Access. Insured Title And Warranty Deed. Your Inspection Welcomed. Free Brochure, Maps, Color Photos. LARGER WHOLESALE BLOCKS AVAIL-ABLE. CALL TODAY TOLL FREE: 1-800-252-5263. YEL-LOWSTONE BASIN PROPERTIES, 1119 N. 7th Ave., Dept. PM, P.O. Box 3027, Bozeman, MT 59772-3027 • (406) 587-5489

#### **BUY IT WHOLESALE**

400,000 BARGAINS Below Wholesale: Many Free! Liquidations . . . Closeouts . . . Job Lots . . . Single Samples. Free Details. Bargainhunters Opportunities, Box 730-A, Holland. Michigan 49423.

BELTS and Buckles. Complete line fast sellers, including truckers, motorcycles, wildlife, westerns etc. Big Profits. Complete dealer set up. Catalog \$1.00. Anchor Specialties, Box 3958-BPM, North Providence, RI 02911

CLOSEOUT Jewelry 55¢ dozen. (Catalog 25¢), Roussels, 107-1631 Dow, Arlington, MA 02174

SINGAPORE, HONG KONG, TAIWAN DIRECTORIES. Listing 11,000 suppliers, 20,000 products. Buy direct! Informa-tion \$1.00. Merrick Distributing, Box 274M, Merrick, NY 11566

NOVELTY Pranks, Jokes. Catalog 45c. BWH, 1827 North Charles, Dept. PM, Belleville, Illinois 62221

CLOSEOUTS! Discounts! Below Wholesale! Freebies! Information/stamp: DDN, Box 20152K, Ferndale, Michigan 48220

WORLDWIDE BARGAINS . . . Imports — Dropship – loseout — Surplus — Freebies — (stamped Envelope - (stamped Envelope). Marnees, Box 1717PM, Highland, Ind. 46322

#### ADVERTISING AGENCIES, ADV. SER. **MAILING LISTS**

QUALITY Lists of mailorder BUYERS! All categories, Com puterized in ZIP CODE ORDER.Guaranteed Deliverable! A&D DISTRIBUTORS, 5017 NE 86th, Albany, OR 97321

OPPORTUNITY SEEKERS/MLM NAMES. FREE SAM-PLE. Venture-PM, Box 336, Riviera, AZ 86442

FREE Mailing List Consultation. Details. GOC-23P, Box 1107, Stuart, FL 33494. (305) 334-5205. 1-800-554-5478

MAILORDER BUYERS LISTS available for IMMEDIATE USE! Computerized on Peel and Stick labels in ZIP CODE ORDER. GUARANTEED DELIVERABLE! For complete details send \$1.00 to: WHITFIELD COMPANY, BOX 249, TIVERTON, R.I. 02878

AMAZING RESULTS! INCREASE PROFITS IMMEDIATE-LY mailing lists 39 categories. FREE information SASE. Lavon's Success Enterprise, 5000-B670P1 Santa Rosa Rd., Camarillo 93010

FREE! 200+ Sample (seekers) List. Test First! \$2 P/H. Parkway/8, Box 75, Hinesville, GA 31313

MAIL ORDER NAMES, computerized, adhesived fabels ZIP CODE order. Guaranteed deliverable! RUSH SASE to: EDNA EARLS, 204 SOUTHSIDE, LAKE VILLAGE, ARK. 71653

#### **BUSINESS SERVICES**

INCORPORATE without legal fees! Free bookiet tells how, includes forms. Call now 800-345-CORP.

#### PRINTING PRESSES, RUBBER STAMP OUTFITS

BARCO Type Founders. Type and Rubber Stamps catalogue. Mail \$2.00 refundable on first order. 237 S. Evergreen, Bensenville, 60106

TYPE for printing. Catalog \$1,00/deductible 1st order. Quaker City Type, R.D. 3, Box 134, Honeybrook, PA 19344

TYPE Fonts, Hand Printing Presses, Hot Stampers, Supplies. 120 Pages. \$2.00 Deductible first order. Acme Type, 1720 N. Marshfield, Chicago, 60622

BUSINESS CARDS (thermographed) free samples. BG, 808 Taylor, Pittsburgh, PA 15202

MAKE rubber stamps - big profits. Complete supply and equipment catalog with instructions. \$1 deductible with order. Star Stamp Supply, 1720 N. Marshfield, Chicago 60622

PRINT YOUR OWN - Printing presses, type, supplies, direct from factory. Famous since 1872. Send \$1.00 for catalog and samples to: Kelsey Company, DM, Meriden, CT

#### PRINTING SUPPLIES

QUICK Copy Printing. Low Prices. Write: Nationwide, 614 North Main, Bloomington, Illinois 61701

#### **GIFT SHOPPING**

PACEMAKER Users, Travellers, Monaco "wind-up" shaver needs no electricity, no batteries. It's safe. \$39-US refundable. Seaward Bound Enterprises, 219-1207 Douglas St., Victoria, B.C. Canada V8W 2E7 (604)381-4220

PERSONALIZED Canvas Duffle Bag Regular (9" ×16") \$12.95 Large (10"×20") \$14.95 Guarantee. Red or Navy, Order Today, Gifts From June, 18423 Pacific St., Hesperia, Calif. 92345

SECURITY. Catalog of unique items. Valley Forge Sentry, P.O. Box 205, King of Prussia, PA 19406.

WALL PLAQUE "Clean House Button, Depress Fully to Activate" \$4.95. IPS, Dept. 11, 1109 Linden, Wichita, KS 67207

#### CLOCKS, WATCHES, OLD GOLD, **JEWELRY**

HIGHEST CASH for Gold, Jewelry, Gold Teeth, Rings, Dia-monds, Watches, Silver, Platinum, Mail Articles Today, Free gift with Information. Chicago Gold & Precious Metals, 10 South Wabash, Dept. 558, Chicago, 60603.

CLOCKWORKS, wood clock blanks, rockhound supplies. belt buckles, cut stones, etc. Wholesale catalog 25c. Eloxite Corp., 8061/2 10th Street, Wheatland, Wyoming 82201

TAKE NO CHANCES. Deal with oldest, most reliable firm in old gold business. Established in 1934. We buy Gold, Silver, Platinum, Diamonds, Highest Cash, Free Information: Rose Industries, 29-A East Madison, Chicago 60602

#### TREASURE FINDERS

FIND old coins, jewelry, gold nuggets. New patented revolutionary device. Free catalog. Gardiner, 4729M N. 7th Ave., Phoenix, AZ 85013

SAVE up to 40% on metal detectors. All major brands including White's and Garrett. FREE discount catalog. Northwoods General Store, Dept. DPM1, 1325 Greenway Cross, Madison, WI 53713. (608) 274-4680.

DIVINING Rod - Locates Buried Glass, Metal, Pottery. Graves, Building Foundations, Pipes, \$37.50, Instructions, Returnable, Bloch, Box 18058G, Cleveland, Ohio 44118

TREASURE - Locate quarter mile away with ultra sensitive locator - brochure free. Research Products, Box 270270 -AMC, Tampa, Florida 33688

#### **FRANCHISES**

EXPAND your business by advertising your product in this space for only \$6.70 a word, zip-code free; \$45.00 will give you a bold centered head-line. Your offer will reach 8,000,000 readers a month! 80% of our advertisers that you see on these pages are repeaters, so the magazine must be working for them. In addition our readers are do-it-yourselfers, self-confident self-starters willing to commit themselves in any worthwhile endeavors. Reach out to these groups with your fran-chise opportunities and services. Send your ad to: Popular Mechanics Classified, 224 W. 57th St., New York, NY 10019.

#### PROFITABLE OCCUPATIONS

FT. SMITH Auction School, Ft. Smith, Ark. 72903. Resident & Home study, Veteran Approved,

REPAIR lawnmowers thousands of parts and tools whole sale list 40c. Ellwanger's, PM, P.O. Box V, Port Jervis, NY 12771

PLASTERCRAFT . . . Profitable Home Business 3000 Molds Available. Details. Lynnette, 6251C Mentpark, Me Ohio 44060.

AMAZING PROFITS with small SAWMILL. 46 pages How To; SATISFACTION GUARANTEED. \$6.95. Ste Sawmill, P.O. Box 281, Elizabethtown, Ky. 42701

#### SALESMEN-DIST.

MAKE EXTRA MONEY DURING YOUR SPARE TIME! Earn weekly commissions showing our exciting line of Calendars, Pens and other popular Advertising Gifts. Prompt, peroars, Pens and other popular Adventising Citiss. Prompt, per-sonal service from AAA-1 firm. Our 77th year. No experience necessary. No investment or collections. Set your own hours. Full Time Potential! Write to: Kevin Peska, NEWTON MANUFACTURING COMPANY, Dept. DPMC1, Newton, lowa 50208

#### **AGENTS WANTED**

WITH Mason Shoes, pay day is when you want it! Take orders from friends and neighbors. Watch your business build, nt. Write: Mason Shoes, K-972, Chicoewa Falls, WI 54774.

MAKE MONEY IN SPARE TIME. As a subscription sales representative for leading national magazines, you can earn generous commissions while learning the art of selling. Instructions and supplies will be sent to you free. Send this ad with your name and address to: POPULAR MECHANICS, Dept. AB-L. 250 W. 55th St., New York, NY 10019

#### **BUSINESS OPPORTUNITIES**

IMPORT-Export opportunity, profitable world-wide, mail order business from home, without capital. We ship plan for no risk examination. Experience unnecessary. Free Report. Mellinger, Dept. C2703, Woodland Hills, California 91367

AUTOMATIC donut machine can make \$200/HR Profits. Portable. Easy. Free details. Lil' Orbits Mfg., 8851-42 Research Center, Minneapolis, MN 55428

\$480 Weekly. Home mailing program. Goodworld, Box 26233-R, Tamarac, Florida 33320

HIGH PROFITS WITH CUSTOM T-SHIRTS AND CAPS. plies. PRESS MAGIC, P. O. Box 22809 (GC), Tampa, FL. 33623

BIG MONEY and be your own boss. We made \$4,000 to \$10,000 a month in commercial cleaning working part-time. Will show you how IN DETAIL in 29 page booklet, \$5.50. J&J Enterprises, P.O. Box 1456, Longmont, Colo. 80502

FREE Information. Quit wasting your time chasing a dud! All new mail order program is exploding! Write: Moore Merchandising, Box 277E, Carrboro, NC 27510.

MAILORDER Opportunity: Start profitable home business without experience or capital. Write for free book, plus details: Mail Order Associates, Inc., Dept. 65, Montvale, NJ 07645.

SCREEN PRINT T-SHIRTS. Inexpensive kits. Free Details. "T-Printer," POB 23991 (GC), Tampa, FL 33623.

LUCKY TEEN PAPERWEIGHTS Bring Money - Success -Happiness! Free Brochure. Write: Hall's, USSAH, Box 23X, Washington, D.C. 20317

GOLD STAMPING MACHINES. Inexpensive. Quality. Large imprint Area. Free details. Magic Systems, POB 24986 (GC), Tampa, FL 33623.

BUMPER STICKER PRINTING DEVICE. Cheap, Simple Portable. Free details. Bumper, POB 22791 (GC), Tampa, FL

MAKE Rubber Stamps. Highly Profitable Business. Free Details, Stamper, POB 22809 (GC), Tampa, FL 33622.

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. 20-61, Chatsworth, CA 91311-4991.

#### **BUSINESS OPPORTUNITIES**

(Continued from preceding page)

ALUMINUM SCRAP - Recycle Yourself - MAKE \$25.00/ POUND! Free Information: Industrial-PM61, Box 127, Alexandria Bay, New York 13607

VINYL'S Where the money is! Professionally repair, refinish, recolor furniture, luggage, car tops. Quick, easy. Two small \$20 jobs a day earn you \$1,000 a month. Homes, cars, offices, restaurants, unlimited customers. Start earning after a few days practice. Sensational details free. VIP, 2007 Montrose, Chicago, 60618

PIANO Tuning quickly learned with home study courses. Diploma granted. American Tuning School, 17050 Telfer Drive, Morgan Hill, Calif. 95037.

CONCRETE Block Machines: Catalog \$1.00. Roule One, Box 3740, Rapid City, South Dakota 57702-3740

REPAIR HYDRAULIC JACKS — DETAILS FREE. WRITE: HYDRAULIC PARTS SUPPLY, BOX 4157, BROWNSVILLE, TEXAS 78520.

VENDING MACHINES. No selling. Routes earn amazing profits. "Big Catalogue FREE." Parkway Corporation, 1930 PMB Greenspring Drive, Timonium, Maryland 21093

**LEARN** Sewing Machine Repairing, Men. Women. Lucrative Profits. Gresslin Correspondence School, Box 5104, Spencer, Iowa 51301.

MAKE MILLIONS MANUFACTURING BATTERIES!!! Supplies available. Everlast, Box 365, Bogota, NJ 07603.

\$25,000 LOANS INTEREST FREE!! Secret Federal law WIPES OUT DEBTS!! Details FREE!! Moneywise B, LaGrange, NY 12540

GET RICH using OTHER PEOPLE'S MONEY!! Unique amazing business!! Details FREE!! Finance Consultants/B, Billings, NY 12510

CLIP newspaper terns-\$2 - \$25 EACH!! FREE Report! Clippings/B, Billings, NY 12510

GET RICH!! Secret law smashes debts—brings Cash, Creditl FREE report!! WealthKit/B, Billings, NY 12510

SAVE! Two stamps sends your name to Thousands of Opportunity Advertisers. B/Assoc.; Box 4222, Rockford, Blinois 61110.

HUGE profits! Reconditioning used car batteries. Secrets others don't tell. Stamp please. Battery Outlet, Box 3300, Hickory, N.C. 28603.

\$192.00 From Square Foot Plywood. (Hugh Demand) Revealing Proof 25c. (Refundable). Woodwin, Bridgewater, Mass. 02324

\$1,000.00 WEEKLY Possible Bronzing Baby Shoes FREE BROCHURE SHOWS HOW, NBPM, 398 Airport, Sebring, FL 33870

ALTERNATOR Starter rebuilding manual. Shop training available. AOM, Box 33, Buffalo 14207

"UNDERSTANDING MULTI-LEVEL MARKETING" FREE REPORT. VENTURE SYSTEMS, BOX 336, RIVIERA, AZ 86442

ANYONE CAN EARN MONEY . . . FAST . . . Crafting / Vending Balloons! Exceptionally easy prolits! Free Information: Funnyman's - PM61, Box 250, Alexandria Bay, New York 13607

NEW discovery in battery reconditioning. Eighteen months guarantee means "Big Profits Fast"! Electone, 7415 Gable Dr., Little Rock, AR 72205

SECOND Income Mailing Circulars, Details Free! JCS, Box 3732PM1, Centerline, MI 48015

PREPARE Tax Returns. Earn high fees, dignified work. Train at home. Accredited Program. National Tax Training School, Monsey, 2AT, New York 10952.

RESIDENTIAL School for Battery Manufacturing. Leon Battery Factory N.V. P.O. Box 386. Bernhardstraat 72-74. San Nicolas, Aruba, N.A. Cable: "Leonbat" Aruba.

EARN MONEY AT HOME. Outstanding opportunity for home business, Write for free information. The Kegara Company, 12009 Manwood Lane, Cincinnati, Ohio 45246

SURE TO SUCCEED! Seven home businesses, guaranteed, free details! Business Dynamics, Suite 32,PM, 1220 3rd Ave., Chula Vista, Calif. 92011

LEARN MIRROR RESILVERING free information. Silvercraft, Box 127, Lansdowne, PA 19050.

FREE!... "TREASURY OF HOME BUSINESS OPPORTUNITIES" ... MAILCO, BOX 34370, BARTLETT, TENNESSEE 38134-0370

I MADE \$40,000 Year by Mailorder! Helped others make money! Details 25c. Torrey. Box 318YY, Ypsilanti, Michigan 48197.

IMMEDIATE IMPORT BUSINESS! European And Far East Companies Looking For Importers. Agents Representatives. Our TELEX SERVICE Starts You At Once. 1,000's Of Products and Lines. Write: Artek-D, 127 East 59th Street, New York, NY 10022.

SELL Books by Mail. Dealership-25c. Midwest, Box 44R2-PM, Shawano, Wis, 54166

\$1000's WEEKLY clipping articles. Self-addressed, stamped envelope: National, Box 85518, Los Angeles. CA 90072.

\$10,/\$50. Hour! Multi-level Opportunity! Full Part Time. Free Valuable Report. Aubrey, Box 1648PM, Tomball, Texas 77375.

START MONEYMAKING WOODCRAFT BUSINESS making "Easy - Quick" toys, gifts, novelties. Free details, Williams, 3600L San Sebastien, Tucson, AZ 85715

EARN \$800 Weekend With Profitable Mini Donut Business. Financing Available: Donut Man. 9853 13th, Minneapolis, MN 55441

MAILORDER Buyers! All Categories. Computerized In Zip Code Order. These People Will Respond To Mailorder Offers. Guaranteed Deliverable! For Full Details Rush SASE To: Perferred Index Co., Box 735A, East Sandwich, Mass. 02537.

RECOVER Pure Gold From Scrap Circuit Boards, Electronic Parts, Easy Method, Send \$5.00, Recycling, Box 11216P, Reno, NV 89510-1216

SELL books by mail. 400-900% profit. Free sales kit. Speedibooks, 23860-3A Miles, Cleveland, Ohio 44128

FREE Catalog, How to Make Money Books, K. Frank, 530 Stockton, #107, San Francisco, CA 94108

STAY HOME AND MAKE MONEY! HUNDREDS OF PROFITABLE PLANS, Free information. Romig Publications, Dept. 188512, 1539 TR90-R2, Millersburg, OH 44654

FREE book, How to make \$500. Weekly at home, part time, clipping news items. Davis, Box 3565, Myrtle Beach, S.C. 29578

MAKE HOMEMADE BOOKLETS. I've earned \$187,000 with mine. Free information: Falcon, Box 37169, Ft. Worth, TX 76117

HOW To Start & Operate Your Own Prolitable Mail Order Business At Home! Complete 25-Page Booklet! Send Only \$5.00! Graham Inc., Rt-2, Box 128A, Collins, MS 39428.

\$2,000 OR MORE in Cash Per Week Plus Thousands Of Dollars Worth Of Goods And Services Absolutely Freet Guaranteed! Details Free: Freedom, Box 981, Chino, CA 91710

BORROW \$500-\$40,000! "Overnight" On signature. Keep indefinitely! Write: Action RS-1, 3660 Wilshire, Los Angeles, CA 90010.

ARAB BUSINESSMEN Have Money To Buy & Invest. Top Finders Fees Paid. IMEA, 186PM1, Box 5127, Huntington Beach, CA 92646, (714) 722-9260.

GET RICH! Selling Books By Mail . . . 400% Profit! Dealers Wanted. Free Catalog. Premium, Box 1621PM, Spring, Texas 77383

TAKE PICTURES for profit. Photomoney, 14589K West 32nd, Golden, CO 80401.

MAILORDER FORTUNES. BOOKS WHOLESALE. 1000% Profit. Selective, Box 1140, Clearwater, FL 33517.

LEARN DENTAL DRILL REPAIR in your own home. Tools furnished. Southwest Dental, 1501 E. Chapman Ave., Suite 252PM, Fullerton, CA 92631

RECYCLE METALS, NO, NOT BEER CANS! Easy \$458 weekly! Free Information. Recycler, Box 1214, Franklin, TN 37065-1214

BORROW By Mail! \$500-\$25,000 Fast! Easy! Confidential! For info Application Write: Accurate PM2, 2120 Crestmoor, Nashville, TN 37215

PIANO Tuning Business. Low investment, quick profit! Free information. Careers, Box 383PM, Urbana, IL 61801

HIGHLY PROFITABLE home-based, WHOLESALE/RE-TAIL/MAIL-ORDER opportunity. Free information: Cloud, 231-32P Merrick Bivd., Laurelton, NY 11413.

WOODWORKERS - Turn \$4 into \$39.95 - Free details! Pine Shop, 897-3 Mammoth, Manchester, NH 03104-4521 SELL Books by mail! 300%-1000% Profit. Free sales kit. Knort-PM3301 Sarazen, Oakland, CA 94605

\$40,000 ON 1/3 ACRE! New Hydroponics - inexpensive, pleasant, practical! Free information. Robin's, Box 1214, Franklin, TN 37065-1214

NEW Luxury Car Without Cost! Write: AMCO 9, 1601 E. Main, Plainfield, IN 46168

SOLAR Heating learned quickly at home! Free information. Empire School, Box 1014S, Jupiter, FL 33458

GOOD partitime-Full-time INCOME CLIPPING newspaper articles. FREE REPORT: MCPI-PM, 231-32 Marrick Bird., Laurelton, NY 11413.

MAKE MONEY WRITING LETTERS! Details: Wordshop, 7219 Promanade, Salt Lake City, UT 84121.

RICHES!! Two (Classifieds, Mailorder) proven business ventures!! \$7.95 Guaranteed, Dave Lewis Enterprises, 14348 Berg, Sylmar, Ca. 91342

\$500.00 from one sheet of plywood. Amazing new method. Home picture framing business. Free information. Oakstump, 3630 Pacific Way, Longview Wash. 98632

LEARN CLOSET REMODELING. Easy . . . . Profitable Details 25c. 1372 Alexander, Simi Valley, Ca. 93065

CAN you change oil? Here's the business for you! Free information: Whaling Enterprises, Box 1296, Sutter Creek, Ca. 95685

FREE Catalog. Home Business Opportunities, Books, Reports Youngers, Princeton, Iowa 52768

GET Richt Low Investment, Proven Results, Free Details. Fortune, 6520 Selma, #32P13, Los Angeles, CA 90028.

BATHTUB REGLAZING, product sales, service and training. Call Unique Coatings Corp. (313) 538-8600

FLEAMARKET BOOK: How to easily make 1000's. Parttime - solid potential. Send \$10. CFF Publishers, 3979 Chestnut Ave., Concord, Ca. 94519. YOU CAN'T LOOSE!

MAKE MONEY BY THE MINUTE around the clock for doing 8 hours a week paperwork from home. Grows to lifetime income. Totally new ultramodern project unlike anything before. Still ground floor. No experience or education requirements. 10,500 people already doing. Division of major U.S. corporation. For details dial (216) 494-4471, weekdays 8:30 am to 11:30 pm EST. Ask for ext. H83.

NEW Mercedes-Benz, \$153.29 monthly, or BMW, \$91.62 ... Guaranteed ... Write: FoxCo, Box 2655-61, Springfield, VA 22152

\$1,000 Weekly. Home Business Directory, Box 2019-PM, New York, New York 10163.

LIFETIME Security. Multi-Level Mailorder Two Opportunities. Oneil-M, 10 Oak Lane, Suisun, CA 94585

MAKE BIG MONEY REPAIRING WINDSHILDS & Plate Glass! Up to \$60,000 yearly! Call TOLL-FREE for Valuable FREE report. 1-800-321-2597. Glas-Weld Systems, Box 5755D1, Bend, OR 97708.

GIVE yourself \$300 month raise! Sell Hanover Shoes spare time. 25% Discount Certificate sent FREE with Catalog. Hanover, Dept. 3828, Hanover, Pa. 17331.

STARTING YOUR OWN SUCCESSFUL BUSINESS. FREE Subscription to Opportunity Magazine tells how. Write: Opportunity, Dept. G56, 6 N. Michigan, Chicago, IL 60602.

PROJECTION TV . . . Make SSS's assembling Projectors . . . Easy . . . Results comparable to \$2,500 projectors . . . Your . . . . . . . . . . . . . . . Your Information \$17.50 . . . Illustrated information FREE . . . . Macrocoma-BEX, Washington Crossing, Pennsylvania 18977, Creditcard orders 24HRS. (215) 736-2880.

GET RICH QUICK SCHEMES. Proven, Legall Write: The HOG, 8048 Midcrown, #321PM, San Antonio, TX 78218

HUGE Profits! Patented Electronic Energy Saver! Free Details. EBI-1, 2565-D, Cloverdale, Concord, CA 94518.

EASY BUSINESS! Earn \$1,000's Weekly. Free Details. Write or send stamped addressed envelope. Toddco, Dept. PM, 4219 West Olive Ave., Burbank, CA 91505

\$25.00/hour from home. Men, women, all ages. Immediate opportunity. Rahmani, 210 Welch-PM, Ames, IA 50010

SEIZED IN GOVERNMENT NARCOTICS RAID!! Automobiles .. Vans .. Boats .. Furniture ... Thousands other items. Buy Dirt Cheap — Resell for Big Profits! Free Information: Marcel, Box 7557-M, Monroe, LA 71211

#### **BUSINESS OPPORTUNITIES**

**EARNINGS** unlimited! Mail our burglar alarm advertisment from home! RBM Merchandising, Box 59314, Chicago, IL.

\$5000 MONTHLY with GARAGE SALES. Complete details \$5. Lucas Enterprises, Dept. PM186, Box 36333, Houston, Texas 77236-6333

\$3,000 MONTHLY. Information Business Brings. Initiative-P, Box 10179, Alexandria, VA 22310

GET RICH AT HOME! Brand-New With Exhaustively Doced Proof: DKP, Box 18471, Oklahoma City, OK 73154

FREE information. Profitable Home Business Made Easy! Emperor Publishers, Hamilton, Ohio 45013 Publishers, 1638 Brookcrest Dr., Suite #301,

**OUTSTANDING HOME BUSINESS OPPORTUNITIES!** n. Stark, 410 Vandyke, #216, St. Paul, Minnesota 55119

EARN \$15-\$50 per hr. Service Business. Low start up. Low te information \$10. The Phone Man 8, 7433 d. Comple Hubbard Avenue, Middleton, WI 53562

CLEANING BUSINESS FROM HOME, How I did it. My true success story. Send \$12.95 to: Connie Idavoy; Olympic Cleaning, Box 185, 88 Ashwood, Port Washington, N.Y. 11050

UN-REPAIRABLE, UNTIL KNOW! I earn \$40 hour repair ie. Huge demand. Today, Box 19636, ing the unrep Portland OR 97219

EARN \$2500/MO PLUS!!! Easy!!! Business Startup Money Or Whatever, SASE, Free Details, Lorstari, Box 1155, Southfield, Michigan 48075-0155

\$5,000 monthly possible, sparetime, guaranteed! Proven program no selling or investment. Free details! HMCM, 380 Harding Place, Suite T10, Nashville, TN 37211

ASSEMBLE PRODUCTS AT HOME. Many opportunities paying High Weekly Profits presently available without investment. Write: Businesses, 92B Brighton 11th, Brooklyn, New York 11235

#### MONEYMAKING OPPORTUNITIES

GOLD STAMPING MACHINES. Inexpensive. Quality a. Free details. Magic Systems, POB 24986 (GG), Tampa, FL 33623.

NEED Money? Fund, Grants Available, Never Repay. Aid Society, 1121/2 S. Brand-J, Glendale, CA 91204

INGENIOUS TORCH GLASSES. FREE BROCHURE. SAMPLE \$9.50. Harlie Quin, Box 2255, Ogden, Utah 84404

MAKE Rubber Stamps. Highly Profitable Business. Free Details. Stamper, POB 22809 (GG), Tampa, FL 33622.

BUMPER STICKER PRINTING DEVICE. Cheap, Simple, le. Free Details. Bumper, POB 22791 (GG), Tampa, FL 33822

FANTASTIC earnings making from home!! Offer: Rush Stamped Addressed Envelope. Imperial, P-8 X17410, Fort Lauderdale, FL 33318

GET RICH!! Secret law smashes debts-brings Cash, Credit! FREE report!! WealthKit/B, Billings, NY 12510

FINANCIAL INDEPENDENCE. Exciting mailorder business. Work at home. Free details. DACO, 2941 Driftwood, A1, San Jose, Ca. 95128

FREE Report! "999+ unique proven enterprises." Easy ome businesses. Write: Preston's, 511PM Glenwood, home businesses Buffalo, NY 14208

\$1,000,000 Millions have used this method to make \$1,000,000 in 6 months, no investment. Send \$10.00 for com lete package. \$Million, P.O. Box 42293, Portland, OR

HOMEMADE BOOKLET BUSINESS. Earn \$2000-\$5000 monthly! Details: Hartwick House, Box 534, Decorah, IA

ADVERTISE Free in 507 Magazines. \$5.00. Directory, Box 11N, Atlanta, Georgia 30301

GET RICH Overnight! Federal Law ends debts. Borrow \$25,000. Write: Action RX-1, 3660 Wilshire, Los Angeles, CA 90010

FREE Money Making Ideas! Laradise, Dept. 01, Box 1444, Oshawa, Ontario, L1J 6P8.

\$\$\$\$ CAN Be Yours!! Reagle Reports Reveal Moneymak-ing Details. Shirley's, Box 544, Mattoon, IL 61938.

CUCKOO Clocks hand carved from Black Forest, Grand Fathers clocks. Children Clocks. Beautiful gifts. Free Catalog. Hugh Aulisio Imports, P.O. Box 5062, Newark, New Jerse

NEW Luxury Car Without Cost! Write: AMCO 9E, 1601 E. Main, Plainfield, IN 46168

\$50,000 PART-TIME ANNUAL INCOME. Guaranteed Home Business Plan. Free details, write: Madison House, 971-C4 Madison Ave., Plainfield, NJ 07060.

BORROW By Mail! \$500-\$25,000 Fast! Easy! Confidential! For Info Application Write: Accurate PM1, 2120 Crestmoor, Nashville, TN 37215

GET RICH! Zero Investment. No Borrowing. Free Details. Foster, 6520 Selma, #32P13, Los Angeles, CA 90028

MONEY from discarded tires! Details, Brownie, Box 53, Fishers, Indiana 46038

EXTRA INCOME-HUGE SAVINGS - CONSUMER FLEA ARKET WHOLESALE PRODUCT DIRECTORY. MARKET 1,000,000 Products, 100 Suppliers to buy wholes ship/self retail - Government Surplus, Real Estate, Electronic, S.T.V., Satellite-TV Computer, V.C.R. A must for Dealers, Salesmen, Any Consumer looking for a Bargain. \$5.00. Wyatt, POB 128M, Brooklyn, NY 11203

YOU can make \$5,000 a month and more in mail order business. For free details write: Company of Oxnard, 1220 Hull #4, Suite 17, Oxnard, CA 93030

MAKING EXTRA MONEY MADE EASY. FREE Subscrip-tion to Opportunity Magazine offers hundreds of proven ways. Write: Opportunity, Dept. G62, 6 N. Michigan, Chicago, IL 60602

105 WAYS to Make Money at Home. Send \$2.25. Book. Leonard's Gifts, 2749 Lowell, Springfield, III. 62704

MAKE money giving away samples. \$4.00 P&H. Consumers, Box 2856, Paducah, KY 42002-2856.

HUNDREDS OF DOLLARS FREE TO YOU FROM THE GOVERNMENT if you owned an FHA home mortgage. HUR-RY, ACT NOW. Fact sheet \$5.00. Morris Associates, Inc., Dept. PMJ, 4611 Scottsdale Road, Scottsdale, Arizona

BIG BUCKS WRITING/SELLING SIMPLE INFORMA-TION! Details: Workshop, 7219 Promanade, Salt Lake City, UT 84121

BOOKLET with (56) Electroplating Formulas \$5.00. Infor-ation \$1.00 (Refundable when ordered). Metalcrafters, Box 16092, Greensboro, NC 27416-0092

\$50,000 Possible from \$80.00 Investment. Easy, Legal, 25c and SASE shows how. Peavey, Box 2213, Battle Creek, MI 49016-2213

HOW TO MAKE MONEY THROUGH CLASSIFIED AD-VERTISING. Booklet shows you how to start your own ness with Classified Advertising. ONLY \$1.00 FOR BOOK-LET — (\$2.00 coupon refundable with first order). S.S. GRONOWICZ, POPULAR MECHANICS, DEPT. PMC1, 224 WEST 57TH ST., NEW YORK, NY 10019

#### RABBITS-CHINCHILLAS-FUR BEARING ANIMALS

\$500-\$1000 Month Plan raising rabbits for us. Free details. White's Rabbitry, Box 49PM, Clarence Center, NY

CHINCHILLAS: Have Top Record Pelt Prices. Information, Facts \$2.00. 22 Thunder Rd., Alamogordo, NM 88310

#### **EARTHWORMS, LIVE BAIT**

FREE Literature. Haise Fishworms, Crickets. Red 1000-\$8.95, 5000-\$42.50. Book on How and Where to Sell with Order, Carter Fishworms, Plains, GA, 31780.

GREY NIGHTCRAWLERS - "Action Worm" - Free Literature-Telephone - 912-835-2542 - Fain's Farm - Edison, GA 31746

#### OF INTEREST TO ALL

VACUUM Cleaners "Discount Prices" "New" Rainbow \$399.95, Kirby, Fitter Queen, Compact, Defails: ABC Vacuum Warehouse, 6720 Burnet-PM, Austin, Texas 78757.

SAVE Up To 84% On Books. Write Today For Catalog. Earmonite, Box 1649, Bridgeview, IL 60455.

GREYHOUND RACING: two excellent ways of winning big money—\$12.00. Trifecta Solution, P.O. Box 20235, Montgomery, Alabama 36120

GOLD Silver Related Riskless Retirement Plan: Security, 2001 Westrun Road, Munhall, Penna, 15120

FREE Promotional Albums, Concert Tickets, Stereos, etc. Information: Barry Publications, 477 82nd Street, Brooklyn,

NEED Money? 50 Secret Sources. Never be without money again! Guaranteed. Rush \$2.00. Taylor Publishing, 4103 Scovel, Pascagoula, MS 39567

**HOL-TITE** suction cups. Newly formulated resin produces crystal clear cup with amazing grip. Kitchen, bathroom, office, workshop. Four 11/2" cups with attached hangers, \$1.50 postage paid. Specialty Sales, Box 310, Worchester, MA 01606

WHAT your Handwriting reveals - (Character, Personality and tests - Intelligence, Signatures, etc. . .) \$3.50 Postpaid. Clamar (A17), 2440-16th Street, #162, San Francisco, CA

FREE PRIVACY CATALOG. Cash income opportunities. Hiding assets. Secret loans. New identity. Eden, Box 8410-PC, Fountain Valley, CA 92728.

HOME movies, slides, negatives transferred to video tape. Free details. Video Transfer, Box 14298, Tampa, FL 33690

"HALLEYS Comet 1985/1986 An Astronomical Perfo mancel" Celebrate with your Bumper Sticker. \$3.00. S.M. Reynolds, P.O. Box 7696, Berkeley, California 94707-0696.

MAYAN PENDULUMS, TALISMANS. Mystical powers. Made of jadeite, as the Mayans used since BC. Request information and very interesting legend. Noel Merriam, Importer, P.O. Box 6491, Torrance, CA 90504.

SIMPLIFY preparation of your individual income tax return Use proven easy method by CPA. Box 718C, Southberry, CT

POPULAR MECHANICS FILE BOXES — keep magazines + bookshelves orderly. Holds a yeer's magazines. FREE self-adhesive labels (yrs.: 1975 - 1986) with every order. 1 box \$2.95 — 3 or more \$2.50 ea. Popular Mechanics, (PL-1744) Box 1014, Radio City Sta., New York, NY 10101

#### **GOVERNMENT SURPLUS**

IS IT true you can buy jeeps for \$44 through the U.S. Gov-ernment? Get the facts today! Call 1-312-742-1142 Ext.

GOVERNMENT HOMES for as little as \$1.00 for director send \$2.00 to: Turrin Associates, Box 2215, Clifton, NJ

MILLIONS OF SURPLUS BARGAINS! Jeeps included! Many 1% original cost. "Nationwide Government Dir \$2.00 (Guaranteed). DISPOSAL, Box 19 19107-AM WASHINGTON, DC 20038.

"GOVERNMENT SURPLUS" JEEPS \$30.001 5,000,000 Items! Complete Information Your Area. 1986 OFFICIAL DIRECTORY. \$3.00 (Guaranteed). Surplus, (B17), 4620 Wisconsin Northwest, WASHINGTON, D.C. 20016

G.I. SURPLUS, Hunting and Camping Equipment, 56 Page atalog \$2.00. Red Bank Army Navy, 12-M Monmouth Street, Red Bank, NJ 07701

HOW to get government surplus for free. \$1.00. Discovery, Box 43772B, Austin, TX 78745

#### LOANS BY MAIL

STUDENT Financial Aid available to \$10,000! Student Aid, 1121/2 S. Brand-S. Glendale, CA 91204

BORROW \$500-\$25,000 Interest Free! Repay Anytime! All Eligible! Write: Quality, Box 587-SNN, Floral Park, New York

MONEY Problems? Free Book describes Loans, Cash, nent Grants, Other benefits, available to ind Write: Associates, Box 98-A4, Brooklyn, New York 11235

BORROW \$100-\$100,000! Instant Reply! No Co-signers! Rush Stamped Envelope! Financial, P.O. Box 1697(P).

BORROW \$25,000 "overnight." Any purpose. Keep indefi-nitely! Free Report! Success Research, Box 19739-AM, Indianapolis, IN 46219.

BORROW \$500-\$40,000f "Overnight" On signature. Keep indefinite byf Write: Action R-1, 3660 Wilshire, Los Angeles, CA 90010.

#### LOANS BY MAIL

(Continued from preceding page)

BORROW \$1,000-\$100,000 Overnight. Rush Stamped Envelope: Finance, 2409 17th Street Terrace, Leavenworth, Kansas 68048

NO CREDIT? Get major bank credit cards such as VISA and MASTER CARD. Free details. MCPI-CP, 231-32 Merrick Blvd., Laurelton, NY 11413.

NEED money when banks stop - we start! Bad credit no problem. Rocchio Enterprises, Box 19396, Minneapolis, Mn 55419

BORROW By Mail! \$500-\$25,000 Fast! Easy! Confidential! For Info Application Write: Accurate PM, 2120 Crestmoor, Nashville, TN 37215

BORROW \$500-\$25,000 By Mail. Write; Elite, Box 3195-PM, Jamaica, New York 11432.

NEED VISA CARD? No Credit? Bankrupt? Write: Johnson Enterprises, Box 11814-H4, Washington, D.C. 20008-9014.

QUICK Cash LOANS! Write: FICPA, P.O. Box 748, Pinconning, MI 48650.

#### DIVORCE

WINNING Information \$2.00 MEN'S RIGHTS ASSOCIATION, 17854 (Lyons), Forest Lake, MN 55025

#### PERSONAL

"HOW To Handle Life And Death" Jesus Taught How. \$2.00. Suite 188, Box 91016, Baton Rouge, LA 70821-1016

BIBLE Questions answered, Stamped envelope, Bylon, k7167 Bentler, Detroit, Michigan 48219

#### **REMAILING SERVICE**

FREE Remailers List, Agents Needed, PS, Box 29656, San Antonio, Texas 78229

TRUSTWORTHY forwarding. Stamped remails \$1.00. Diamond-H, Box 129A, Caddo, Texas 76029

UNLISTED ADDRESS Discreet and confidential. Remail \$1.00 Single. Mail Forwarding Service, 8050 S. Main, Houston, Texas 77025

CONFIDENTIAL Mail Receiving/Forwarding, Mail Drop, Box 18039PM, Orlando, Ft. 32860

FREE Details! Postal Shoppe, 396 East 900 South, Sait Lake City, UT 84111

REMAILING/FORWARDING. Confidential. Details SASE. Single Remails \$1.00. Consumer Warehouse, 6333 Pacific Avenue, Suite 508, Stockton, Ca. 95207

N.Y.C., N.J. Stamped remails \$1.00, Picture postcards \$1.00-Mailarama, Box 3219, Weehawken, N.J. 07087

FREE packet. Stamped remails \$1.00, Tampa postmark. Flying Fingers, 4806E Steams Rd., Valrico, FL 33594.

PROFESSIONAL FORWARDING/Remailing. Free Details! PRIVATE-MAIL, Box 544, STONE MOUNTAIN, GEORGIA 30086-0544

#### MISCELLANEOUS

BE A REAL MACHO MAN! JOIN W.O.R.M.S. World Organization for the Restoration of Male Supremacy. Charter memberships - Limited time only. Recieve bumpersticker, Creed suitable for framing, etc. Satisfaction Guaranteed. \$6.00. Join today! Worms, 1821 Adams Str., No. 4, Macon, Ga 31201

#### WANTED MISCELLANEOUS

BUYING Tungsten Carbide, Tungsten, Molybdenum, Silver Solder, Silver Contacts, Gold, Platinum. 800-321-6914 Ohio 216-531-8333 collect.

GOLD, Silver, Platinum, Mercury, Tantaium. Samples Evaluated Free. Ore Assaying Service. Call Wholesale Terminal Toll Free: 1-800-932-1010.

BUYING Old Model Airplane Engines. Higgins, 1995 Kaster NE. Bremerton, WA 96310

SCRAP SILVER CONTACTS, FORKLIFT CONTACTS, Silver Solder, Sterling, Gold Plated. Robert Leszczak, 652 Myrtle St., Elizabeth, NJ 07202

#### **HEARING AIDS**

HUGE SAVINGS Eliminate Dealer Markups. Free Trial. Batteries Wholesale. Terms Arranged. Call Toll Free 1-800-323-1212. Or Write: Lloyds-PMC, Rockford, IL 51110

FREE HEARING AID CATALOG - Save 1/2 by mail! Write: "Money\$avers", 9530PM-1 Langdon, Sepulveda, California 91343.

FREE HEARING AID BATTERIES, SIGMOTEK, 327 Clarkin Ct., Walnut Creek, CA 94596

SAVE \$200+. Modern name-brand aids improve understanding. No Salesmen. Free Trial. Free Catalog. J&M, Dept. 132-M. 329 Third. DeKalb. IL 60115

#### TOBACCO

MAKE PIPES. Book, Materials: PIMO P186, Box 59211, Chicago, Illinois 60659.

#### SCIENCE & CHEMISTRY

LABORATORY CHEMICALS, GLASSWARE—APPARA-TUS. Catalog \$1.00. HAGENOW LABORATORIES, 1302 Washington, MANITOWOC, WISCONSIN 54220

CHEMICAL CATALOG Lab Equipment-Glassware \$3.00 Refundable. Scientific Supply, P.O. Box 490, Ranger, TX 76470

#### FORMULAS, PLANS, ETC.

ANY Formula \$10.00. Catalog \$2.00. J. Belfort, Box 568, Chicago, 60690

MONEYMAKING CHEMICAL FORMULAS-THOU-SANDS! CATALOG \$5.00 (REFUNDABLE): GWA3, Box 193. Brooklield, Wisconsin 53005-0193

#### GENEALOGY

ANCESTORS Researched Throughout United States/United Kingdom. Brochure, Quotation, Consultation. \$3.00 (Bills), From Research Service', Eight Meyrick Road, Stafford, ST17 4DG, England

#### SPECIAL SERVICES

INFORMATION On anything. Ferguson Research Specialists, 60-15 Woodside, Woodside, New York 11377.

USED-EQUIPMENT buyers and sellers: List now with ReliaSource's inexpensive national exchange. 1-315-369-6480

#### **HEALTH, VITAMINS**

RESPIRATORY ILLNESSES, sinus, bronchial, etc. RE-SPIRIZER helping thousands breathe easier. Trial available. RESPIRIZERS, 474 BOYDS SCHOOL ROAD, GETTYSBURG, PA 17325, TELEPHONE (717) 334-1478

UNIQUE 10 second Stress Test, credit card size, Only \$3.50 (3 for \$10.00), other items, free brochures. Mallen Enterprises, 5 Wyman, Arlington, Ma. 02174

#### **GARDENING & LAWN CARE**

HYDROPONICS planter. For apartment or greenhouse. For fun or profit. Plans \$9.95. Hydroponics, Box 1600, St. Marys, Canada NOM-2V0

LEARN Gardening and Landscaping at home. Free booklet. Lifetime Career Schools, Dept. A-200, 2251 Barry Avenue, Los Angeles, California 90064.

PLANTS vegetables without soil. High yields. Easy methods. Free details. Arbolyn, Box 2412M, Columbia, SC 29202

#### RECIPES, COOKING, ETC.

DELICIOUS AUTHENTIC EUROPEAN RECIPES \$3.98. EMC Distribution, Suite 1922, 5647 Yonge Street, Toronto, Ontario, Canada M2M-4E9

GIVE the best gift for the holidays, 7 mouth watering Hawaiian teriyaki and bar-b-q sauces. Send \$3.00 to: Leimomi's, 219 First Ave. N. Ste. 402, Seattle, WA 98109-4893

DELICIOUS easy recipe for homemade Schnapps. Create your own flavor! Send \$2.00, SASE to: EMC1P, Box 70, Lenox, lowa 50851

SAYE MONEY - EAT HOME Send \$2.00 to: "Oriental Recipes," 583 East Earl Court, Toms River, New Jersey 08753

CHOWDER LOVERS. 9 Of America's Favorite Chowder And Fish Soups \$2.00. WEB, 7104 Hanover Parkway B1, Greenbelt, MD 20770

MICROWAVE recipes. RV tips. Chk/MO \$3.75 (\$3.96 CA res.) + \$1.20 P&H. The Hill Enterprises, POB 41326, Sacramento, CA 95841

"GOOD OLE DAYS" cookbook. Meats, vegetables, desserts like Grandma cooked. \$5. Kings and Things, Box 220PM, Atascosa, TX 78002.

MY MOTHER'S CHOCOLATE CAKE - Send \$1,00 SASE to: Don Hood, Box 18105, Columbus, OH 43218

SALT SUBSTITUTES for a healthy life, 3 recipes, all natural Herbs, low sodium, send \$3.00 + SASE: Sammuel Walters, Dept. PM1, Box 237, Bogota, N.J. 07603.

DELICIOUS Morny Maits \$1.00 SASE: Deborah, Dept. PM, 717 W. Millitt, Dailas, Texas 75232

#### WINEMAKING, BEERMAKING, ETC.

WINEMAKING-BEERMAKING-QASOHOL. Free Supply Catalog. Yeast Equipment. Continental, Box 188PM, Casselberry, FL 32707

FREE BEERMAKING CATALOG. —Best Value. Selection. 24-hr. Service. HOMEBREW, Box 158M, Haslett, Michigan 48840.

WINEMAKERS-BEERMAKERS— Free Catalog—Fast Service—Large Selection: Kraus, Box 7850-L, Independence, Missouri 64053.

WINEMAKERS-Beermakers: Free Illustrated catalog of supplies. Semplex, Box 12276R, Minneapolis, Minnesota 55412-0276

MAKE QUALITY BEER, Wine. Free catalog. Village Store, Box C-51PM, Westport, MA 02790.

WINE/BEER MAKING Catalog: 8&J Enterprises, 1845 South 19th, Springfield, Illinois 62703

BEER LOYERS — Brew your own. Delicious! Inexpensive! Free Catalog. Beer Gear, Box 25093M, Lansing, Michigan agons

FREE BEERMAKING BOOK Plus Catalog. Finest Equipment, Ingredients. Fully Guaranteed. SPI, Box 784-M, Chapel Hill, NC 27514

BEERMAKERS Winemakers Catalog. Fast Personalized Service. Bacchus & Barleycorn, 6110-H Johnson Dr., Mission, KS 66202.

WINE 28 Days Guaranteed. Instructions. SASE. Box 965, Morrisville, PA 19067

BEST BEERMAKING CATALOG IN USA! FREE! Brewing, Box 1139, South Chatham, MA 02659. 1-800-447-7404

WINEMAKERS — Beermakers Free Catalog, Low Prices. Free Recipes. Cellar-M, Box 33525, Seattle, WA 98133.

BEERMAKERS ONLY! Free Cstalog/Newsletter. Williams', Box 461MX, Oakland, California 94604

ENJOY keg beer at home. Convert your old refrigerator into a beer dispenser. Tastes better than cans and costs less. Free information. Keg Beer Warehouse, 3529 East Grant, Tucson, Arizona 85716

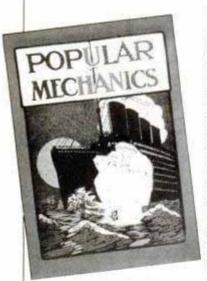
#### BURGLAR ALARMS & HOME PROTECTION

STOP BURGLARY! Security professional tells how. Write: Security, 409A East Ave. E, Alpine, Tx 79630

JANUARY 1986 179

# TIME MACHINE

75 YEARS AGO: January 1911



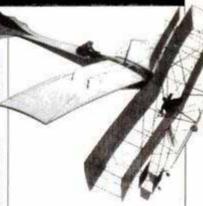
It was a floating hotel.

#### Heavyweight champ

For two years, the world anxiously awaited the completion of White Star Line's monster ocean liner, the Olympic. The Olympic was 105 feet tall and 8821/2 feet in length, compared to the Lusitania's 767 feet. The Olympic was not as swift as the Lusitania, but surpassed her ocean-going cousin in passenger accommodations with complete suites of modern rooms plus a skating rink, racquetball court, sun parlors and palm courts. Today, the world's largest ship, the Norway, stretches to a whopping 1035 feet.

#### Historic takeoff

Eugene B. Ely accomplished a feat that would shape naval operations. Elv launched an airplane from the deck of the USN cruiser Birmingham. Although Ely demonstrated that an aircraft could be launched from the deck, concern remained that Ely might not be able to land on the ship's deck nor could he takeoff from the deck of a moving ship. Among the measures explored by the Navy was a net to receive the aircraft and putting pontoons on the craft so it could land near its launch ship.



#### First collision

During an air meet at Milan, Italy, a Farman biplane and an Antoinette monoplane collided in the air. Both airmen were seriously injured.

#### 50 YEARS AGO: January 1936



French efforts to increase aircraft safety and durability led to the construction of a giant subterranean wind tunnel in a Paris suburb. The French blasted every new plane with gale-force gusts of air to test stability, speed and sturdiness as well as to reveal any stress weaknesses hidden in the craft. Airplanes were mounted inside the tunnel's huge interior. Six giant fans mounted in an oval shape and powered by enormous electric motors thrust powerful streams of air at the craft from every angle.



#### Masked pals

Growing wariness of advancing technology and dire scenarios for the next war led to these gas masks for soldier and trained war dog.

#### Explorer's bonanza

American zoologist Robert T. Moore discovered the supposedly mythical canyon Barranca del Cobre, Mexico, and although it was almost as wide as America's Grand Canyon, it had remained hidden from civilized prying. Moore discovered the goldand silver-rich canyon during an expedition to a vast unexplored area near the Uriqui River. He also found Tarahumara Indians who had never seen a white man. Moore's discovery bolstered belief in Spanish tales of the fabled seven lost cities of the Cibola.

#### 25 YEARS AGO: January 1961

#### Compact capers

The Ninth Annual Auto Issue was a eulogy for the large, powerful and uneconomical medium-priced car and a welcome for the compact: "The present period of restless turmoil in the auto market," wrote PM's editors, "was the result of the public's disenchantment with large, powerful and uneconomical medium-priced cars." That year the growing list of compacts added the Buick Special, Pontiac Tempest, Dodge Lancer and Olds F-85. Lancer won the mileage championship with 20 miles to the gallon.

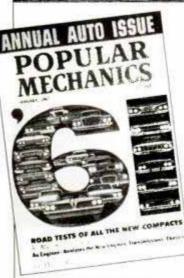
#### Snow tips

Sometimes it pays to take time out to marvel at the way time changes some things and not others. For example, PM's lessons for the three S's-Snow, Sleet and Slush: 1) Never use wiper blades to remove heavy snow from windshield; clean windows with broom. 2) Avoid parking on inclines with one or more wheels on snow or ice. 3) Put chains on one wheel only; drive with chained wheel in loose snow, other on bare pavement. 4) Don't let air out of tires for traction. This creates an arch, and less traction.



#### Catwalk runner

New York Bridge and Tunnel police tested a 550-pound aluminum gas-powered catcar. The walk singlewheeled vehicle, which could reach 30 mph, was a success. They are still in use.



Wind tunnel tests crafts' mettle.

Compacts put to the test.

Мотериал, закрешенный актирусии прове

Wake up to the warm new way to save.

Autostat turns your thermostat into a money saver.

New Autostat fits right on your

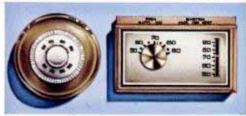
existing thermostat and automatically adjusts the temperature setting up to four times a day. And there are special settings for weekends too.

After you're asleep it turns your heat down to save money.
And before

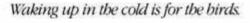
Look, Ma, no wiring.

you wake it turns your heat up so

your mornings are nice and warm.



Fits most thermostats.



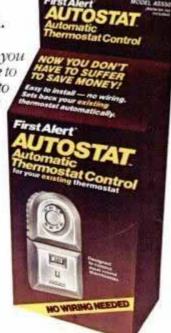
It can also adjust your central air conditioning.

Autostat is easy to install. No wiring is needed. There are models to fit most round and rectangular thermostats.

With Autostat by First Alert you'll save money automatically. And

never wake up in the cold again.

Now you don't have to suffer to save money.



First Alert\*
AUTOSTAT.
Because your family comes first.

