RETURN OF THE MIGHTIEST WARSHIPS

800,000-MILE REPORT

FORD MUSTANG: Owners Praise Sporty Styling And Handling

PLANS: MAKE PM's OUTDOOR ADIRONDACK FURNITURE

CAR STEREO: Add-Ons That Make A Good Set Great!

PLANS: BUILD OUR GIANT GARDEN CART

HOW COMPUTERS ARE DESIGNING YOUR NEXT CAR

Battlewagon New Jersey
Back At Sea With Rocket Punch
KOOL LIGHTS

There's only one way to play it.

There's only one sensation this refreshing. Low 'tar' Kool Lights. The taste doesn't miss a beat. Kings and 100s.


Kings: 9 mg. "tar". 0.8 mg. nicotine. 100s: 10 mg. "tar", 0.9 mg. nicotine av. per cigarette by FTC method.
TWO OF THE WORLD'S GREAT ENGINEERING ACHIEVEMENTS.

Few things in this world are built like Ruth Gordon and the new Subaru Brat.

WHAT OTHER BODIES COMBINE SO MANY IMPRESSIVE FEATURES?

Like Ruth, the Brat is tough. And it has a personality all its own. Besides all new styling, the Brat offers outdoor bucket seats and a Halo Twin Roof.™

GREAT PERFORMERS.
The Brat delivers the best gas mileage of any four wheel drive vehicle. 27 EPA est. mpg, 36 est. highway mpg.** What's more, the Brat has Front and On Demand Four Wheel Drive.

ENGINEERED LIKE FEW THINGS ARE ENGINEERED.

Most importantly, Ruth and the Brat are built to last. So if you're the kind of person who appreciates quality workmanship, look into Ruth Gordon and the new Subaru Brat.

Each sold separately.

THE NEW SUBARU BRAT.® INEXPENSIVE, AND BUILT TO STAY THAT WAY.

*AVAILABLE ON GL MODELS
**1982 EPA ESTIMATES. USE EST. MPG FOR COMPARISONS. YOUR MILEAGE MAY DIFFER DEPENDING ON DRIVING SPEED, WEATHER CONDITIONS AND TRIP LENGTH. ACTUAL HWY. MILEAGE WILL PROBABLY BE LESS.
THE MOST BEAUTIFUL SUMMER EVENINGS START WITH RED.

JOHNNIE WALKER® RED
THE RIGHT SCOTCH WHEN ALL IS SAID AND DONE
On the cover
When it puts to sea for trials in two months, the USS New Jersey will be the world’s only active battleship. Our artist’s view shows the awesome offensive power of the ship provided by its mix of heavy guns and modern missile systems. The story on page 73 tells how the Navy armed the role of its “new” capital ships.
—PM painting by Ed Vangurky

Special features:

Great shop for a master woodworker
Old World craft tools coexist with power equipment in the latest in PM’s Great Shop series.

Computers help design your next car
Detroit turns to computers for optimizing design and performance features.

PM Owners Report: Ford Mustang
Amid the usual glitches over low power and mileage, high marks for styling and handling.

Plans in this issue:
Build terrific-looking outdoor furniture in the “Adirondack” style from our plans.

Plus a full-size garden cart to handle chores, and carry tools and supplies.

Car stereo add-ons
Latest modular refinements can turn an average car system into a mobile concert hall.

Automobiles and bikes
11 Imports and Motorsports
33 The PM Garage
35 Saturday Mechanic: Troubleshooting Ford’s Microcomputer Control Unit—Part 2
40 Car Clinic
50 Detroit Listening Post
58 The high-mileage files:
   New carburetor and manifold yield better mpg
82 PM Owners Report: Mustang 5.0
89 PM’s long-term car tests
90 The hot blast from France . . . and one from Kronshka
147 Firsthand Report: Audi Quattro: Germany’s 4x4 cruise missile

Electronics, radio and TV
20 PM Electronics Monitor
76 How computers bring cars to life
80 Supercharge your car stereo
156 The brain trigger . . .
156 . . . And “champions” who shoot blanks

Science and engineering
8 Science Worldwide
73 The born-again battlewagons
86 Back-yard voyage to the stars
153 It came from Down Under
154 A Fair deal
155 6 rms, iv vu

Boating and outdoors
80 All Outdoors
92 New look for no-fuel boating

Photography
54 Photo hints
84 Capture the stars on film

PM’S 1982 OUTDOOR LIVING GUIDE
101 Cover
103 PM’s custom deck for a charming home
110 Little sheds for your yard
116 Build PM’s Adirondack lawn furniture set
123 Build this garden cart
126 Energy-wise guide to spring pool maintenance
129 New products for outdoor living

Shop and crafts
48 PM Workbench
55 New Now for home and shop
56, 137, 140 Hints from readers
94 Great Shop: A master craftsman’s old world shop
98 2 shop tricks from master craftsmen
100 Workshop Minicourse: Getting an edge
132 Build this Colonial drop-leaf table
182 Turning a scaled-down wood replica
184 PM looks at new abrasive system

Home and yard
24 Homeowners’ Clinic
48 Appliance Clinic
138 Build this tomato trellis.
180 PM looks at portable blower

Aviation
31 Anatomy of a wing-walk
154 Everyman’s crop duster

Every month
6 Letters
14 Notes from the Editor
27 PM Briefs
153 Technology Update

Worth writing for
Looking for more ideas and information? See page 177.

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 manufacture products or reader-built projects resulting from plans printed in this magazine.

POPULAR MECHANICS, 7350 W. 35th Street, New York, N.Y. 10018 U.S.A. Subscription price: United States and possessions, $2.50 per year; 39c. for one year; $1.00 for two years. Canada and all other countries, add $2.00 for each year. Second-class postage paid at New York, N.Y. and additional mailing offices. Authorized as second-class mail by the Postal Office Department, Ottawa, and for payment of postage in cash, Registered as second-class mail in the Postal Office of Mexico, D.F., Mexico, June 20, 1901, t 1982 by The Hearst Corporation. All rights reserved. Printed in U.S.A.

POSTMASTER: Please send address changes to Popular Mechanics. P.O. Box 16064, Des Moines, Iowa 50306.

SUGGESTIONS TO READERS: Popular Mechanics welcomes and encourages you to help make it the best mechanical magazine in the world. Your suggestions can be helpful in improving the magazine, and if you have a criticism, we always want to hear it. If you have a suggestion, please write to: Popular Mechanics, P.O. Box 16064, Des Moines, Iowa 50306. If you have any question about your subscription, please write to: Popular Mechanics, Customer Service Department, Popular Mechanics, P.O. Box 16064, Des Moines, Iowa 50306. To receive prompt service, please include your mailing label when writing to us or returning your mail. This address is for domestic orders only. Foreign orders must be received at least eight weeks prior to expiration to ensure continued service.

Use this address for P.O. Box 16064
orders & inquiries
Des Moines, Iowa 50306

POPULAR MECHANICS
POSTMASTER: Please send address changes to this address.

JUNE 1982
What do you do when the load’s too heavy for your little Chevy?

Take the Coleman® Caboose.

The new Coleman Caboose lets your quick little car carry like a wagon.

The Caboose is light, lithe and rolls like a royce. Just the ticket for spools and spring seedlings, bricks and boards, luggage and leisure gear or the antiques you can’t pass up at the auction.

You can even get an optional top that keeps out weather, and locks to keep out intruders.

And when your haul is over, the Caboose stands on end and hides against a garage wall, fence or utility shed.

The Coleman Caboose. It’s fun. It’s functional. And it only costs about as much as a good set of radials.

*Complete Flags and Trim Kit Available As Option.
HANDYMEN, MEET YOUR MAKERS.

Black & Decker 7¼" Circular Saw: With no-ground double insulation, power lock-off button, sawdust ejection chute, and permanent lubrication. $42.97

Black & Decker ½-HP Variable Speed Jigsaw: Featuring fingertip speed control, calibrated tilting shoe, detachable cord, and no-ground double insulation. $27.97

Black & Decker Bench Grinder: With 4½" wheel spread for grinding larger objects, and self-aligning sleeve bearings for accurate work. Includes two grinding wheels, tool rests, wheel guard covers, eye shields, rubber feet, and 6' cord. $34.97

Black & Decker ¾-HP Router: Routes, grooves, trims, decorates; featuring all-ball-bearing construction, precision vertical depth adjustment, and no-ground double insulation. $29.97

Black & Decker Quality at a K mart price. Nice.

Kmart
The Saving Place
Letters to the Editor

Some like 'em hot

As a woman considering a new high-
performance car, I enjoyed Joe Old-
ham's article Detroit Futs Muscle
Back in (page 109, Mar. '82). But in
his review of the Mercury Capri, he
says: "Most women won't like this
car. Most men will."

Unless Oldham has had a sex-
exchange operation, he doesn't know
what women will like. I, and many of
my women friends, enjoy a car that
really goes.

KrisTi caRLoR
LIbOr, N.D.

What happened to the Chevrolet
Citation XI and Pontiac Phoenix
SJ? I was under the impression
these cars were made in Detroit.

AlVin WasSeRMaRN
MIAMi BaCHe

Oldham writes in glowing terms
about super fast acceleration, smok-
ing tires and beating out the next
guy at a stoplight. People with driv-
ing habits like these are bad news
for everyone on the road. A car is a
piece of heavy machinery that can
mangle people and other cars when
driven without caution.

Our roads are crowded with cars,
pedestrians, cyclists and children.
No one can drive in a vacuum.

FRED DeVIN
NeW HaVEN, CONN.

Author Oldham replies: Maybe our
roads wouldn't be so crowded if peo-
ples didn't poke along at ridiculously
low speeds. Seriously, though, we
were talking about what seems to be a
peculiarly American phenomenon:
we certainly aren't advocating reck-
less driving habits.

We reviewed the Chevy Citation
XI in our January '82 issue (An
American Sport Coupe Takes On
Four Imports, page 88). It blew the
doors off the foreign competition.
Pontiac wasn't advertising its Phoe-
nix SJ as a performance car until
recently. We tried to get a Trans Am
for our muscle-car test, but only one
had been built at the time and it was
not available.

Missing windmill mystery

Motorists on Interstate 10 near
Palm Springs, Calif., will not see
two giant windmills you showed in
your March '82 issue (PM
Briefs, page 96). The vertical Dar-
ruess rotor blew to pieces the first
time it was started, and the propeller
type had to be dismantled shortly
thereafter because of problems.

If NASA had acted with the same
efficiency on the space program,
John Glenn would still be waiting on
the launch pad.

ADAM BALAS
PAlM SPRINGS, CAf.

It's a bit embarrassing, we admit,
but they sure were there when the
photo was taken. Word from DOE is
that the Darrieus rotor has been tem-
porarily abandoned, but the propeller
type is being rebuilt and will be
back in service soon.

PM's treetop hideaway

Here's a photo (below) of the tree
house I built from your plans (Build
This Treetop Hideaway For Your
Youngsters, page 92, Aug. '80). Be-
cause my trees were farther apart
than the ones you showed, I used
2x8s for the main support beams
instead of 2x6s. I also had room to
add an open porch in front of the
roofed section.

The children love the house, but
there's one problem: Now they want
me to build furniture for it.

MaRIO ALeAnO
ShREVeFORT, L.A.

Sorry we got you into more work,
but you did a great job on the struc-
ture. For others who may be interest-
ed in this project, photocopies of the
article are available for 75 cents from
Popular Mechanics, Box 1014, Ra-
dio City Station, New York, N.Y. 10101.

No hot air

It was great to see your article Now
We're Ballooning on Solar Power
(page 100, Apr. '82). In 1967, I built a
model of Lee Ashman's solar-pow-
ered balloon for a science fair
project. My teacher said I was wasting
my time and should be working on
something "important."

Funny how times change.

ScoTT PARKeR
BaEU MoNT, TEx.

Zap—you're alive!

I'm very pleased with the NiCd bat-
tery rejuvenator I built from your
plans (Zap Your NiCd Batteries To
Life, page 92, Feb. '82). It has made it
possible for me to rejuvenate NiCds
that I was unable to restore by any
other means.

CAReLS. J. aSEa
FaRSHiPpAy, N. J.

Automated gate

In a recent Homeowners' Clinic
(page 32, Jan. '82), a reader inquired
about using an electric garage-door
opener to operate a fence gate. We
did exactly this to control a 12-foot
sliding driveway gate. It works
great.

I used a standard opener, modified
to operate at 90° from its intended
position. I lengthened the rail, chain
and cable, readjusted the stop
switches to accommodate the longer
tavel and enclosed the motor as-
sembly in a waterproof housing.

Total cost: $198.

Anyone wishing more information
about this procedure is welcome to
write to us.

GuS FrOSSUM
43952 3rd St. E.
LANcaster, CAf. 93535

A cool idea

In your March '82 issue (The PM
Garage, page 74), you say that elec-
tric cooling fans in cars are more
efficient than belt-driven ones. How
can it be more efficient to run a fan
off the generator, which is driven by
the engine, than directly off the
engine itself?

W. B. DeLoNG
HoCKeSSiN, DEl.

Auto editor Tony Assenza replies:
An engine-driven fan uses 3 to 5 hp
and runs all the time, even when it
doesn't have to, such as during high-
way cruising. But a thermostatically
controlled electric fan comes on only
when water temperature indicates
it's needed, and it runs on reserve
power already available. Thus, the
saving.
Dodge introduces the
"Four Wheeler of the Year."

"...the Power Ram 50 is one of the all-around great mini 4x4 pickups to hit the market."
Four Wheeler, Jan. 1982

"...any way you slice it, the Power Ram 50 is the best there is among small 4x4 pickups."
Pickup, Van & 4WD, Jan. 1982

"This is not a mini pickup like all the others from Japan but rather a mini 4x4 that rivals the power and performance of any (small) pickup you choose to stick it against."
4 Wheel & Off-Road, Jan. 1982

That's a sampling of what the experts have to say about the new Dodge Power Ram 50. Here are some key facts behind the raves.

More hauling power than Datsun and Toyota.
Power Ram 50 hauls the biggest standard payload in its wheelbase class. It's got the biggest engine you can get in a small 4x4 pickup. Most horsepower, most torque. Its independent front suspension shows you true grit over rocky terrain.

Drive it yourself. Odds are you'll discover what the experts already know: in the tough world of 4-wheel drive, Dodge Power Ram 50 is the toughest small pickup of them all.

Dodge Ram 50 4x2. Introducing a new, low-priced Dodge Ram 50 model, available in limited quantity. Order now while supplies last.

Dodge Ram 50 4x2. $6199

More specs:

<table>
<thead>
<tr>
<th>Engine, liters, cyl.</th>
<th>2.6 Four</th>
<th>2.7 Four</th>
<th>2.4 Four</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horsepower @rpm</td>
<td>105 @3000</td>
<td>98 @3200</td>
<td>103 @4800</td>
</tr>
<tr>
<td>Torque @rpm, lbs-ft.</td>
<td>139 @2500</td>
<td>127 @2800</td>
<td>129 @2800</td>
</tr>
<tr>
<td>Payload, lbs.</td>
<td>1510</td>
<td>1460</td>
<td>1400</td>
</tr>
<tr>
<td>Fuel tank capacity, U.S. gal.</td>
<td>18.0</td>
<td>15.9</td>
<td>13.5</td>
</tr>
<tr>
<td>Box length, in.</td>
<td>81.5</td>
<td>72.4</td>
<td>72.2</td>
</tr>
</tbody>
</table>

*Base sticker price excluding title, taxes and destination charges. Price as of 3/15/82.

Winners: In 1981 Dodge Ramcharger won Four Wheeler magazine's "Four Wheeler of the Year" award. Now Dodge Power Ram 50 is 1982's winner, and Off Road magazine's "4x4 of the Year."
SCIENCE WORLDWIDE

Water, water everywhere
Calling all scientists: Be on the lookout for 260 million tons of water vapor missing each year. Originally, scientists thought the water that evaporates from the Earth's surface trickles back down as precipitation.

But Lawrence Livermore physics lab sleuth Hugh Eilssasser has measured the vapor content of the stratosphere and discovered hundreds of millions of tons less vapor than expected. In a recent paper, NASA researcher Ed Danielson suggested that the missing vapor may get supercooled at high altitudes, float part way down, get warmed and rise again. This moving around keeps it from being detected. However, Eilssasser notes, the large thunderstorm systems in which this supposedly takes place aren't massive enough to hide the vapor. Thus, the mystery continues.

Sunlight
Solar collectors of the future may look like arrays of fluorescent bulbs on a large rectangular frame. Researchers at the General Electric labs in Schenectady, N.Y., report that experimental collectors, using clear plastic glass tubes resembling fluorescent bulbs, gathered more sunlight than standard glass or plastic bubble covers of conventional collectors.

As the sun moves across the sky, the tube shape presents a greater surface area on which to shine. The glass-tube array sits atop slabs of high-temperature plastic foam that serves as a perfect insulator.

When the collector comes to market later this decade, GE expects it to gather three times more solar heat during a northern U.S. winter than conventional models.

Skin-chilling news
Skin taken from a dead donor's back, chest and thighs once could remain "viable" for only 24 hours. But Dr. Randolph May at St. Agnes Medical Center in Philadelphia now reports keeping skin viable for weeks by slowly freezing it to -38°F. for storage, then warming it to room temperature in 15 seconds when a transplant is required.

Viability is the skin's ability to retain moisture, control body temperature and prevent infection. After a few weeks, the body rejects the donated skin. But by then, a fresh layer of skin has grown back to do the job. With the new technique, skin has been kept up to 80 percent viable for "several weeks."

New chemical group
A Purdue University team has discovered the first new class of "chondrite" meteorite in 150 years. (Chondrites are the remains of meteors created at the beginning of the solar system.)

Examining a meteorite that fell near Cumberland Falls, Ky., chemist Michael Lipshutz and his assistants dubbed the group "fosterite," after the iron-magnesium fosterite mineral particles found inside the meteor. The chondrites drew the chemists' attention because of its odd interior color—ash white with jet-black speckles. Lipshutz says that analysis has shown it contains carbon, which is odd for a meteorite.

Whistle stop
An unidentified federal agency was about to grant money to a scientist whose work had been exposed as a fraud, when "someone blew the whistle," according to Rep. Albert Gore Jr. (D-Tenn.). But members of the congressional science and technology oversight subcommittee—chaired by Gore—met with officials of the agency and the grant money was quickly withdrawn.

In an exclusive interview with PM, Gore declined to name the agency, but said the subcommittee probably will hold hearings later this year, because he and other members aren't "entirely satisfied with the response" of federal agencies to charges of unchecked fraud by scientists working under federal grants.

During hearings last year, the House panel uncovered several incidents in which scientists knowingly falsified data to get papers published or to qualify for grants.
Did you say 1/3 less tar?

Pall Mall Light 100’s.
A third less tar than the leading filter king, and still great taste.

Windsor's taste beats V.O.!

Over 7,000 drinkers across the country have compared the taste of Imported Windsor Canadian to the taste of Seagram's V.O.

And they chose the mild, smooth taste of Windsor over V.O.—57% to 43%.

If you're a Windsor drinker, that will come as no surprise. But if you're not, try the taste of Windsor and find out for yourself why it's the Canadian that stands alone.

You can't beat the taste of Windsor. And you certainly can't beat the price.

Windsor
One Canadian Stands Alone
Turbos galore

Making its world premiere at Geneva was Mitsubishi’s Starion, a turbocharged 2+2 fastback that’ll be the eye-catching car in the new Mitsubishi dealer network. It’ll have to buck the tough RX7/Supra/Z-car triumvirate. In Europe, all of Mitsubishi’s cars—Starion, Sapporo, Colt, Gallant and Lancer—are offered with turbos.

Turbos for diesel and gas engines are showing up everywhere: Rolls-Royce previewed the Bentley Mulsanne Turbo, one hot luxury sedan,

Mitsubishi Starion Turbo arrives in ’83. with the turbo boosting top end to 150 mph and cutting 0 to 60 to 7.4 seconds. Then there are the VW-Audi cars, which are getting turbodiesels almost across the board. We’ll be seeing some this fall.

Gimme a break

A new version of Peugeot’s 505 made its début at the Salon International de l’Automobile: It’s the wagon, of course—or “break” as they call it in

Peugeot 505 wagon will get a turbodiesel. Europe—and it will delight Peugeot fans who have tired of the bulbous old 504 wagon. So, if you’re all ready for a really elegant hauler, this is the one.

By Bill Hartford
It's times like this you've got a Wagner

3 mins.
We painted a shutter in 3 minutes with a Wagner Power Painter. It took us 22 minutes with a brush.

6½ hrs.
We painted this house in 6½ hours with a Wagner Power Painter. It took us 17 hours with a brush. Both were done excluding trim.

4½ mins.
We painted this wicker chair in 4½ minutes with a Wagner Power Painter. It took us 1 hour and 10 minutes with a brush.

21 mins.
We painted an eight-foot section of this fence in 21 minutes with a Wagner Power Painter. It took us 1 hour and 20 minutes with a brush.
that’ll make you glad
Power Painter.

Every once in a while you come across a product that offers significant advantages over a tried-and-true method of doing things. In the case of painting, consider a Wagner Power Painter instead of a brush.

A Wagner Power Painter’s speed should quickly make a believer out of you. Just among the examples we’ve shown, the time saved is astonishing. And a Wagner Power Painter is ideal for dozens of other painting chores around the house.

Professional-looking results made easier.

Of course, speed isn’t a Wagner Power Painter’s only long suit. A Wagner Power Painter also makes it remarkably easy to achieve professional-looking results—the spray lays down a smooth, even finish with no brush marks.

And when it comes to intricate painting jobs like wrought iron railings, louvered doors and bicycles, its amazing the way a Wagner Power Painter reaches into crevices and applies paint.

That’s also why a Wagner Power Painter is so effective on rough, textured surfaces like shake shingles.

Spray paints, lacquers, stains, varnishes, and more.

Virtually any kind of latex or oil-based paint is compatible with a Wagner Power Painter. It can also apply stains, varnishes and lacquers. Or spray almost any other liquid, even pesticides.

So a Wagner Power Painter is a lot more than just a “one project” tool. And cleanup is simple—just run the appropriate solvent through until it’s clean.

No air compressor.

The secret to a Wagner Power Painter is a precision electric, piston-driven pump. It creates a pressure that propels liquid out through the tip, which then forms the spray. There’s no bulky air compressor to lug around. And significantly reduced “fogging” that usually accompanies painting with compressor-powered sprayers because a Wagner Power Painter doesn’t mix the paint with air.

Helpful attachments.

A variety of helpful attachments make Wagner Power Painters even more versatile. Complete outfits include things like a flexible spray tip designed exclusively for floors and ceilings. And a tube that replaces the reservoir, so you can draw paint right from the can.

You can even get an optional spray tip that narrows the spray for precision painting. But rather than simply reading about a Wagner Power Painter, we suggest you visit your local hardware store, paint store, home center or wherever quality paints are sold.

Then ask to examine a Wagner Power Painter first-hand. Whether you’re painting your ‘57 Chevy or the broad side of a barn, you’ll discover there’s a Wagner Power Painter that’s just right for you.

And we think you’ll also discover it’s high time you owned one.

WAGNER
Brochures
Dept. L
1770 Fernbrook Lane
Minneapolis, MN 55441

Please send your free “How to...” brochures to help me learn more about painting with a Wagner Power Painter.

Name ____________________________

Address __________________________

City ______________________________

State __________ Zip ____________

Allow 4-6 weeks for delivery

Please allow 4-6 weeks for delivery.

Wagner
The Right Tool for Painting™

© 1982 Wagner Spray Tech, Inc.
NOTES FROM THE EDITOR

"It was one of those small, but telling, points," said PM's Steve Willson to sum up a visit to Ernest Glaser's shop (page 94).

While examining some pine cabinets Glaser made, Steve asked why the drawers worked so well. Glaser revealed that he had carefully laminated maple strips to the drawer bottoms and cabinets to gain such effortless movement—instead of using commercial slides.

It was a simple technique, and nothing to rival the elegance of his furniture making. But, such details mark the work of a craftsman.

The cutting edge: PM's Willson makes time-honored inspection in a fine craftsman's great shop.

Out of the Fuego and into the bunkers: Auto buff Assenza becomes a war-history buff while at Omaha Beach.

Are car buffs truly fighter pilots at heart? Seems so. PM's Tony Assenza, after testing a new Fuego and Renault 9 (page 90), toured Normandy's war sites. Devoted as he is to cars, Tony was finally moved to murmur: "I'd even turn in my driver's license to have been in the cockpit of a P-51 here."

Touring the mothballed Iowa for our born-again battleship story (page 73), Technology Editor Robin Nelson reports he felt he had entered a time capsule. He found such relics as a complete, 1940s-style soda fountain. But most interesting was the ship's newspaper print shop—with drawers of hand-set type. "Somehow," says our bemused technologist, "I think news that crawls across the inevitable TV monitors of the reactivated Iowa is not going to have the same flavor."

PM
Michelin radials for every road. Or no road at all.

Michelin 'X' radials are designed to give you the ground-grabbing traction you need on just about any kind of road. Or no road at all.

And you've got a lot more going for you when you're going on Michelin. Like outstanding handling, and traction, fuel savings up to 6% depending on how you drive, and long tread life compared to bias ply tires. Puncture protection, too, and excellent rideability.

That's why more and more drivers are picking up Michelin radials for their pickups. We pioneered the radial for light trucks and we pioneered specially designed radials for vans, campers and 4-WD's, too.

See your authorized Michelin dealer. You'll find Michelin radials are competitively priced with other leading radials. When you start with Michelin there's no stopping you.

MICHELIN
We put America on radials.
Announcing
a major new porcelain plate collection...

WATER BIRDS OF THE WORLD

by Basil Ede

An exciting new series of twelve collector's plates
by Europe's foremost wild bird portraitist.
Each plate bearing an original work of art created by Basil Ede exclusively for this collection.

Each decorated with a border of pure 24 karat gold.

Available by subscription only.
Advance subscription deadline: July 31, 1982

THE ARTIST. Basil Ede, of Sussex, England, has been called "the outstanding wild bird portraitist of his generation, and perhaps of his century." He is widely regarded as Europe's most distinguished bird artist. Indeed, the authority of his style and the distinction of his work have profoundly influenced the way birds are portrayed by artists throughout the world.

After notable exhibitions in London and other major European cities, Basil Ede was honored by a one-man show at the Smithsonian Institution's National Collection of Fine Arts in Washington, D.C. This was followed, during recent years, by important exhibitions at New York's famous Kennedy Galleries.

His paintings have been commissioned by the National Audubon Society and the World Wildlife Fund, among others. And he is represented in many public and private collections, including the Smithsonian Institution and the collection of HRH Prince Philip, Duke of Edinburgh.

Now, at the height of his career, Basil Ede has created an important new series of superlative works of art in fine porcelain - Water Birds of the World. Twelve collector's plates portraying the wild beauty and majesty of water birds in precise, authentic detail — with Ede's inimitable flair for color and composition.

Each of these twelve plates is, in itself, a masterful work of art. Together, they form an incomparable collection that will be a proud acquisition for every subscriber... a focus for conversation and admiration when displayed in the home.

THE WATER BIRDS PLATES. The plates will be large in size — 9 inches in diameter—to provide full scope for Ede's finely detailed portrayals of water birds in their natural habitat.

And they will be crafted under the supervision of Franklin Porcelain in Japan, by craftsmen schooled in the delicate, demanding art of fine porcelain.

Franklin Porcelain has devoted more than two years to meticulous preparation for the issuance of these plates and every detail will be of the highest quality. For example, each plate will be hand-decorated with a border of pure 24 karat gold. And each plate will incorporate as many as sixteen separate ceramic colors.

Ede's very beautiful and marvelously accurate works of art — created especially for this collection and available only on these fine porcelain plates — make this an acquisition that will be enjoyed and prized by all who love the beauty of birds, of art, and of porcelain.

THE SIGNATURE EDITION. The first edition of this collection will be a special Signature Edition. Each collector's plate in this limited edition will bear Basil Ede's signature on the back in 24 karat gold. This signature will appear only on the plates in this first edition.

The plates in this unique edition will be crafted exclusively for individual subscribers. The edition is available only until the end of 1982. And the limit of one collection per subscriber will be enforced without exception. Thus, the total number of sets of the Signature Edition will be forever limited to the exact number of original subscriptions entered during the offering period.

ADVANCE SUBSCRIPTION DEADLINE: July 31, 1982. The Signature Edition will be issued to subscribers at the convenient rate of one plate every other month. The original issue price of just $55 per plate is payable in two convenient monthly installments of $27.50 per month. Each plate will be accompanied by a specially printed reference material and a special wall mount. And a Certificate of Authenticity will accompany each collection.

There is no need to send any payment now. But your advance subscription application is valid only if postmarked by July 31st.

WATER BIRDS OF THE WORLD
Valid only if postmarked by July 31, 1982.

Franklin Porcelain
Franklin Center, Pennsylvania 19034

Please enter my subscription for the Water Birds of the World porcelain plate collection, bearing new and original works of art by Basil Ede and his signature in 24 karat gold.

I will send no payment now. The twelve plates are to be sent to me at the rate of one plate every other month, and I will be billed for each plate in two equal monthly installments of $27.50 each, with the first payment due in advance of shipment.

Signature: __________________________
Mr. 
Mrs. Miss. 

Address: __________________________

City: __________________________

State, Zip: _______________________

Limit: One collection per subscriber.

Advance Subscription Application
Portable videotex

I stood in the plush, combined lobby and casino of Las Vegas's famed Caesars Palace hotel. Around me swirled the glittering girls and gaudy, pinky-ringed men who throng to that city—to win or lose. But before me stood one incredulous hotel clerk who could only, in massive befuddlement, repeat my own words to me.

"You want to change your room to one with a modular phone plug?" he asked me. His voice hinted at his suspicion that I had discovered a new perversion.

"Well," I explained, "I have this new computer... not really a computer—more a terminal. It's the new RCA VP3501... and I'd like to plug it in and... ." The clerk's eyes were glassy. He motioned for the night manager to join our conversation. Joe Oldham, PM's Executive Editor who was attending an electronics show with me, mumbled an excuse and hurriedly detached himself from my side to vanish among the slot machines and showgirls.

On my own, I explained, as best I could, to the Caesars nightlife staff:

"This terminal looks like a flat typewriter keyboard; you just plug it into any phone line and attach it to a TV. Then you can call any of the national computer services."

"Computers?" the night manager looked at me suspiciously, her eyes heaven-bound. "Why would you want to call a computer?" Off to the side, a million bells and sirens announced suddenly that at least one jackpot had been won, temporarily drowning out the moans and curses of the losers.

I wondered if I should tell her about MicroNET and other such computer networks—that the terminal would allow me to stay in touch with friends throughout the country via electronic mail and conference style typing. Or perhaps, I could mention the up-to-the-minute news and features. Then again, I could explain how I could have access to various programming languages to while away my after-losing hours.

But I had hesitated too long.

"Surely," she said, "you realize that finding one room with a modular phone plug out of all our rooms would be," she paused, "like looking for a needle in a haystack." A slight smile at her own originality flickered at the corners of her mouth.

"Oh, well, thanks," I mumbled and turned away. My heart fell. I was alone in Caesars Palace, Las Vegas, without even a computer terminal. I would have to make do.

Later in the week, in the far less boisterous setting of Detroit, I again checked into a hotel without the right style phone jack. But at least I would be able to play with the automakers' computers in Motown for a PM story (see How Computers Bring Cars to Life, page 76).

A real test of the VP3501 would have to wait until I got home.

Socket to 'em

Have you ever finished an electronic project which uses integrated circuits, turned it on and watched it just sit there? If so, you may know how difficult, annoying and often impossible it is to desolder "chips" without hurting the printed-circuit or perfboard. The solution is simple: Use sockets—all the time. DIP (dual in-line packaging) sockets sell for under a dollar, but they can be worth a million when you really need them.

I have yet to see an integrated circuit (IC) package which can't be used in a socket. Printed-circuit boards and perfboards are modified with sockets on the side to accept the ICs. Sockets are available in a multitude of configurations, including single IC, dual IC and quad IC. Most are available to eliminate the need for sockets as the ICs are plugged directly into the circuit board. Usesockets all the time and you'll save your job and your sanity.

Plugging in

Back on familiar turf again, I connected the terminal to a modular phone jack—the kind that's available in most private homes. Installation took only about five minutes. Then, at last, I was able to put this exciting new machine through its video paces.

As I had told the hotel people, the VP3501 looks like a flat, compact keyboard. Its keys are membrane switches (if you've seen the Atari 400 computer or Odyssey home-video game, you'll note that they have similar keyboards).

Dialing MicroNET (the terminal comes with an application to join that network; costs are $5 per hour), and connecting took only a minute or two.

The VP3501 lets the user choose from six bright colors (or black) as a background on the TV screen and also change either the intensity or color of the scrolling type.

Even the membrane keyboard was easy to get used to. Luckily, the RCA engineers had thought to have the TV speaker "beep" whenever a key was typed, so the absence of a typewriter "feel" didn't matter.

At about $400, this new terminal is a first in inexpensive at-home or office telecommunications. It was simple to use (complete with an excellent instruction manual) and reliable.

If all you need is communications and not a computer, this is a good buy. Or if you want to add a portable terminal to an existing computer or network, this is the most portable one I've seen that offers a full keyboard and a 40-character by 24-line display.

Last I heard, RCA was even coming out with an attachment that would let you use any telephone—maybe even Caesars'.
Nobody does it better.
Nobody does it better.

Winston

This is your world. This is your Winston. The only low tar built on taste. Winston Lights
Soundproofing a room
My bedroom is on the second floor of a remodeled house. The studs are 2 x 6s with 6 in. of insulation in the walls. I sometimes work night shifts and sleep during the day. Since my neighborhood is quite noisy, I wondered if you could tell me how to soundproof the room inexpensively?—Jeff Nelson, Virginia, Min.
The National Bureau of Standards book, NBS Building Science Series 104, quotes from the 1974 ASHRAE (American Society of Heating, Refrigerating and Air-conditioning Engineers) Handbook of Fundamentals that "noise within a room is absorbed by draperies, rather than reflected as from uncovered glass. Also, outside noise transmitted through the glass is partially absorbed (by draperies). The denser the weave and the heavier the drapery, the more effective it is in reducing noise transmission." The same book mentions that storm windows and weatherstripping aid in stopping sound. I would add storm windows and, if space permits, a floor-to-ceiling drape the length of the outside wall. A thermal drape installed on a traverse rod would also help.

Insulation removal
The local roofing company that just reshingled my roof, told me to remove the fiberglass insulation installed between my ceiling rafters. I installed this insulation about 10 years ago with the vapor barrier facing the living space. When the new roof was put on, I also had a thermostatically controlled fan installed on my roof. The roofer said that unless I removed the insulation, the shingles would curl. Is he right?—James Barber, New Castle, Pa.

James, unless you're not telling me all, I think the roofer has a part ownership in your heating-fuel supplier. We can't imagine why he would have given you such advice.

Blazing campfires
Our fireplace is about 4 ft below grade in our tri-level house. Two or three days after we have a fire, the family room still smells like a campfire. I added a draft stopper on top of the chimney, installed glass doors and have had the chimney cleaned professionally. However, the problem persists. Any suggestions?—Craig G. Letchner, Livonia, Mich.

Craig, I've checked several authorities, but can only give you some general theories here. The odor could be the result of flow reversal, a situation that is most typical of basement fireplaces in multistory houses. When the temperature of the air within your chimney is lower than in the house, the air in the chimney can flow downward. The higher the chimney, the colder the air and, thus, the better chance you have of downdrafts. Also, your house can become slightly depressurized from exhaust fans in the kitchen, bathroom and clothes dryer. This also causes flow reversal.

To prevent the latter from happening, introduce outside air into your home with a vent to your fireplace, for example. This is discussed in "Having And Eating Cake" (Homeowners' Clinic, page 70, June '80). Such problems are covered thoroughly by Jay Shelton in his excellent book, Wood Heat Safety; it's $10.95 postpaid from Garden Way Publishing, 1508 Perry Rd., Charlotte, Vt. 05445.

SERVICE TIP
In past Homeowners' Clinics, I've mentioned the need—under certain conditions—to introduce fresh, outside air into the living environment. The main problem to overcome is the prewarming of the air in the winter, and the precycling of it in the summer prior to distributing it in the house. E-Z-Vent, by Des Champs Laboratories Inc., accomplishes this by ducting the stale and moist air through a heat exchanger prior to exhausting it to the atmosphere (see drawing below). In the summer, this may be the cooled air, and in the winter, the warmed air. The fresh outside air is then drawn into the heat exchanger, circulated around the heated or cooled (depending upon the season) air and deposited into the house at temperatures very near those of the exhausted air. (The heat exchanger permits the two airstreams to be brought into close proximity, but doesn't allow them to mix.) The E-Z-Vent "transfers the heat or energy of outgoing air to the fresh air," as the company explains it.

You can install E-Z-Vent in the attic or crawl space of your home. It's approximately 14 x 16 x 62 in.; the unit contains a heat exchanger, two blowers and a filter. It sells for about $50. For more information, write: Des Champs Laboratories Inc., Box 440, East Hanover, N.J. 07936.

Outside air enters the E-Z-Vent, is cooled or warmed, depending on the season, and then enters the room via the supply air duct. Stale, moist return (room) air enters the heat exchanger and passes to the atmosphere via the exhaust air duct.
THE SECRET OF THE LONG-LASTING ROOF SHINGLES.

To understand what makes an Owens-Corning roof so incredibly durable, you have to look inside one of our roof shingles.

There. Right in the middle. The heart of the shingle is a layer of pink Fiberglas® mat.

A HEART OF PINK FIBER GLASS MAKES THEM LAST.

It won’t absorb moisture. So the shingles defy years of rain and snow. Without blistering, curling or buckling.

The mat also allows us to add almost twice as much weatherproofing asphalt as you’ll find in ordinary shingles.

And, because they won’t burn, Owens-Corning’s Fiberglas shingles come with a Class-A Fire Rating. Not just the Class-C you get with ordinary shingles.

A heart of pink fiber glass. It’s why Owens-Corning’s are shingles that last.

Case closed.

Ask your contractor or dealer. Or write to B.F.W. Meeks, Owens-Corning Fiberglas Corp., Fiberglas Tower, Toledo, Ohio 43659.
With new Minute Wax™
you can wax your car
in less than 15 minutes.

That's what we said, less than
15 minutes. And people just like you
proved it in an independent research
study.

It's another amazing break-
through from Turtle Wax: the first
and only no-wait car wax. All you do is
spray it on. And wipe it off. There's
no waiting for a haze. No hard buffing
for a shine.

Just think, that famous Turtle
Wax® finish in less than 15 minutes.
The impossible is now possible with
new Minute Wax™ silicone car wax.

Spray it on.
Wipe it off.
No waiting.
No hard buffing.

That famous
Turtle Wax® finish
in less than 15 minutes.
Great Guns

Fascinated by the information that a 2,700 pound projectile can go from zero to 1,700 mph within the 58 feet of a battleship's 16-inch gun barrel (see page 73), we had a question: How fast, we wondered, was that same shell going at the end of its 20-plus-mile trajectory? With the Pentagon on the other end of the phone, we requested to know the 16-incher's "terminal velocity"—aware that proper terminology is everything when approaching the military. The Navy said it would get back to us.

A few days later, word came that the "terminal velocity" of the shell is zero.

It turns out that the Navy measures "impact velocity" of a projectile at a theoretical point one foot from a target. For a 16-inch shell, it's about 1,100 mph.

Oh, the humanity...

Are you ready for Blimpboard? It's being billed as an indoor advertising medium, suitable (it says here) for arenas, gymnasiums, malls and schools. The blimp is 5 feet long and filled with 14 cu. ft. of helium (breathe easier; sports fans). It flies and maneuvers entirely by remote control, powered by batteries driving three gondola-mounted motors. Promotional messages can be silk-screened on the blimp's sides; or a banner can be flown beneath it. And for getting out of those tight corners, it offers a unique function: It flies in reverse. Blimpboard is at 1636 North Woodland, Provo, Utah 84601.

PM's Whatsit

Given the culture's inclination for poetry in plumbing, you might easily guess at first sight that the device shown in this photo sprang from the brow of a Frenchman. Correct. In addition, what's happening is quite clearly indicated—all you have to do in this case is believe it. You don't? Turn the page.
Whatsit revealed

What the Société Française de Développement et Distribution has wrought—and already has marketed to some European restaurants—is a public convenience which has three interchangeable seats and presents each user with one that has been newly cleaned and disinfected. A chain conveyor pulls the used seat into the cabinet, simultaneously positioning a fresh version. The entire process, including a rotary scrubber, is initiated and driven by normal water pressure, adding greatly to the context of the word, flush.

Klystron Kops

Make way for the video police. As of a recent Appellate Court decision overturning a previous ruling in favor of Sony Corp., several retailers and one poor stiff who told the world he had bought videotape in order to record copyrighted material (films) on his VCR, it is illegal to tape movies at home. (See PM Electronics Monitor, page 10, March 82.)

There is a petition before the Supreme Court asking it to hear an appeal of the appeal (unlikely—since the Court has agreed to hear only five copyright cases in its entire history). There is also Congressional legislation in the committee—Fearing stage which would bring videotaping for home use under the Fair Use Doctrine—making it licit.

But the movie industry, under association kingpin Jack Valenti, has found some Congressmen sympathetic to a bizarre proposal: that a surcharge be placed on both videocassette machines and blank tape, paid ultimately by the consumer, for pooling and eventual dispersal to producers whose films are being copied.

The concept that innovative technology should cost us more just because it has leapfrogged conventional marketing structures is a hard one to swallow. And doesn’t this “probable use” precedent invite, say, music publishers to tax Xerography supplies?

Through their industry association, the tape and VCR marketers are pursuing legal remedies and lobbying hard. But there may be a simpler solution: Every time a Hollywood producer turns out a movie that is unfit for home taping, for reasons of content or execution, he’ll be assessed a sum to be pooled for return to owners of videocassette equipment.

Poles apart

TechEx is a combination exhibit and seminar for technology exchange and licensing sponsored by an internationally known, Florida-based firm, Dvorkovitz & Associates, specialists in technology transfer. At this year’s U.S. TechEx show, held recently in Atlanta, several East Bloc countries had scheduled exhibits. (Because of lack of manufacturing capacity, most of the Warsaw Pact nations, including the U.S.S.R., are active in licensing their technological developments and inventions.) They all showed up—except the contingent from Poland, which cancelled “because of circumstances beyond our control.” The sponsors presented an exhibit anyway (photo): a black curtain—upon which descriptions of the Polish inventions that were to be shown were hung—plus a suitable floral arrangement.
It comes to grips with almost any condition.

Goodyear’s all-season, all-terrain, all-position Wrangler Radial.

Rain, mud, sun or snow. Wrangler All-Season Radial helps you drive through almost any weather.

Its tread and construction give you the traction characteristics of a mud-snow tire.

The fact is, Goodyear Wrangler Radials were developed and proved in off-road racing. Through deep mud and sand, over sharp rocks.

And, unlike some tires of its type, Wrangler Radial has a tread computer-designed for quiet highway driving.

Wrangler Radial also has steel-belted construction. With the greater strength, flatter footprint, longer tread life, and slightly better fuel economy of radials over bias-ply tires.

So put your truck on the radial that comes to grips with almost any condition. The all-season tire that’s identical to the one we race.

Goodyear’s all-season, all-terrain, all-position Wrangler Radial.

GOOD YEAR
QUALITY AND INNOVATION
CANADA AT ITS BEST

The whisky that's becoming America's favorite Canadian.

Share some tonight.

Anatomy Of A Wing-Walk

Don't call it a stunt, says a pilot who put a world's record 19 souls on an airplane wing and calls it 'an adventure in engineering.'

Writer Martin Caidin has always been obsessed by airplanes, but his life took on another dimension when he acquired a vintage German Ju-52 transport several years ago. A frequent airshow participant, Caidin was looking for something new to do with his bird, dubbed "Iron Annie," when the idea of a record-setting wing-walk came up...

PM Why did you do this stunt?
MC Don't call it a stunt. That's the last thing it was.

PM Then what would you call it and why did you do it?
MC I'd call it an answer to a challenge. An engineering adventure. A dream for a pilot. A lot of people said it simply couldn't be done. That tells you what it was—a challenge, engineering, pilotwise and personal.

PM Describe how you prepared for the, well, let's call it the event.
MC It started a few months before we began getting ready to try for the world's record—14 people outside an airplane. Around Christmas in 1989, U.S. Army sky diver Phil Regge asked if I ever tried putting people out on the wing of the Ju-52. We'd done it a few times, but it was small stuff. So we decided to try it by putting people almost all the way out instead of hugging the fuselage?

PM How many people?
MC We figured seven on the wing and a couple atop the fuselage. Remember, we had no idea what would happen. We took off the left door, tied ropes all over the place and went up to 9,000 feet. I figured I'd better cut power so the prop blast wouldn't dump these guys off the wing. I was hitting about 115 mph when out they went on the wing and... good-by life! The control yoke in my hands went mad and jumped around and she rolled right over on her back.

PM That plane went inverted?
MC She rolled over on her back as pretty as you please. Shaking like mad, and went down in a gentle rolling dive and got up to about 160 mph true airspeed. Those guys out there on the wing were hanging on and yelling like maniacs. At 5,000 feet, I hit power, they let go of the ropes, the shaking stopped and we pulled out. It was a terrific ride.

PM And that gave you the idea for the world's record?
MC It sure did. We figured if we could have seven on a wing and two atop the fuselage, without any power, we could fly with 18 people on the wings.

PM You said wings, plural. Did you try it that way?
MC We sure as hell tried. We

(Please turn to page 61)
CHANGE THE WORLD.

It's easy with the Cokin Creative Filter System.

If you can snap a picture, you can create a magical city. Light up the day with stars. And turn ordinary things into extraordinary works of art.

You can travel anywhere your imagination will take you — and come back with brilliant pictures. All you need is the amazing Cokin System and any 35mm SLR camera.

Simply attach the unique Cokin filter holder to your lens with an easy adapter ring. And the fun begins.

Each filter holder holds up to three Cokin filters. You create dazzling effects, effortlessly, by slipping filters in and out. As you look through the viewfinder, you'll let your eye see what you've created instantly. What you see is what you like, press the shutter and you've got it.

With over 100 filters to choose from, the possibilities are endless. There are rainbows, pastels, prisms and more. Special effect close-up, diffraction filters and more.

Visit your local camera outlet and ask for Cokin. We've even expanded the System. Cokin filters easily fit medium format, movie, TV cameras and enlargers. And almost all the lenses that go with them. From 35mm to 82mm filter diameters.

Whether you travel around the world or around the corner, changing the world is simply “funtastic” with Cokin.

Cokin®
CREATIVE FILTER SYSTEM
Marketed by Minolta Corporation

Find out how easy it is to change the world! Send check or money order for $1, made payable to Minolta Corp. We'll send you a 40-page booklet with 158 full-color examples of Cokin filters in action.

Mail to:
Cokin Creative Filter System, Minolta Corp.
P.O. Box 600, Garden City, N.Y. 11530

NAME (PLEASE PRINT)
ADDRESS
CITY
STATE ZIP

©1981 Minolta Corporation MEC-B

Please allow 4-6 weeks for delivery.
Self-powered ratchet

You've seen the electric-powered wrench and the air-powered wrench. Now meet the battery-powered wrench. The Redi-Ratchet is supposed to spin threaded fasteners on and off all day on a three-hour charge to its NiCd battery pack. We didn't use it long enough to test that, but we did find it strong: The ¼-inch car's battery, you'll find that using a battery disconnect switch is easier than removing battery cables.

Safety/Switch Model ST-9 for side-terminal batteries lets you cut the juice simply by flipping a knife switch.

The unit is rated at 250 amps continuous use, and uses cast brass and copper construction. We found it to be a well-made, heavy-duty switch, which accounts for its $19.95 price tag.

Once the power is cut, you can work safely on your car's electrical system.

It's from Paragon Manufacturing Corp., 622 13th Avenue S., Hopkins, Minn. 55343.—T.A.

Battery-operated Redi-Ratchet provides 20 ft-lb. of torque. Free speed is 110 rpm.

A drive tool turns with a free speed of 110 rpm and supplies up to 20 foot-pounds of torque. The wrench can handle up to 100 foot-pounds of torque.

Weighing in at 3¾ pounds, the ¼-inch wrench uses a grease fitting to lube its reversible ratchet mechanism. A slim profile and 360-degree rotatable head help you work the tool in tight places.

The price is $180 for ratchet and battery charger from Ingersoll-Rand, Dept. 50707, 253 East Washington Ave., Washington, N.J. 07882.—T.A.

Battery disconnect switch

If you're looking for a quick and easy way to temporarily disconnect your car's battery, you'll find that using a battery disconnect switch is easier than removing battery cables.

Safety/Switch Model ST-9 for side-terminal batteries lets you cut the juice simply by flipping a knife switch.

The unit is rated at 250 amps continuous use, and uses cast brass and copper construction. We found it to be a well-made, heavy-duty switch, which accounts for its $19.95 price tag.

Once the power is cut, you can work safely on your car's electrical system.

It's from Paragon Manufacturing Corp., 622 13th Avenue S., Hopkins, Minn. 55343.—T.A.

Clip-on sun visor

Driving into the blinding late afternoon sun is a hazardous condition easily dealt with, thanks to Yankee Products' foldaway sun visor. It's an oldie, but a goody. The smoked plastic shield mounts to the sun visor with two slide-on clips. No tools are needed. When not in use, the visor flips up and out of sight.

I found this Yankee product in the automotive section of a large department store for $3. Yankee Products has a free catalog of its wares.

You can obtain one by writing to Box 210, 25 Grand St., Norwalk, Conn. 06852.—Joel Breault

Lifting the fog

The Tracer Chemical Corp., out of Tampa, Fla., has just begun selling its antifogging compound originally developed for NASA.

The TRX Anti-Fog Composition will eliminate fogging on both plastic and glass. It did a good job on my motorcycle helmet face shield and the car windshield, and also worked well on goggles and the bathroom mirror.

The small, 1-ounce bottle I tested is said to be good for 25 applications the size of the average auto wind-

Smoked plastic sun visor clips onto regular visor and folds away when not in use.

Wet- or dry-use sandpaper uses silicon-carbide abrasive, comes in variety of grits.

grit to super-fine 1200 Type WTCC.

Each sheet retails for about 75 cents and must be ordered in bulk. Contact Emgee Marketing Co., 5802 Tennessee, Clarendon Hills, Ill. 60514.—Joel Breault

The right stuff

We've found that rubbing out new paint jobs requires a lot of muscle and a really fine-grit sandpaper. If you've got the muscle, Nikken's got a good waterproof sandpaper for either wet or dry use.

The silicon carbide closed coat is available in "C" weight 9 x 11-inch sheets ranging from 80 Type RRCC to super-fine 1200 Type WTCC.

Each sheet retails for about 75 cents and must be ordered in bulk. Contact Emgee Marketing Co., 5802 Tennessee, Clarendon Hills, Ill. 60514.—Joel Breault

Anti-fogging compound, originally made for NASA, stops fogging on glass and plastic.

shield. It costs about $2.50 plus shipping, and you can order the product by writing directly to Tracer Chemical Corp., Box 7494, Tampa, Fla. 33673.

—Joel Breault
Quality is Job 1

“My job is to help prevent wind noise and water leaks.”

Gary Lilley
Weather Stripping Installer
Kansas City, Missouri
Assembly Plant

Everybody talks about quality, Ford people make it happen.

Our engineers create a design and specify materials that protect against wind noise and water leaks. People like Gary Lilley carefully fit weather stripping to provide a pleasing interior environment for driver and passengers in every Ford vehicle.

This dedication to quality at Ford Motor Company is paying off. Latest results show a 48% average improvement in quality over 1980 models as reported by new car owners.

Visit a Ford or Lincoln-Mercury dealer and take a close look at what total employee, management, union and supplier involvement can achieve. At Ford Motor Company, Quality is Job 1!
Troubleshooting Ford's Microcomputer Control Unit

by Mort Schultz

PART 2

Low-temperature switch (far left), transmitting data to an electronic control module (ECM), computer of the MCU system, by way of the harness plug. Test procedures for the switch vary, depending on engine displacement.

If you don’t have a copy of the April 1982 Saturday Mechanic on hand, rustle it up. You’ll need the chart it contains that lists parts of the Microprocessor Control Unit (MCU), which is what Ford Motor Co. calls its computerized engine control system.

The April article (Part 1, Troubleshooting Ford’s Microcomputer Control Unit, page 53) outlines which engines have the MCU. The MCU system regulates various engine functions and includes a self-diagnostic function. The system provides diagnostic messages in the form of numerical service codes, presented as intermittent voltages. The service codes reveal whether the MCU system is working properly; if it’s not, the codes locate the trouble area. And the self-diagnosing feature of MCU makes troubleshooting a job you can do yourself.

The purpose of troubleshooting the MCU is to determine if a part of the system is causing poor engine performance. To check the MCU, you’ll need one of two instruments: the Self-Test Automatic Readout (STAR) unit or an analog voltmeter.

STAR (part No. 07-0004) is about $125 from Ford/Mercury dealers or parts and accessories stores that sell Rotunda products. The STAR displays two-digit service codes to let you know the source of a problem.

If you choose to use an analog voltmeter instead of the STAR, it should have a 0 to 20-volt d.c. scale. You’ll also need a jumper wire.

With a voltmeter, you have to count pulses of the voltmeter needle to read the service codes. Interpreting this takes practice.

The first pulse or series of pulses is equivalent to the first digit of the two-digit code a STAR unit would display. Then there is a pause, followed by another pulse or series of
pulses, which is equivalent to the second digit of the two-digit code STAR would display.

If you use STAR, an “11” is displayed to let you know the system is okay. A voltmeter registers an “11” when the needle rises for ½ second, drops to 0 for 2 seconds, then, rises for another ½ second. To verify the reading, keep the voltmeter in place. After a pause of 4 seconds (needle on 0), the cycle will repeat itself.

Take another example. A STAR display of “42” indicates that a rich fuel mixture is affecting engine performance. The trouble could be a sticking choke, high resistance in a fuel-control-solenoid circuit or a malfunctioning exhaust-gas oxygen sensor. The voltmeter would display a code 42 in the manner shown in the illustration on page 36.

Before testing the MCU
Before you begin the MCU diagnostic check, make sure all other potential sources of poor engine performance have been eliminated. This includes general electrical problems, vacuum leaks, ignition component malfunctions, problems in carburetor systems not controlled by the MCU, various emissions-control part malfunctions and internal engine problems.

If problems persist, proceed to troubleshoot the MCU. Warm up the engine to normal operating temperature—that is, until the upper radiator hose feels hot. Then, shut off the engine, place the transmission in PARK or NEUTRAL, engage the parking brake and make sure all accessories are off.

There are two conditions that can upset this procedure: 1. The engine won’t start; 2. The engine problem you’re trying to solve occurs only when the engine is cold. In both cases, you can’t use the MCU self-test feature, but must try a different troubleshooting procedure.

Engine won’t start
The only way the MCU can keep an engine from starting is if the TACH input circuit to the MCU computer is shorted to ground. This causes current to bypass the ignition coil primary. If the ignition coil isn’t getting current, neither will spark plugs. The engine, therefore, can’t start.

If a no-start condition exists and all conventional causes have been ruled out, there might be a short. The short could be in the wiring harness from the ignition control module or in the MCU computer. To discover and locate a short do the following:

1. Disconnect the horseshoe-shaped connector from the top of the coil. Disconnect the plug that attaches the ignition control module to the horseshoe connector and the distributor. Then measure resistance with an ohmmeter between the terminal on the horseshoe connector marked TACH and ground.

2. If the resistance is greater than 1,000 ohms, the MCU system is not the cause of the no-start condition. If resistance is less than 1,000 ohms, disconnect the MCU module from the wiring harness and measure resistance again. If the resistance measures less than 1,000 ohms, the fault is somewhere in the circuit that Ford refers to as circuit 11 in its wiring-diagram manual. If the resistance is greater than 1,000 ohms with the MCU module disconnected from the wiring circuit (but less than 1,000 when connected), the MCU control module is defective.

You can’t repair the MCU control module. It must be replaced, but remember that the MCU system, including the control module, carries a 50,000-mile/five-year warranty, whichever comes first. However, if you go back to the dealer, don’t tell him you’ve been troubleshooting the MCU system: He can probably void the warranty.

Handling cold-engine problems
All MCU systems have a low-temperature switch that sends signals
If there's no vacuum, find the ported vacuum switch (PVS) at the other end of the vacuum hose. The PVS controls vacuum to the temperature switch, so that it's supplied only when the coolant temperature drops below 95°F.

Disconnect the vacuum hose that extends from the engine to the PVS. With the engine running, check for vacuum to the PVS by holding your finger over the end of the hose. If there is vacuum, the PVS is bad. Replace it. If there's no vacuum, check the vacuum hose from the engine to the PVS for a leak or blockage.

**V8 engine:** This engine uses two low-temperature switches that are activated electrically. One should open when engine coolant is below 128°F. The other switch should open when the engine coolant is below 55°F. Those switches are tested during the MCU “functional” or diagnostic test.

### Connecting test equipment
To connect the STAR, keep the ignition off and attach the ground (black) lead to the battery negative terminal, test output (red) to the output terminal of the MCU computer self-test connector, and test trigger (white) lead to the self-test trigger terminal of the self-test connector. The self-test connector is a plug attached to the MCU computer (electronic control module).

Once the STAR displays a service code, it will keep showing it even if you disconnect the unit from the vehicle. To erase a code, press the push button or turn off the power switch.

The STAR indicates when its bat-

---

To test the low-temperature switch on V8 engines (right), turn engine off, disconnect the switch and test the resistance across the terminals. You should tap a knock sensor with a light hammer in order to begin the MCU testing cycle.

---

Attach voltmeter and jumper wire to trigger the MCU system into the self-test mode. The voltmeter needle will begin to pulse, as indicated in the illustration. This particular example indicates a code 42 (four pulses, a short pause, followed by two pulses).
battery has to be replaced. When the STAR is turned off, the battery will appear briefly in the upper left-hand corner of the display window. This is normal. However, if the battery stays on, turn off the power switch and replace the 9-volt battery.

To use an analog voltmeter rather than the STAR, make sure the car ignition switch is off. Connect a jumper wire between the self-test trigger and ground of the self-test connector by clipping the jumper alligator clips between two of the terminals you can see in the self-test connector plug.

Hook up the voltmeter (+) lead to the battery positive post, and the voltmeter (-) lead to the self-test output of the self-test connector. Set the voltmeter d.c.-volt selector switch to the 0 to 20 d.c. scale.

If you're testing the MCU system of a four- or six-cylinder engine using a STAR or voltmeter, disable the canister purge valve of the fuel evaporation control system to prevent a wrong signal to the computer, indicating that the engine is operating on a rich fuel mixture. To do this, disconnect the charcoal canister hose from the canister purge valve and plug it with a golf tee or pencil.

If you're testing the MCU of a V8 engine, remove the PCV valve from the valve cover to prevent a wrong signal to the computer when the engine is warmed up, indicating that the fuel mixture is too rich.

On V8 engines equipped with a vacuum delay valve (a washer-shaped, two-color valve that is spliced into a vacuum line in the air-
pump control system), there's a tee and restrictor in the thermactor vacuum control line. The restrictor must be unclipped during the functional test.

**Getting test grades**

To perform the diagnostic test on a V8, perform the following:

1. **Make sure the engine is fully warmed and the upper radiator hose is hot and pressurized.** Connect the STAR or your analog voltmeter as described. Turn the STAR on. It should flash "88," then "00." Press the push button. Run the engine at 2,000 rpm for 2 minutes, then shut it off. Restart the engine immediately and allow it to idle.

2. **If you're working with the STAR, a code 40 should appear.** If you're working with a voltmeter, the needle will pulse four times. The throttle kick will increase the idle speed. Either of these is the initialization code. On cars equipped with a knock sensor, place a ¼-in. extension on the manifold near the base of the knock sensor. Tap the end of the extension lightly with a small hammer for 15 seconds as soon as the initialization code appears.

3. **After the four initial pulses or code 40 appears, record voltmeter pulses (transcribed into service codes) or the STAR service codes.** Within 90 seconds, the throttle kicker will retract. If a code 11 is displayed, the MCU system is okay. For vehicles equipped with universal ignition modules, however, Ford prescribes additional tests if the vehicle has detonation problems at wide open throttle and/or poor performance.

To perform the diagnostic test on a four- or six-cylinder:

1. **Make sure the engine is fully warmed.** Connect the STAR unit or analog voltmeter as indicated. Turn the unit on. If it should flash "88," then record a steady "00." To receive service codes, press the push button.

2. **If a code 11 appears, start or restart the engine.** Increase engine speed to 3,000 rpm and watch for a code 20 or 30 on the STAR, two or three pulses on a voltmeter. If code 11 reappears, the basic MCU system is sound, however, Ford recommends additional component tests. If a malfunction code appears, additional subtests are necessary.

The chart in the April '82 issue outlines service codes and what components of MCU may be involved.

*Note:* In a case where a code or pulses indicate a malfunction, a different code or number of pulses may show itself during the "repeat" cycle. This indicates that more than one malfunction exists. Furthermore, during four- and six-cylinder tests, if you get a code 11 during fast (or slow) idle, but a different code during slow (or fast) idle, there's a malfunction. The only time you don't have a problem in the MCU system is when code 11 or pulses equivalent to code 11 appear during both the fast- and slow-idle phases of the test.
NOW FIRESTONE LIGHT TRUCK RADIALS COME WITH A SPECIAL BONUS: COLEMAN CAMPING GEAR.

Here’s a deal so good no true outdoorsman can pass it by.

It starts with the Firestone line of steel belted light truck radials: ATX™, the one that’s been winning big in off-road racing; Steeltex™, our tough all-position light truck radial; and the Steeltex Radial Town & Country™ with its special deep biting traction tread.

And now, for a limited time, with each one you buy, we’ll give you a coupon good for a special super saver’s discount on your choice of a Coleman® portable air compressor, cooler, stove, or lantern.

To be sure you don’t miss out on this great offer, get the details now at your participating Firestone tire retailer. He’s got the tires to get you to that special spot. Plus the Coleman camping gear to help you enjoy it more.

Coastal Inflator-All® Portable Air Compressor
$29.35 plus shipping and handling

Coastal “Lunch Pack™” Cooler
$10.47 plus shipping and handling

Coastal Deluxe 2 Burner Stove
$35.91 plus shipping and handling

Coastal Double Mantle Lantern
$28.60 plus shipping and handling

Firestone
Offer ends November 30, 1982
Living in the past
My 1981 Dodge Aries (2.2-liter engine and automatic transmission) is a pleasure to drive, except for one thing. Upon starting out, the car hesitates so badly it nearly conks out. Pushing the accelerator pedal down makes it suddenly catch hold. The dealer says he replaced the accelerator pump in the carburetor, but the engine still stumbles badly. Any ideas?—Don Launderback, Hickory, Pa.

Faulty accelerator pumps are a major cause of hesitation, but not the only cause. There are a number of other possible conditions that can cause initial stumble. They include a sticking secondary throttle valve, a dirty idle-transfer port, or even an incorrect idle-speed or idle-mixture adjustment. If the problem occurs only when the engine is cold, the EGR system may be malfunctioning.

I would, therefore, ask the dealer to get out his 1981 Engine Performance Manual for Aries, Reliant, Omni and Horizon. It explains how to diagnose hesitation problems. Note, in particular, the chart on page 14-6 of the manual. It explains what to do if the hesitation occurs only when the engine is warm, or under both warm and cold conditions.

There's another publication that can help your dealer get to the bottom of this and other driving problems exhibited by both 2.2- and 1.7-liter engines. It's called Driveability Test Procedure, 1982 Electronic Feedback Carburetor System. The booklet provides a step-by-step troubleshooting procedure for every component that can conceivably cause the kind of driving problem you're having.

Licking clicking
Not long after purchasing a new 1978 Chevrolet Malibu station wagon, I noticed a faint clicking from the wheels that increased and decreased in intensity with speed. The Chevrolet dealer said he couldn't hear the noise, so we took the car to an independent brake mechanic who turned the rear-wheel drums on a lathe, thinking that perhaps they were out-of-round. There seemed to be some improvement, but the noise is again as loud as ever. Our brakeman now says the front-wheel rotors are wearing heavily on the side closest to the axle.

The Chevrolet dealer says this is normal and that rotors should be turned when I have new pads installed. I understand new rotors cost $80 each. Is there anything I can do to correct this condition and avoid the expense of new rotors? Do you know of any remedy for the clicking noise?—Wesley R. Kimbel, West Covina, Calif.

It seems that you are concerned about two separate problems: rotor wear and a clicking noise. I'll assume that they're not related, in that you seem to have determined that the noise is coming from the rear.

First, why do you assume your car needs new rotors? Maybe it does, and maybe it doesn't. Your dealer said rotors would have to be turned—not replaced.

I agree with the dealer that it's normal for rotors to wear more heavily on the axle side. When braking, the pressure exerted by the pistons is on the inner brake pads, which apply on the inside (axle) part of the rotors.

Rotors can be turned and reused as long as the minimum-thickness dimension embossed into them is not exceeded.

For example, if the refinished dimension found on a rotor calls for a minimum thickness of 1.230 inches, and your rotor after refinishing is 1.230 inches or thicker, keep the rotor in use. But if the thickness after turning is 1.215 inches, replace the rotor.

However, due to uneven wear, some rotors have maximum machining specs for each face, in addition to a minimum thickness spec.

In respect to the clicking noise, the fact that it diminished when the rear drums were turned indicates that the brake mechanic was on the right track.

It's quite possible that one of your rear axles is slightly bent. This might cause the drum to contact the rear shoes in such a way as to create the clicking noise. When the mechanic reinstalled the machined drums, he probably loosened up the brake adjustment, which caused the noise to be diminished. Another possibility is a bad rear axle bearing. A faulty rear brake component is a third candidate.

Biting the hand...
The front wheels of my Volkswagen Rabbit diesel are extremely difficult to turn when the car is standing still and just plain difficult when underway. My ungrateful little rascal has stricken back at me several times, leaving me with fingers that felt as if they were gnawed by a dog. Assuming a power steering unit would solve this problem, I'm wondering if it would wipe out whatever engine power my airconditioned Rabbit now possesses. Can you tell me?—Norman Williamson, Jr., Claremont, Calif.

Probably, if you don't have a 1982

Say ahh
The number of complaints about cold-engine problems—stalling, surging and hesitation—has risen sharply since early in the 1970s when manufacturers started equipping cars with preheated intake air systems (so-called thermostatic air cleaners). This system has a damper valve operated by a vacuum motor which, in turn, is controlled by a temperature sensor in the air cleaner. By providing warm air, it allows a cold engine to run at a cleaner choke setting than it otherwise would. When you check this system, you may have trouble seeing the damper valve, which is buried deep inside the throat of the air cleaner snorkel.

A solution is to hold an old rear-view mirror at the mouth of the snorkel and, if necessary, to aim a flashlight down the throat. Start the engine, which should be cold. The damper valve should close. As the engine gets warm, the valve should open slowly.
Most guys go through job after job before they finally land one they can build into a career. In today’s high-tech Navy, you can start with a job important enough to become a career.

Learning a valuable career skill is an important part of your Navy Adventure. And it starts when you choose the kind of job or technical training that’s right for you. The Navy offers training in fields like electronics, computers, aviation mechanics — over 60 career areas in all.

Then the Navy gives you the training and experience you need to master the career skill you chose. In the Navy you use the most up-to-date equipment and methods in your field. In-school training and on-the-job experience can give you a level of technical skill and professionalism second to none.

Becoming the best at the job you want to do is important to your future, and important to the Navy. Because today’s Navy depends on modern equipment and the men and women who operate and maintain it.

And the modern Navy pays you like the skilled professional you are. You’ll earn over $550 a month, right away, with special pay for sea duty, and other benefits like food and housing, medical and dental care. That’s good starting pay for any job, and in the Navy that job can be the start of a career.

Navy. It’s Not Just A Job, It’s An Adventure.
model. From the sound of your letter, I don’t think you do.

Volkswagen did not equip pre-1982 Rabbits with power steering. Neither does it have a retrofit power steering kit for pre-1982 models, diesel or gasoline.

For 1982, VW is offering power steering as an option. However, the sizes of Rabbit engines have been increased to compensate for the added load. Pre-1981 Rabbit diesel engines are 1,471 cc in size, but the 1981 Rabbit diesel is 1,588 cc. The 1981 Rabbit gasoline engine is 1,715 cc. Previous-year models with gasoline engines have either 1,457-cc, 1,471-cc or 1,588-cc engines, depending on the year.

Make sure your tires are fully inflated. Underinflated tires can make the steering “heavier” than it should be. Tires that are wider than original equipment can produce the same result.

**Ins and outs**

On five occasions over the last two months, the 3.7-liter V8 diesel engine of my 1980 Oldsmobile Delta 88 has died on me while traveling on a level road at a speed of about 20 mph. There’s never been a problem getting started again. At higher speeds, the engine performs flawlessly. I’ve changed the fuel filter, but it hasn’t helped.

The car had been driven only 8,700 miles when the trouble started. What could be the cause? —Harry Westerberg, Portland, Ore.

Since I received your letter toward the end of winter, I would say that the most likely cause of the condition that you describe is fuel waxing.

Although this condition generally causes hard starting, it frequently results in the kind of performance you describe when a garage-kept car is driven in cold weather. Is your car equipped with the fuel-heater option? If not, it should be in an area where the temperature drops below 20°F. It’s also important that you use winterized fuel.

Another possibility is that the mechanical fuel-delivery pump, which looks just like a conventional gas-engine fuel pump, has failed. It can be pressure-tested in the same manner as the conventional pump.

There’s also a chance that the cause of your trouble is inside the fuel-injection pump with a sticking

**Hat trick**

If you get a higher-than-normal fluid level on a dipstick, maybe it’s filled itself. Suppose the engine oil level reads “overfilled” after an oil change, when you know the engine’s been filled with the amount of oil specified by the manufacturer. Check the retaining cap on the dipstick. It may have come loose and been pushed up as you shoved the dipstick into the tube. This will cause the dipstick to sink deeper into the oil than it should, and the level will read higher than it really is. To repair this, position the dipstick so the oil level reads full. Slide the cap down until it rests on the tube, remove the dipstick as you hold the cap steady and braze or weld the cap to the dipstick.

Make this repair after changing the oil and the oil filter and running the engine a while when the correct amount of oil is in the engine and the filter is already filled.

---

**WE’RE NOT JUST ANOTHER FLASH IN JAPAN.**

It’s true that Nippondenso Spark Plugs are original equipment in Toyota, Honda, Subaru, Mazdas, and other Japanese cars and trucks, as well as on Suzuki, Yamaha, Kawasaki, and Honda motorcycles.

But then ND plugs also meet the factory specifications for major American and European makes as well.

In fact, Nippondenso is a leader in electronics technology for just about everything that moves on wheels.

So if you thought ND plugs were just for Japanese machines... have we got a flash for you.

**NIPPODENSO**

The Fastest Growing Spark Plug in America.
Does The Sharp-All Pay
YOU BET

$100.00
a day
$32 in
2 hours
Wanted
Retire

Can't beat it

Recently I had three days in a row here I made
over $100.00 a day

William J. Mitchell, Tempe, Arizona

I have had excellent results with the Sharp-All... you just can't beat it... it is easy to set up, doesn't take long to change stones... all in all, it is no trouble to work with.

LaVerne Helm, Canton, Kansas

There's always work in a sharpening business of your own if you want it... Yesterday, I made $32.00 in two hours.

Dave R. Lewis, Hequaham, Washington

I had dreamed of retiring for years, but was afraid to quit my salaried job. I had never used this type of equipment, but the Sharp-All was real easy to learn. I sharpened 30 blades my first week—without advertising at all. Now, for the first time in my life, I can say that I am content.

Farris Cornelius, Wellington, Texas 79095

No Selling, No Inventory... Year Round
Cash Profits and YOU Set The Hours!

machining valve or a weak governor weight retainer. If so, the pump has to be disassembled to clean or replace the metering valve or to replace the governor unit. This job should be done by a technician trained in handling Roosa Master pumps, which are manufactured by Stanadyne Inc.

However, before getting involved in pump overhaul, there are three more "exterior" conditions that should be checked.

One of them concerns the fuel-return line which comes off the fuel-injection pump and goes to the fuel tank. This line helps maintain a specific differential pressure inside the pump, which is necessary to maintain the right amount of fuel delivery.

If the fuel-return line is partially plugged, the differential pressure is thrown out of wack, upsetting correct fuel delivery.

Another condition that may cause low-speed stalling is an air leak into the fuel system.

The slightest leak in the diesel fuel system—even one so slight that fuel won't drip through to reveal the leak—will draw air into the system to displace fuel. When this happens, a condition occurs that is similar to vacuum lock in a gasoline engine.

Your diesel starves for fuel and may stall, be hard to start or emit excessive amounts of smoke. How it reacts depends on how large the leak is and at what speed the engine is being run.

The air leak could be located at the injection-pump suction line, at the inlet fitting of the fuel filter, at any of the fuel-line clamps or at any one of a number of other places. Determine if there is a leak by splicing a short piece of clear plastic hose into the return line where it leaves the injection pump. Start the engine. If you see foam or air bubbles in the fuel flowing through the plastic hose, there is an air leak. To find the leak, examine all connections for moistness. Check the condition of all clamps and hoses.

It's also quite possible that general fuel-system contamination is causing your low-speed stall. If so, the tank will have to be removed, drained and cleaned.

GOT A PROBLEM WITH YOUR CAR?
Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be published in the column.

Let FOLEY BELSAW PROVE
You can do it too! On our
30-DAY FREE TRIAL OFFER

SEND FOR FREE FACTS!
Our Free Book tells how to start a profitable, lifetime home sharpening business, how we help you grow, how we'll finance you.

FIND OUT ALL ABOUT IT
No Obligation —
No Salesman Will Call

FOLEY BELSAW CO.
8713 E. HAIL BUILDING, KANSAS CITY, MO. 64114
Send details of FREE TRIAL OFFER and Free Book "Lifetime Security"

Free Book

No Obligation. No Salesman Will Call

SERVICE TIPS

■ According to American Motors, there's something new to worry about if you accidentally reverse the battery cables. You can damage a fuel-feedback module in 1980-82 models, as well as the alternator diodes and radio. So be sure to get them straight.

■ For years, you've heard not to tighten a new filter with a wrench. That's changed now for new GM engines using the small 75-mm oil filters, of which the PF 40, PF 45, PF 47 and PF 51 are the most common. If you can't hand-tighten the filter the number of turns specified on the oil-filter label, use an oil-filter wrench.

■ Engine oil leaking from the rear of the intake manifold of a 1980-82 Chrysler Corp. 318- or 360-cu.-in. engine is probably caused by a rear gasket that's slipped from between the manifold and block. Service bulletin 09-04-82 (1/25/82) tells you how to deal with RTV sealer (part No. 4026070) and a retainer (part No. 4105671) to stop the leak.

■ If you get a misfire when you blow the horn of a 1982 GM 2.5-liter, four-cylinder engine with electronic fuel injection built before November 1981, have a .25-S-RMD capacitor (part No. 1851428) installed between the horn feed wire and ground at the horn connection. Voltage feedback from the horn coil when the horn touts results in irregular injection-unit pulses. Each GM division has issued a service bulletin about this. For instance, the Oldsmobile bulletin is No. 82-T-3.
I figure it's worth keeping so it's worth genuine GM parts.

Mr. Good
And genuine Mr. Goodwrench good service.

Mr. Goodwrench is trained by General Motors to understand GM cars. He knows how to analyze problems. Fix them. And get me rolling again. Fast. And he can get genuine GM parts. To me, it's important to keep my GM car GM all the way through.

I'd expect to pay more, but I find that Mr. Goodwrench is committed to reasonable prices—he has pledged to be competitive with other places. I can go around here for service. Besides that, he gives me a written estimate on request so I know what I'm spending before I've spent it. I like that.

So keep that great GM feeling with genuine GM parts at participating independent Mr. Goodwrench dealers selling Chevrolets, Pontiacs, Oldsmobiles, Buicks, Cadillacs, GMC and Chevy trucks.

WRENCH
**APPLIANCE CLINIC**

**QUESTIONS ANSWERED**

**Plugged up**
My problem concerns the automatic ice maker on my Sears refrigerator-freezer, model No. 100-7820601, purchased 1954. There are made-works line for four or five years, until it suddenly refused to turn out any more ice cubes. I checked every component in the ice cube unit, the ice water valve and solenoid, but could find no fault.

As a last resort, I removed the water valve; at the point where it passes through the back of the box, there was an ice plug preventing water from flowing into the ice maker. All efforts have failed to produce a permanent solution. Your comments and suggestions would be most appreciated.—Stanley Draper, Cerritos, Calif.

Sounds as if the water-fill valve for your ice maker is causing your problem. There’s a possibility that the valve is not seating properly. If a few drops of water leak through the valve when they shouldn’t, these could freeze at the point where the tubing enters the cold water temperature. I suggest replacing the water valve as a complete assembly. The part is No. 627558; it costs approximately $14 at any Sears store.

**Blanket blues**
Can you provide some information on how to repair an electric blanket that won’t heat anymore? If home repair is impractical, I want to buy a new one now, during the summer sales. Thanks for your help.—John Wendling, Chicago

If you think that your blanket isn’t heating, try this test: Fold the blanket as it would be in the box or package. Connect the control thermostat to the blanket and to a wall outlet. Next, switch the blanket on and set the dial to high. Wait 10 to 15 minutes. Put your hand between the folds of the blanket; you should feel warmth.

If the blanket is cold, you will need to take it to an authorized service repair facility or buy a new one. It isn’t a great idea to make home repair on the blanket or control. Electric blankets are made according to Underwriters Laboratories (UL) standards and the electrical components are sealed inside the blanket. Also, the thermostat which controls the amount of heat given off by the blanket is calibrated when the dial is assembled at the factory.

**Tired dishwasher**
I have a KitchenAid dishwasher, Model KDS-17. During the wash cycle, dishes aren’t cleaned satisfactorily. The soap in the soap dispenser is only partially dissolved. The water temperature is 150°F. Could it be that the pump is worn and not pumping the water with sufficient force to remove all the food particles from the dishes?—Robert H. Arman, Lakeland, Fla.

Sounds like your problem may be in one of several areas: the wash arm (a four-way hydro sweep), the wash-arm support, the water-fill valve or the drain valve. First, remove the wash arm. Check the spray holes for any blockage. Turn the wash arm over. Check the area inside at the point that the wash arm attaches to the wash-arm support. Look for any deep grooves in the black plastic. Deep grooves can cause a drop in pump pressure being delivered to the wash arm.

Next, check the wash-arm support (see drawing). The support looks like a black tower; it’s located under the wash arm. Check the stainless-steel pin which protrudes from the top of the support. You shouldn’t be able to turn or move this pin up or down. Look at the bronze split ring below the pin. Check for cracks or possibly a broken ring. If you notice anything wrong with the wash-arm support, you can buy a new one. The support comes as one assembly for replacement; it’s part No. B111431.

Now, check the water level in the tub. Start the dishwasher. Listen for the machine to fill. As soon as the fill cycle stops, open the door. Check the water level. It should be about ¾ in. below the bottom of the wash-arm hub. If there isn’t enough water in the tub, look for a restricted water-fill valve or a leaking drain valve.

**SERVICE TIPS**
Saving energy is as important in summer as it is in winter. That’s why you should get your air conditioner ready for those hot days ahead with a little maintenance now. Here are some tips from Research Products Corp., makers of Ezkleen room air conditioner filters:

- If you notice any mechanical problems toward the end of last summer, have the unit checked by a service specialist; otherwise, basic maintenance will be sufficient.
- Air conditioners need a strong, steady flow of air to perform properly. Filters are used to trap pollen, dust and dirt, so you have clean air at all times. If the filter becomes clogged, airflow is reduced and you won’t get maximum performance from your unit.
- Cleaning your air conditioner is easy. Remove the front panel. Using a vacuum cleaner, work inside the walls, louvers in the front panel and inlet louvers. You may also want to wipe the inside with a solution of water and mild detergent.
- Next, check the air filter. If it’s made of aluminum, wash it and recoat it with filter adhesive. It can be reused for many years. If it’s made of nonwashable material, replace it when it becomes dirty.
- When you start using your air conditioner, keep the following suggestions in mind:
  1. Use your air conditioner according to current energy recommendations suggested by your local utility.
  2. If possible, turn on the air conditioner before the room heats up.
  3. Keep windows and doors closed to prevent escape of cold air.
  4. Use shades, awnings and drapes to keep direct sunlight out.
  5. Keep the grill and register open for proper alignment.
  6. Check and clean the air filter periodically.

**BY STEVE TOTH**
NO WASHERS
NO TOOLS
NO SWEAT

HOOK UP ONE WITH YOUR BARE HANDS

It took Peerless® to take the hassle out of hooking up a faucet. Because with this "no-tools" Peerless® faucet, all you need are your own two hands.

Peerless developed a way to drop in the entire assembly and tighten it—by hand. Then you just connect the supply lines with special quick-connectors—by hand. And you're done.

All Peerless® faucets are washerless—so there are no washers to wear out and cause drips. They all come with the Peerless warranty.* And nobody gives you as many do-it-yourself faucet designs as Peerless. See them all, and choose yours at your Peerless dealer’s Good-Better-Best display.

Peerless makes it easy to be handy.
Durable finish
A well-known maker of quality wood finishing materials—Deft Inc., 17451 Von Karman Ave., Irvine, Calif. 92714—has introduced a new product called Deftco Danish Oil Finish. It is claimed to successfully combine the superior penetrating qualities of tung oil with the durability of polyurethane finishes. At paint and hardware stores, it comes in three shades of walnut and a natural wood tone.—S.W.

New finish is sold in 13-oz. aerosol, pint, quart and gallon cans at these suggested prices: $3.49, $4.94, $6.60 and $19.99.

Tools for master woodturners
For the past six months I have had the joy of working with two beautiful woodturning tools. The first, a 3/8-in.-diameter turning gouge, has to be the best gouge I’ve used. Crafted of M2 tool steel, it’s hardened to R68 and sharpened to a fingernail shape. It comes with a 24%-in. Brazilian hardwood handle for use with extension cords, these simple devices come with 7- or 10-amp. fuses that will tell you right away if you’re putting unsafe demands on a particular circuit. Each plug is about $1.50 at hardware stores. Made by New York Merchandise Co. Inc., 30 West 23rd St., New York, N.Y. 10010.—S.W.

Squeezable P-trap
The Squeeze-N-Flow is a new flexible plumbing trap with several good

Flexible trap fits both 1/2-in. and 1-1/4-in. plumbing lines. It can be installed quickly, using only a screwdriver.

Home and shop update
It seems we got our chemical terminology mixed up in our story, Here’s A Brush Cleaner that Works for All Paints, (page 168, Mar. ’82). Methylene chloride is the compound used in paint cleaners and it is the one we intended to recommend. Chemists tell us that “meth”-compounds are numerous and some are very dangerous, but that methylene chloride is safe if used as we described.

If you’ve come across a new product with some special features, let us know about it. Write to: PM Workbench, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.
YOU-CAN-DO-IT STORAGE: UPSTAIRS, DOWNSTAIRS, ALL AROUND THE HOUSE.

Stanley comes to the rescue! Just when you’re absolutely sure you’ve run out of places to store things, Stanley comes up with a booklet crammed full of great ideas. Free, too. You can build (or build in) all these suggestions yourself—just as long as you’re somewhat handy with tools and wood.

The list starts with a blanket chest/toy chest. A behind-the-couch bookcase with hidden storage for valuables. A pantry on a door. Useful under-stairs storage, too. There are also some suggestions for a home entertainment wall, between studs shelving and much more.

To build these projects, all you need is wood and some standard hand tools—a Stanley saw, hammer, screwdriver, Powerlock® rule, to mention a few. You’ll also want to pick up some basic Stanley hardware—screws, shelf brackets, nails, bolts, etc.

So go to it. There’s a lot of satisfaction to be had in finding and building extra storage space around your house.

Order this free booklet from Stanley, The Do-It-Yourself Company that makes Stanley tools; hardware; weather stripping; shelf standards and brackets; fasteners; garage door openers; replacement entry doors.

GET FREE BOOKLET FROM THE DO-IT-YOURSELF COMPANY

STANLEY® helps you do things right*

The Stanley Works
Ad Services Dept.
Box 1800, PME-2
New Britain, CT 06050

Please send me your free Storage Ideas Booklet.

Name

Street

Town

State

Zip
The large and small of it

Now that the vast middle ground is pretty well filled in with efficient new products, Detroit is looking hard at the fringes of the new car market—big, luxury cars, mini and microcars, and high performance sports and sporty cars. That’s where most of the new product action will be in the next several years.

Honda recently introduced its City mini in Japan. Rumors have it that Mitsubishi, long the supplier of Chrysler’s Japanese imports, may begin importing the front-wheel-drive Minica AMI for its own dealers as early as next year. So Detroit is scrambling for baby cars, too.

In Japan, the Mitsubishi AMI seats four, but weighs only 1,250 pounds and measures just 124 in. on a 79-in. wheelbase. Even in U.S.-legal form, it could get 50-plus mpg from its half-liter, two-cylinder engine. Chrysler may negotiate its own version of the AMI.

In 1985, Ford is looking into importing a similar-sized car from its Japanese partner, Toyo Kogyo, maker of Mazda cars and trucks and Ford’s Courier mini-pickup. The Ford/Toyo Kogyo car also may offer an optional 50-plus mpg diesel.

Meanwhile, Chevrolet is firming up plans to import its own Japanese-built mini, beginning about the same time.

The vehicle will be styled by Giugiaro of Italy, jointly developed by GM affiliates Isuzu and Suzuki, and assembled by Isuzu. Isuzu already supplies Chevy’s Luv mini-trucks and last year established itself as America’s newest car and truck importer.

Slightly larger than GM’s European S-car, but a foot shorter than the current rear-drive T-car (Chevy Chevette/Pontiac T1000), the diminutive GM/Isuzu/Suzuki four-seater should measure about 150 in. overall on a 90-in. wheelbase, weigh around 1,600 pounds and deliver over 40 mpg in the city. It will be powered by an overhead-cam, four-cylinder engine displacing 1.0 to 1.3 liters and will come with a standard, five-speed, manual transaxle.

With fuel supplies high and prices actually slipping at the moment, short-term U.S. demand for such vehicles is not judged to be very high. But it looks like Detroit has decided to prepare itself for changes in the situation.

The Camaro Z28 (above) and Pontiac Trans Am will both be fighting for your attention on the racetracks this season. The Chevy is the official pace car for the Indy 500 May 30, while the TA will circulate with the Grand National stockers at various NASCAR events.

Full-size futures

At the other end of the market, GM’s ‘84 front-wheel-drive C-cars—Olds 98/Buick Electra/Cadillac deVille and the Brougham—seem to be progressing on schedule. Riding on a 108-in. wheelbase, these will be about 2 feet shorter and a half-ton lighter than their current counterparts and are expected to retail for close to $20,000.

Ford plans to come in a year later with new fwd, 106-in.-wheelbase LTD/Marquis replacements. Code-named Taurus, these will be four-cylinder, five-speed-powered in their standard form, and about the size of today’s Granada. A year or so later, an all-new breed of Lincolns will bow on the Taurus platform.

The new muscle car era

Most everyone in Detroit has gotten the message by now: The market is getting bored with economy and ready for renewed excitement—cars that stir the libido, that people buy because they want to, not because they have to. The rebirth of convertibles is one result, and renewed interest in performance is another.

Chrysler engineers are working on supercharging small engines and turbocharging larger ones for extra power at low speeds. Pontiac is investigating a turbo version of its fuel-injected, 1.8-liter overhead-cam Four for future J2000s, and Buick is developing a turbocharged 3.8-liter V6 with multipoint fuel injection for coming sporty models.

Ford, which is back into racing and marketing excitement for all it’s worth, has its Special Vehicle Operations working up super Mustangs and Capris for ‘85 that’ll be “the best-handling cars Ford Motor Co. can do.” They will have turbo four-cylinder power and perhaps an optional turbo Six, as well. And Chrysler is on schedule with a Porsche-looking fwd sporty car with optional turbocharging for the ’84 model year.

On the convertible front, Chevy has confirmed that its ragtop Cava...
We Back Our R.V. Service Coast to Coast

“If we serve you in Seattle, we’ll back you in Paducah.”

- ENGINE & DRIVE TRAIN
- BRAKES • ELECTRICAL
- GENERATOR • A/C, HEATING
- REFRIGERATOR • PLUMBING
- ROOF COATING • AWNINGS
- CHEMICALS & SUPPLIES
- HITCHES • LOAD EQUALIZERS
- SWAY CONTROLS • SUSPENSION AIDS
- BRAKE CONTROLS • LIGHTING AIDS
- TRANSMISSION COOLERS • LP GAS

Now there’s somebody who backs their R.V. service throughout the U.S. and Canada. No matter where you travel, there’s a U-HAUL® REC VEE WORLD® and U-HAUL HITCH WORLD® nearby to stand behind its parts and service work, coast to coast. U-HAUL has over 1,000 Moving Center locations open seven days a week.

ON-SITE OR IN-SHOP SERVICE
We’ll do the job at your place or ours with factory authorized service, parts & supplies.

24-HOUR ROAD SERVICE If you break down while traveling, call 1-800-528-0355 (toll-free).

PARTS, SUPPLIES & ACCESSORIES
Chemicals, directories, maps, hoses, appliances, toilets, pumps, lighting, awnings, TV antennas, tire carriers and more!

COMPLETE TOWING SYSTEMS
U-HAUL HITCH WORLD® has everything you need for your tow vehicle and trailer. With over 35 years experience, nobody knows more about trailer towing than U-HAUL.

Hitches for domestic and foreign cars, trucks and motor homes. All from top-brand names such as REESE, DRAW-TITE and VALLEY. Also custom fabrication for unique vehicles and towing needs.

COMPLETE LINE OF TOWING ACCESSORIES
Brake and sway controls, electrical connectors, transmission coolers, ball mounts, suspension aids, tow bars, mirrors and more!

FIND US IN THE WHITE PAGES UNDER U-HAUL MOVING CENTERS.

Join the winning team. We’re hiring experienced R.V. technicians. Call Don Noel. 1-800-528-0463.
DETOUR LISTENING POST
(Continued from page 50)

dlier J-car will go into limited production for ’83. American Sunroof will do the conversions. Ford is already thinking of moving its soon-to-be introduced soft-top Mustang by Cars and Concepts in-house, if demand justifies it. Pontiac displayed a J2000 convertible at the Miami Auto Show last December, and says it may may not be produced. But the open-air Pontiac was last February’s SAE engineering show.

Automakers should take note, however, of a recent J.D. Power & Associates automotive consumer profile survey. It showed that, while fuel economy had slipped to third on the list of what buyers want from their new cars, dependability/toubl-free operation, and low purchase price were first and second.

Pontiac pace car
Chevrolet’s Camaro Z28 is the Indy pace car for ’82 (Imports and Motorsports, page 20, May ’82). But arche-rival Pontiac has the NASCAR safety car assignment for the 11th straight year. Watch for the bright red Firebird Trans Am at Daytona, Talladega, Charlotte, Darlington and other famous NASCAR tracks. One reason, says Pontiac, is that with its drag coefficient of .309, the new Trans Am just may be the most aerodynamic production car in the world today.

Ford’s going Aero

Last month, we talked about the Continental Concept 90, the striking new Lincoln-Mercury car that’s traveling the auto show circuit. Now Ford has confirmed that this new car provides an excellent preview of its products.

It’s no secret that this Lincoln of the future—except for details like the grille, wheel covers and pillarless hardtop roofline—looks a lot like the sexy ’83 Thunderbird due for introduction in January 1983. Privately, Ford designers say they think everything else will look old fashioned once their slippery new cars start hitting the road.

The truth about diesels

Partly because of their well-known fuel efficiency and range, and partly because they’ve attained a certain amount of status appeal, diesel-powered cars have enjoyed great sales success in the past few years. But there’s talk around Detroit that perhaps diesel growth has just about topped out for the moment.

Now Stanadyne Diesel Systems, America’s leading maker of diesel fuel injection equipment, is speaking out in an understandable effort to win more converts. Their pitch:

Diesels are long-lived and, because they’re compression-ignited, don’t need the regular electrical tune-ups required by gas engines. They do need more frequent oil changes, though.

Diesels are more expensive initially by about $200 to $1,000, but offset that cost through fuel and maintenance savings. Of course, the amount depends on how long you keep the car and how much you drive.

Stanadyne says that the diesel’s disadvantages—sluggish acceleration, difficult cold-weather starting, water-in-fuel problems—can be taken care of by, respectively, turbocharging, electric engine block and fuel heaters, and warning systems, water separators and filters. Stanadyne, in fact, recently introduced an easily installed aftermarket fuel heater.

Manufacturers have made good progress in reducing other minor diesel annoyances such as noise, smoke and odor, and Stanadyne predicts that diesel acceptance will continue to increase in the future.
If your old guzzler is on this list, you're in luck.

AMC
8 Cyl.—1968-76 304", 360" 2 bbl. engines, all transmissions.
6 Cyl.—1970-76 232", 258" 1 bbl. engines, all transmissions.

BUICK
8 Cyl.—1970-76 350", 455" 2 & 4 bbl. engines, all transmissions.
6 Cyl.—1968-75 250" 1 bbl. engines, all transmissions. 1978
231" 2 bbl. engines, all transmissions.

CHEVROLET
8 Cyl.—1968-69 327", 350", 454" 2 & 4 bbl. engines, all transmissions. 6 Cyl.—1963-74
230", 250" 1 bbl. engines, all transmissions.
4 Cyl.—1973-77 140" 2 bbl. engines, all transmissions.

DODGE/CHRYSLE/PLYMOUTH
8 Cyl.—1970-77 318", 440" 2 & 4 bbl. engines, all transmissions.
6 Cyl.—1969-77 170", 225" 1 & 2 bbl. engines, all transmissions.
4 Cyl.—1979-80 1.7 litre 2 bbl. engines, all transmissions.

FORD/MERCURY
8 Cyl.—1962-77 289", 302", 400" 2 bbl. engines, all transmissions.
6 Cyl.—1965-77 170", 200" (incl. 2800cc) 1 & 2 bbl. engines, all transmissions.
4 Cyl.—1971-74 1977 2000cc, 2300cc 2 bbl. engines, all transmissions.

OLDSMOBILE
8 Cyl.—1975-77 350", 455" 2 & 4 bbl. engines, all transmissions.
6 Cyl.—1968-78 231", 250" 1 & 2 bbl. engines, all transmissions.
4 Cyl.—1976-77 140" 2 bbl. engines, all transmissions.

PONTIAC
8 Cyl.—1967-78 305", 455" 2 & 4 bbl. engines, all transmissions. 6 Cyl.—1970-78
231", 250" 1 & 2 bbl. engines, all transmissions. 4 Cyl.—1975-77 140", 151"
2 bbl. engines, all transmissions.

TOYOTA
4 Cyl.—1975-77 1600cc 2 bbl. engines, all transmissions.

If it's there, then there's an ECONOMASTER® brand Fuel Economy carburetor that can improve your car's gas mileage from 5 to 10 percent depending on engine. How's that for luck?
The ECONOMASTER brand Fuel Economy carburetor is the only replacement carburetor designed to deliver improved fuel economy. Many models have enlarged metering ports in the carburetor's idle system to improve fuel conditioning. An exclusive vane-style booster venturi for better fuel atomization. Plus two-stage power valves for improved mid-range efficiency. So you can put that old guzzler on a diet. Fast.

If your car isn't on this list, you may still be in luck. There are ECONOMASTER brand Standard Replacement carburetors for many cars. It can restore your car's original performance.

Holley Replacement Parts Division:
11955 East Nine Mile Road,
Warren, Michigan 48090.

*Actual economy may vary due to application, engine modifications and driving habits.
For passenger cars only.
*Registered Trademark

Holley Makes Fuel Efficient

Holley
Replacement Parts Division

Colt Industries
CHUG A LUG. FREE.

You're invited to a mugging.
Just buy any set of four genuine Cragar wheels between now and November 1, 1982, and get this genuine Cragar lug nut mug Free.

It's a quality-crafted, polished aluminum beauty ready and waiting for 12 frosty ounces of your favorite brew or soft drink.
And every time you hoist it in good company, you'll be reminded of the great-looking set of Cragar wheels you've got waiting outside.
So drop by your Cragar dealer. Pick up a set of dynamite Cragar wheels. And get one for the road. Free.

PHOTO HINTS

Free space
Keep your enlarger off your darkroom table with four scrap pieces of 2x4, each about 3 inches long. This will leave space for a print easel and hundreds of sheets of paper. —Robert Hertzberg

Battery pouch
Remove dry cells from equipment when not in use to prolong their life. Store them in bubble material they came in. Cut bubble from cardboard and tape its two sides to form pouch. —A. Weber

Better safe
An overly bright safelight can fog prints. Cover half a fresh sheet of paper in easel with a black card for two minutes; develop it. If uncovered half is darker, light is too bright. —Robert Hertzberg
NEW NOW for home and shop

A The Miser is a new 120-watt reflector lamp designed to produce the same usable light as a 150-watt spot or flood lamp. According to the manufacturer, a new reflector with slotted sides directs the light more accurately, thus providing the same illumination with a 50-watt savings. The new lamps are interchangeable with all medium-screw-base 150-watt lamps and can be used both indoors and out. Made by General Electric Co., Nela Park, Cleveland, Ohio 44121, they cost about $6 apiece at hardware stores and home centers.

B Heirloom is a new style of replacement plumbing fixtures from Dolly Trim Inc., 3222 East Willow St., Signal Hill, Calif. 90680. The wash basin unit shown features washerless valves, 7/16-turn nonrising stems and metal or porcelain handles. A matching bath fixture (not shown) has an adjustable valve stem that compensates for differing valve depths; this allows you to replace old shower fixtures without having to tear apart the shower wall. Both fixtures are made of solid polished brass and cost about $200 if they are not available at your local plumbing supply store, write to the manufacturer.

C Pine Crest 2 is Champion's newest style of knotty pine lumber paneling. It comes in 4 x 3½ x 96-in. reversible tongue-and-groove boards. One side is rough-sawn, while the other is smooth, with beaded grooves cut so the surface simulates two 2-in.-wide boards (shown). It can be installed vertically—with the use of blocking between the studs—and diagonally and horizontally by simply nailing boards to the studs. It's from Champion Panel Corp., 1 Champion Plaza, Stamford, Conn. 06902. A 10-board package (about 24-sq.-ft. coverage) sells for around $21 at home centers.

D The MasterCutter is a new, all-purpose glass cutter with a nonslip finish made to fit the contour of the user's hand. According to the manufacturer, this design provides better control and less wrist fatigue over extended periods of use. As such, it is a replaceable carbide steel wheel. It can be changed for one of five other wheels that are designed specifically for the type of glass being cut. The tool lists for $12.99 at hardware stores and home centers. It's from Red Devil Inc., 2600 Vauxhall Rd., Union, N.J. 07083.
CAMEL
Where a man belongs.

LIGHTS: 8 mg. "tar", 0.7 mg. nicotine av. per cigarette. FTC Report 1961.
FILTERS: 15 mg. "tar", 1.1 mg. nicotine av. per cigarette by FTC method.

Experience the Camel taste in Lights and Filters.
New Carburetor And Manifold Yield Better MPG

The Z System certainly works. But your payback period may take too long.

You must have noticed the ad: Zora Arkus-Duntov, father of the Corvette, looking tan and fit, is standing next to a Camaro Z28 surrounded by oversize engine parts. The headline reads, “Designed for new levels of efficient performance,” and the copy idles on about “optimum performance combined with fuel efficiency and driveability.”

Despite appearances, Zora isn’t selling Chevrolets, but rather a new intake manifold/carburetor combination. Holley calls it the Z System. And Zora Arkus-Duntov is more than Holley’s answer to Ricardo Montalban. Not only is Duntov the celebrity “spokesman” for the Z System, but he designed it and holds the patent.

According to Holley test and development engineer Frank Walter, who worked with Duntov, almost every carbureted engine has a fuel-feed problem; the cylinders farthest from the carburetor tend to run lean. In order to compensate, you have to run a too-rich mixture to the cylinders near the carburetor. The result is wasted fuel, loss of power and a hesitation under low-rpm acceleration.

When Zora Duntov was hired as a consultant, says Walter, he brought with him a manifold design to eliminate this uneven distribution. Duntov’s idea was simple, at least in theory. He thought that he could boost the signal in a given manifold runner by the use of a resonating chamber. “He had this all mathematically plotted out,” says Walter. “But as is often the case, the theory didn’t work on an actual car.

Theory and practice

“What we ended up doing was trial and error development, trying different things: little pocket valves, resonating chambers on all the cylinders, interconnecting the cylinders. We were using the small-block Chevy V8 for development, and found out the most significant improvement was when we tied cylinders seven and eight together.

“There was a lean mixture in these cylinders, and cylinder five tended to scavenge from cylinder seven. By connecting cylinders seven and eight together with a resonating chamber in the manifold, we were able to boost the fuel charge in cylinder seven, and to a lesser extent, in eight. This increases the efficiency of the fuel distribution in the manifold, which in turn allows you to lean out the carburetor for lower emissions, better fuel economy and, usually, better driveability.

“Then we added a divider in the plenum chamber under the carburetor. This isolates one side of the carburetor from the other. The ‘open plenum’ manifold without a divider is good for breathing at high rpm, but it isn’t as sensitive to throttle variations at low rpm.

Please turn to page 69.
Dunlop Light Truck Radials

Durable, Dependable and Economical.

If you carry your livelihood in the back of your truck, you need tires that work as hard as you do. Dunlop light truck radials. Day in, day out they deliver cost saving benefits and dependable performance ... but that's what you'd expect from one of the pioneers of light truck radial tires in America.

Dunlop radials stretch your tire buying dollars with longer tread life than bias ply tires. And, the lower rolling resistance of radial construction means fewer stops at the gas pump.

Out on the job, Dunlop light truck radials keep working from sun-up to sun-down with twin steel belts that protect against road hazards; sidewalls that resist cuts, bruises and abrasions; and dual polyester body plies that absorb road shocks. Job after job they deliver comfort, control and easy handling.

There's the Gold Seal LT Rib ... an all position highway radial with a wide five-rib tread pattern. Or the Gold Seal LT Traction ... a rough road, bad weather, mean condition workhorse with a wide, deep traction tread for on and off road service.

The Gold Seal LT Rib and Gold Seal LT Traction ... use them in sets of four, or in tandem with the LT Rib on the front and the LT Traction on the rear. Either way they'll work as hard as you do.


DUNLOP
For the long run

Dunlop Tire & Rubber Corp., Buffalo, New York 14240
Better bull's-eyes
Air guns, particularly the new adult models, can supply great accuracy, are quieter than firearms, and can be used for target practice indoors as well as out. With care, a basement or back yard can become a target range. The newest aid to make this changeover easy is a Target Trap Model 850 from Crosman Air Guns. It's true that after studying one in a store you may be tempted to make your own. Behind the bull's-eye are three curtains of material that dampen the impact of a BB or pellet the way a blanket on a clothesline acts as a good backstop for baseball pitching practice. Behind the trap's curtains is a slanted metal plate to deflect and collect the BBs.

But at a price of only $17, the Crosman model is probably better than a homemade one. A phone book, cardboard box or plywood plank—some of the other favorite backstops—have been known to bounce pellets back at the shooter or around the basement. Even the frame edges of the Crosman target trap have been rounded and slanted to prevent this. The added safety is worth the modest expense.

Equally inexpensive are a set of scaled-down metal silhouettes—the standard turkey, chicken, pig and ram—designed just for air-gun practice and $5 at Crosman dealers. Beeman Precision Airguns, San Rafael Calif., and their dealers, have printed silhouette targets scaled for a 10-meter (33-foot) air-rifle range. There are five targets of each animal mentioned above for a total of 20 tries. And there's enough border on the targets so you can see where the shots are going if you miss. There's also a new short, rubber-coated 2.5X-power telescopic sight for air rifles and rimfires for under $100 from Beeman.

Car camping
Turning your auto into a recreational vehicle is still one of the bargain ways to travel, and new small tents, sleeping bags and cooking gear all help cut costs for a family vacation trip. The Kool Rest, a car-seat ice chest from Igloo, in Houston, can sit between front- or rear-seat passengers, be strapped in with a safety belt, and hold two six-packs or sandwiches, maps, toll coins and dark glasses. Igloo also has a new mid-size, 34-quart ice chest especially designed to fit the luggage compartments of new compact cars.

Plates to camp are listed in national directories, like the $1 KOA Handbook & Directory, Box 30558, Billings, Mont. 59114, and various state guides. The Colorado Campground Assn., 5101 Penn. Ave., Boulder, Colo. 80303, has one for $1 by mail. And a Family Camping Vehicles Publications Catalog lists books such as RV Repair and Maintenance, Energy-Saving RV Tips, and Living in Style—The RV Way and 33 others. All are available from RVIA, Box 204, 14650 Lee Rd., Chantilly, Va. 22021, if you send a business-size, self-addressed, stamped envelope.

Cool comfort
This month, warmer weather returns to the northlands of the country, but not yet to their waters. Charlie Walbridge of the American Canoe Assn., Lorton, Va., suggests that any time water and air temper-atures add up to less than 100°F, a wetsuit should be worn under your life vest. Nearly 50 percent of all canoeing accidents occur early in the season, and anyone working near water still chilly from winter runoff should take precautions to prevent hypothermia, especially if there is a chance of falling in. The ACA Safety Committee recommends refresher canoeing instruction at the beginning of the season for paddlers with limited experience, plus a personal flotation device that is worn at all times.

Folding firearm
For camping and survival shooting, a new over-and-under has been announced by the Springfield Armory, Geneseo, Ill. This one folds up conveniently, fires a single-shot .22 long rifle in the top barrel, a 410-bore shotgun shell in the bottom, and stores nine additional .22 cartridges plus four 410 shells in the stock—all at a weight of under four pounds.

It's a modernized version of the World War II Air Force M8, has a mil-

Backpack beast
For hikers who like to share the burden, Early Winters Ltd. in Seattle is offering trained and friendly llamas for up to $2,000 f.o.b.
With the price of oil today, you don't dare waste a single drop. Neither does the Datsun King Cab diesel. It gets better mileage than any gas-powered truck.

And while it's conserving fuel, the King Cab is comforting people with more room than any compact diesel: enough room to recline the bucket seats for regal relaxation. Behind those buckets, up to 7.1 cubic feet of inner space for available jump seats or safe cargo. (That's a comfort!)

King Cab, Long Bed or Standard, you can't buy a better-built compact than Datsun.

They're made by Nissan Motor Company Ltd., the worldwide company who's driven to make tough on the competition.

39 39 33
EPA EST HWY  EPA EST MPG

From one tough customer to another.

Datsun
We Are Driven

Product of NISSAN
These four matched volumes tell you and show you how to fix any building or carpentry job...from framing to remodeling to building a new house! You can even build an addition or a house even building an addition or a house!
you need to know to do just about a foundation, installing new paneling.

Look at what you get...

- How to read plans, specs
- How to use carpentry hand tools
- How to use woodworking power tools
- How to build concrete block foundations
- How to choose best woods, materials, fasteners
- How to plan and build roofing, flooring
- How to construct walls, doors, windows
- How to make joints
- How to build stairs
- How to build chimneys and fireplaces
- How to use builders' math, do surveying
- How to make kitchen cabinets, counters
- How to do cabinetmaking joinery
- How to build A-frame, 1-story houses
- How to plan a home workshop
- How to do house insulation
- How to build scaffolding, hoisting apparatus
- How to do wood pattern-making for castings
- How to do sheathing and siding
- How to do concrete construction
- How to plan termite protection
- How to do interior-exterior painting
- How to build garders and sits
- How to make concrete forms and molds
- How to sharpen saws
- How to build skylights
- How to do house maintenance and repair
- and much more

MAIL THE ATTACHED CARD OR WRITE TO:

Popular Science BOOK CLUB
P.O. Box 2006, Latham, N.Y. 12111
**HUG THE ROAD BETTER...LONGER.**

Bobby Unser, auto expert and champion driver says

"With Gas-a-just Shock Absorbers you'll hug the road better than with ordinary shocks because Gas-a-just's patented design seals in nitrogen gas and all-weather fluid under pressure to give you smoother, consistent performance throughout the full stroke of the shock absorber."

And this superior performance lasts throughout your trip because Gas-a-just's design eliminates the foaming and aeration which is so common in ordinary shocks and causes their performance to become erratic and face as you drive.

**INSIST ON GAS-A-JUST SHOCK ABSORBERS**
Modern as Tomorrow

KYB®, KYB Corporation of America
901 Oak Creek Drive
Lombard, IL 60148

Great with Radial Tires, too!

---

**HINTS FROM READERS**

**Salvaging hacksaw blades**

Although I usually buy high-quality tools, when it comes to hacksaw blades, I find that the least expensive ones are the best buy. I try to get a 20-blade pack for about $1.50. The blades I buy are extremely hard; on the other hand, they also break easily.

These blades are still a good purchase, however, because I save and reuse all the broken pieces. I grind some of them to fit my sabre saw. Recently I cut a 40-gallon hot-water heater in half lengthwise, using some oil and three broken blades. I use other fragments as scrapers; many scraper shapes are formed when the blades break. Sometimes, I grind them to suit a certain job.

Last summer, I reglazed and painted all the windows in my house with the help of these broken blades. —John Nelson

**Magnet saw stop**

A strong permanent magnet can serve as an improvised and easily adjustable stop for a circular, band or jigsaw that has a metal table. The stop simply limits the length the workpiece is cut. Toward the end of a cut, feed the work slowly so the magnet won't shift. The photo shows an Alnico magnet used as a table-saw stop. The magnet is a blend of aluminum, nickel, iron and cobalt.

In setup above, the rip fence is positioned close to the saw blade. A stop clamped to the fence would be impractical. When the first series of cuts is completed, adjust the magnet to make the next cut. Alnico and other magnets are available by mail from Edmund Scientific, 101 Gloucester Pike, Barrington, N.J. 08007; catalog, $1.

—Walter E. Burton
ANATOMY OF A WING-WALK

(Continued from page 31)

approached the record slowly and carefully. We made tests. For example, regular nylon rope isn’t any good because it stretches. We hunted all over for special rope until we found Larry Caldwell of Pigeon Mountain Industries in Georgia. He had a rope with only 2 percent stretch and an 11,000-pound test strength.

PM What about the right wing?

MC We have a forward cabin door, right over the wing-root leading edge. I didn’t know of anyone who’d ever flown a Ju-52 with that door off. I checked with a whole bunch of former Ju-52 pilots from Germany and drew a blank everywhere. I went over the possibilities for this and many other things, by the way, with Dr. John Hoover of the University of Florida. He did engineering, air drag and other tests for us. The only way to find out was to try it. So we removed the door, crossed our fingers and took off. We got a strong burble going through 90 mph on the climbout and I did a whole series of maneuvers in the air, going up and coming down. Any time we went through 90 mph, the burble shook the plane, then quit. Great! So we got ready to make a test with six guys on the left wing and six more on the right.

PM And how did that go?

MC It scared the hell out of us. We put Dave Kanamine on the left wing with a bunch of guys, and the Ju-52 was shaking and kicking up a fuss and then six more guys started out on the right side. We planned it so Steve Weiss would jam his body against the door, plant a foot on the wing, and block the wind for the rest of the guys. But when he did, the airplane shuddered and shook like crazy. Things ripped off the cabin walls; we lost headsets and mikes—they just zapped out of sight. We gave the emergency signal and everybody jumped for their lives.

PM What went wrong?

MC Like I said, this was an engineering adventure. When Weiss put his foot onto the wing, it was at the leading edge and close to the root: the worst possible place. The air ripped around his body, in the door and smashed right through the airplane.

Actually, it was a good thing, because it made us think. If you kill the lift between the outside are of your prop tips and the fuselage on just one side of this type of plane, you’re destroying 40 percent of all your lift.

PM So the decision to use only one wing was made for you.

MC Definitely. It was safer because we’d have more lift and more control.

PM You said you were going for 18 people, but you set a record with 19. How come?

MC Major Don Towner of the U.S. Air Force joined up with us. He took (Please turn to page 69)
LECTRIC SHAVE
MAKES YOUR BRISTLES STAND UP
FOR A CLOSER SHAVE.

Lectric Shave is putting its money where your face is. Here's the deal: apply Lectric Shave to one side of your face. Then use your electric razor. Compare the Lectric Shave side with the dry side. The Lectric Shave side should feel closer, smoother. That's because Lectric Shave makes your beard stand up. So you shave closer, faster, with less irritation.

OR YOUR MONEY BACK.

GUARANTEE

If you don't agree that Lectric Shave gives you a closer shave, we'll give you a complete refund. Just send your bottle of Lectric Shave with the unused portion and the deposit refund check with the purchase price of the new 6-weeks Lectric Shave Guarantee Offer. P.O. Box 5035, Merrick, New York 11566.

ANATOMY OF A WING-WALK (Continued from page 57)

some fabulous films to document the event and he made it!

PM Did you run into any other unexpected problems?

MC Every time we flew a test. For example, we made our early tests with up to 12 people on a wing. We figured we would need every ounce of lift, so we used 15° of flaps. Big mistake. All of a sudden, the airplane put its nose down sharply and dived almost vertically, out of control. We dumped the crowd and recovered.

PM What was wrong?

MC When we put the people on the wing, we added camber, or curve, to the upper surface of the wing. This increases lift and does a couple of other things. The flaps at 15° further cambered the wing. Presto! The center of pressure under the wing moved aft and the center of lift moved forward. The turbulence off the bodies on the wing unloaded the tail surfaces, which went up, and the nose went down, and all together, whoa! We became a finned bomb. After that, we changed positions on the wing and left the flaps up.

PM Tell us about the parameters you finally selected for the record wing-walk.

MC We had 24 people aboard: I had left seat, Don Yahrling was in the right seat, Bill Tharp flew as crew chief, Art Barchie was jumpmaster and Mike Fuller had a camera, plus the 18 wing-walkers. Out on the left wing was a big vertical boom with a couple of cameras, and Ken Lindsley and Gene Chevalier had stuck cameras all over the plane. We were at 25,000 pounds and had a hell of a lot of drag. We thought that we'd need up to 4,000 feet for the takeoff roll, and my first surprise came when we used 25° of flaps for takeoff and jumped into the air after just 1,200 feet. We flew over Palatka, Fl., our designated drop zone, with three chase and camera aircraft. We had planned to go at 8,500 feet. But people moving around the Ju-52 got me into a bad center of gravity position and I started the final run at 9,000 feet, letting the speed build up so that at 8,500 feet, we were indicating 120 mph.

PM So they started onto the wing at 8,500 feet?

MC Yes. About six of them went out fast. Dave Kanamune took a point position behind the left engine and Mike Maguire held along the fuselage. They blocked the wind for everybody else. My first real big surprise in the air was a sudden, severe yaw of the nose to the left. I kicked right rudder as hard as I could and she came around. Our speed went to 140 mph indicated, faster than I believed, and she put her nose down as that gang kept pouring out on the wing. And just like that, she went through a 2,000, then a 3,000, then a 4,000 feet-per-minute rate of descent.

PM Did you lose control?

MC For a while, we didn't think we could hang on to her. The buffet ing was wild, really bad. We got a pogo effect, up and down. The left wing was twisting wildly—you could see it flexing like mad—and the right wing was drumming like a washboard. Then we heard this terrific booming sound. She was oil-canving. Our speed built up to a true 190 mph and the yaw was terrific. She was trying to roll over on her back. But now, I was holding full left rudder and full right aileron, so there we were, coming out of the sky with full crossed controls. I didn't think the airplane was going to stay together.

The yoke columns were shaking as if they were going to burst right out of the floorboards and I couldn't read the instruments anymore because of the vibration. I had to kill power because we were accelerating so fast. I almost hit the smoke switches for the emergency signal to bail out. Tharp was screaming that we had only four more to go. I thought he meant four more people, but it was four more seconds for the prearranged eighth-second ride. I glanced at the left wing and it was twisting and rippling. Then I heard Tharp yelling on the radio, "They're going!" He meant the jumpers, not the wings. As the wing-walkers were spilling off, things were smoothing out and, suddenly, we were back in the real world with a docile airplane coming downstairs like a bat out of hell, but smooth. And we'd done it!

PM Did the airplane suffer any damage?

MC We busted a couple of things, but they were minor. We were amazed at that. One chase plane pilot said the whole right wing was a blur of vibration and the tail was twisting in a crazy whirl mode. He didn't know how it was staying on.

PM What's next on your agenda of nonstop?

MC A new world's wing-walking record.

PM You're kidding.

MC I'm serious. All women: 21 or more.

PM Bikini-clad, no doubt.

MC You've got it.
THE HIGH-MILEAGE FILES
(Continued from page 58)

rpm. That big plenum acts like a large mixing bowl. By splitting the plenum, we can increase the flow rate in the manifold runners to the cylinders. That's why you get better throttle response at the bottom end.

"We put this manifold together with our small, four-barrel carburetor. Now, most people think that when you go from a two-barrel to a four-barrel, your gas mileage will go down. But at highway speeds, you're driving on just the primaries of the four-barrel, which are smaller than the two-barrel bores. We pick up economy on most two-barrel to four-barrel conversions. It's perfectly logical, when you think about it."

Trying out the Z System

It all sounds perfectly logical, but does it work? We decided to put Duntov to the test.

A complete Holley Z System starts with Duntov's patented manifold, cast in aluminum, Model 300-282. With it comes a matching Holley Model 4560 four-barrel carburetor rated at 450 cu. ft. per minute (cfm). Holley also includes a 14-inch "free-flow" air cleaner and a high-output fuel pump, rated at 80 gallons per hour at 4.5 psi. Finally, there's a pair of polished aluminum valve covers. They don't do a thing for performance, but they make your engine prettier.

All of this is not cheap. Holley's suggested retail price for the complete package is $864.60, though almost any auto parts store will discount this price to around $600, which still isn't peanuts.

The Z System is available for a variety of engines, but we used a small-block Chevy similar to that for which it was originally developed. Ours is a 305-cu.-in. version, fitted in a 1979 Nova.

At a steady 60 mph on the highway, the 3,000-plus pounds of the Nova required a gallon of unleaded premium every 22.50 miles with the stock two-barrel carburetor. With the Z System, fuel economy improved to 23.64 mpg, a solid gain of 1.34 mpg or 6 percent. Exhaust emissions were reduced, too: HC dropped from 380 parts per million (ppm) to 35 ppm, CO from .22 percent to .03 percent. CO₂, however, went from 12 percent to 14.9 percent, indicating more efficient combustion and cleaner burning.

But that's not the half of it. Since the day it was born, this Nova has suffered from annoying detonation, asthmatic acceleration and a gener-
THE LEADER OF THE PACK.


Ford, the Wagonmaster, has been pleasing wagon owners for over 50 years. In fact, since 1949, a million more people have bought Ford Wagons than any others.*

LTD Country Squire. A fine car and a wagon, too.
LTD Country Squire, a Wagonmaster tradition, still offers full-size room and quiet comfort. There's room for eight passengers with the Dual Facing Rear Seats option. And LTD has more cargo room than any wagon in America.**

Almost 90 cubic feet with the rear seat down.

Ford Granada. The first Granada wagon ever.
Ford is proud to introduce the first Granada wagon—with all the style of Granada and more cargo room than any American-built wagon in its
class.** Granada wagon for 1982, built with Ford's commitment to quality.

*Ford Escort. The bestselling wagon in America.*

Escort is the only American-built wagon with both the traction of front-wheel drive and the smoothness of four-wheel independent suspension. And Escort was designed with special high-strength steel to achieve lighter weight and excellent fuel economy.

44 EST HWY
28 EPA EST MPG

For comparison, your mileage may differ depending on speed, distance and weather. Actual highway mileage lower.

Whether you buy or lease, see the LTD, Granada and Escort wagons at your Ford Dealer now.

FORD WAGONS
FORD DIVISION

---

WAGONS
Come to Marlboro Country.

Critics call them tempting targets, but the Navy says the updated mix of missiles and BB guns is worth a lot more than four on the shore.

by Robin Nelson TECHNOLOGY EDITOR

It didn't take long. Only a few days after the Navy's plan to reactivate its four Iowa-class battleships was revealed in detail last year during Congressional hearings, the letters started coming in. They read as if from a ditto machine..."I'm ready. Take me. I know that ship." The writers listed either USS New Jersey (BB 62), Missouri (BB 63), Wisconsin (BB 64) or Iowa (BB 61) herself.

The typical correspondent was in his mid-to-late 50s—a child of the Depression who grew up to sail off in righteous defense of his country in the most feared ships in the world. Now they are going back to sea, and he wants to cross a gulf of four decades to be there, too.

Insofar as modern military institutions can be touched by such gestures, the Navy was. But official reaction was tempered by the fact that emotions do not justify multimillion-dollar defense appropriations. What does justify the return of the battleship, according to the Navy, is a simple matter of cost efficiency in an increasingly complex defense environment. In the case of the
New Jersey, which will undertake sea trials as early as next September, an outlay of $326 million will put to sea a capital ship unmatched in offensive firepower by anything even on a drawing board, not to mention in a shipyard or afloat. The same sum applied to building a completely new ship, the reasoning goes on, might be sufficient to produce a frigate, the least capable escort-type vessel, at today's prices.

New Jersey's sister ships, beginning with Iowa in 1985, will follow at approximately yearly intervals if the Navy gets its way. Reactivation costs for each of these will far exceed the New Jersey's price tag, since they will have to be brought to the latter's 1969 "baseline" configuration (during previous reactivation for Vietnam) before receiving the mix of missiles and defense systems the Navy considers crucial to the update.

Still a bargain, according to the plan, and the logic seems intact: Although the Iowa-class battlewagons were all launched between 1942 and 1943, they were, with the exception of New Jersey, permanently moth-
balled by the late 1950s. A ship's technical age is figured by time on the powerplant; even including New Jersey they average only about 12 years' steaming and should look forward to a total lifetime of between 25 and 30. By that standard, curiously, the World War II battleships will emerge from drydock as some of the Navy's youngest ships.

Yet it's impossible to regard a battleship—a dreadnought—merely as a relative bargain in steam boilers and armor plate. Before strategic airpower and nuclear bombs came simultaneously of age, this century's arms race knew only one doomsday machine, one balance-of-power weapon: the battleship.

In planning the original South Dakota class as early as 1916, the United States was determined to have a ship that could control the seas against whoever won World War I—whether it was Germany or Britain—and cancellation of it short of completion in 1921 was as ironclad a guarantee of peaceful intent as a nation could offer. Naval treaties limit...
How Computers Bring Cars to Life

Wire-frame image of a car (top) is displayed on computer screen. Designers can zoom in on one feature, check mechanical design criteria, or even put the car through various stress tests. The image here shows the front end of a car being placed under tremendous stress. Video tests like this can predict how the finished product will perform.

Other programs allow for three-dimensional images to be viewed (left). These 3D views can be used to design everything from the complex ups and downs of a camshaft to machining a wheel. More than ever, computers are getting involved in car design.
Under the guidance of skilled humans who man the keyboards, computers are now designing the look, drive and durability of Detroit’s cars of tomorrow.

by Neil Shapiro ELECTRONICS EDITOR

To you and me, a car is a symphony of curvaceous metal, of touchy but stalwart machinery—all wrapped up around a little bit of soul. But to calculating computers deep in the heart of Motown, a car is nothing more—or less—than a collection of 20,000 points to be plotted and replotted, twisted and displayed as ghostly, video images on flickering monitors.

It’s all part of Detroit’s ongoing commitment to CAD—Computer-Assisted Design. The shape of many of the cars you’ll be driving tomorrow, or even today, is influenced by a computer, guided by human hands, eyes and feelings.

As Frank Biondo of GM Design put it, “We can’t forget the human areas.”

And human hands still shape the clay from which automotive dreams are made. Full-size clay models—design mock-ups—are exact replicas of what the designers first envision as the finished car. Just walk through the basement areas of GM’s...
main design division in Detroit and you'll catch an occasional sniff of clay seeping out from behind locked, no-admittance doors.

The smell of clay is the odor of mystery. Within those secret chambers, the plans and dreams of the corporate car giants begin to take physical form. Smooched and finished by loving hands, with glossy plastic sheets applied tightly enough to clay sides so that they appear to have coats of shiny lacquer, the clay models wait for the approval of both man and machine.

A mechanical scanner, taller than a tall man, but with the delicate touch of a young girl, is rolled into position beside the clay model. The mechanical arm of the scanner reaches out, traces the graceful curves one by one and converts each aerodynamic sleekness, every stylistic bump, into a series of coordinates. Then these coordinates are stored as binary bits on a floppy disc that, to a computer, is more readable than the glossiest clay surface.

From there, the wet smell of clay becomes a background memory to the air-conditioned, office-clean cubicles of the design-team people.

The stored points are instantly accessed by desktop computer terminals as clay is converted to video. A car appears on the screen: It's tilted, moved around and examined in detail until every part of the dream can be certified as being worthy of reality. Of course, reality to GM or Ford may differ somewhat from our own consumer-oriented perceptions of a car.

On-screen wizardry

On a recent trip to Detroit, we watched anonymous video cars being put through their computerized paces on monitor after monitor. It was a combination of the Indy 500 and a pinball fantasy. But it was all deadly serious.

The first test we watched involved a procedure as human-oriented as packing your trunk for a long trip. The video display zoomed in, under the guidance of the designer, and became a full-screen view of a car's open trunk. The screen beneath the trunk was filled with a list of options, such as "golf bag" and "lady's overnight."

The designer touched his light pen, like a magic wand, to one of the on-screen choices. Instantly, a golf bag appeared, as transparent as the car it would soon be packed in.

With the light pen, he positioned one piece of luggage at a time. Everything fit. But if it didn't, it would have been back to the clay for redesign and further study of the car's understructure.

If necessary, the clay model's trunk could be widened, the hinges redesigned, or room could be added somehow to achieve what the computer-aided designers consider satisfactory space. Any changes would require careful scraping of clay, accompanied by new measurements to be turned into computer coordinates.

Phantom rider

Then we watched as, back on video, a computer's version of a human being took the driver's seat. He looked for all the world like one of Casper the Ghost's best friends.

This time, the light pen was used to choose options that detailed the amount of legroom, ankle flex and other human-machine measurements that drivers of various sizes could expect in the car as designed.
Mechanical arms scan clay models and translate model's stylistic detail into coordinates that can be computerized.

A range of people, big and small, stout and thin, could be called on for video duty.

In the old days, the designer would have had to depend on plastic models of people. These plastic likenesses, hinged to move in the same manner as humans and slotted to be adjustable in size, were laboriously compared to diagrams, blueprints and maybe concepts scribbled on a napkin, in order to determine human/machine compatibility.

Now, without ever having built the car, the designer can talk over its comfort features with the auto's first "driver."

"Without computers," GM's Frank Biondo told us, "the design process would be far more time consuming. The computer is helping us primarily in the definition of design. We're confident it delivers a far greater degree of reliability and value."

Everything on the car is tried out on video. Will the door swing open properly, or scrape against normal-height curbs? Or will it pound the pizazz out of the car's painted fender? Do the seat backs have sufficient rake? Does the hood open wide enough to allow the engine to be worked on?

Then, when the design is complete artistically, it must be re-examined structurally. The cleanest, smoothest lines don't guarantee a heavenly ride or good gas mileage.

The points whiz from one computer to the next, from the design people to the ones in charge of man-

(Please turn to page 162)
If you already have a good, basic sound system in your car, fear not—you can always upgrade it into a rip-snorting, on-the-road system.

by Gary Stock

There comes a day in the life of every car-stereo owner when his basic sound system—usually an AM/FM cassette unit and a pair of speakers—just doesn’t excite anymore. It may lack power, or a solid low end, or "shimmer" in the treble or even a few desired control features—but, somehow, the thrill is gone.

On that day, you have two options: throw out the whole system and start from scratch on a new megabuck setup, or use your existing equipment as you upgrade, adding new components and accessories, one by one.

To illustrate this second approach, we took a well-known sports GT car—a Mercedes-Benz 450SL roadster equipped with a good, basic sound system—and subjected it to a full range of sound-system improvements. The owner of the car had outfitted it with two excellent components which served as our starting points: an Alpine 7138 full-digital AM/FM cassette unit and a pair of 4 1/2-inch Blaupunkt full-range speakers, fitted into the small speaker enclosures at the sides of the dash. The sound from this combination was smooth and well...
Car Stereo

The Altec SW-1 subwoofer (above) includes all of the electronics on the same chassis as the speaker cone. A subwoofer allows you to take that bone-jarring sound of real bass along wherever you roam. The tuning controls are mounted separately in the dashboard area.

Fitted into a glovebox (above) or under a dash, high-tech addons have a beauty all their own. Alpine’s 3011 equalizer, Altec’s SW-1 subwoofer, dbx’s model 22 decoder, and other items (shown elsewhere) turned this Mercedes into a movable feast of sound.

Altec SW-1 subwoofer

Alpine 3011 equalizer

Dbx Model 22 decoder

Philips 8320 tweeter

Alpine 3002 amplifier

ADS 100 amplifier

Philips 8320 tweeter (above) was mounted on each Mercedes door. Placing them forward on doors protected them from slamming impacts. Alpine’s 3002 power amplifier (left, above) was mounted in trunk space. It can also be mounted on firewall. ADS 100 power amplifier (left, below) was hidden beneath the driver’s seat. Make certain (as shown) that the unit will fit with adequate clearance before you begin the actual installation.
Styling and handling satisfy pony owners.

According to owners, the 1982 Mustang goes a long way toward satisfying their urges and doing the things expected of America's original pony car.

Styling came away with top honors and generous praise from the owners we interviewed—both as a reason for buying the car initially and as a source of long-term satisfaction after purchase.

A West Virginia student beamed, "Styling and fuel economy sold me. My car is black with three shades of orange, which gives it a beautiful appearance. I also like the fuel mileage; I'm getting 24/30 mpg with this four-cylinder four-speed."

A cola bottler from Georgia told us, "I wanted a small car, but not too small, and I liked the looks of the Mustang." And a North Dakota sergeant admitted, "Appearance was the overall reason we bought the car."

An Ohio financial vice president confided, "I didn't want a box on wheels." A Michigan realtor added, "This Mustang is a sporty car and more fun to drive than larger models," and a New York secretary smiled, "I've had a lot of people comment on my Mustang's good, clean, sporty looks."

Handling ended up a close second behind styling among the Mustang's best liked attributes. You can order any new Mustang with the TRX handling package, but some fea-
A nationwide survey based on 802,115 owner-driven miles

"It's certainly a solidly built car."

Ohio Hostess

"Styling and fuel economy sold me."

West Virginia Student

"Bottom edges of the doors had no paint on them."

Kentucky Programmer

Most fuel-mileage complaints came from owners with the four-cylinder engine and automatic, and so did gripes about engine power. An Illinois production foreman wrote, "I bought this car for good gas mileage, but I'm averaging barely 18 mpg around town. The EPA said I should expect 22 mpg. The engine doesn't have enough power to get out of the way of other cars and I'm disappointed with fuel economy."

A Maine banker: "The four-cylinder engine is too small. It won't go up a steep hill without the transmission dropping into low range."

And a North Carolina analyst wasn't alone when she observed, "If (Please turn to page 160)"

The optional 5.0-liter V8 engine makes the Mustang the quickest car on the market.

Fuel economy came in for mixed reviews, some owners praising their cars and others telling us they'd expected better. Economy placed among the Mustang's best liked qualities with 26 percent of our respondents, while 15.2 percent rated it below expectations.

Tires, like alloy wheels and Michelin TRX low-profile tires, along with recalibrated springs, shocks and stabilizer bars, are mandatory.

A Kentucky hairstylist told us, "On the road, it clings and holds fast around curves; is also good on ice and easy to maneuver through traffic. Yet despite the sporting suspension, the ride isn't too stiff, so it's a comfortable car for long trips."

PM photos. Jerry Abramowitz

JUNE 1982  B3
CAPTURE THE STARS

Taking beautiful astrophotographs need not mean a large outlay for equipment. Here’s how to use an inexpensive telescope—or how to forego a telescope entirely.

by Robert Little

Almost all amateur astronomers—sooner or later—become sky photographers, and it’s not hard to understand why. Many of the most beautiful sky objects can be seen only dimly—or cannot be seen at all—with even a fair-sized telescope.

Unlike the eye, film has the ability to build up an image during a time exposure and will record colors that the eye cannot detect at low light levels. For instance, the translucent, purple veils of the Orion Nebula appear greenish when observed visually in a telescope.

Constellation photos can be taken with modest equipment—you don’t even need a telescope (see Build This Star Photography Platform, at the end of this story). The moon, too, can be captured with only a camera and tripod. But if you do have access to a telescope, the whole universe awaits you.

Although the moon appears large in the sky, it’s really a small object photographically. A camera with a 50-mm lens would capture an image on film of only ¼ mm in diameter—not suitable for good size enlargements. A telephoto lens of 300 mm, however, would reveal many lunar features. To compute image size on film, divide a lens’s focal length by 110. So a 300-mm lens would give a lunar disc slightly under 3 mm across.

The moon is so bright you can use a 1:500 F/11 telescope was used with proper filters. Exposure was 1/250 second. Note sun’s fiery corona around edge in the third photo.

This solar-eclipse sequence (below) shows some of the spectacular sights a skillful amateur can capture. An inexpensive 4-inch
ON FILM

ORION NEBULA (prime focus):
Criterion 6-inch telescope
(F/10) at 45-minute exposure

Sun filter covers end of telescope, and the guiderope is
blocked off completely. These and other special precautions
must be taken during any type of solar photography.

A “piggyback” camera is mounted on top of a telescope
tube. Telescope’s motor drive tracks camera through heav-
ens and telescope optics are used to spot targets.

Robert Little’s astrophotographs have
appeared in many astronomical
magazines and on the cover of Life. He works for
Criterion Scientific
Instruments.

MOON (eyepiece projection):
Criterion 6-inch telescope
(F/10) at 1 second.
The big white Meade and stubby orange Celestron have outstanding optics. Both were able to catch cloud bands on Jupiter.
Fasten your seat belts and get yourself ready: This month, the Earth begins a summer-long plunge through a sea of meteor chunks left behind by several streaking comets. As our orbit crosses paths with the meteor swarms, thousands of brilliant chunks of iron will flash across the evening sky, signaling the beginning of the summer meteor showers.

The spectacular nighttime display is enough to send you running to the local shopping mall in search of a hobbyist’s telescope. But before you spend good money on what may turn out to be useless telescopic equipment, feast
your eyes on the eight models tested by PM. In selecting our test telescopes, we tried to avoid the two biggest mistakes made by newcomers to stargazing: spending too little, or spending too much.

"Do you have any idea how many thousands of cheap Japanese telescopes are sitting unused in people's garages?" asks New York Amateur Astronomy Society president John Marshall. "Thousands of them are sold every year—it's criminal."

**Cheap is no bargain**

The scopes Marshall and others avoid are those slender tubes sold for under $100 in the camera departments of big stores. No bargain, they generally have inferior optics and they frustrate the new user.

The instruments we tried are all high-quality reflector telescopes. Each is basically a mirror mounted inside a tube. Light from a heavy object hits the mirror, which is focused on a facing mirror and angled out an eyepiece to the stargazer. We avoided refractor scopes—the long, skinny types (with lenses, no mirrors) a sea captain might use in search of a landfall, but never in search of a planet. Good refractor telescopes, for astronomy do exist, but the optics are far more expensive than the mirrors in scopes we tested.

PM found excellent telescopes for no more than $850 and as little as $159. Each had advantages—and disadvantages.

For instance, we focused the Meade 8-inch scope—which provided the most spectacular sky show—on what appears to be a single point of light known as "iota" in the constellation Cassiopeia. With the Meade 8-inch, we could see that three bright and distinct stars make up the apparent point. The Meade also gave us breathtaking views of the rings of Saturn and the cloud bands of Jupiter. Its biggest disadvantage was weight and bulk—it weighs 65 pounds and has a tube 50 inches long.

Celestron's 5-inch mirror couldn't resolve the triple star clearly, but it showed us a nebula—or "clouds" of stars—in Orion and yielded good detail of Jupiter's cloud bands. Still, it did have one advantage over the Meade. The C-90 is a catadioptric scope, meaning its optics are arranged in a compact tube. It's easier to carry around than the Meade and other long-tubed Newtonians.

The other catadioptric we tried, the Dynamax 6-inch model, focuses on more outer space details. But our model's mounting structure was a

(Please turn to page 172)
PM's Long-Term Car Tests

Our new durability testing program will put on the miles to learn how some popular makes stand up to the rigors of the road.

by Tony Assenza

There's nothing quite as wonderful as the feel of a brand-new car. It smells good, everything is tight—usually—and everything works. But what happens when the engine has a few miles on it and the chassis is subjected to thousands of miles of bumps, potholes and highway expansion joints? And does that wonderful paint job start bleaching after its first month in the summer sun?

These are the kinds of things we can't find out in our regular road tests. After purchase price and fuel mileage, the next thing prospective car buyers want to know is how well their new car will stand up. We've never been able to fully answer that question before. Now, our long-term test program will help remedy that situation.

To better furnish you with the kind of information you need to make a wise buying decision, we've embarked on an ambitious durability testing program. Obviously, we cannot test every car on the market.

The next best thing is to select a group of cars which we feel is significantly interesting to you—the types of vehicles you'd most probably consider buying—and drive them for thousands of miles under a variety of road conditions.

We'll be keeping careful records of mileage, oil consumption, mechanical problems and general durability. We'll also be maintaining the cars ourselves, so, hopefully, we'll be able to give you some insight on serviceability.

Our first group is a varied lot—from a simple economy car to a thinly disguised hot rod. Here are the cars and how they stack up.

Plymouth Horizon

Remember our 'Real People' Road Test Of Economy Cars (page 65, Aug. '81)? We're still scarred from the withering barrage of letters that poured in following our report on the Omni Miser. If you recall, we weren't exactly fond of that car. And you, along with some powerful Chrysler executives, weren't overly fond of us for ranking it dead last in a field of 10 competitors. So, we decided to take another look at the Dodge Omni (the Plymouth Horizon is the same car with a different grille).

We picked up our test car in Detroit on January 16, 1982. The car had 582 miles on it. It was a deluxe model, loaded down with every comfort and convenience option in the Plymouth book: airconditioning, deluxe cloth interior, automatic transmission, AM/FM stereo, cruise control, rear defogger, bucket seats, console and more. List price of the car came to $8,595, although you can buy any car at less than list price.

Upon receipt of the car, we immediately started driving it to New York via Canada—in one of the worst blizzards of the year. Thanks to the car's 2.2-liter engine, sport suspension and Michelin XZX radial tires, we found the car very stable and sure-footed, despite the das-tardly weather. Except for a minor off-road excursion involving a jackknifed tanker full of deadly chemical waste, we were able to press on with vigor and still managed to get 22.3 mpg for the trip. Really respectable.

Okay, Chrysler, we're not exactly eating our words on the Miser—nibbling just a bit, maybe—but this Horizon is certainly heads and shoulders better than the little gobbler we got the first time.

The car was put into regular commuting service upon its arrival in New York and has so far accumulated 3,050 rather uneventful miles. At 2,654 miles, the front spoiler fell off as we were pulling into a parking lot in Atlantic City, N.J., to attend an old-car auction. At 2,834 miles the engine suddenly developed a heavy thirst for oil and gulped down two quarts at a routine gas stop. The car had not used any oil previously, and has not used any since. It must have been the culture shock of being piloted through the asphalt warfare of New York traffic that scared it into ingesting the two quarts of 40-weight lubricant.

Despite the heavy load of options, the 2.2-liter engine in our test car powers out the Horizon with brisk acceleration. Zero to 60 happens in 10.3 seconds, shifting the automatic manually. We've surprised many so-called sports cars with the Horizon's excellent performance and handling. It's great fun to blow off these pretenders on freeway on-ramps. They never quite believe that they're being outcornered and out-accelerated by a Plymouth Horizon.

We've been driving this car extra-long...
The Hot Blast From France...

Renault Fuego

In turbo or normally aspirated form, the Fuego provides sparkling performance and handling.

FIRSTHAND REPORT

by Tony Assenza  AUTO EDITOR

For those of you—and you know who you are—who have been calling us about advance information on the Fuego, the word is pronounced Fwaygo. In Spanish it means fire. In French it means an exercise in technologically advanced motoring. And in America it will most certainly mean speeding tickets for those who explore the Fuego’s full potential. We know, because we had the opportunity to drive American-specification Fuegos on the streets and high-speed autoroutes of northern France.

Ordinarily, driving American-spec cars in Europe is an open invitation to being humiliated by domestic cars with half your displacement. Since they have fewer emissions controls, European engines generally make more horsepower than ours and get better fuel consumption. And the average European driver misses few opportunities to make full use of his available ponies.

This was not the case with the Fuegos. This time, the contest was more evenly matched.

On a run from Paris to Caen—exuberant about driving the turbo for the first time—we averaged a shade over 80 mph, which meant the engine spent most of its time near the red zone in fifth gear. The mile-

Even in base trim, the Fuego comes well appointed. It has excellent bucket seats, thickly padded wheel and lots of gauges.

The 1.6-liter turbo engine has an air-to-air intercooler and an integral waste gate.
And One From Kenosha

Renault 9

Although it looks a bit like a toolbox, the Renault 9 is nonetheless pleasant and fun to drive. The U.S. versions will have recessed headlights and 5-mpg bumpers.

Unlike the Fuego, the Renault 9 will be built in an AMC plant in Kenosha, Wis. The first U.S. car has yet to roll off the line (it'll go on sale this fall as '83 model), but we did have a chance to drive the European version in Normandy.

Where the Fuego is more road-scorcher than transportation, the 9 (still unofficially referred to as the Alliance) is utilitarian, yet competent and a satisfying car, nonetheless.

It's powered by a 1.4-liter Four going through a four- or five-speed manual or an automatic transmission, uses front-wheel drive and, uncharacteristically for Renault in this class of car, has a trunk rather than a hatchback.

The French engine, with no pollution-control devices, cranks out 72 hp, which is adequate for most of the driving chores the 9 would be expected to perform. In American trim, the engine is expected to produce horsepower in the 60s and yield in-town mileage of around 30 mpg. Final tuning is still to be determined, but we have it on good authority that 1 or 2 mpg may be sacrificed for better performance—a sensible approach.

AMC engineers and assembly people have been shuttling back and forth between Douai, France (where the European 9 is built), and Kenosha, in an effort to make sure that nothing is lost in the translation.

Both AMC and Renault are concerned that the U.S. versions be as lovingly screwed together as their European Car of the Year winner for 1981.

One unique feature of the 9 is the Monotrace seat mount. Instead of the usual two-rail subframe, it has a central pedestal which allows the seat to rock fore and aft for adjustment. This saves space and leaves more room for rear seat passengers' feet.

The 9's most attractive feature to me is the ride quality and that all-important, but undefinable quantity, "feel." The car feels right—stable, precise, compliant, but not fussy. I know AMC will try to "tailor" it for American tastes (i.e., softer ride), but I would leave it alone.—T.A.

Interior of the 9 features Monotrace seats (no tracks) as well as a surprising amount of room. The fit and finish quality is quite good and the dash is very well instrumented.
Hobie Alter, speed specialist with surfboards and catamarans, is introducing his first single-hull sailboat, a 33 footer. With only an 8-foot beam so it can be trailered, it has hinged, deck-mounted mast, retractable keel and bunks for seven.
New Look For No-Fuel Boating

Even though the wind is still free, boat designers keep trying to use it more efficiently. This summer, twin-hull sailboat makers are testing single-hull performance while mono-bottom powerboat builders are expanding sailing catamaran lines. Sailing surfboards are growing in popularity, with one- and two-hull models available. Even inflatable sailboards are here.

Mono and multihull designers seek more speed on wind power.

by Bill McKeown
Boating Editor

With the new Hobie 33, you don’t need a slip. The big 33-footer is only 8 feet wide so it can be trailer-towed without a special permit. The mast is stepped in a tabernacle on deck so that it can be hinged down or raised without a hoist. Roller reefing aids single-handling. Halyards are led down inside the mast. A compartment aft houses an outboard motor that can be tilted down for auxiliary power.

Below, in the cabin, the galley

Supercat 20 is the largest catamaran that’s built by Boston Whaler Multihulls.
Like the larger Supercats, the 15 features computer-created elliptical hulls.
Supercat 17 is sharper forward, needs no daggerboards and has an 8-foot beam.
Kona Kat has the stand-up action of a sailboard, but with catamaran stability.
Freesails 1 and 2 are newest sailboards from the O’Brien division of Coleman.
A Master Craftsman's Old World Shop

For every power tool in this workshop, there are scores of hand tools—all used in traditional ways.

by Steve Willson

The latest installment in our Great Shop series has much in common with its predecessors—and something a little different. This time, we tried to focus a bit more on the man behind the tools, and with good reason: His traditional training and old-world devotion to craft are more rare and remarkable today than they have ever been.

Ernest Glaser is a master furniture maker schooled in Germany during the early 1920s under the old European Guild System. He came to the United States in 1928 and began work in cabinet shops around the

1. Glaser converted a smokehouse (inset) into a comfortable shop. He reinforced the floor and roof, installed bigger windows and added maple flooring and pine boards to the interior. As floor plan at right shows, shop is compact, but has plenty of room.

2. Antique toolbox holds seldom used tools, leaving wall space free for others.

3. Shop has nearly 200 different clamps, including bar clamps on a special rack.

4. Hardwood brackets hold over 40 hand-screw clamps within reach, but out of way.

5. Razor-sharp carving chisels are used for fine-detail carving, precise inlay work.
A Master Craftsman's Old World Shop

Shop has collection of 40 wood planes that Glaser still uses to cut rabbets, plow dadoes and form intricate molding shapes.

New York City area. By 1945, he earned the B.S. degree in education from Rutgers University and began teaching woodworking in high schools near Plainfield, N.J. He stayed there until 1964, when he and his wife Elizabeth retired to the Eastern Shore of Maryland to begin a life that was anything but retiring.

Along with refurbishing a huge, two-story house, he gave an old smokehouse a structural and cosmetic face lift, turning it into the great shop shown here. From the maple floors to the knotty pine boards on the walls, he realized his dream: to create a shop where he could make fine furniture as he had been trained to do.

When we arrived to see his shop, Glaser confessed that he'd spent some time cleaning up for us: A working shop is rarely as clean as these photos show. He had four projects in the works, three on commission. The first was a series of six identical boxes made of ash with rosewood inlay. Each had a hand-rubbed finish and showed off Glaser's considerable expertise in making hand-wrought dovetail joints.

The second was a five-drawer mahogany silver cabinet that stood about 42 in. high. It was completely sanded, but not yet finished or rubbed.

The third was a small chest of drawers in the Virginia style—mahogany again—that was just being readied for shipping. And the last project was for his personal use: a series of four Chippendale side chair reproductions. He used these unassembled chairs to illustrate how he builds a piece of furniture.

His starting point is his drawing board, where he sketches a design, altering it here and there until he is satisfied. For the chairs, this was unnecessary, because he wanted to match some existing chairs. Next, he makes a full-scale drawing which, he says, is crucial. "The eye can play tricks in the smaller scale. It is only when the piece is full size that you can know with certainty how it looks."

After any final design adjustments are made, he cuts full-sized patterns from cardboard or ¼-in. plywood. He admitted that this was a time-consuming job, but nonetheless recommended it. These patterns eliminate mistakes in measuring and they're also a perfect record that can be used later to duplicate the piece without repeating the design work. Finally, he traces the patterns onto stock and proceeds with the cutting.

As a rule, he performs his joinery by hand. He enjoys the work and is so quick with it that, in many cases, he could rival power equipment if machine setup time were included in the comparison.

One of Glaser's favorite woods is African mahogany. Many of the pieces in his home, as well as those in photos of commissioned work, were made of this wood. Most of it came from one lot of mahogany he purchased over 30 years ago. It was, without a doubt, the best looking mahogany I have ever seen. The grain was extremely tight and the

The European Guild System

Emmet Glaser was born and raised in Hamburg, Germany. When he was 16 years old, his mother signed a legal contract, committing him to a four-year apprenticeship in the cabinetmaking trade. During the term of his contract, he was responsible to just one man, his master. He lived at home and worked in the shop five days a week; on the sixth, he attended a Guild-sponsored school where he learned drawing and mathematics.

When he completed his apprenticeship, he was awarded a Journeyman's Certificate (above), which qualified him for cabinetmaking work. By this time, the Guild no longer required its members

Glaser (left) shows author the jack plane he made over 50 years ago. Journeyman's Certificate (right) was his after he had completed a Guild-approved apprenticeship.

Heavy-duty carving chisels (left) hang next to turning-tool rack. Make the rack by boring handle holes half through one support, blade holes completely through other.

96  POPULAR MECHANICS
Each room in Glaser's huge, two-story house is filled with his work. Sheraton-period dining table here is an example.

Color was deep and rich. He still has some left for special projects, stored in another building with the rest of his hardwood stock.

A craftsmenlike approach

At one point in our conversation, Glaser mentioned that he preferred to work alone in his shop, without distraction from other people. "To do this work properly," he explained, "requires great concentration."

Later, he took me on a tour of his home. Walking through the house was like taking a stroll through a museum. All the rooms were filled with furniture of the highest workmanship—both his reproductions and his original designs.

One of the most remarkable pieces was a desk he made for his wife. Almost self-consciously, he explained that when he was a young man and he became engaged to his wife, he didn't have the money to buy her a ring. So instead, he built her a desk. It is in the Hepplewhite style and has seven, virtually undetectable secret compartments incorporated into the design.

He proudly showed me how the piece "worked," taking off a decorative molding here and there to expose a hidden drawer or a narrow compartment. While admiring his workmanship, I suddenly realized that the piece of furniture, though nearly 50 years old, looked as if it were brand new. There were no cracks in the finish, no rubbing on any drawers, no obvious signs of wear. When I remarked on this, Glaser looked completely surprised, as if my idea of what furniture should be was different than his. He seemed to think it should last forever.

Do you know of a shop that we should include in the Popular Mechanics Great Shop Series? Send snapshots plus a description of shop and owner to Home and Shop Editor, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. If we agree, we'll visit the shop, photograph it and share it with PM readers. (Enclose a stamped, self-addressed envelope if you want your photos returned.)

3 Planes To Make

In the "good old days" before power equipment, there was only one way to surface a board: by hand. Without jointers, planers and lumberyards that sell their wood already dressed, most of us would be lost. But when you have the proper hand tools and the know-how to use them, the job is far from imposing. In the photos at left, Glaser shows us how.

He begins with a piece of 1-in.-thick pine stock and a scrub plane, a narrow tool with a convex-edged plane iron which cuts deep grooves in a board's surface. It removes stock rapidly, so care must be taken to set the blade depth properly.

Next comes the jack plane, a real shop workhorse. It quickly removes the ridges left by the scrub and brings the board to desired thickness. Finally, he uses the smoothing plane to remove irregularities left by the jack plane.

In just a couple of minutes the board is planed to a uniform 3/8-in. thickness and, though this sample is soft wood, Glaser says that as long as the iron is sharp, it will work just as well on hardwood.

Both the jack and smoothing planes pictured were made by Glaser over 50 years ago. Plans are shown below.

The jack plane is diagrammed completely; the others are variations based on this style. Because the smoothing plane is identical to the jack—just one inch shorter—it is omitted from the drawing. The scrub plane, however, is different and the appropriate section and top views are provided.

Straight-grained white beech is the preferred material for plane-making. After the plane bodies and 7-in. wedges are made, they are soaked in linseed oil for four to six weeks to harden them. Plane and cap irons are available in assembled form from tool suppliers like Woodcraft, 313 Montvale Ave., Woburn, Mass. 01888—S.W.
Here are two nifty tricks that will make working in your shop even more satisfying. Master craftsman C.E. "Doe" Banister shows the secret of his modified finger-lap jig that will make you want to throw your old one away. Or, you may be able to incorporate this modification into your present jig. Another craftsman shows an easy way to make wooden dowel buttons.

**Antisplit Device**

Finger-lap jigs, or boxed-joined jigs as they are sometimes called, are among the most common jigs found in a craftsman's shop. Once you've used your jig for several different widths of fingers, however, you know that splitting begins to occur during the cut. This didn't happen the first several times you used the jig because the jig itself was serving as the backup board. The modification shown allows you to renew the kerf immediately behind the workpiece each time you use the jig. The hardwood backup-board insert is simply removed and the previous kerf area is sawed off.

Look over the drawing and you'll see that the jig is very easy to make. Note that the finger gauge key is positioned so that it clears the slot. If you prefer your key closer to the kerf, you'll have to whittle off a bit of the back edge of the backup board each time it's renewed so it clears the key running through the slot. We include a few holes for storing the miter-gauge mounting bolts and the jig itself. The hole shown in one end of the backup-board insert is for the backup board out after each session and saw off the length containing the kerf. Wood insert is visible in the slot.

The vertical piece behind the workpiece is a renewable kerf backup board. Jig is attached to miter gauge with bolts in slots. Finger gauge key is attached to bottom of the jig.
same purpose. Make a supply of these inserts while you are at it.

Cut the dovetail slot (and the inserts) at 20°. The inserts should be cut for a snug but sliding fit. Bore and tap the hole for the wood insert ¼ in. below the slot centerline intersection. Install a compatible stovebolt or wingnut and use this system to lock the backup board in place.

Wood inserts are usually available in hardware stores in sizes accepting ¼− ¾-in.-dia. bolts or screws. If you have trouble finding them, write to Albert Constantine & Son Inc., 2040 Eastchester Rd., Bronx, N.Y. 10461. The ¼-in. size used here comes in sets of 10 for $3.50, plus postage; catalog No. is 119E25.—C.E. Banister

Dowel Buttons

If you have had difficulty finding wooden buttons for your furniture projects, take heart. You can make your own with this system.

Here’s how: Measure the diameter of the hole you wish to fill, then with the appropriate-size dowel, cut dado depth, using table below.

Put a strip of masking tape on the blade insert just in front of the blade. Set your dado head for a ¼-in.-wide cut. Note that an adjustable dado head was used here. This cuts a dado wider than the tooth width because its design changes the blade angle.

Make a test cut in scrap dowel and mark the tape with a pencil to correspond to gauge side of kerf. Make a second mark on the tape ½ in. toward the fence from the shoulder mark. Adjust the tooth height according to the table below. Set the rip fence on the line closest to it. Place the dowel against the miter gauge, allowing the dowel end to just touch the rip fence.

Start the saw and move the miter gauge to engage the dowel with the dado blade. Stop when the dowel is directly over the center of the blade (at its highest point). Then, using your free hand, rotate the dowel until a ¼-in.-wide cut is made completely around the dowel.

Return the miter gauge and dowel to saw front, loosen the rip fence and move it aside. Slide the dowel to the new position by aligning as shown in the right top photo. Repeat the process for as many plugs as you need. Caution: Do not continue working on a length of dowel when the outboard, dadoed section becomes awkward and unmanageable.

Use a backup board against the miter gauge, as shown in the pictures. Allow the board to support the dowel to within ¼ in. of the blade.

Take the grooved dowel to a sanding disc and rotate it while feeding it at changing angles to round the tip. Use a fine miter saw or coping saw to cut off the button at the shoulder. Repeat the sanding and cutting process.—Dr. Robert N. Stopp

**Dowel Plug Table**

<table>
<thead>
<tr>
<th>Plug Diameter</th>
<th>Dowel Diameter</th>
<th>Dado Width</th>
<th>Dado Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>⅛</td>
<td>⅛</td>
<td>⅛</td>
<td>⅛</td>
</tr>
<tr>
<td>¼</td>
<td>⅛</td>
<td>⅛</td>
<td>⅛</td>
</tr>
</tbody>
</table>

Use padded sanding block and drill press as an alternate method for sanding heads.
WORKSHOP MINICOURSE
GETTING AN EDGE

There's at least one time that splitting hairs can be a positive, happy experience. That's when you have the satisfaction of taking a dull plane blade and putting an edge so keen on it that it will, in fact, cut a human hair. Many fear that getting a good cutting edge is beyond their skills. In fact, it isn't.

For openers, you need a grinding wheel. Unless you plan to become a serious woodworker, you can do a beyond restoration by honing alone.

To grind a blade, hold it at an angle against the grinding wheel and apply slight pressure as the wheel spins. Keep the iron moving back and forth in a straight line across the grinding-wheel edge. Besides reshaping the tool edge properly, you also want to make certain that the stone wears as evenly as possible.

Grinding is done to straighten the edge of a cutting tool. It's done before sharpening by honing. The grindstone should turn toward the plane iron (arrow). The guide supporting the plane iron is set so the bevel will be ground accurately. The guide should always be used for that reason.

The iron is moved from side to side so that the full surface on the edge bevel is ground straight. This also keeps the wheel true.

A few drops of light oil applied to the stone serve as the vehicle for carrying steel particles away from the cutting edge. Use only quality oil and be sure to wipe the stone with a clean rag after each use.

Wet the cutting edge on the oilstone to create the sharp edge. Hold the bevel edge flat against stone at 30° and work with a circular or figure-eight motion. The stone here is protected by a rosewood box the author made for it several years ago.

Have an open can of water nearby—my grinder is equipped with a tool-hung bucket—so that you can quench the tool to prevent it from becoming overheated with resultant loss of temper.

The edge should be ground so that it is almost at 90° to the sides. But professionals have known for years that a plane is easier to handle if you round the iron's corners ever so slightly. Thus, as you grind a bevel moving back and forth across the wheel, your goal should be to create ever-so-slight rounded corners, as well.

Once you're satisfied with grinding, you can move the iron to the oilstone. The oilstone, in fact, should be carried to any job away from the shop in case a cutting tool needs a quick touch-up during a planing task.

Put a couple of drops of light oil (oil)

The bevel angle for chisels and irons might vary slightly, depending upon whether the tool will be used in hardwood or softwood. In general use, however, 25° is the acceptable bevel for grinding. Whetting is done at a 30° to 35° angle at the very edge.

The feather edge—often called wire—is removed by placing the flat side of the iron on the stone and making a few strokes. Do not create even the slightest bevel on this side of the iron, however.

BY HARRY WICKS
It's true. You can find happiness right in your own back yard. Using your do-it-yourself skills and the Popular Mechanics projects on these pages, you can make your home the envy of the neighborhood.
The reason they live so long in the city is because they were born on the farm. Where we come from, work goes dawn to dusk and equipment that isn’t built right falls apart in a hurry.

So even though our lawn tractors, riders and walk-behind mowers may never see a rutted wheat field, they still have some of the stoutest frames and wheel assemblies around.

You probably won’t be cutting eighteen hours straight, either. But you can understand the importance of having an engine that’s synchro-balanced and shielded to run quiet and smooth.

You see, building things that last is kind of an obsession with us. A drive through farm country’ll tell you that.

We want folks who buy John Deere products to appreciate ’em as much as we do. And we figure the best way to do that is make sure they’re going to have them for an awful long time.

Nothing Runs Like a Deere®

For nearest dealer or for free folder call 800-447-9576.
Illinois, 800-322-6796 or write John Deere, Dept. 62, Moline, IL 61265.
PM’s Custom Deck For A Charming Home

This handsome deck joins your home and pool to provide a handy new area where you can relax and entertain.

A pocket created by the house walls on a gentle slope of lawn leading to the swimming pool seemed tailor-made for the PM deck. The major access to the house from this deck is through an enclosed sun porch that adjoins the kitchen, making the deck a perfect area for outdoor dining. The deck also has a secondary access to the house, which helps the traffic flow and adds to the deck’s appeal as a party spot. Another advantage this deck has for its owner: Situated between house walls, it provides a shady area much of the time, offering a retreat from the sunny pool side.

Ira Grandberg, A.I.A., designed this multiangled deck. The benches and planters follow the deck angles and obviate the need for conventional railings.

The deck is constructed of knot-textured garden-grade redwood. We used construction heart (all heartwood) for
1. This deck fits into a pocket made by the walls of the house. Deck is attached to three walls; it can be reached through two doors.

2. The two seating sections form an angle. Joint is centered over a vertical support; a box frame covered by mitered, horizontal 2x4s on edge.

3. Planter on the house wall ends neatly at doorway. The planter is filled with bark and potted blooms, which can be removed for tending.

4. One planter, positioned next to the deck stairs, abuts a seating section at a 45° angle, to continue pattern of angled joints.
NOW DOING IT YOURSELF IS EVEN MORE REWARDING.

You can make anything on a WORKMATE® Work Center. Even money.

Because from May 1 to July 31, 1982, Black & Decker is offering rebates on selected WORKMATE® models. $10 off the purchase of our dual-height models. And $5 off our single-height models.

There's never been a better time to buy one. So go see your dealer for details.

After all, with a WORKMATE® plus a rebate, doing it yourself can be twice as rewarding.

$10 off models 79-001, 79-003, and 79-006.
$5 off model 79-003.

Black & Decker.

THE WORKMATIC®
$5 AND $10 REBATE.
Locate and dig holes for the footings supporting the 4×4 posts. Footings must be below the area frostline to prevent the deck from heaving with the freezing and thawing of the earth. Footings should be spaced no more than 8 ft apart. We poured concrete piers into Sonotube forms and used a step-flange anchor in each pier. Bore holes in the posts as needed to bolt them to the anchors. When you install the posts, make sure they are plumb in both planes, and in alignment with each other. Use a spirit level to check vertical alignment. While the posts are exposed, apply a water-repellent coating with mildewcide to them.

Next, 2×6 beams are fastened to the posts with ½ × 8-in. hot-dipped galvanized carriage bolts. (Note: Hot-dipped galvanized hardware and fasteners are used throughout.) When fastening boards on edge, sight along the edge to determine if there is a crown (convex edge); if so, install the board, crown edge up. The weight of the deck will tend to straighten the stock. A board installed convex edge down will sag after a while. (Boards installed on the flat should also be placed with the...)

(please turn to page 108)
convex surface on top for the same reason.) To calculate the attachment point of the beams, first determine the height you want the deck. This is based upon house floor elevation. The finished deck should be located 2 to 3 in. below the door's sill. Use a mason's line and a spirit level to determine the deck height; subtract the thickness of the deck board. The top of the ledger strips should be located at this elevation.

We fastened header and stringer joists to the house joists. To do it, remove the siding so the header and stringer joists can be installed flat against the sheathing. Snap a chalk line along both walls. Then run a hefty bead of caulk along the chalkline and install the joists with 1/2 x 6-in. lag screws and washers. If you have a brick house, you must use expansion shields and bolts.

Before you begin fastening, make sure there's no chance of hitting in-the-wall electric or plumbing lines. Play it safe and make a trip to the basement to inspect the wall area. The deck joists are attached to these joists and to the beams with joist hangers. Joists in the area of the steps are of 2 x 4 stock, which accommodates 2 x 4 decking installed on edge above (see decking and step cross-sectional drawings). A 2 x 12 skirt is fastened to the outboard header joists to give a finished appearance.

Install the 2 x 6 deck boards, using 12d nails. To avoid splitting the wood, blunt the nail points slightly by striking them with a hammer. Place the nails no closer to the board edge than half the board thickness; no closer to the board end than board thickness. Set all nailheads slightly below the surface, using a large punch or heavy nailset.

There should be a 1/4-in. spacing between the boards to allow for water runoff. To add visual interest, the architect specified diagonally installed boards. To ensure a straight deck edge, trim off all the boards at one time after installation. Snap a chalkline at the trim mark and make the cut with a combination blade in a circular saw, its blade set so it just cuts through the decking.

**Continuity of pattern**

A band of spaced 2 x 4s on edge at the deck perimeter leads to a step of similar 2 x 4s on edge. This band continues the wood pattern of the seating. A flagstone step leads to a small flagstone area that provides an attractive transition between the wooden deck and the masonry pool walk. The flagstone is added after the planters and seating are installed.

The bases of the seating units are simple 2 x 4 box frames nailed to the deck. The frame is sheathed with 2 x 4s installed on the flat, their ends meeting in miter joints. The seating surface is composed of 2 x 4s on edge, evenly spaced the length of the cases. The 2 x 4s are fastened to the bases with 5-in. No. 12 screws; the holes are counterbored and plugged.

The planters are similar in construction to the seating bases. Nail a 2 x 2 base for each planter to the deck. Then install 2 x 4 uprights on the face. The planters have a liner of 3/4-in. exterior plywood sealed with epoxy resin. Install the 2 x 4 siding on the flat and top it with a 2 x 4 cap rail around the top. The two planters flanking the stairs are supported by 2 x 8s at the point where they overhang the step area.

You can finish the exposed wood members shortly after completing the deck, using a clear water repellent containing a mildewcide, such as Woodlife, Cuprinol No. 20 or Pentaseal.

Before you treat the deck, be sure to remove any dirt with a detergent solution. After washing, rinse the wood thoroughly and let it dry for two or three days before treatment. Lightly sand off any lumber-grade stampings. To ensure an even application, spread the preservative over the wood with a pad applicator or a brush. For the best results, apply two light wetting coats, allowing one day's drying time between each coat.

To keep the deck in top condition, you should reapply the water repellent every two years. Gradually, the wood will weather to a driftwood gray.
IF WHAT YOU'RE PAINTING ISN'T ORDINARY, WHY SHOULD YOUR PAINT BE?

Your father gave you that wagon for your fifth birthday. Now it's your turn to pass it on. Any spray paint could make it red again. If that's all you wanted.

But Rust-Oleum, with an average of 50% more protective ingredients than its nearest competitor, can do more. Its protective formula not only prevents rust, it also gives metal better protection from chipping, peeling and fading than other spray paints.

Something you might want to think about next time you're painting something you care very much about. ANY METAL WORTH PAINTING, IS WORTH PROTECTING.
Little Sheds For Your Yard

If your garage is already full and your back-yard space is too precious for a yard building, get the storage you need with these lean-to sheds. The designs, done for PM by Ira Grandberg, A.I.A., should inspire you to build your own with the dimensions that work best.

**Garden Supply Shed**

Use the lower shelves for garden supplies and small tools, and the upper shelves for plants. The acrylic allows the sunshine in, but it protects plants from heavy frost. In the spring, you can make room in your hotbed for delicate garden plants by moving the harder ones (pepper, cabbage, onion) into the cold frame at the top of this shed. Chrysanthemums and geraniums will continue to bloom in here long after autumn frosts have killed most other plants.

Remember that concrete footings must extend below the frostline in your area. Building suppliers carry a variety of ready-made concrete footing forms. Use 3/4-in.- or 1/2-in.-dia. lagscrews 2 ft. on center to secure the shed frame to the house frame. Screws should be long enough to penetrate the siding and studs.

(Please turn to page 112)
The Honda EM-500 portable generator is really going places. The mountains. The lake. The desert. Out to sea. Anyplace people need to power camping accessories. Charge their boat or RV batteries. Run small tools or appliances. Or shed some light on emergencies.

**TRAVEL LIGHT**
You can carry the EM-500 anywhere. It gives you a maximum 500 watts of power in a lightweight 40 lb. package.

The EM-500’s engine is a Honda. Designed and built by the people famous for engine innovations. And like all Honda engines, it’s fuel efficient. It’ll run up to 4 hours on half a gallon of gasoline.

**THE STRONG, SILENT TYPE.**
The EM-500’s superb engineering design provides quiet operation. An automatic choke and Capacitor Discharge Ignition make starting fast, easy and reliable.

An Automatic Voltage Regulator gives you steady output to run appliances smoothly regardless of changes in engine speed and load.

Whether you need power in some faraway place, or just want emergency auxiliary power in your home, you’d have to go a long way to beat the Honda EM-500.

To see one, stop by your nearby Honda Generator dealer.

For the one nearest you, just look in the Yellow Pages, or call toll-free 800-447-4400. And in Illinois 800-322-4400.
Trash Can Hideaway

You may be enjoying your yard more than ever before, but you'll take even greater pride in the view if you can manage to hide away unsightly garbage cans.

This shed does the job without sacrificing accessibility to the cans. Regardless of the size of the cans you choose to keep in the shed, they can be easily removed through the doors below for trash disposal.

The upper doors allow for easy trash deposit, whether in large quantities (top door) or small scraps through the upper front door.

Pour a rectangular concrete slab, using plywood forms. Install the anchor bolts for the sill.

The "lean-to" design allows for construction without a frame because the house wall provides structural support. Note that the shed dimensions must be based on the size of your trash cans:

It's important that you remember to leave clearance for easy removal of the cans through the bottom doors.

All of the sheds in this collection may be finished to match your house. Whether you use textured or smooth-surfaced plywood, you should make certain that the plywood you select is rated for outdoor use.

SAKRETE does it right. SAKRETE was the world's first cement mix in a bag. And today, 45 years later, it's still the industry standard for excellence — because the consistent quality of SAKRETE is seldom equaled.

SAKRETE is Economical. SAKRETE is the best buy on the market because it's strong — long lasting — use it when you want to — buy only what you need. And you increase the value of your property.

SAKRETE is Strong. SAKRETE concrete and mortar mixes are designed, batched, and mixed to be strong and workable.

SAKRETE is Easy. No guesswork. Complete step-by-step directions are right on the bag. And the free SAKRETE Project Booklet gives you illustrated pages of ideas and easy-to-follow instructions.

When you do it yourself — do it right with SAKRETE Cement Mixes.

SAKRETE® Cement Mixes
There's no substitute for the best.
Tool Storage Shed

Accessibility is the most impressive feature of this shed. Miscellaneous small tools or the unwieldy garden hose can be stored in the upper bin, while heavy equipment can be rolled up the ramp and into the lower area.

Decide on the dimensions that will suit your storage needs. Then excavate for the concrete slab and footings. Remember that footings must be below the area frostline.

Notice that the ramp is part of the slab and is angled at about 25°. Construct the slab form of plywood and incorporate the ramp into the form. Secure forms with stakes and backfill soil outside between the stakes. This will provide added bracing for the form.

Before the concrete sets, bury the heads of three lagbolts (1/4-in. -dia. x 5 in.) along the sides of the slab for securing the sill. Leave the threaded end of the bolt extending up about 2 in. Make sure it is plumb.

This shed does not have a frame. The doors are hinged directly to the side panels and the panels are attached to headers and to the sills which are bolted to the slab. The floor of the upper bin provides rigidity for the structure.

(Please turn to page 114)
Long-hardened garden tools such as rakes, hoes and edgers practically demand their own storage space. This shed is designed to keep those tools neatly and safely corralled. Its open-outer doors design keeps articles in full view.

The shed sits on a concrete slab (like the garbage-can shed). Secured to the slab is a partial plywood sill, in the form of a right triangle, which serves as a door stop. The front and sides of the shed itself are actually the open-out doors. They are attached to the 4×4s which, in turn, are screebied and secured to the house. The continuous hinges run the full length of the doors and are rated for heavy-duty use. Position the hinges carefully to ensure a good fit when the doors are in the closed position.

Available in hardware stores, continuous hinge (often called piano hinge) is usually available in 6- and 8-ft. lengths. Cut the hinge with a hacksaw to suit your needs. Use brass hinge to avoid rust stains on the wood.

Note that the right-angle joints in the doors are rabbeded. Take care when assembling the doors. If the doors are not assembled accurately, they won't come together for a good fit when they are finally attached to the shed.

Cover the shed roof with asphalt shingles. Since you have less than 30 sq. ft. to cover, you won't need more than one bundle of shingles. Install the shingles, using standard roofing techniques. If you plan to use any of the area underneath the shed roof, be sure to nip off all nails through the plywood with nippers, or clinch the nails with a hammer.

For outdoor projects, ORTHO knows how and shows how.

Build the yard of your dreams — it's easy with ORTHO books. How to Design and Build Decks and Patios and Wood Projects for the Garden are full of imaginative ideas, full-color illustrations and easy-to-follow instructions for everything from planters and patio furniture to full-scale decks. With ORTHO know-how and your handiwork, you'll get good-looking, money-saving results you can enjoy for years.

Look for the complete line of ORTHO how-to books at your nearest home and garden center, at hardware stores and at finer bookstores. Send for a free catalog of all 43 ORTHO Books. Write: Chevron Chemical Co., ORTHO Books, Room 3646, Dept. 82A, 575 Market Street, San Francisco, CA 94105.
A TOP TO BOTTOM COMPARISON OF GAS POWERED TRIMMERS.

Top-mounted Weed Eater® Trimmer
- Engine is here, on top, for balance and easier handling, not at the end of a long shaft, so there's less fatigue and back strain.
- Adjustable handle allows you to change cutting angle for edging. No way with a bottom-mounted engine.
- Fuel is in this shaft, instead of a fuel tank.

Bottom-mounted competitor
- Engine mounted down here, at the end of handle. Unwieldy and not well balanced. And right down in the dust and debris of cutting.
- Bulky engine obstructs cutting under low bushes and shrubs.
- Starter is down here. Near the cutting head. So you either bend over or lift the whole machine. Awkward.
- Almost impossible to change cutting angle for edging.
- Direct drive, with no clutch to stop cutting head from turning while starting and at idle.

WEED EATER. ON TOP FOR A LOT OF GOOD REASONS.
Fifty years ago, lawn furniture like the handsome pieces shown here could be found on the front lawns of mansions and vacation spas. But now, you'll be able to make your own sets.

The very look of this classic wooden lawn furniture conjures up images of more serene times. Though simple in design, this furniture from years past boasts an elegance all its own. Along with mission furniture, country pine, and other older styles, Adirondack lawn furniture is currently enjoying renewed interest at antique shops and flea markets.

Though you may not have a sweeping lawn like those in front of the old mansions in New York’s Adirondack mountain region—from which the furniture gets its name—PM’s re-created set of lawn
Lawn Furniture Set

Named after the beautiful mountains in upper New York State, this traditional Adirondack furniture is as durable as it is attractive. Crafted of hardwood, each piece is carefully sanded, then assembled with water-resistant glue, sealed with wood preservative and painted—all to make it stand the rigors of outdoor use.

Design and construction: Rosario Capotosto
PM color photo: Harry Hartman
Technical art: Eugene P. Thompson
1. If stock is dressed on the sides only, joint one edge, then rip to proper width.

2. Use band saw or sabre saw to cut contours. Slow feed makes for better cut.

3. Use spoke shave to smooth saw marks. Always work with grain, not against it.

4. Start each assembly with legs. Use plastic resin glue throughout construction.

5. Clamp cleats to back boards, then nail. Use spacers between boards for accuracy.

6. Bar clamp at back and spacing strip on front keep legs aligned while nailing seat.

---

**MATERIALS LIST—SETTEE**

<table>
<thead>
<tr>
<th>Key</th>
<th>No.</th>
<th>Size and description (use)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>13&quot; x 5 x 33½&quot; poplar (back)</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>13&quot; x 5 x 33½&quot; poplar (back)</td>
</tr>
<tr>
<td>D</td>
<td>1</td>
<td>13&quot; x 5 x 10&quot; poplar (upper cleat)</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>13&quot; x 5 x 10&quot; poplar (middle cleat)</td>
</tr>
<tr>
<td>F</td>
<td>1</td>
<td>13&quot; x 5 x 10&quot; poplar (lower cleat)</td>
</tr>
<tr>
<td>G</td>
<td>2</td>
<td>13&quot; x 5 x 20&quot; poplar (armrest)</td>
</tr>
<tr>
<td>H</td>
<td>1</td>
<td>13&quot; x 4 x 61½&quot; poplar (arm support)</td>
</tr>
<tr>
<td>I</td>
<td>1</td>
<td>13&quot; x 6 x 33½&quot; poplar (rear leg)</td>
</tr>
<tr>
<td>J</td>
<td>2</td>
<td>13&quot; x 6 x 20&quot; poplar (front leg)</td>
</tr>
<tr>
<td>K</td>
<td>1</td>
<td>13&quot; x 5 x 41½&quot; poplar (rear stretcher)</td>
</tr>
<tr>
<td>L</td>
<td>1</td>
<td>13&quot; x 3 x 41½&quot; poplar (seat)</td>
</tr>
<tr>
<td>M</td>
<td>1</td>
<td>13&quot; x 3 x 41½&quot; poplar (front stretcher)</td>
</tr>
<tr>
<td>N</td>
<td>2</td>
<td>13&quot; x 4 x 8&quot; poplar (back support block)</td>
</tr>
<tr>
<td>O</td>
<td>1</td>
<td>13&quot; x 3 x 41½&quot; poplar (seat)</td>
</tr>
<tr>
<td>P</td>
<td>2</td>
<td>13&quot; x 3 x 41½&quot; poplar (seat)</td>
</tr>
<tr>
<td>Q</td>
<td>1</td>
<td>13&quot; x 3 x 41½&quot; poplar (seat)</td>
</tr>
<tr>
<td>R</td>
<td>8</td>
<td>6d hot-dipped galvanized finishing nails</td>
</tr>
<tr>
<td>S</td>
<td>4</td>
<td>6d hot-dipped galvanized nails</td>
</tr>
<tr>
<td>T</td>
<td>8</td>
<td>1½&quot; No. 10 fl. screws</td>
</tr>
</tbody>
</table>

*As reqd.

**MATERIALS LIST—CHAIR**

<table>
<thead>
<tr>
<th>Key</th>
<th>No.</th>
<th>Size and description (use)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>13&quot; x 5 x 33½&quot; poplar (back)</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>13&quot; x 5 x 33½&quot; poplar (back)</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>13&quot; x 5 x 20&quot; poplar (upper cleat)</td>
</tr>
<tr>
<td>D</td>
<td>1</td>
<td>13&quot; x 5 x 20&quot; poplar (middle cleat)</td>
</tr>
<tr>
<td>E</td>
<td>2</td>
<td>13&quot; x 5 x 20&quot; poplar (lower cleat)</td>
</tr>
<tr>
<td>F</td>
<td>2</td>
<td>13&quot; x 4 x 61½&quot; poplar (arm support)</td>
</tr>
<tr>
<td>G</td>
<td>2</td>
<td>13&quot; x 6 x 33½&quot; poplar (rear leg)</td>
</tr>
<tr>
<td>H</td>
<td>2</td>
<td>13&quot; x 6 x 20&quot; poplar (front leg)</td>
</tr>
<tr>
<td>I</td>
<td>1</td>
<td>13&quot; x 5 x 41½&quot; poplar (rear stretcher)</td>
</tr>
<tr>
<td>J</td>
<td>1</td>
<td>13&quot; x 3 x 41½&quot; poplar (front stretcher)</td>
</tr>
<tr>
<td>K</td>
<td>1</td>
<td>13&quot; x 3 x 22½&quot; poplar (sprin)</td>
</tr>
<tr>
<td>L</td>
<td>1</td>
<td>13&quot; x 3 x 21½&quot; poplar (sprin)</td>
</tr>
<tr>
<td>M</td>
<td>2</td>
<td>13&quot; x 3 x 22½&quot; poplar (seat)</td>
</tr>
<tr>
<td>N</td>
<td>2</td>
<td>13&quot; x 3 x 22½&quot; poplar (seat)</td>
</tr>
<tr>
<td>O</td>
<td>1</td>
<td>13&quot; x 3 x 22½&quot; poplar (seat)</td>
</tr>
<tr>
<td>P</td>
<td>3</td>
<td>6d hot-dipped galvanized nails</td>
</tr>
<tr>
<td>Q</td>
<td>2</td>
<td>No. 10 fl. screws</td>
</tr>
<tr>
<td>R</td>
<td>8</td>
<td>6d hot-dipped galvanized finishing nails</td>
</tr>
<tr>
<td>S</td>
<td>2½</td>
<td>No. 10 fl. screws</td>
</tr>
</tbody>
</table>

*As reqd.

---

furniture is sure to evoke ohs and ahs when your neighbors spot it on your patio or deck.

Getting ready

For openers, carefully study the drawings and the materials lists. Do as professional cabinetmakers do. Make certain you understand exactly how the three pieces go together before ever putting a saw blade to a piece of wood.

You can use practically any kind of lumber to construct this furniture. If you apply wood preservative—an undercoat and two top coats of high-quality exterior paint—any species should weather quite well.

We chose a hardwood, poplar, for its added strength.

The chair and table are made from 4/4 stock (1¼ in. thick), while the settee uses both 4/4 and 5/4 stock (1½ in. thick). The poplar is easy to work, highly warp-resistant and reasonably inexpensive. In the New York City area, it's only slightly more expensive than common pine and about half as expensive as clear pine.

Most hardwoods are sold surfaced on two sides only (SSS), not on the edges. So your first step is to cut the boards to approximate length, then dress one edge on the jointer. By keeping this straight edge against your table saw rip fence when ripping to the required width, you'll automatically dress the second edge.

Using the drawing grids for reference, make paper patterns for all contoured parts and trace them onto the appropriate-sized stock. The rear legs should be positioned so that the long part of the leg is in line with the grain direction of the board. When assembled, this will make the leg as strong as possible.

Next, cut the contours with either a band saw or a sabre saw. Then sand out the saw marks from the edge with a drum sander mounted in your drill press or portable drill. Or, use a spoke shave. With a little practice, this easy-to-use hand tool will do a better and quicker job. Just be sure to use it as shown in the photo. Never scrape against the grain. Always stroke with the grain.

Next, round over all edges except those indicated with an asterisk (*) on the drawing, using a 3/8-in. rounding-over bit in a router. This will give all the pieces a soft, comfortable look, while also reducing the possibility of wood splinters. All edges that have not been removed by the router

( Please turn to page 121)
What small building would improve your property?

Build it better, easier, and cheaper, with STAR*PLATE Frame Connectors!

What are STAR*PLATES?
They're heavy gauge steel plates with channels to hold 2 x 2's, 2 x 3's or 2 x 4's, so they can be bolted together to make a basic geometric framework. It takes one set of eleven STAR*PLATES for each framework.

What size framework do they make?
Any size you want. STAR*PLATES hold 25 equal-length struts together. If the struts are short, say 2-3 feet, you've built something like a dog house or small playhouse. If they're 9 feet long, you've built yourself a greenhouse or back-40 hideaway. The framework is made of 15 triangles, all exactly the same.

Is it hard to build?
Not at all. To build the frame, you only have to drill 50 holes, and bolt the struts to the STAR*PLATES with 3/8 in. carriage bolts. The only tools required are a saw, a drill, and a wrench. It's much simpler than conventional framing. For a roof and walls, or even a floor, our plans (included with each set) give you cutting patterns and tips to make it easy.

How can I finish it off?
Any way you want to. Some STAR*PLATE buildings are elaborate, with shingled roofs, clapboard sides, and fancy doors and windows. Others are merely covered with canvas and used as beach cabanas, or with plastic to make greenhouses. One customer told us he was going to thatch his with palm leaves! You can make it as plain or as fancy as you want to.

Could I build a full-size geodesic dome house?
No. STAR*PLATES are designed for smaller structures. We recommend a maximum strut length of 9 feet. That makes a structure 13 feet high and about 14 feet in diameter, with a floor area of 140 square feet.

How can I get a set of STAR*PLATES?
Order them from The Countryside General Store, Waterloo, Wisconsin 53594, for only $39.95, postpaid. Phone orders are welcome (414/476-2139) and you can use your Visa or MasterCard.

Order today!
Only $39.95
Postpaid

Complete instructions, and building advice, included.

Five good reasons why STAR*PLATES will make you proud of your building project:
1. Strength — you'll be amazed at the strength of geodesic dome construction! Much stronger than conventional framing!
2. Beauty — STAR*PLATE mini-domes are unusual and attractive additions to any property.
3. Ease of construction — no special skills or experience necessary.
4. Economy — A dome is the most efficient way to enclose a space, save up to 15% on materials alone.
5. Flexibility — Mini-domes have dozens of uses. Whatever small building you need, make it a STAR*PLATE mini-dome!

Send for the FREE Countryside General Store catalog, describing 100's of unusual and innovative aids to modern "homedest" living!

Money back guarantee!
Please send me ________ sets of STAR*PLATES complete with directions and building tips. @ $39.95 each, postpaid. (Wis. residents add 4% sales tax.)

Total amount enclosed: ____________________________

Charge my [ ] Visa [ ] MasterCard

Name ____________________________

Address ____________________________

City, state, zip ____________________________

Mail today to:
Countryside General Store, Dept. PM, 103 N. Monroe St., Waterloo, WI 53594

Expires ________

[ ] Please send me more information on STAR*PLATES.

[ ] Please send me the latest Countryside General Store Homestead catalog.
should be eased with sandpaper before the parts are assembled.

Use highly water-resistant plastic resin glue for all assemblies. It is far less expensive than waterproof resorcinol glue and will serve quite well for this application. Also, hot-dipped galvanized nails are used throughout. Their dimensions are listed in the materials lists.

Because hardwood is being used, the nailing will be more difficult—a difficulty compounded by using the generally rough and nubby hot-dipped galvanized nails. For this reason, you may want to drill pilot holes for the nails. This will make driving them easier and will reduce the chance of splitting the wood.

In any case, do not nail closer than ½ in. to the edge of the board and ¾ in. to the end of a board without using a pilot hole.

Assembling the furniture

Assemble the chair and settle it in the following order: Glue and nail the back support blocks to the rear legs, then attach the rear legs to the front legs. Join the armrest support to the front legs, then assemble the backs as separate units. Use ½-in.-thick spacers to keep the back boards aligned properly.

Apply glue, then clamp and nail the cleats to the back boards, as shown in the photo.

Keep in mind that the middle cleat is ⅜ in. longer than the backboard assembly is wide to accommodate the armrests. Just center it on the back. When the armrests are finally attached, the cleat ends can be cut to exactly the size and shape needed for a professional-looking fit.

Next, support the leg assembly in the upright position as shown in photo No. 6, and slide the back assembly into the notched supports. Then attach the aprons, stretchers and armrests and you are done.

Assemble the table by first joining the aprons, then nailing the top boards in place. Nail the leg parts together. Then glue and nail the completed legs to the aprons from the inside.

To complete the job, sand all surfaces thoroughly and apply a high-quality wood preservative following the manufacturer's directions on the can. Then give all the pieces three coats of paint.

New Electronic Bug Killer Clears up to a Full Acre of Insect Pests

Insect-Aside™ is a clean, silent version of the government-developed pest killer that can't harm people or the ecology. Try it free for 15 days!

Here they come—the bugs of summer. The buzzing, biting, flying insect pests that drive you off your patio, spoil your outdoor barbecues...pool parties...coast-of-the-evening hammock sores. But now you can enjoy bug-free comfort, thanks to new Insect-Aside™!

DEVELOPED BY SCIENTISTS TO CLEAR MALARIAL SWAMPS

The heart of the Insect-Aside™ is a special type fluorescent lamp originally developed to clear swamps and protect cotton crops. Mosquitoes, gnats, mosquitos, midges—almost 300 kinds of light-sensitive insects—are irresistibly attracted to it. And instantly, silently “zapped” by an electronic field.

NO ANNOYING "POP", NO DANGER TO PEOPLE, AND NO HARM TO THE ECOLOGY.

Unlike competitive devices costing up to $150 more, Insect-Aside™ doesn’t make the loud “pop” many people find so annoying. Our state-of-the-art version uses a special low-voltage electronic grid that kills bugs instantly. They drop into a receptacle you empty like a car ashtray. (It makes excellent food for birds or fertilizer for your plants.)

Since there are no poisonous liquids or sprays—no chemicals of any kind—the ecology isn’t harmed in the slightest. Humans, pets, birds, even small infants, can’t be hurt in any way.

It’s so safe, many people use Insect-Aside™ as a nursery night light in summer to protect babies from mosquitoes. The only danger is to the buzzing, biting, irritating flying insects who flock toward its cool blue light and die there.

As a matter of fact, Insect-Aside™ won’t even bother the useful insects—ladybugs, butterflies, bees—that you want around to help keep your garden and plants healthy.

U.L. LISTED FOR YOUR PROTECTION AND MADE OF SHOCKPROOF, RUSTPROOF MATERIALS

The simple, attractive lantern design stands or hangs anywhere you want protection, plugging into any AC outlet. The case is virtually indestructible plastic—the same used for phones and football helmets.

There are no moving parts. And unlike some imported models, the lamp for this American-made unit is easily replaceable. It’s rustproof, shockproof, and U.L. listed for use both outdoors and indoors.

TRY IT FOR 15 DAYS AT ABSOLUTELY NO RISK

Try Insect-Aside™ for 15 days. If it isn’t everything we say, return it for a full refund. You are protected by a 1-year limited warranty of the unit (including lamp) as well as Shelburne’s 25-year reputation for satisfied customers.

YOU CAN’T BUY BETTER PROTECTION FOR TWO OR THREE TIMES THE PRICE.

Insect-Aside™ costs just $49.95 (plus $3.95 shipping and handling). It’s special type fluorescent lamp uses about 440-watt electric of electricity a month, and lasts 6 to 7 years in normal service. Yet it gives the same type of protection as units costing up to $200—without their “snap, crackle, and pop.”

ATTENTION CAMPERS AND BOATERS

Insect-Aside™ is available in a 12-volt model that plugs into any car, RV, or boat cigarette lighter. The Camper Model lures and kills insects from up to 1/2 acre for $34.95 (plus $3.95 shipping and handling). If you'd like to plug your Camper Model in AC current too, you order it with the optional AC converter for $66.95 plus $4.50.

CREDIT CARD HOLDERS: CALL TOLL-FREE: 24 hours a Day - 7 Days a Week

800-639-6170

OR

800-228-2606

Maryland Residents Call 363-4304

To order by mail, send your check to: The Shelburne Company, 110 Painters Mill Road, Owings Mills, MD 21117. Checks should be made out to the Shelburne Company. (Maryland residents should add 5% tax)

The Shelburne Company

110 Painters Mill Road Dept. K82, Owings Mills, MD 21177 (301) 363-4304
© The Shelburne Company 1982
DUTCH BOY KNOWS THIS PAINT IS GOOD.

THEY MAKE IT.

The Performer

Supreme 9 YEAR DURABILITY

Exterior

DURA WHITE 3809

Acrylic Latex Flat

House Paint

ONE GALLON

3.785 liters

Available at over 1,900 K mart stores across the U.S.A.

Performer quality by Dutch Boy. The price by K mart.

Kmart
The Saving Place®
Build This Garden Cart For The Big Jobs

This cart holds over eight bushels and stores tools and supplies.

The lawn and garden cart carries long-handled tools in racks and small tools and supplies in boxes over the wheels (above). It can hold more than eight bushels of weeds and clippings (left). With the front gate lifted slightly, the cart can dump a 2-ft.-wide course of sand or gravel (below).

The large garden cart is gaining steadily in popularity, because it hauls so much, so easily. These carts are expensive, but you needn't let the price stop you from owning one. For about half the price of a commercial cart, you can build your own cart with features that make it comparable to anything on the market.

Boxes above the wheels of the garden cart shown here hold small tools and seed packets. Tool racks tote up to 10 lawn and garden tools. Removable gates at both ends quickly give you a 5½-ft.-long bed for oversize loads. And there's no need to bring sawhorses along for outside jobs: Just clamp work to the tool racks.

The design requires two 26-in.-diameter bicycle wheels with front hubs. You can adapt a rear wheel by removing the drive and brake mechanisms and making one of the boxes 1 in. wider. Old bikes are readily available at garage sales or bike shops. New bicycle wheels cost from $25 to $40 each.

Begin by shaping the cart handles. Reduce the ends and round over the edges to make a comfortable grip. Screw-fasten the bottom to the handles with ten 1¾-in. No. 10 flathead screws. The handles should extend 1½ in. beyond the bottom's front edge. Bore ¼-in.-diameter pilot screw holes.

Next, attach the sides to the handles with six screws in each side. Notch the bottom corners of the end gates. Each gate is held in place by four lengths of angle iron (M). The upper two are screwed to the gate; the lower two are screwed to the sides so gate can slide up. Round over the gate edges slightly to fit the inside corner of the angle iron.

Attach the wheel angle irons and locate the mounting position by tipping the cart on end. A ¾-in.-thick scrap of wood under the gate will keep the cart steady. A ¾-in. piece under the wheel will give the right clearance. Be sure the 1½-in. No. 12 roundhead screws that secure the angle irons (N) are centered on the handle, rather than on the plywood side. Bore ¾-in.-diameter pilot holes.

With the cart on a hard, level surface, clamp the legs to the handles so that the cart is level. Mark and trim the legs to length. Attach them to the handles about ¾ in. from the rear gate with three 1¼-in. No. 10 flathead screws.

Glue and nail the storage boxes together as shown in the drawing. Screw-fasten the cleats to the box bottoms and attach them to the sides of the cart. Align all screw holes carefully and bore pilot holes when screwing into plywood edges.

Bore a ¾-in.-diameter hole in the box bottom directly above the axle for the lag bolt that holds the strut (O). Flatten the bottom 2 in. of the strut. Align the wheels and mark the center of the axle hole on each strut. Punch and bore the holes. Adjust the wheel bearings and attach the...
strut. It helps to hold it with a pipe wrench or piers while tightening the lagbolt. Screw the tool racks to the sides, then screw the bottom pieces to the handles.

Finally, paint the cart with a heavy-duty enamel. And it's done.—John M. Nolta

MATERIALS LIST—GARDEN CART

<table>
<thead>
<tr>
<th>Key</th>
<th>No.</th>
<th>Size and description (use)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>9 x 3 x 72&quot; oak, preferable (handles)</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>9 x 23 x 48&quot; plywood (bottom)</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>9 x 18 x 48&quot; plywood (sides)</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
<td>9 x 18 x 24/8&quot; plywood (end gates)</td>
</tr>
<tr>
<td>E</td>
<td>2</td>
<td>9 x 3/2 x 161/2&quot; oak approx. (legs)</td>
</tr>
<tr>
<td>F</td>
<td>2</td>
<td>9 x 3/2 x 23&quot; plywood (box sides)</td>
</tr>
<tr>
<td>G</td>
<td>3</td>
<td>9 x 3/2 x 35&quot; plywood (box bottoms)</td>
</tr>
<tr>
<td>H1</td>
<td>2</td>
<td>9 x 3 x 47/4&quot; plywood (box ends)</td>
</tr>
<tr>
<td>H2</td>
<td>2</td>
<td>9 x 3 x 47/4&quot; plywood (box ends)</td>
</tr>
<tr>
<td>I</td>
<td>2</td>
<td>9 x 3 x 23&quot; oak or pine (rods)</td>
</tr>
<tr>
<td>J</td>
<td>3</td>
<td>9 x 3 x 23&quot; oak or pine (tool racks)</td>
</tr>
<tr>
<td>K</td>
<td>3</td>
<td>9 x 3 x 22&quot; oak or pine rack (bottom)</td>
</tr>
<tr>
<td>L</td>
<td>2</td>
<td>26-ga. bicycle wheels with axle nuts, washers, and lock washers</td>
</tr>
<tr>
<td>M</td>
<td>3</td>
<td>9 x 11/4 x 11/4 x 3&quot; angle iron (gate bracket)</td>
</tr>
<tr>
<td>N</td>
<td>2</td>
<td>9 x 11/4 x 11/4 x 6&quot; angle iron (wheel bracket)</td>
</tr>
<tr>
<td>O</td>
<td>2</td>
<td>9/4&quot; id. x 14/16&quot; galvanized water pipe (wheel struts)</td>
</tr>
</tbody>
</table>

To mount wheels, stand cart on its front end. Place a 1/4-in. thick wood scrap under front gate and a 1/4-in. scrap under wheel. With angle iron attached to wheel, locate screw holes in center of oak handle.

P   | 1/4" No. 10 th screws |
G   | 16  9 x 9" No. 8 screws (to fasten M) |
R   | 4   1/2" No. 12 th screws (to fasten N) |
S   | 4   4d finishing nails |
T   | 2   9 x 2/2" lagbolts with 1/2" anchors (to fasten O) |
U   | 4   9/4" washers |
V   | 4   9/4" washers |

Misc.: Waterproof glue, primer and paint. 

*As required.

On a hard, level surface, clamp the legs of the cart to the handles so the cart is level. Double-check with a spirit level. Mark the legs and trim them to length.

Cutaway through a storage-box side and metal strut (O) shows how they're attached. A lagbolt with two washers passes through the box bottom into anchor in the strut.
LIQUIDATION
5-gal. WET or DRY
SHOP-VAC
Factory refurbished just like brand new!
Get a great bargain on a terrific Shop-Vac!

List Price
When New
$79.95
Out they go at
$30

90 DAY WARRANTY
FROM SHOP-VAC!
Gist a messy cleanup job? Reach for Shop-Vac. It's perfect for wet or dry pickup, indoors or out. It's easy to use, it goes up dirty, grimey liquids and gobbles up chunky, dry debris that would choke your ordinary household vac! Shop-Vac has plenty of power to pickup nails, broken glass, wet leaves, gravel, cinders, etc. Heavy duty 8-gal. steel container provides plenty of storage between dumpings. Motor is ABOVE storage tank. Water, dirt, dust, and debris never touch the motor! For wet pickup, a float type automatic shutdown is actuated by liquid reaches capacity level. There's never an overflow. Moves around easily on 4 swivel casters. Front wheel swivels to allow a 180° wide nozzle.

These units have been factory reconditioned by Shop-Vac technicians to look like new, work like new. Get a great vac at a big savings! But Hurry! Our supply is definitely limited. Order today.

Credit card customers can order by phone:
Toll-Free: 1-800-328-0609
8 hours a day, 7 days a week.

C.O.M.B. Co. / Liquidators
Dept 8-722 3270
6850 Wayzata Blvd / Golden Valley, Minn. 55426

Send___Shop-Vacs at $30 each plus $5 each for shipping & handling. Allow 3 to 4 weeks for delivery. Add 2 to 3 weeks extra if paid by check. Sorry, no C.O.D. orders.

Mon. - Sat. 9 a.m. to 9 p.m. / Sun. 11 a.m. to 9 p.m. / Mon. - Sat. 9 a.m. to 9 p.m. / Sun. 11 a.m. to 9 p.m.

C.O.M.B. Co.
ONE OF THE NATION'S LARGEST
AUTHORIZED MAIL ORDER LIQUIDATORS
OF CONSUMER PRODUCTS
6850 WAYZATA BOULEVARD
GOLDEN VALLEY, MN 55426

MUST LIQUIDATE
AT BELOW DEALER COST!
4000 Watt, Gas Operated, Emergency
Power Generator

FACTORY NEW! FACTORY PERFECT!

Don't let a storm rob YOUR home of vital
electric power! With this 4000 watt generator,
you ALWAYS have a reliable standby source of 120 volts and 240 volt plug-in power!

- 8 hp, Briggs & Stratton
- 4-cycle gasoline engine!
- U.S. made, U.S. quality!
- Fairbanks-Ward model!
- Mfrs. 1 year warranty!

For home, farm, cabin, contractors!

Four outlets. 16.5 amp each for 120V & 240V service.

A storm could knock out your electrical power for hours or for days. Food could spoil in your refrigerator. A motor in your furnace could stop running in winter and leave your family shivering in the cold. A well could stop pumping water needed for cooking or bathroom facilities. The losses could cost you to hundreds of dollars...or maybe even much more! And think of all the discomfort and inconvenience!

But you needn't worry when you have this excellent quality portable generator. It's U.S. made and it provides you with 4 convenient plug-in outlets for 120V and 240V service...16.5 amp each. Just pour in the gasoline. Start the engine. And there you are.

Use the Power Generator to run your electric lights, power tools, sump pump, well pump, etc. Plug in small kitchen appliances, a refrigerator, a freezer, etc. Of course, you can't run everything at one time. Remember the 4000 watt maximum capacity. But you can run enough things to keep vital functions working as you need them.

- 4-cycle, single cylinder, Briggs & Stratton engine.
- Produces 8 hp at 3600 rpm.
- 4-quart capacity gasoline tank.
- Chrome plated piston and aluminum alloy cylinder head dissipate heat for cooler running.
- Sturdy, durable construction.
- Size: 17½"W x 28"H x 17"H.
- Shipping weight: approx. 150 lbs.

Now available at huge savings during this liquidation sale.

Compare at over $1,000.00
Out they go at only:

$488

Price is subject to change after 60 days.

C.O.M.B. Co. / Liquidators
Dept 8-722 1180
6850 Wayzata Boulevard / Golden Valley, MN 55426

Send___4000 watt Generator(s) at $488.00 each. I will pay shipping charge to driver upon delivery. Allow 3 to 4 weeks for delivery. Add 2 to 3 weeks extra if paid by check. Sorry, no C.O.D. orders.

My check or money order is enclosed. (Minnesota residents add 5% state sales tax)

Charge my: Mastercard / VISA / Am. Exp. / Diners Club

Acct No. ____________________________ Exp. ____________________________

C.O.M.B. Co.
ONE OF THE NATION'S LARGEST
AUTHORIZED MAIL ORDER LIQUIDATORS
OF CONSUMER PRODUCTS
6850 WAYZATA BLVD / MINNEAPOLIS, MN 55426

For Rural Route Customers: If truck carriers do not normally deliver to your home, include with this order stating town or city of nearest store, brand or truck terminal to ship to.
Energy-Wise Guide To Spring Pool Maintenance

By taking these steps when you open your pool, you can greatly reduce maintenance and operating costs:

1 Opening the pool
If your pool has been empty all winter, cleaning it is a three-step job: 1. Sweep down the coping, walls and bottom and remove debris. 2. Close the drain plugs and flush the piping; then drain water to the sewer. 3. Remove hard-water and sure it is closed. Also make certain the pump is primed with water. Backwash the filter, then disassemble it and wash away caked diatomaceous earth.

For increased energy savings, set the pump timer to operate the pump a maximum of eight hours a day during heavy pool use and four hours a day during light use. Raise the filtration cycle time only if needed to control debris or algae. Also, run the pump during the less expensive energy-consumption hours.

2 Preparing the pump and filter
To ready the pump and filter, check the filter pressure gauge (or air valve) to be

3 Treating the pool water
The key to clear pool water is maintaining a balance between acidity and alkalinity, referred to as pH balance. Balanced

4 Heating the pool
To prepare your heater, clean all open areas thoroughly. Set the thermostat; to assure that it remains at an energy-saving
What a difference a Bilco Door makes!

Replacing that troublesome old wooden door with a modern Bilco Basement Door will add new beauty and convenience to your home. You'll like its neat, trim appearance and rugged construction. Long lasting, watertight, safe and secure, it pays for itself in savings on repair and replacement costs. Ease of operation is a special Bilco feature. Tension rods provide effortless opening and closing of the heavy gauge steel doors. A Bilco Basement Door is also the ideal addition to your present home or the home you're planning. It saves tracking through first floor rooms, makes the basement useful, convenient, safe. Just like adding a whole new floor of valuable living space.

STRIPPED EASE.

Now you can get a dollar rebate on the fast and easy way to strip paint.

The 3M Paint Stripper Kit—nothin' takes it off quite like it.

The adhesive-backed sandpaper sticks firmly in place, so it lasts a long time without tearing. And the padded wheel keeps you from gouging or damaging the wood. Look for it in the power tool and accessories department.

Now there's just one rule for do-it-yourself stripping jobs... Don't do it yourself without 3M.

The 3M Paint Stripper Kit

3M hears you...
level (78° F. or below) use a seismograph.
During the swimming season, operate the heater only when your pool is in use. It costs less to heat the water over a weekend than it does to maintain the temperature all week.

5 Using a solar pool cover

For added energy savings, cover your pool with a solar pool cover when no one is swimming. On the average, these covers raise the water temperature during the swimming season by 10° F. or more. They also impede chemical evaporation. Unroll the cover from storage and remove grime and algae with a soft brush and water.

5 Use a soft brush and water to remove grime and algae on the solar pool cover.

If your pool isn’t used for long periods, remove and store the solar cover. This retards cover deterioration caused by exposure to ultraviolet rays and pool chemicals. Store the cover away from sunlight and in temperatures below 120° F. Note that a solar cover left on the lawn can kill the grass in an hour.

6 Solar heating systems

A solar heating system extends the swimming season and reduces energy use significantly. Cold pool water pours

6 If you heat pool water with solar panels, hose off accumulated leaves and grime.

through the sun-heated panels, where it is warmed and returned to the pool.

When you’re opening your pool, hose accumulated debris off the panels. The panels shown (below) are made by Solar Industries, Manasquan, N.J. 08736.

The pool-opening procedures above were outlined by Jim Jones, a pool-care specialist. For a free booklet, Pool Care: A Complete Guide to Pool Maintenance, write Jim Jones, Georgia-Pacific Corp., 1001 Dove St., Newport Beach, Calif. 92660.
New Products For Outdoor Living

The Smoker-Grill (cutaway shown on left) is a combination outdoor cooker that lets you wet- or dry-smoke food: roast, bake and steam it; or just grill it by removing the upper smoke barrel, as shown below. It can hold up to 50 pounds of food and comes in charcoal and gas-fueled models that cost between $70 and $110. At home centers, it's from Coleman Patio Products, 250 North St. Francis, Wichita, Kan. 67201.

Aladdin's Bug Battier is a new insect killer that operates silently—no popping or zapping. Insects flock to 8-watt black lamp where an electric fan forces them into a water-filled tray below, where they drown. It's $70 at home centers. From ALH Inc., Box 100255, Nashville, Tenn. 37210.

The Bagger Vac, a new attachment for the Ariens line of garden tractors, can vacuum leaves, grass and other debris from your yard. It includes a 12-bushel, rear-mounted container and an all-steel blower with ABS plastic hose. According to the manufacturer, the unit mounts in less than a half hour. It is driven by the power takeoff at the back of the tractor. The hose hooks over the discharge port on mower deck. The unit is about $600 at dealers. It's made by Ariens Co., 655 West Ryan St., Brillion, Wis. 54110.

The Solarium is a new glass enclosure designed to be used as a year-round addition to your home. The modular glass sections are made of either clear or tinted insulated safety glass and aluminum frames, colored dark bronze or white. Each module is 30 in. wide, but the lengths differ depending on specific use. Made by Lord and Burnham, Box 255, Dept. 3060, Irvington, N.Y. 10533, the unit shown is about 10 x 25 ft. and costs between $16,000 and $19,000 installed. For information, write to the maker.

Now's a great time to replace your old entry door with a beautiful, secure, energy-efficient Therma-Tru door. It's pre-hung, so you can install it yourself with ordinary tools. Complete step-by-step directions are included.

Or, if you prefer, your Therma-Tru Dealer can recommend someone to help with installation. Therma-Tru doors feature self-sealing sills and door bottoms that virtually eliminate air and moisture infiltration, arctic magnetic weather stripping that seals like a refrigerator door, and our patented adjustable security strike plate that wraps around the jambs to provide greater resistance to forced entry.

Choose from more than 100 beautiful raised panel or deeply embossed doors, and many leaded, beveled glass designs.

THERMA TRU
The More Door
Division of LST Corporation
Free Brochure To receive a free copy of our new replacement door brochure, fill out this coupon and mail it to Therma-Tru, Division of LST Corp., 4747 Holland Sylvania Road, Sylvania, Ohio 43560.

Name ___________________________________________  
Address ___________________________________________  
City_________________________________________ State____ Zip_________  

(Please turn to page 130)
WATER, FILL, DRAIN, TRANSFER, SPRAY, WASH.

The new Waterbug™
At only 9 lbs., put lightweight, water pumping power wherever you want it.


With a 1350 gallons-per-hour capacity, Waterbug comes complete with couplings, adapters and 12 feet of 1" suction hose with strainer. Discharge is through a standard garden hose.

For the name of your nearest Waterbug dealer, write to Homelite Waterbug, Dept. A82, PO. Box 7047, Charlotte, N.C. 28217.

HOMELITE
Homelite Division of Textron Inc.
You Can Be In Demand Too!
There is a growing demand for trained, top-paid mechanics in the field of air conditioning, refrigeration, heating, and solar energy.

Employment for mechanics and technicians in this field is expected to grow faster than the average of all other occupations in the 1980's, according to the U.S. Department of Labor. And you can be a part of that exciting growth by learning air conditioning, refrigeration, and heating repair and installation today through the Commercial Trades Institute.

More new heating and cooling systems are being installed every day in homes, cars, factories, offices and shopping centers. These systems must first be installed and then maintained and repaired.

With C.T.I. training you can be in demand too — either owning your own business or as a highly paid technician with industrial, maintenance, and construction firms.

Join America's Top Wage Earners!
Because of the increasing demand and the lack of trained people, the earnings of air conditioning and heating specialists are among the top. It is estimated that mechanics in this field earn more than 50% above the average hourly rate of other production workers. You can join the top wage earners through the C.T.I. home study course.

Best Course Available
The C.T.I. 77 lessons cover every phase of this important field. It is the most comprehensive course available. You learn at your own pace, in the comfort and privacy of your own home. There are no classroom schedules to be met or to hold you back.

C.T.I. Gives You Two Big Pluses
First, you get 20 big job-oriented shop projects and training kits. These are practical projects which give you hands-on training. You do work and projects just as you would do them on the job.

Second, you get everything you need to build a complete working refrigeration system: you assemble the system, you pump it down, charge it, perform experiments, check for leaks, and trouble shoot it! Tools you receive include: volt-amp tester, flaring tools, tubing cutter, torch leak detector, charging lines, gauges, motor test cord, and many more items that you will use every day on the job. There is no extra charge for this professional equipment. The equipment is yours to keep and use.

You Benefit From C.T.I.'s 40 Years of Training Excellence
Lessons are provided in simple steps with easy to understand examples and clear illustrations.

You learn by the 6-step system. You read it, write it, repeat it, do it, sand in answers and ask questions. Both your mind and hands quickly learn the skills that put you with the top wage earners.

Mail Coupon Today To Get Free Brochure Which Starts You On Your Way
Get the full story on your unlimited potential for prestige, high earnings, and security. In fact, you can become fully independent for the rest of your life if you decide to start your own business as 25% of the people in the field have done. Remember, today, skilled technicians can and often do out earn the college grad. Put yourself in the picture by sending for your FREE BROCHURE today. You'll be on your way to a well-paid, satisfying, lifetime career.

If the coupon is missing write:
C.T.I. Air Conditioning, Dept. 110-062
1500 Cardinal Dr., Little Falls, N.J. 07424

No Salesman will call.

SEND TODAY FOR YOUR FREE BROCHURE

☐ Air Conditioning
☐ Other courses available
☐ Automation Electronics ☐ Conservation
☐ Color Television Electronics ☐ Locksmithing
☐ Drafting ☐ Legal Investigation
☐ Bookkeeping and ☐ Insurance Adjusting
General Accounting

Commercial Trades Institute
A Correspondence Institution
Dept. 110-062, 1500 Cardinal Drive
Little Falls, N.J. 07424

Name ____________________________
Address __________________________
City ____________________________ State ______ Zip ______
Phone ( ______ ) __________________
Build This Colonial Drop-Leaf Table

This handsome mahogany end table doubles as a serving table when its leaves are raised.

by G.S. Wing

Colonial-style furniture never seems to lose its appeal. For people venturing through flea markets and roadside garage sales or for those frequenting antique shops and new furniture showrooms, the colonial piece is a magnet—and with good reason. Simple design and straightforward function are rarely combined in a more elegant way.

This reproduction of an 18th-century drop-leaf table is perfect for a living room. Its solid mahogany construction is eye-catching and versatile. With leaves dropped, it measures less than 12 x 24 in.—just right for an end table. Yet, with leaves raised, the 23-in.-diameter top is large enough to be a serving table or a casual dining table for two.

Getting started

Before you begin, study the drawings on page 134. Because of its splayed legs, this piece is a bit more complicated than it appears.

Cut all parts to width, using the materials list on page 134 as a guide. Then turn the legs to match the shape shown in the drawing. Finish sand the legs while they’re still in the lathe, using 1-in. strips of abrasive paper in a 100-, 180-, 220-grit progression.

Next, cut the 7½° bevel on the top of each leg and cut 1½° off each end of the aprons. Though we have supplied the length of the end supports in the materials list, you should take an actual measurement first. Do this by placing the legs and matching aprons on a flat surface and clamping them together lightly. Then take a measurement for the actual size of the end stretcher.

Next, cut the grooves in the aprons for the wood fasteners and bore dowel holes in all parts that will be joined.

I used a boring attachment on a radial-arm saw, but a drill press or a portable electric drill with a doweling jig would work as well. Remember to bore the holes perpendicular to the edge that’s being joined. This ensures that mating parts will align. Note that both the stretchers and aprons join the legs ½ in. in from the sides of the legs.

Assembling the table

Bore the two pivot pin holes in the lateral stretchers 7½° off perpendicular, as shown. Make them ¼ in. in diameter—½ in. bigger than the pins—to allow the support to move freely.

Test-assemble all parts to make sure everything fits, and glue and clamp the entire leg assembly. Check all lateral stretcher and leg joints for square.

Next, glue up stock for the table top and leaves into one 24 x 24-in. piece. Once dry, rip it into three boards—8, 8¾, and 8 in. wide, working from one side to the other. Keep track of which leaf was cut from which side, so when the table is assembled, the grain patterns will match. Now, cut the rule joint in all three parts.

Lay the boards flat on the workbench and place a ¼-in.-thick spacer between each leaf and the top to simulate the joined position of these parts. Without disturbing the arrangement, draw a 23-in.-diameter circle on the underside of the table top, then cut this circle out with a router or handsaw. Make sure that the leaves are set in so the joints are tightly in line. Then, reassemble the aprons to the legs and top. Assemble the stretchers to the aprons, making sure that the ends of the stretchers fit flush with the ends of the top. Finally, after the glue has dried, oil the entire table top to help bring out the grain and condition the surface.
MUST LIQUIDATE
AT BELOW DEALER COST!
$2,500,000 INVENTORY
McGRAW EDISON TOOLS

FACTORY NEW! TOP OF THE LINE!

Sure, you can buy "cheepie" models of "bargain basement" power tools at stores in town. But those tools are made specifically for cut-rate selling... NOT for high quality! But with our huge liquidation of McGraw Edision tools, you get top-of-the-line quality at BELOW dealer cost! These tools are 100% U.S. made. Each one has a One Year Warranty. Although Shopsmith bought out McGraw Edison's power tool division, Shopsmith plans to continue producing these same great tools under their new Benchmark label.

A. — 7 1/4" Circular Saw
Max. 3/4 hp. 1500 rpm. Rip capacity of 12" blade of nickel-chrome. Sawdust ejection chute keeps cutting line visible and saw dust off your includes handy rip guide. Mfg. Suggested Retail $69.00
Liquidation Closeout Price $38.00

B. — 6" Bench Grinder
Powerful 5 amp motor for heavy-duty performance. Includes eye shield, and bell, adjustable tool rest, water trough, line and coarse grit 6" x 3/4" grinding wheels. Has maximum motor speed of 3450 rpm. Mfg. Suggested Retail $95.00
Liquidation Closeout Price $49.00

C. — 4" Belt Sander
1-1/2 hp. with standard 4" x 21½" belt size, 20 sq. in. sanding area. Adjustable tracking mechanism. Sands flush to vertical surfaces. Ball-bearing construction. Rear handle and hard grip in front for maximum control. Mfg. Suggested Retail $50.00
Liquidation Closeout Price $49.00

D. — 1/2" Variable Speed Drill
It's reversible tool 1/2 hp. with variable speeds from 0-740 rpm. Lock button will maintain constant desired speed. Auxiliary handle included. Mfg. Suggested Retail $55.00
Liquidation Closeout Price $29.00

E. — 3/8" Drill Press
1-1/2 hp., variable speed. 700-1800 rpm. For metal, wood, etc. 3/8" chuck, 12-position handle. Depth adjustment to 2 1/2". 18" column with quick height adjustment. 360° head rotation. Mfg. Suggested Retail $95.00
Liquidation Closeout Price $44.00

F. — 7" Wood Lathe
Liquidation Closeout Price $88.00

Buy any THREE tools above and get a BONUS BARGAIN!

McGraw Edison DUAL MOTION SANDER
1/4 hp, model 3000 orbital or straight motion per minute. Has 7" x 3½" sanding platen, mounted on rubber pads. Mfg. Suggested Retail $40.00

Credit card members can order by phone:
Toll-Free: 1-800-328-0609
If busy signal, or after business hours, or if in Minnesota, call 1-800-228-2606

ORDER 3 or more tools above for Bonus Bargain Special:
DI have ordered THREE or more of the above tools. Include a Dual Motion Sander for only $5 plus $4 for shipping and handling.

C.O.M.B. Co. / Authorized Liquidators
6850 Wayzata Boulevard / Minneapolis, Minn. 55426

Please send the following McGraw Edison power tools:

Order 3 or more tools above for Bonus Bargain Special!

Please print clearly.

Name: ____________________________
Address: _________________________
City: _____________________________
State: __________ ZIP: ____________
Phone: ___________________________

Change to: □ Mastercard □ VISA □ Am. Express □ DINERS Club
Account No: ______________________
Exp. Date: __________

Success! Your request has been submitted. A representative will contact you shortly to confirm your order details.
COLONIAL DROP-LEAF TABLE

(Continued from page 132)

circle on these boards and cut out
the shape. Round over the outside
edges on both leaves and top—not
the rule joint—with a router and a

(Make turn to page 136)

<table>
<thead>
<tr>
<th>Key</th>
<th>No.</th>
<th>Size and description (use)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4</td>
<td>1-1/4 x 1-1/4 x 20&quot; mahogany (leg)</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>3-3/4 x 8-3/4 x 23&quot; mahogany (tabletop)</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>3-3/4 x 1-1/2 x 23&quot; mahogany (leaf)</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
<td>3-3/4 x 2-1/8 x 4-1/8&quot; mahogany (side apron)</td>
</tr>
<tr>
<td>E</td>
<td>2</td>
<td>3-3/4 x 2-1/8 x 3-1/8&quot; mahogany (end apron)</td>
</tr>
<tr>
<td>F</td>
<td>2</td>
<td>3-3/4 x 1-1/2 x 4-1/8&quot; mahogany (lateral stretcher)</td>
</tr>
<tr>
<td>G</td>
<td>2</td>
<td>3/8 x 1-1/8 x 6-7/8&quot; mahogany (end stretcher)</td>
</tr>
<tr>
<td>H</td>
<td>6</td>
<td>3/8 x 2 x 2-1/4&quot; mahogany (fasteners)</td>
</tr>
<tr>
<td>I</td>
<td>2</td>
<td>1/4 x 6 x 1-1/4&quot; mahogany (leaf support)</td>
</tr>
<tr>
<td>J</td>
<td>32</td>
<td>3/8 dia. x 1-1/8&quot; dowel</td>
</tr>
<tr>
<td>K</td>
<td>4</td>
<td>3&quot; drop-leaf hinge</td>
</tr>
<tr>
<td>L</td>
<td>24</td>
<td>1/4&quot; No. 8 flat head screw</td>
</tr>
<tr>
<td>M</td>
<td>6</td>
<td>1-1/4&quot; No. 10 flat head screw</td>
</tr>
<tr>
<td>N</td>
<td>4</td>
<td>3/8 dia. x 1-1/2&quot; steel pin</td>
</tr>
</tbody>
</table>

MATERIALS LIST—COLONIAL TABLE
Ultimate Button
PRICE SLASHED
Was $49 --- We sold it for only $19
NOW JUST $69.90
With two free modules valued at $46.90

Regency has a problem. They built thousands of these computerized remote control systems they call the Regency Regulator to compete with the BSR X10 system. They built theirs to be much better.

The Regulator can handle up to 100 modules, the BSR only 16. The Regulator has 3 preprogrammed dimming levels you set and a quartz timing system that automatically directs 16 programmed functions per day. Unfortunately, the Regulator was priced higher than the BSR and competition is rough.

So through a one time large cash purchase, DAK has 1500 master command consoles on sale for the once time sale price of just $69.90 ($36 P&H Or. No. 9313). EXTRA HOME BONUS—There's more. You get absolutely free one appliance and one lamp module to help you get started. Plus you can buy more modules with your order for the command console for 1/2 price. The Regulator is warranted by Regency, and is compatible with BSR modules. Offer Limited.

SPECIAL MODULES
3) Heat and Air. This unit controls standard 24 volt thermostat wiring so that you can preprogram heat and air.
   This unit needs to be wired in by an electrician or yourself. Instructions included. Save on your energy bills. 100 code choices. Just $43.95 ($1 P&H) Order Number 9314.
4) If you want to control a light that is controlled now by a light switch, such as patio lights or room lights, we have the basic BSR light switch. It only has 16 code choices, but other than that limitation it works perfectly with this system including the 3 preset dimming levels, 500 watt rating. Just $19.95 ($1 P&H) Order Number 9217.

TRY THE REGULATOR RISK FREE
It's the professional system. It's built like a tank and it should last for years. If you already have a BSR system, it will be fully compatible.

Try the Regulator in your own home or office. If you aren't 100% satisfied simply return it in its original box within 30 days for a courteous refund.

To order your Regency Programmable Regulator risk free with your credit card call our toll free hotline, or send your check for the $149 list price, and not for DAK's $119 old price, but send only $69.90 plus $6 for postage and handling to DAK, Order Number 9313, CA res add 6% sales tax. Remember you also get 1 free appliance module and 1 free lamp module. It's an extra value of $43.90. Neither Regency nor DAK ever included a free module before.

DAK INDUSTRIES INCORPORATED
Call TOLL-FREE (800) 423-2636
In California Call (213) 864-1559
10845 Vanowen St., North Hollywood, CA 91605
If you use a radial-saw boring attachment, shim leg to proper height and clamp to fence. Use same setup to bore leg holes.

**COLONIAL DROP-LEAF TABLE**

(Continued from page 134)

rounding-over bit, or use a molding cutter of your choice.

Once again, lay the tabletop, leaves and spacers finished side down on the workbench. Then center the leg assembly on top of it. Position the hinges as shown in the drawing and trace their outline and screw-hole positions. Chisel out the groove for the hinge knuckle and bore the pivot holes for the screws.

With the leg assembly still in place, cut the wood fasteners to size and position them. Bore the pivot holes for their mounting screws, but don’t install the blocks yet.

**Precision measurements**

Measure the distance between the inside top edge of the lateral stretcher and the underside of the tabletop. Do this for both sides of the table, then subtract ¼ in. from each to allow for free movement of the support. The drawing gives a detailed view of this construction.

Next, cut the leaf supports from ⅝-in. thick stock and bore a ¼-in.-diameter pivot pin hole in the top and bottom edge of both. (The bottom hole is ⅜ in. deep; the top hole is 1 in. deep.) Then fashion the steel pivot pins by cutting a 1½-in. clear section from between the head and the threads of four ⅜-in.-dia. x 5-in. carriage bolts.

Using the drawing as a guide, bore the two ½-in.-deep pivot holes in the underside of the tabletop. Each is positioned about 1 in. out of plumb in relation to the hole on the lateral stretcher. This deflection keeps the hole far enough from the edge so the rule joint isn’t weakened. It also raises the outside edge of the sup-

**Clamp end aprons to table and fence; bore dowel holes. Adjust boring attachment so holes are bored perpendicular to edge.**

Align leaves with tabletop, using spacers; then position and install each hinge, using aprons and legs as reference points.

**Finishing up**

Install the support, then attach the tabletop with the fasteners. Set the table upright and test the movement of the supports. If they’re too tight, remove the top and sand the upper edge. If they’re too loose, glue a small wood block on top of each support. Once the assembly is complete, sand the piece in a 100-, 180-, 220-grit progression and finish with a rubbing of 400 steel wool. Because Philippine mahogany grain is so open, fill all the pores with paste wood filler. When it’s dry, sand it smooth, wipe with a tack cloth and apply the finish of your choice. I used paste furniture wax.
Neater barbecue cooking

Although food tastes great after it has sizzled over charcoal, cooking can be hazardous when grease hits the coals, flames up and spatters. However, you can soak up greasy drippings and stop flare-up in the grill by putting a layer of cat-box filler beneath the coals. The filler absorbs grease as it drops. You’ll also find that you don’t have to use as much charcoal.—Susan Parker

Quick freezer defrost

If your food freezer or the freezer section of your refrigerator has to be defrosted manually, do the job before the frost builds up. A heavy frost deposit on the plates or coils reduces the cooling efficiency of the refrigerator.

You can speed your defrosting job by using a portable hair dryer to blow warm air on the freezer surface. Note: Make sure you unplug the refrigerator before you begin defrosting. If your vacuum cleaner works as a blower, it will serve nearly as well as a dryer, even though the air it exhausts is at room temperature. Use a sponge and basin to pick up the water. Warning: Never use a knife or other sharp metal instrument to scrape the coils or plates. You may puncture them. A plastic windshield scraper or plastic pot and pan scraper both do good jobs.—Ralph S. Wilkes

HINTS FROM READERS

Hard working oil for hard working engines.

Here’s tough protection for the vehicle that carries the load—the car, truck or RV that performs under stress.

Pennzoil GT Performance Motor Oil is a product of our long on-track experience. It contains the friction reducers that help that hard working engine of yours run easy, increase its efficiency.

Pennzoil GT Performance Motor Oil: Protection, Quality, Efficiency.

GT WITH IT!
Build This Tomato Trellis

An easy-to-build tomato trellis like the one shown has several advantages over conventional, single support stakes. To begin with, one 8-ft. rack accommodates more plants—in this case, six—without sacrificing exposure to the sun. It also ensures air space between low-growing tomatoes and the ground. This cuts loss due to rot and insects.

Additionally, the trellis can support cheesecloth or similar material to shade newly transplanted seedlings or protect them against a late frost.

The entire rack is made of 1 x 2-in. furring held together with 6d (1½-in.) galvanized nails. The side rails are 8 ft. long and the cross-supports and hinged stakes are 22 in. long. But these dimensions can vary, depending on the species of tomato you're growing.

I found that 1½-in. utility hinges worked well for joining the stakes to the cross-supports. And they facilitate easy winter storage: Just fold up the rack and hang it on a garage or basement wall.

These supports can last for many seasons if you coat them first with a wood preservative and two coats of exterior paint.—Wilson G. Walters

Acrylic-Tough Protection.

Acrylic Kit

Trellis keeps fruit off the ground, thus holds crop loss, caused by rot, to a minimum.

Stakes are hinged to cross-supports for compact winter storage of complete trellis.
AMAZING HARD-TO-FIND SCIENCE BUYS
NOW ON SALE!

Bargains in Alternate Energy — Health — Weather
Hobbies — Magnifiers — Magnets — Telescopes — More

NEW! THE 76 MM 1/6 EDMUND TELESCOPE...
COMPLETE WITH MOUNT READY TO USE
Journey to the craters of the moon... study skyscrapers or nature's wonders! Expertly crafted in our own plant and specially designed as your first telescope. Precision optics, durable tube, all-metal mount. The 25 mm eyepiece delivers 17X magnification, perfect for all-around viewing. Its sleek design complements living room or den, yet it's sturdy enough to be the perfect companion on a field trip or star party. Weighs just 3 lbs. Measures 13½" x 17½" x 11". Comes ready to use... so your exploration into space can begin right away.

NOW $89.95

BUILD YOUR OWN WEATHER STATION
Accurately forecast weather and check your predictions against TV and radio. Kit includes anemometer with windvane, indoor indicator board to show wind speed & direction, sensitive air tank barometer with 2 ft. indicator, sling psychrometer, rain gauge with calibrated tube to measure rime as little as 1/100 inch, 100 ft. lead in wire, color cloud i.d. chart, forecasting manual. Powered by 115V AC house current with safety card.

NOW $26.95

SAVE $8.00 ON THE 30X MICROSCOPE WITH BUILT-IN LIGHT! Ideal for inspecting plants, insects, photos. Center focus wheel bolt-on light source; retractable condenser lens. 5½" x 1½" x 3¼".

NOW $16.95

MAKE YOUR OWN 9 FT. HOT AIR BALLOON. Watch it rise to about 200 ft. on just hot air. Will lift anything up to 1/2 lb. Kit includes 10 precut gores, 6 ft. of 14 gauge wire for ring and core. Instructions included.

NOW $5.35

SAVE WATER WITH SHOWERSAVER. Cut hot water bill without giving up a stimulating hot shower. A perfect mixture of air and water provides increased velocity at 75% less volume. Easy to install. Chrome plated brass.

NOW $15.95

FREE!

Giant Size Catalog
4,000 Unusual Bargains in Hard-to-Find Science Buys for Hobbyists, Schools & Industry

COMPLETE AND MAIL TODAY
To: Edmund Scientific Co. 7211 H-12 Edscopy Building Barrington, N.J. 08007

CREDIT CARD HOLDERS ORDER TOLL FREE 1-800-257-6173
In New Jersey 1-800-222-6677
Method of Payment
☐ Check ☐ MC ☐ Visa ☐ Am Exp
☐ Discover

Cart No.

Send Free Giant Size Catalog

Signature

Name (Print)

Address

City State Zip

Expired

Edmund Scientific
7211 H-12 Edscopy Bldg., Barrington, N.J. 08007
When it's your turn to mow, take your turns on a DIXON.

Every turn. But take those turns on a DIXON Zero Turning Radius mower, and it shortens the work so fast you'll think your yard got smaller!

Push or pull a pair of hand levers to move the mower forward or back.

Don't take our word for it; see your DIXON Dealer and mow-test 42" or 30" of pure Mowability...for yourself. Or write for "Ask Any Owner" and read how ZTR owners praise DIXON...

the first real turnaround in mowing circlers.

DIXON INDUSTRIES, INC.
BOX 454, PM
COPLEYVILLE, KS 67337
(316) 651-2200

NAME
ADDRESS
CITY, STATE ZIP

HINTS FROM READERS

Quick workbench cleanup

The handiest addition to my workbench is a supermarket bag fastened to the bench with a few scraps of wood. This lets me pivot the bag forward to receive debris I sweep into it. The top edge of the bag turns down 1½ in. to form a lip, which hooks onto a bag support fastened to a plywood front.

Cut the parts to size. Locate the front so it fits under the benchtop with a 1-in. space at top. Prebore and fasten cleat C and bag support D across the front, 4 in. from the top edge, with ½-in. No. 4 screws. Prebore and secure platform E to cleat F with four 1½-in. No. 6 screws. Prebore and attach cleat G to the front from the outside with four 1¼-in. No. 6 screws. Prebore and fasten verticals B to cleats G with 1-in. No. 8 screws.

Two 1½-in. No. 10 screws with four washers serve as pivots to open the front. Bore holes in vertical B and cleat F at pivot points and insert screws and washers. Attach G to benchtop with 1½-in. No. 10 screws.—William Lothaud

LUBRIPLATE® "MARINE" LUBRICANTS

For protection beyond the call of duty!

LUBRIPLATE DIVISION, HICKS BROTHERS REFINING COMPANY
MANUFACTURING PLANTS IN NEWARK, N. J. AND THE KEY WEST; DISTRIBUTORS NATIONWIDE

<table>
<thead>
<tr>
<th>MATERIALS LIST—WORKBENCH BAG</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key</strong></td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
<tr>
<td>E</td>
</tr>
<tr>
<td>F</td>
</tr>
<tr>
<td>G</td>
</tr>
</tbody>
</table>

Note: Four ⅝-in. No. 4 flathead screws; eight 1½-in. No. 6 flathead screws; four 1½-in. No. 6 flathead screws; six 1½-in. No. 10 flathead screws with washers (4).
ing tonnage of capital ships were the crucibles of the world powers' foreign policies in the two decades leading up to World War II. Things began to fall apart in the '30s: Germany blatantly violated the Treaty of Versailles, building the battlecruisers **Scharnhorst** and **Gneisenau** and the battleships **Bismarck** and **Tirpitz** at a rate to tens of thousands of displacement tons in excess of specified limits. Japan had begun planning the huge **Yamato**-class battleships, which were built in 1934, violating the Washington Treaty, and continued to maintain secrecy as two ships were built.

The Japanese were after an edge in time, maybe two or three years. In addition, they believed that even if the United States got wind of what the **Yamato** was all about, an appropriate response in dreadnought terms would probably have to be built in an East Coast yard and would be too large to fit through the Panama Canal. The Japanese failure to immediately ratify the London Naval Treaty of 1936 was duly noted by the Roosevelt administration; design work began in earnest in 1937 on what would be the **Iowa**-class battleships.

They would be fast, capable of 33 knots flank speed, but with a slow-cruising range that would take them three-fourths of the way around the world without refueling. Nine 16-inch guns would each throw a 2,700-pound projectile over 20 miles with accuracy. A full salvo would literally flatten everything within one square mile. They would be 887 feet long and, yes, they would fit through the 110-foot-wide Panama Canal... with slightly less than two feet to spare. Yet, one consideration made the **Iowas** less than the dreadnoughts of their time: armor.

Even though the Roosevelt War Department suspected that the Japanese might field 18-inch guns (which they eventually did—the largest ever to be sent to sea), the main armament of the **Iowa**-class was held to 12 inches thick at its maximum to cut weight in favor of speed. It meant that a direct encounter with Yamato-class ships might be survivable. However, even before war broke out, most Naval strategists had moved well away from the idea that one dreadnought alone could be committed to attack another. There was too much to lose on either side. Even so, in the anxious months before Pearl Harbor, an almost ludicrous—considered in retrospect—series of false-intelligence figures was leaked from opposite sides of the Pacific. While we overstated our armor dimensions, the Japanese deflated their gun-barrel diameters.

What could be more unlikely than...
to find, 40 years later, an entire new generation of military men forced to issue daily assurances from the Pentagon regarding the no-sweat survivability of those same ships.

This time, dreadnought parity is not the issue, of course, because nobody else has any. Critics of the battleship reactivation program consider this in itself to be a fairly eloquent fact. The battleship is primarily a target today, the argument goes, and even if it could be written off as only a frigate-scale investment, there will be a crew of 1,600 (some 700 less than the WW II complement) to consider. The Navy will have to put so many resources into protecting it that it will actually detract from the overall seapower mission. Furthermore, the critics contend, it is a tempting target, capable of eliciting not only the obvious Soviet countermeasures but also sea- or airborne equivalents of Khaddaficrazed hit teams—remember the Maine—in any corner of the globe. Such is the liability of residual dreadnought symbolism.

"I've heard it all," says Cmdr. Jack Dennis from his Pentagon office. "Described as the other in charge of explaining born-again battleships to the world. He explains that an on-the-horizon presence—parked ominously just off, say, El Salvador—is on the list of battleship missions, but well down in priority. "In any case," Dennis notes, "that would be a political and not a Navy decision."

The more likely mode of deployment of the Iowa-class battleships today would be within what the Navy calls a Surface Action Group (SAG). The guided-missile cruiser and various smaller escort components would offer the integrity of antiaircraft and antisubmarine defenses (illustration, page 74). Should there be a serious escalation of threat, either worldwide or in a particular high-seas environment, the SAG could be folded into a Carrier Battle Group (CBG), further affording a 500-mile air umbrella, on the average, over the entire flotilla. In the Navy's view, the amount of sheer offensive punch an updated battleswagon would add in these situations is well worth the additional defensive considerations.

In the case of USS New Jersey, due to be commissioned next January following sea trials, the initial-phase "upgunning" will include:

- Tomahawk missiles—32 of them in eight sets of armed launching tubes. These are cruise missiles operating on a turbojet engine after being launched by solid-propellant rocket, with both land-attack and ship-to-ship capabilities. A (tactical) nuclear-tipped version for land attack would have a range of as much as 1,700 miles; the conventional land-attack version ranges to about half that, and the antiship version can be launched at a range of just under 300 miles. In recent tests, according to McDonnell Douglas, a guidance supplier, land-attack Tomahawks have regularly impacted within a few feet of targets after long-range cruise flight.

- Harpoon antiship missiles—16 in four quad launchers. These attack hostile ships at about 70 miles, using their own active radar after launch on an approximate target bearing. In the terminal flight phase, after the launch, the Harpoon flies a "pop-up" maneuver to foil enemy defenses and enhance its effectiveness.

- Vulcan/Phalanx close-in weapon system—four mounts. This is the melding of sophisticated radar tracking and electrohydraulic aiming system with the Gatling-type, six-barrel, 20-mm cannon automatically firing a heavy (uranium-densified) projectile at 3,000 rounds per minute. (In fact, this little gun could get off a higher total weight in rounds over extended times than a 16-incher in the main battery can.) It will be the battleship's primary defensive weapon, able to acquire cruise missiles (or aircraft) on its tracking system at about six miles out and begin rapid fire at about three. As formidable as this sounds, it is well known that the Navy would like something better for "point defense" of ships. Nonballistic systems using laser or particle beams are being researched.

- Helicopter flight deck on the fantail, with storage area for up to three battleship-based "copers"—adding a dimension in over-the-horizon surveillance and targeting to both missiles and conventional ordnance.

In view of this high-tech reworking, it is rather remarkable that anyone can get excited about something so primitive as a gun, but any Navy man who has seen it fired in anger apparently remains permanently in awe of a battleship's "main battery" (it won't be called that any longer). Completing the anachronism, those 16-inch guns on the New Jersey will still be aimed by the 1950s-design mechanical fire-control computer in which not only target range and bearing, but also the rotation of the Earth (still the same old Coriolis force), are ingeniously reduced to a matter of gear ratios, handcranked to an instantaneous sum.

Out of mothballs

There are some two dozen unused 16-inch gun barrel liners available from storage depots in the southwestern desert and in the Philippines. Although no facility now exists to manufacture ammunition for these guns, there are about 3,000 armor-piercing and 16,000 high-capacity (less metal, more explosive) rounds in Naval inventory. Although some were 30 years old when loaded for the New Jersey's Vietnam tour, they were found to be generally in good working order: Flop them high-capacity rounds 20 miles away, and dense canister and gun- and Instant Helicopter Landing Zone (carefully avoiding the imposing central crater) of some 200 meters' breadth, with a generally defoliated perimeter extending out another 100 to 200 meters. Once the battleships are out there again, it's unlikely that the Navy will be able to resist fooling around with adding a "smart" dimension—final trajectory control—to 16-inch ordnance. Lilies also remain to be gilded.

Six of the original 16-inch twin gun turrets will remain on the New Jersey. These guns have a 10-mile range for shore bombardment, but can also be used against aircraft. (The first time proximity-fused projectiles were ever fired at sea, aboard the USS South Dakota in October 1942, she shot down 26 enemy aircraft in one day.) Although it is a 600-pound system, and most of today's Navy ships run on 1200-pound steam turbines, the Iowa-class powerplant is by no means a gross anachronism. Eight boilers feed turbines to provide a total of 212,000 hp to four propeller shafts. Conversion from "black oil" to standard Navy fuel (diesel distillate) will be the bulk of powerplant update work.

The "habitability" area is the one in which the battleships most resemble time capsules (with exception of
New Jersey). Today’s Navy tries not to stack seamen’s bunks more than three tiers high—they’re five up on the BBs—and, of course, they must have provision for “privacy curtains.” The galleys will need to be equipped to produce the fast-food items modern sailors prefer; space will be reclaimed from the admiral’s quarters to provide for a completely electronic Combat Information Center, soul of a modern fighting ship.

While things are looking up for seamen, and down for admirals, the question of whether a battleship will still need a six-cell brig—bigger than most small-town jails—has not yet been decided. An earlier decision to strip what could be as much as $50,000 worth of teak from the decks of reactivated battleships—giving rise to a sudden interest in woodcraft among Naval shipyard employees—has been reversed. Teak will come off the fantail, in the helicopter landing zone, but will be used to patch other deck areas. The time-honored practice of “holystoning” teak decks, however, is no part of today’s Navy, so the decks will stay bone gray in appearance.

Appearances can be deceiving, however, particularly in regard to mothballed ships. Walking through the Iowa recently, you would have found plenty of peeled paint; it only means the dehumidification system is doing its job.

Yet appearances, in a larger sense, are what may determine whether the Navy wins Congressional approval to reactivate all four Iowa-class ships. If New Jersey’s trials and recommissioning prove at least uneventful, the plan stands a chance. But battleships, historically, have tended to attract the wrong kind of attention. Beautiful at sea, they are brutes in close quarters; Missouri’s losing encounter with the bottom of Chesapeake Bay in 1950 sticks in more memories than the landing at Inchon of the same year. Wisconsin wears the bow of her never-completed sister ship, Kentucky, affixed as a major repair after she rammed a destroyer in 1956.

It would be worse yet to be hounded down by inferior forces—as dreadnoughts often were in war—to take some popgun nation’s lucky shot in the magazines where 1,005 16-inch shells and their propellant charges (a “full bag” for an Iowa-class battleship) are stored. This would be an incalculable blow to national morale.

Small chance? Perhaps, but in any case, it’s one the Navy is ready to take.
Most of the Formula One cars in the Detroit Grand Prix this coming June 6th will be powered by an engine pioneered by Ford Motor Company. Through 16 years of evolutionary design, the Ford Cosworth engine is still winning races. In fact, it is the winningest engine in the history of Formula One... and has also won the Indy 500 and the 24 hours of Le Mans.

Not until now, however, has the Ford-developed engine seen
competition in our home town, because not until now has there been a Detroit Grand Prix to run through the heart of the city.

Come join our cheering section in the Motor City on June 6th. And watch the Ford power go by.

There’s A Ford In America’s Future.

Welcomes Back Its Own.
If you think STP is only for racing cars... think again.

STP was born on the racetracks of America. STP—The Racer’s Edge® throughout the world. And from that discipline... where performance is all that counts... STP brings a complete line of Performance Products to your car. Where performance is all that counts, too.

STP Performance Products. Designed to help you get the best out of your car for a long, long time.

On the world’s racetracks. On the world’s roads. Wherever performance counts. STP is there. Satisfaction guaranteed.

1. **STP Oil Treatment.**
   
   Even the best motor oils begin to lose their protective properties under the high engine heat of everyday driving. That’s where STP Oil Treatment comes in. It gives your oil muscle. STP’s special polymers flex with heat... strengthening the film between vital moving parts, just where it’s needed.

   **Introducing STP “4.”** Specially formulated for today’s 4-cylinder engines that work harder, rev higher and run hotter than larger engines. Whenever you change or add oil, get STP Oil Treatment... in original or new 4-cylinder formulas. And give your oil muscle.

2. **STP Protector/Beautifier.**
   
   STP Protector/Beautifier, with its exclusive “Sunscreen” formula, protects your car’s vinyl, leather and rubber surfaces against fading, drying and cracking. It actually screens out the sun’s harmful ultraviolet rays. STP Protector/Beautifier... because the STP shine means protection.

3. **STP Gas Treatment.**
   
   STP Gas Treatment tunes-up your gas... no matter what grade gasoline you’re using. Used regularly it keeps water from building up in your tank, helps clear your entire fuel line and cleans dirty carburetors... for better performance and better mileage.

4. **AND OTHER PERFORMANCE PRODUCTS.**
   
   The lineup goes on and on... Motor Oil, Air and Oil Filters, Carburetor Cleaner, Diesel Fuel Treatment, PCV Valves, Breathe Elements, Foaming Engine Degreaser and more. All consumer proven. All satisfaction guaranteed or your money back. If the brand name is STP, you’ll get proven performance.

**Depend on STP proven performance.**
FIRSTHAND REPORT

Audi Quattro: Germany’s 4x4 Cruise Missile

Four-wheel-drive doesn’t necessarily mean getting your hubcaps dirty.

by Tony Assenza

Made for the open road, the Quattro has a top end of 125 mph and it gets there quickly.

The Audi Quattro is the pet project of one Dr. Ing. Ferdinand Piech, who, it happens, looks a good bit like Frank Perdue and is possessed of one of the gentlest souls you’re likely to encounter anywhere. Unlike Perdue, who traffics in poultry, Ferdinand Piech, Audi’s head of research, deals out tactical weapons for the open road.

Herr Piech’s latest exercise in road-going exotica reads like an incongruous concoction—the genetic splicing of a 4x4 and a sports coupe.

The pieces that make it work are as follows: a 2.2-liter, 156-hp, fuel-injected, five-cylinder engine fitted with a turbocharger and an intercooler, connected to a four-wheel drive system which distributes traction evenly to the four corners without benefit of viscous coupling. Added to this all-wheel drive system is a differential lock feature, which allows you to lock the rear and center differentials. As we discovered trying to climb a mountain road covered with two inches of ice, this locking system works like road glue. The differentials are locked by pulling a knob on the center of the console. When the two lights flanking the knob light up, that’s your indication that the differentials are locked.

Unlike most two-wheelers converted to four-wheel traction, the Quattro doesn’t penalize a low center of gravity by sitting any higher off the pavement. Incredibly it has the same five inches of ground clearance as the Coupe on which it is based.

On dry pavement, in the fully locked mode, the Quattro is transformed into a gravity-enhancement machine. Thanks to the low center of gravity, all-wheel-drive and the 205/60 x 15 Goodyear NCTs, the Quattro feels as if it’s defying the laws of physics. Although it feels quite good without the lockup engaged, the car seems to only really come together when it is engaged. Although Audi suggests using the lockup feature only on slick roads, I have a feeling

(Please turn to page 148)
This VET Did It — and YOU Can Do It Too!

"War injuries left me badly handicapped, but now I'm a financial success as a Locksmith thanks to your training. Besides, the work is fascinating. If I can't do it anybody can!" — Glen Johnson, Laredo, Kan.

Train FAST at Home!

If you enjoy fixing things, you're "natural" to make hundreds of EXTRA DOLLARS a year in the fascinating business of Locksmithing. Rising crime has increased demand for service a thousandfold. Yet there's only one Locksmith for every 17,000 people!
COLLECT CASH PROFITS ALMOST AT ONCE!
You're "in business" ready to make $5 to $10 an hour a few days after you begin Belsaw's shortcut training. Easy, illustrated lessons complete with ALL practice equipment.

• ALL TOOLS YOURS TO KEEP!
• KEY MACHINE YOURS TO KEEP!
• EXPERIMENTAL PERSONAL ASSISTANCE!
• BUSINESS-BUILDING HELP!

This Do-All Pro KEY MACHINE YOURS TO KEEP!

MAIL COUPON for FREE book, "Keys to your Future."

Name ____________________________
Address __________________________
City ____________________________ State ______ Zip ____________

MAIL THIS COUPON • NO SALESMAN WILL CALL

BELSAW INSTITUTE, 1039 Field Bldg.
Kansas City, Mo. 64111

Fender flares and logo on door are only indications that this isn't new Coupe model.

Freewheeling or not, the Quattro can cruise at elevated speeds for hours on end without flagging. In Death Valley, where we tested the car, we had a chance to mash the throttle and watch what happened. What happened was a calculated speed of around 125 mph — calculated because, as you might know, government-approved speedometers only register to 85 mph. At top speed, the Quattro does tend to get light in the front end.

The Quattro shares with the Renault Fuego (see story on page 90) the distinction of being one of the only two turbo cars on the market with an intercooler. It does what it sounds like — cools the boosted air between the compressor of the turbo and the intake manifold.

Intercooling alleviates the main problem with turbo engines — heat. Excessive heat causes a variety of problems, the worst being a tendency to detonate. Without an intercooler, the only ways of controlling detonation are by feeding the engine an overly rich mixture of fuel to cool the charge, or retarding spark timing (equally wasteful because it reduces thermal efficiency and results in a loss of power). The intercooler lets you run a fairly lean mixture without fear of detonation and doesn't require greatly retarded timing.

The cost for all this marvelous technology is about $38,000. Audi will only import 500 units this year, so if you want one, you have to hurry. See your local Audi dealer and tell him Dr. Fiech sent you.
PM's LONG-TERM CAR TESTS
(Continued from page 89)

Extremely hard, enjoying its fine performance and lively acceleration with lots of heavy-footed action. Still, we've managed to average 21.7 mpg. Other than the spoiler, nothing else has fallen off or acted up in any way. We'll let you know how things progress.

Toyota Celica Supra

Since about 25 percent of all cars sold in this country are imports, we're going to keep about the same ratio in our long-term test fleet. Our first import is Toyota's newest supercar, the Celica Supra.

Choosing this car was, admittedly, purely subjective. We liked the way it looked and wanted to find out if it had the performance, handling and durability to match.

We picked up our car at Toyota's East Coast headquarters in West Caldwell, N.J., on March 3, 1982. So far, we've only put 100 or so miles on the car so really, there's nothing to report. We can tell you that, next to the Camaro/Firebird twins, this is one of the best looking vehicles extant. And even going through a slushbox (automatic transmission), the dual-overhead-camshaft, 2.8-liter engine yields sparkling performance and decent mileage.

It's equipped with just about every available option, including air conditioning, power seats, a killer of a stereo system, remote outside mirrors, full instrumentation and digital readouts plus the graphic speed display. The list price of the car is $15,910, although we've seen Supras discounted in the New York area for $12,900.

In our next report, we'll have more details on the Supra's performance, handling and fuel mileage, as well as how the car has held up after some hard driving at the hands of the PM staff.

The 5.0-liter HO Mustang

Whereas the Supra is sophisticated and subtle, the Mustang is primitive and a bit brutal. It is precisely because of those qualities that we chose it for long-term testing. You can order it any way you want, from a thrifty 2.3-liter Four to the 151-hp, 5.0-liter high-output V8.

The only options we chose were those which enhanced performance, rather than creature comforts. Those options were the TRX suspension package which includes Michelin TRX tires, alloy wheels, stabilizer bars and specific shock absorbers. We also added Recaro seats, and the four-speed manual transmission.

Other than that, air conditioning and a leather-wrapped steering wheel are the only comfort options. With all of that, the retail price is $8,682.

So far, we've put 2,332 very hard miles on the car and the mileage has been a very respectable 14.7 mpg. Not bad, considering all the tire blistering burn-outs and redline runs through the gears at every opportunity. We're not exactly beating on the Mustang, merely using it in the way it was built to be used.

It has consumed precisely 1½ quarts of oil in 2,362 miles and has developed only one peculiarity. It will occasionally refuse to idle until it's thoroughly warmed and at other times it will idle at 1,400 rpm for a few minutes. These anomalies disappear as quickly as they come and a visit to the local dealer found all systems normal. Curious.

Those two problems notwithstanding, the car has started promptly in the most frigid winter mornings, run unfailingly strong and given hours of pleasure on spirited back-road missions. The one other problem area is the car's tail-
Come home to quality.
Come home to Andersen.

English Leather: DRIVES WOMEN CRAZY!

STOP PAYING RENT TO THE PHONE COMPANY!!!
The phone company is charging you as much as $7.77 a month for each telephone that you are renting. It makes good sense to return those outdated phones to "Ma Bell," and do away with rental fees forever.

Invest in the phones of the future from US Tone. Phonanza Model 167LX will automatically dial the last number you have dialed and spell the number of busy numbers. The mute switch gives you privacy. All this at the remarkably low price of $24.95. Buy your first Phonanza at $24.95 and we will offer you a second one at only $19.95. This will include two free wall holders which normally cost $8.95 each.

Everyone's talking about U.S. Tone being the innovator in the telephone industry. Shouldn't you have your own U.S. Tone phone to talk on?

Other models available from U.S. Tone are:

- DialLog Model DL: Last number redial, mute and on/off ringer switch $34.95
- DialLog Model DL-H: "Melody on Hold" $35.95
- DialLog Model DL-11: Built in 11 number automatic dialer $72.95
- DialLog Model DL-11H: Built in 11 number automatic dialer and "Melody on Hold" $89.95
- Wall holder $8.95

If you are not fully satisfied, return to us within 30 days for a proper refund.

Order Toll Free (Credit card holders only)
800-551-3384

Visa and Mastercard are welcome

Checks or money orders to be sent to:
Consumer Wholesaleers, Ltd., 3572 High Green Drive
Manista, GA 30067
Telephone: (404) 971-3464

* Please add $2.50 for insured postage and handling for first product and $1.00 for each additional product.

PM'S LONG-TERM CAR TESTS
(Continued from page 146)

happiness when powering out of a corner. Due to the light rear end and heavy front end, the instant horsepower conspires with the solid rear axle to move you sideways. To overcome this problem, you'll have to steady-throttle the car through a corner and get back on the gas only after you've gotten the car unwound and back on the straight.

Ease of service is something which Ford seems to have on its list of priorities because the engine box is one of the neatest and least cluttered we've seen in a long time, especially for a V8.

We'll bring you a further report on the Mustang when we get more miles on it.

Pontiac A6000

The GM A-cars are the most significant and, quite probably, the best cars the General has ever produced. Unfortunately, they were introduced simultaneously with the F-cars (Camaro/Firebird) and these two vehicles have stolen a lot of publicity thunder from the A-cars.

We've barely had a chance to turn a wheel on the 6000, so there isn't much to say in the way of mileage, durability, or behavior in daily commuting. We can tell you that it is optioned up almost to the limit, with power seats and windows, automatic transmission, super deluxe interior, high-dollar stereo, sport suspension and more. It's powered by the TBI Four which, so far, has yielded close to 20 mpg. A lot more on this car to come.

WORKSHOP MINICOURSE
(Continued from page 100)

thinned a bit with kerosene is perfect on the stone to float metal particles to the surface and to keep the stone's pores from clogging. Remember that a plane iron's cutting edge actually should have two angles on it—the grinding angle and the whetting angle (see drawing).

In practice, when using the oilstone you should only be touching that portion of the blade necessary to create the whetting angle.

Use a perfectly flat stone and keep the edge of the iron flat as you move the iron in either circular or figure-eight motion. After you have whetted the 30° angle on the edge, you will notice a slight wire curl on the flat edge of the blade. This must be removed by making several passes of the plane iron, flat side down as shown.
Treat the inside of your car as well as you treat the outside.
PONTIAC GIVES ECONOMY A NEW KICK

1982 J2000
Pontiac has charged-up its fantastic J2000 with a newly available 1.6 liter overhead cam 4-cylinder engine with Electronic Fuel Injection!
A product of advanced technology and our unwavering love of driving, this efficient little beauty delivers the tough and responsive performance you need, with free-breathing excitement you can feel*
Pontiac's fun new overhead cam J2000! Economy with a Kick!

THE DRIVER'S CAR
The makings of a sports machine
- 1.6 liter overhead cam engine with Electronic Fuel Injection, requires only auto trans.
- Front wheel drive
- MacPherson front strut
- Rack and pinion steering
- Power front disc brakes

OHC • FUEL INJECTION

PONTIAC NOW THE EXCITEMENT REALLY BEGINS
It came from Down Under

Inventions

Tinkering and inventing are more than a national pastime in Australia; there's even a television show that celebrates inventors and their hardware. At the recent TechEx technology transfer expositions in Lyon, France, and Atlanta, Australian innovations were on hand in abundance. Here are some award winners.

The Marine Thermal Auto-Pilot signals a helmsman when a vessel approaches a current of a desired temperature, such as the critical 72° to 73°F range required by the tuna industry.

The device is able to interface with an automatic pilot to keep the boat within the thermal current.

offering considerable savings in fuel. Temperature probes in stainless-steel cases trail in the water on either side of the boat. The 12-volt circuitry operates on a window principle. The operator sets a central temperature and the system steers toward the warmest probe. Developing company is Michael Australia, Box 82, Desmond, New South Wales (N.S.W.) 2299.

The Mono Wind Turbine offers a step up in pumping power for agricultural applications. It couples "S" rotor turbines at low wind speeds) to a positive displacement helical rotor pump through belt drives and a special clutch. The latter, a centrifugal type, engages (at about twice its cutout speed) when the turbines have stored energy in low winds. The system slows under the drag of the pump, then disengages and the cycle begins again. In moderate (15 to 30 mph) winds, performance is continuous and doesn't need reduction gears to achieve starting torque in low winds. Unisearch Ltd., University of New South Wales, Box 1, Kensington, N.S.W. 2033, is licensing the technology.

The MacLeod Rolling Diaphragm Valve is based on a sealed case containing a short section of silicon rubber tubing which rolls around a central shaft, sealing or opening the valve body. Since there is no sliding friction, wear is reduced; disassembly for maintenance is simple.

The positive pressure seal of the diaphragm makes the valve appropriate for a wide range of applications—from domestic water taps to anesthetic gas control, almost anything, except extremely high-pressure or solvent fluids. Design & Technology Ser-

Rolling diaphragm valve: positive seal without any friction.

vices Pty. Ltd., 225 Colchester Rd., Kilsyth, Victoria 3137 is the licensor.

The Push Cush was invented by housewife Mrs. Joan Stuckey. It's a two-section plastic cushion with a restrictive orifice between sections. The user inflates it partially, then pushes air from one side to the other with the feet. Airplane travelers, arthritics and others have hailed it as the best take-along therapy. Push Cush Co. is at 1166 Burns Rd., Turramurra, N.S.W. 2074.

Push Cush has been hailed as best therapy for aching feet.
**Aviation**

**Everyman’s crop duster**

Crop-dusting airplanes come in odd shapes, but this may be the strangest of all—at least to insects lurking on the ground. Looking a bit like a giant bug itself, it’s a modified Goldwing ultralight aircraft fitted with sprayers that dispense pesticides, herbicides and other crop-control chemicals.

Dubbed the Gold Duster, it’s said to be ideal for aerial bug spraying because it can hedgehop close to the ground and land in a peapatch. But the best news for farmers is that it comes as a low-cost, build-it-yourself kit and, under current FAA regulations, its pilot requires no license (though flight instruction is a requisite for an inexperienced owner).

The Gold Duster can cover a 40-foot-wide swath at up to 60 mph, dispensing up to six gallons per minute from each of two spry heads mounted on a boom under the fuselage. In each spryhead, a tiny, variable-pitch propeller, spinning in the slipstream like a pinwheel, drives a rotating atomizer. Adjusting the blade pitch varies droplet size from 80 to 1,000 microns. Thus, the spray pattern can be tailored to type of crop, wind and weather conditions.

Originally designed as an ultralight sports plane, the Gold Duster employs a sophisticated three-axis control system, spoilers and an anti-stall canard wing on the nose—features well suited to the slow, tight maneuvering of crop dusting. (For more on the Goldwing, see 14 New Ultralights You Can Build From Kits, page 94, May ’82.)

It’s sold in kit form for $5,500 and complete for $9,000. An intro pack is $6 from Goldwing Ltd., Box 1123, Jackson, Calif. 95642.

**Attractions**

**A Fair deal**

The 1982 World’s Fair opened recently for a six-month stint on a 72-acre fairground in Knoxville, Tenn. Following is a rundown of some technology on display:

**Japan**—Of the 21 nations taking part, the Republic of Japan steals the show with its industrial robots. The world’s robotics leader shows how the automated manipulators perform. Don’t miss the unique dome-screen movie theater with a moving floor to transport viewers through Japan’s technical history.

**Saudi Arabia**—The pre-eminence of petroleum in the Middle East energy picture has not prevented the Saudis from developing alternatives. The exhibit focuses on domestic uses of solar energy, creating an authentic desert environment.

**China**—The Chinese consistently tie past and present to the future, so the use of solar energy to power an antiquated, 20-foot “dragon boat” on the Tennessee River seems in keeping. Making propane from local marsh gases is another energy-related demonstration.

**Australia**—The Australian exhibition houses solar water heaters and a whole family of futuristic windmills that irrigate exotic Eucalyptus trees and similar transplanted flora.

**United States**—The most impressive pavilion in size and design is the energy-efficient U.S. hall, with 42,000 square feet of exhibit space. The building’s roof is a 5,000-square-foot solar collector. And there’s a 65- by 90-foot IMAX movie theater, the world’s largest, which seats more than 1,200.

The series of exhibit lev-
Design

6 rms, riv vu

We're all familiar with the mobile home as a way to have your house and take it with you, but Gary Dunne of Patchogue, N.Y., has a new wrinkle on the idea. Dunne built his first floating home in 1971 for his own family. Before he knew it, he was in the business.

At present, Dunne has completed over 30 homes, from the most popular 1,000-square-foot, two-bedroom, two-story unit to a 1,700 square-foot version with three bedrooms, two baths, a third-story penthouse and a cathedral-ceiling living room.

Dunne's floating house differs from a houseboat because it has no internal power and must be towed to its dock. The homes meet all maritime regulations for floating structures, as well as standard residential building codes, so an owner could lift his home out of the water and set it up on a dry-land foundation.

The house itself is built on a flat-bottom plywood and fiberglass barge which has a draft of only 8 inches. The 4-foot-deep barge is 14½ x 40 feet for the 1,000-square-foot version and 20 x 40 for the three-story model.

The hull is built of pressure-impregnated beams skinned with ¼-inch exterior plywood which has been sealed with a polyester resin. Hot-dipped galvanized nails are used throughout. The whole unit is fused into a monolithic structure with three layers of fiberglass and polyester resin.

Dunne says the key to making a floating house work in terms of comfort is extensive insolation and sealing. He uses double-paned tempered glass for the extensive glass walls used throughout the structure. The ceiling is insulated to a full R-22 value and walls and hull are covered with double-foil-faced fiberglass for an R-11 value.

Warm air is ducted through the house by a propane-fired hot-air furnace. Dunne claims this isn't needed except in the evenings and on overcast days: The large amount of south-facing glass serves as a passive heating system. If the south-facing windows supply too much heat, there is nothing to stop an owner from turning the house around during the hot months.

Mooring is by a pile-and-ring system that allows the house to rise and fall with the tide, but prevents almost all rocking and surging motion.

els show America's energy history in fabulous, eye-filling detail.

Symbolic of the '82 Fair is the 266-foot-high Sunsphere, a spectacular 24-carat-gold-coated, energy-efficient glass globe, that houses a split-level restaurant and three observation decks.

The Fair is the most energy-efficient way to see how the world plans to cope with its energy needs—at $9.95 for a one-day admission.

While most of exhibits deal with the future, a brewery-sponsored show recreates a pre-Civil War foundry.
Electronics

The brain trigger . . .
Move over, Freud. The story from the Psychology Dept. of the University of Vienna these days involves sophisticated electronic measurement apparatus and on-line computer monitoring of human brain functions. With systems capable of measuring a d.c. potential change of as little as 1 microvolt (.001 volt) within the cerebral cortex of subjects performing perceptive (reading, memorization) tasks, a major phenomenon has been confirmed:

When there is a slight negative shift in d.c. potential in the cortex, a person's learning ability improves immediately by 25 percent. This lets a subject absorb 25 percent more material in a given time, or a given amount of material in three-fourths the time.

So sure are Dr. G. Guttman, department head, and his colleagues of the advantages of learning during cortical negativity, that hundreds of Austrian schoolchildren now spend part of each school day doing relaxed and meditative exercises (see photo) to induce this tiny, critical negative shift in brain electricity.

Guttman's group developed the Austrian pilot candidates must solve a series of computer-generated spatial-relation problems (right), while working against resistance machines. Some bomb out under the additional physical stress.

exercises through the use of biofeedback techniques: Negative d.c. potential is picked up via electrode, amplified and converted to a tone which the subject learns to control through trial and error.

... And 'champions' who shoot blanks
In a related branch of brain-activity monitoring, the Vienna Psychology group has developed computer software that presents a subject with perceptual problems while he is undergoing physical stress (on a bicycle ergometer, for example). Some can hack it; others bomb out on arcade-game type maneuvers that they can perform easily without the added stress. It's led to a system that identifies the "training champion"—the guy who shoots 80 percent from the foul line in practice, but can't convert one out of two in a pressure game situation. And the tests are remarkably consistent: Subjects whose performance isn't altered by added physical stress occasionally even improve slightly; the failures never do.

An outgrowth of these stress games is now used to screen Austrian Air Force pilot candidates, and other NATO military services are considering it.

Is there any hope for the "training champion"? Possibly. Stress performance could be related to the same brain-current shift that regulates perceptual ability—biofeedback training may apply.
28K PERSONAL COMPUTER
Only
$299.00
Special Sale Price

GREATEST BUY IN AMERICA
It has color, sound and music with a powerful 8552 microprocessor (like Apple). 20,000 Bytes ROM with a 16K microcsoft extended Level II Basic built in, 8000 Bytes RAM plug in expandable to 32K RAM, Cursor, Real Time. Full size easy to use 66 key professional typewriter keyboard, 62 keys with graphics symbols, 4 programmable function keys. High resolution graphics, 512 displayable characters, Text display is 23 lines 22 characters, 16 colors. Will accept Tape, Disk-#64 Pin Cartridges. Has low priced plug in peripherals, Connects to any TV or monitor. Includes AC adapter, RF modulator, Switch box, Cables and self teaching instruction book - all in a beautiful Creme Colored Console Case. This is a powerful-full sized extra featured computer for only $299.00.

WHY SUCH A LOW PRICE
Selling direct to the customer we save you the profit margin normally made by the computer manufacturers and distributors. We are willing to take a smaller margin to develop volume to cut our cost of operation.

COMPETITIVE LIST PRICES
APPLE $1125, T. I. $525, ATARI $399.95, RADIO SHACK TRS 80 color with only 12K memory sells for $399.50.

LOW COST PLUG IN EXPANSION
Expansion accessories plug directly into this computer, extra RAM memory, Controllers, a Cassette, A Telephone for modem for only $109.00, an 80 Column Printer for $375.00, even the 170K Disk Drive plug in direct. You do not have to buy an expensive expansion interface.

GET JOB OPPORTUNITIES NOW
Every newspaper has several pages of want ads for computer people. You can learn to operate and program a computer for these opportunities available to those who prepare for the computer revolution. This computer has extended Level II Basic with floating point: decimal, Integer and String Arrays, Text functions, Direct Statement, Execution. Multi-statement Lines, Cursor, Full screen editing, Color Command Keys, Graphics, Scrolling, File Management, Upper-Lower Case, Direct Memory Access, Peek and Poke and much more! Assembly machine language is available. We have easy to follow self teaching books and programs.

INVEST IN YOUR CHILDREN
Educate your children while they play. Every kid wants to play electronic games. We have some of the best. The next natural step for their curiosity is to try simple programming. They can do this in 20 minutes with our simple self teaching instruction book. High schools are teaching computer math, science and programming - some start in grammar school. If you provide this computer as a Teacher and Tutor at home, before you know it your child will be writing computer programs. You can use your TV to EDUCATE not frustrate your family and eliminate TV boredom with programs that challenge, stimulate and entertain the whole family. We have a wide variety of games, recreational, home finance and educational programs to choose from. Why pay $140.00 to $295.00 for an electronic game when you can buy this powerful computer for only $299.00.

COMMUNICATE WITH THE WORLD
Plug in your VIC telephone modem. Now you can get a world of information through your telephone, plus electronic mail. Just dial up the information you want. UPI wire service, stock market, historical information by topic from over 80 magazines, including New York Times. Airline information, order tickets, get weather information anywhere in the world, restaurant and hotel information, thousands of categories are on line for you, business, finance, education, entertainment, games etc. YOU'LL BE THE TALK OF YOUR NEIGHBORHOOD. Our telephone modem price is far the lowest available.

IMMEDIATE REPLACEMENT WARRANTY
If your computer fails because of warranty defect within 90 days from date of purchase, you simply send your computer to us via United Parcel Service prepaid. We will "immediately" send you a replacement computer at no charge via United Parcel Service prepaid. No one knows your business like we do, this kind of warranty service is rare. Most computer warranty service takes 30 to 90 days to handle - this fantastic "immediate replacement warranty" is backed by COMMODE MD COMPUTER, A MAJOR national brand electronics manufacturer.

SPECIAL SALE PRICE $299.00 For only $299.00 you get the powerful 28K COMMODORE VIC with 20K ROM, 8K RAM and Extended Level II BASIC, The professional 66 keyboard, color, sound, music, self teaching instruction. AC adapter, RF modulator, TV switch box, owners manual, plus all of the other extra features listed, in a beautiful Creme Colored Console Case.

SPECIAL SALE PRICE $379.00 For only $379.00 you get the more powerful 41K COMMODORE VIC with 20K ROM, 21K RAM and Extended Level II BASIC, plus all of the other extra features shown for the 28K COMMODORE VIC!

DON'T MISS THIS SALE - ORDER NOW
☐ Please send me the 28K Commodore VIC Computer for $299.00.
☐ Please send me the 41K Commodore VIC Computer for $379.00.
☐ Special Data Cassette $99.00.
We ship C.O.D. and honor Visa and MasterCard.

Name ____________________________
Address __________________________
City ______________________________
State __________________ Zip Code ___
☐ VISA ☐ MASTERCARD ☐ C.O.D.
Credit Card No. ________________
Expiration Date ________________
Add $10.00 for shipping, handling and Insurance. Illinois residents please add 6% tax. Add $20.00 for CANADA, PUERTO RICO, HAWAII orders. WE DO NOT EXPORT TO OTHER COUNTRIES. Enclose Cashiers Check, Money Order or Personal Check. Allow 10 days for delivery (21 days for Personal Check orders.) 2 to 7 days for phone orders. Canada orders must be in U.S. dollars.

PROTECTO ENTERPRIZE (FACTORY-DIRECT)
BOX 550, BARRINGTON, ILLINOIS 60010
Phone 312/382-5244 to order

we are commodore VIC experts!!

VIC 20 owner? Register with us for new product and program information.
To remedy this, we followed the same approach as designers of large home speaker systems: We used specialized speaker drivers that handle the extremes of the music spectrum. At the bass end, we added an Altec SW-1 subwoofer system ($239.95), which is a 6 x 9 driver with its own built-in amplifier and associated dash-mount control box.

The SW-1 is designed to reproduce the range from 20 to 200 Hz, using what engineers call a "long-throw" cone design—a cone capable of moving long distances in and out, thereby moving enough air to pump out high-level bass with minimal distortion. It can be mounted in any mid-sized enclosed space: trunk, footwell or even rear side panel, with its control unit up front within easy reach. We dropped one into place behind the seats in the 450SL with about two hours' work. The differences in deep-bass solidity and "oomph" were obvious as soon as we cranked it up.

At the other end of the musical spectrum, a pair of add-on treble units were the key to better high-end definition and more convincing stereo "images." The idea here was to put the two treble units up as high as possible in the vehicle interior, so that their output blended with and augmented the treble response of the main speakers.

We mounted a pair of Philips 8320 Tune Up Tweeters ($79.95 per pair) forward in the doors. These speakers consist of 1-inch dome drivers in a sleek, high-tech case with a built-in thumb-wheel level control. In place, their Eurostyled appearance looked just right, and the source of sound had moved upward and acquired a new sharpness—the music now seemed to come from a broad area somewhere on the hood. (All door-mounted speakers, by the way, should be located as far forward as possible to minimize the impact of the slamming doors.)

Another deficiency of the car's original sound system had been a lack of power—the Alpine has only 4 watts per channel built into its chassis. (The manufacturer expected most purchasers to use the cassette deck in conjunction with a separate power amplifier.) The owner of the Mercedes had opted to use it without external amplification. Our interest in setting up the system for wider range sound, though, made a separate power amplifier a necessity.

**Power to burn**

Though only a single, two-channel power amplifier was needed, PM fitted two power amps (shown in the photos on page 31) to illustrate the two basic installation options available. As one approach, we mounted an Alpine 3002 50-watt-per-channel amp in the trunk, fastening it to an inner side panel and routing the speaker and power cables back through the rear panel to the passenger compartment.

As an alternative approach—which might be used in a hatchback, a station wagon or a subcompact car—we installed a low-profile, 50-watt-per-channel ADS Power Plate 100 amplifier ($320) under the driver's seat, routing its wiring beneath the floor carpeting to the dash. Both of these locations provide the mod-

---

**CAN A MOTOR OIL ACTUALLY HELP YOUR CAR LAST YEARS LONGER?**

"AT QUAKER STATE WE PUT IT IN WRITING."

James Pillar

---

When you buy motor oil, you can't see it in the can. When you put it in your crankcase, you can't watch it work. So how do you know how good it really is?

At Quaker State, we put it in writing. We back up our quality with a lifetime guarantee. We guarantee every new car engine against oil-related failure for as long as you own your car and use Quaker State. To obtain coverage and for details, write Quaker State, Warranty Department, Oil City, PA, 16301.

And you don't have to buy a new car to benefit from Quaker State quality. When you put Quaker State in your car—old or new—you're putting in America's quality motor oil. Made only from Pennsylvania Grade Crude Oil.

**STAYIN' ON THE ROAD WITH QUAKER STATE**
The best amount of air circulation needed to keep the two amplifiers' operating temperatures within bounds.

Fortunately, with the convertible top down, the 6 watts per channel from the front-end unit had been adequate for little more than fresh-air background music. The added power from the external amplifiers made it possible to listen to concert-hall volumes and added a sense of unstrained, sonic openness.

In the third phase of our upgrading, we expanded the system's control flexibility—its capacity to be adjusted for proper balance on different types of music. This was accomplished by adding an Alpine 3011 equalizer to the system, mounting it within the driver's reach in the left-hand side of the glovebox. An equalizer is a sort of expanded tone control (see Get Customized Sound With An Equalizer, page 110, Apr. '82). It allows the user to boost or cut the system's tonal response more precisely than conventional bass and treble controls do.

By dividing the musical spectrum into many separate bands, each adjustable with a slider control, an equalizer can be used to balance the deep bass with the mid-range, the lower mid-range and so on, up through the extreme treble.

The Alpine equalizer has five bands per channel, plus illuminated level meters, and an array of secondary controls to be used with rear speakers (which our two-seater project car didn't have).

You can use a car-stereo equalizer two ways: either as a one-time "fix" for your vehicle's acoustical shortcomings, or as a superflexible tone control for the persnickety music listener. In our case, we spent an hour or so adjusting the slider positions, while listening to a variety of musical formats. After that, we found that the controls needed little additional fiddling.

We had noticed a lower mid-range hollowness and a bit of mid-treble "sizzle." We were able to rectify both conditions with a few adjustments, further smoothing the sound of what was becoming a first-rate sound system.

Fine tuning

A couple of additional details rounded out the 450SL's sound equipment. To play back the ultra-wide dynamic range, dbx-encoded cassette tapes the car owner had made on his dbx-equipped home cassette deck, we added an automotive dbx Model 22 decoder to the array of "black boxes" in the glove compartment. We used it in lieu of the Dolby noise-reduction system built into the Alpine unit, but only on cassettes encoded in the dbx format.

We also replaced the stock Mercedes antenna—which mounts on the right rear quarter—with an extremely sensitive Hirschmann 6000U electronic antenna. It incorporates signal-boosting circuitry built into its cast housing and has a whip length of only 18 inches.

And to connect all of the elements, we used two types of premium low-resistance Monster Cables (that's the company's name, honest)—a heavy-duty, double-jacketed speaker cable that goes by the name Hot-wires, and a thick shielded wire, called Interlink, for low-level signals. Both are weather-resistant and freer of stray electrical gremlins like excess capacitance and inductance than conventional wiring. We crimped the speaker connections to spade lugs at each end and covered all wiring splices with heat-shrink tubing.

The final result lived up to our expectations. The upgraded system's sound had an effortless, spacious quality, along with all of the volume and flexibility that an audiophile demands.

---

**PUT YOUR X-ACTO BLADE TO THE TEST IF IT CAN'T CUT IT ... CHANGE IT**

The difference between a dull X-Acto blade and a sharp one can't be seen. Until it shows up in your work. But before that happens, take a minute to take the X-Acto test.

**THE X-ACTO TEST:**

1. Put the magazine down. Face up. 2. Put your X-Acto Blade on the dotted line and cut along the border. 3. Remove this ad. 4. If your blade didn't cut through three or more pages, replace it. If it did, replace the magazine.

Your X-Acto Blade is designed to make the clearest cut under the least pressure. When it takes work to make it work, change the blade. And remember: Your X-Acto Blade is indispensable. But your X-Acto Blade is conveniently disposable.

In a variety of blade types and package sizes wherever X-Acto Products are sold.

---

Put new life in your X-Acto Knife.
Protect your mileage

Nothing can spoil your engine's performance faster than a balky carburetor.

A piece of grit or rust no larger than a pinpoint can keep needle valves and metering rods from seating properly, wasting fuel and spoiling performance.

The best way to stop trouble is in the fuel line, before it reaches the carburetor.

The ProFuel filter has a grit-grabbing element that nabs dirt down to forty microns, protecting vital carburetor parts beyond the original equipment specifications.

And with ProFuel you change only the element, not the whole filter. It's quick and economical.

The ProFuel body is clear, so you can check the condition of the fuel and the filter.

The finish is hard chrome that reflects heat and resists rust. ProFuel is a product of CR Industries, Elgin, IL 60120.

Easily installed, it's available in auto stores in your area.

PM OWNERS REPORT: MUSTANG

(Continued from page 83)

sion dropping down into low range."

And a North Carolina analyst wasn't alone when she observed, "If I had it to do over, I'd upgrade my current four-cylinder Mustang to a Six. I miss the performance of a more powerful engine."

In the area of quality and workmanship, nearly half our respondents said "good," but fewer than one-quarter gave Ford workmanship an unqualified "excellent" rating. That's the reverse of the marks given the 1981 Ford Escort, EXP and the '82 Continental.

A Texas aircraft mechanic stated, "Body metal is so thin that if you're not careful, you can dent the car just by leaning on it." A Kentucky programmer noted, "The bottom edges of the doors had no paint on them at all!"

And a New Hampshire secretary: "My Mustang has many body leaks. I'm disappointed in the workmanship of a car that is so costly. I've brought it back to the dealer 10 times in 1,000 miles and the transmission still isn't shifting right. I feel Ford should take this car back and start over!"

However, in fairness, we did hear an impressive number of comments from owners who felt good about quality and workmanship. For example, an Ohio hostess: "It's certainly a solidly built car. I rear-ended another vehicle at a red light and the front bumper and hood of my Mustang came out without a scratch. I hit the other car pretty hard, too."

A Texas auto parts consultant: "My Mustang is so airtight that, even with the T-top, I have to slam the door to shut it against the air pressure inside."

When we asked owners for suggested changes, several said they'd appreciate higher fuel mileage, better workmanship and a lower price tag. Other recommendations included the following:

From a Michigan insurance manager, "I wish they'd change the hood. Pushing inward on the turn lever is a lousy way to height, even after you get used to it."

A Minnesota machine operator: "I suggest that Ford expand the size of the glove compartment. Nothing fits in it. The trunk doesn't hold much either — too shallow."

"More legroom in the rear seat," suggested a Wisconsin student. And from an Ohio accountant: "Give us some work space under the hood. Adding oil to the six-cylinder engine amounts to a major operation."

General comfort received high praise for the front seats and, considering the nature of the car, fairly high marks for the rear seat, too. A Michigan salesman noted that, "I'm 6'2, and even when I'm driving with the seat shoved all the way back, passengers tell me there's plenty of room in the rear."

But a North Carolina systems analyst countered with, "When my rear passengers get their knees out of their mouths, I'll ask them how they like it back there."

A Tennessee student: "Good driv-

Wild Horses To Go

Try to imagine the automotive equivalent of Genghis Khan pillaging a defenseless village and you'll have some idea of what the 5.0-liter HO Mustang is all about. It's loud and arrogant and it will suck the hubcaps off anything that dares to challenge it.

Granted, it doesn't have the sensuous curves of the new Camaros, the technical sophistication of a Porsche or the exclusivity of an exotic. But the fact that you can buy the 161-hp, 5.0-liter for $3,682 more than makes up for any deficiency. At that price, it has to be one of the best go-fast bargains on the market. For that low entry fee, you'll have a vehicle that scatters lesser cars before it like a stiff wind through a pile of leaves.

There is room for improvement, however. The wood-grained dash looks out of place in such a muscular car, the steering effort is too light and the clutch pedal effort is too high. But the fact that you can wipe the smile off the faces of Porsche owners makes those compromises seem minor indeed. — T.A
ing comfort, smooth ride for such a short wheelbase." A New York factory worker: "I enjoy my AM/FM cassette deck. The sound is beautiful. Interior feels nice and comfortable, and I enjoy my Mustang's ride and the way it handles."

Only about one-third of our respondents had experienced mechanical problems, and among those, dealer service came in for general praise. The most common malfunctions involved the Mustang's electrical and fuel-intake systems.

In all, then, the Mustang consensus has to be one of owner pleasure and satisfaction. And while only about 75 percent say they'll buy another Mustang next time, most hasten to add that, with growing families, a pony car might not be practical for their next purchase.

The person who summed it all up, however, was a teacher from Utah, who wrote, "I love my Mustang! The luxury and comfort, the smooth ride, handling on curves and slippery roads, the appearance, detail work, service—all these add up to great satisfaction. Besides, the car is fun to drive. I get a lot of compliments and I come from a long line of Ford owners. I'm totally satisfied."
COMPUTERS BRING CARS TO LIFE
(Continued from page 79)

manufacturing a steel body from a video framework.

"We're always investigating new areas with the computer," Don Parker told us as we were being shown
around GM's Fisher Body Div. "With it, we can find inherently weak areas. Or we can see areas that may
not do as much work as other areas—and use mass reduction there."

Put to the test

We watched as a doorpost was put through something called finite regression analysis. The video display
was zoomed in until only a portion of the doorpost's destination was visible. Then, the computer
displayed a network of triangles all along the magnified part.

The woman working the console took control of that doorpost's destiny as she entered several variables
via keyboard and light pen to simulate the stresses on an entire doorpost. Within each triangular area, she
questioned the computer for a detailed printout of the stresses and how they affected the stability of the
"metal."

We watched spellbound. Had Detroit forgotten how to make a doorpost? What was all the fuss about?

The idea was mass reduction. Less mass means better fuel economy. By using the computer, designers can
find out just how much mass to shave away from the finished version so that it would still support the
roof, yet have the least possible mass. Almost anyone could figure out that a thick doorpost would support
a roof. But how slender can that post become and still hold a roof above your head? Finite regression
analysis can tell you.

The computer helped to shave away a little here and a little there—a bit off the top, a slice off the side.

Finally, a computer is used to design the dies from which the actual parts of the car's body will be cast.

From clay, through video, to the blazing furnaces of a steel mill, the typical design project takes four
years.

There are even more applications of the computer just over the automotive horizon.

At Ford, we watched a video driving simulator. Seated at the console, the operator could "drive" a car
through a number of different road conditions. With just a touch of the keyboard, he could drive an entirely
different car, or adjust such things as spring rates, shock-absorber rebound and roll steel. When the drive

felt good, then a prototype car could be built for road testing.

But while most of today's computer applications involve structural metal design, engineers are also getting
ready to design the functioning parts of automotive machinery on computer. Instead of ghostly, wire-
frame images of cars on screen, there are already computer programs that can display exact three-
dimensional representations of everything from hubcaps to camshafts.

Dr. J.W. Boyse, of GM's research labs, explained how the new GM-Solid computer program works.

A collection of "primitive" shapes is stored in the computer's memory banks. These simple, 3-D shapes
may be combined into any number of very complex shapes.

Suppose, for example, you want to "drill" a few holes into a flat plate of "steel" on the screen. What you do is
to "subtract" cylinders whose diam-

eters match those of the holes from the plate. Presto. The holes are drilled.

We saw a camshaft model that was
as accurate and detailed as a photo of an actual part. But the camshaft had yet to be manufactured and
existed only in the computer. Ford uses a similar system to analyze stress.

An ever-increasing amount of design work will be accomplished by these computers. Even more exact
tests and procedures will be developed. But no matter how important the computer becomes, human ingenuity and appreciation of beauty and utility will be the driving force.

Yesterday's car designers sat in dim classrooms, doodling futuristic autos in their notebooks as the pro-
fessors droned on. Tomorrow's designers may be doodling, too—and dreaming of a keyboard to call their
own.

162}

PM
AMERICA'S TRUCK,
BUILT FORD TOUGH.

New high-MPG Ford pickup rated 22 MPG.

Introducing Ford's new fuel-saving FS pickup. It's a tough, full-size pickup with comfort for three, and a big 4.9L Six. For even heavier hauling, pick Ford's F-150. This rugged truck delivers 20 EPA estimated MPG plus 2,500 lbs. of payload. And there's more for '82.

Adjustable Twin-Beam. Ford's tough suspension is now designed with lubed-for-life ball joints and adjustable camber.

New V-6 engine. Modern 3.8L V-6 is a high-technology engine with excellent horse power per liter. Standard in F-100 models.

NEW FORD FS: WITH 4.9L SIX

FORD F-150

31 EST. HWY* 22 EPA EST. MPG*
29 EST. HWY 20 EPA EST. MPG*

*Requires optional 4-speed overdrive. Compare these estimates with offers. Your mileage may differ depending on speed, distance and weather. Actual highway mileage and California ratings lower. FS model and V6 not available in California.

FORD
FORD DIVISION
Electronic Water Injection... The Only Accurate Way to Suppress Knock & Ping. **VARA-JECTION by Edelbrock!**

100% solid state control box eliminates need for additional metering valves, oil and vacuum switches found on mechanical systems.

You set the system electronically for 4-, 6-, or 8-cylinder engines specifically; mechanical units do not.

Control module signals variable speed pump to make split second water flow changes: mechanical units do not.

Fine tuning adjustments allow tailoring of system to specific vehicle use, road, weather and fuel conditions.

Components sense positive pressure (boost) as well as depression (vacuum), making Varajection applicable to turbocargers; mechanical units are not.

Reliable, solid state electronics allows essential functions impossible to achieve with any mechanical water injection system. As vehicle and application vary, so do the amount and timing of water required to control detonation. Varajection assures broad adjustment capability through a combination of fine tuning and nozzle selection. Synchronize water delivery to match your specific engine's needs through the accuracy of Varajection electronics.

Receive a free 4-page brochure by writing 411 Coral Circle, Dept. PM862, El Segundo, CA 90245.

---

**MasterShop...**

**cast iron tables make the difference!**

**MasterShop** measures up to the toughest woodworking project with the accuracy of cast iron tables, like those used in industry—to give you results you can be proud of every time!

A complete home workshop in one easy to handle unit equips you to tackle almost any job. Converts in seconds to a powerful 10" table saw, 12" disc sander, 16" x 36" drill press, 34" table and horizontal drilling machine—powered by a heavy duty 1/3 hp ball bearing motor. A variable speed range from 800 to 4500 RPM's allows the precise speed selection necessary for any operation.

Make your own furniture, remodel a room—build any project large or small. You can do it easily and professionally and save money too! Even beginners find themselves quickly achieving beautiful results on every project.

**MasterShop is affordable**—more value, quality and accuracy for substantially less money than other home workshop systems. Send for free information or call today and learn why more and more people are turning to MasterShop to satisfy their home workshop needs.

---

**NO-FUEL BOATING**

(Continued from page 53)

folds away, and there are bunks for seven. At about $1,000 a foot, it's no more than big yachts of years ago.

Meanwhile, Supercats of 15, 17 and 20 feet, have been cleaning up at catamaran regattas. They are built by Boston Whaler Multihulls, at Riviera Beach, Fla., with computer-influenced elliptical hulls. Prices are $4,490, $5,670 and $9,950 f.o.b.

New $995 Fressail board-sailers have been announced by O'Brien:

---

Assorted color combinations for hulls and sails are new for popular Homar Phantoms.

---

Twin inflated tubes are said to aid the stability of the British Twinsurfer sailboard.

---

The New MonArk M-1 14’er has lockers for oars and outboard if the wind fails.

and Kona, in Oak Hill, Fla., has a $1,995 catamaran sailboard. Twinsurfer is a British inflatable surfboard. Homar Boats, Edison, N.J., has three new Phantom models for under $1,400. MonArk is introducing a $2,915 row-power-sailboat.
many early turbo cars, isn’t evident in the Fuego. Boost comes on smoothly at 2,500 rpm and stays steady all the way up to red line. Mercifully, the engine isn’t saddled with a rev limiter or any of that nonsense, but has a genuine waste gate to blow off excess boost. The turbo itself is a Garrett T3 unit.

Both engines provide lively performance, though the turbocarbed version is, understandably, a lot more fun to drive and yields respectable mileage, even at very high speeds.

There was indication from Renault that a two-liter turbocarbed version of that engine might eventually be introduced in the United States. If that does come to pass, those extra 400 cc might very well propel the Fuego into a supercar. The Turbo will be available only with the five-speed manual transmission. The shiftless will rightfully be limited to the normally aspirated version.

Traditionally good ride

The French have always been able to dial in a good ride and the Fuego doesn’t break this tradition. The ride quality is firm, yet supple, and fords road irregularities without drama.

However, these were European roads, mind you. The car has yet to be tested in the ultimate trial by city—New York City stress.

The Fuego styling is something no one will be lukewarm about. Comments from knowledgeable observers ranged from “stunning” to “the hunchback of Malmaison.” I liked it a lot in European trim, and, with some reservation, like it in its American version, as well. At any rate, it’s a refreshing change from the Japanese folded-paper school of design and the quickly vanishing American chiseled-shoebox approach.

As a strictly technical exercise in packaging, the Fuego is an unqualified success. Even though its wheelbase is a mere 2 inches longer than the R6 (96 vs. 94), Renault has managed to carve out a huge amount of interior space.

The one reservation I have in the American version is the chromed headlight “buckets.” By law, manufacturers are not allowed to use flush headlight covers as they do in Europe, a dumb law if ever there was one. But to be with chrome for the besels is making a bad situation worse. My humble suggestion would be to make them black.

The question that needs to be asked now is “Can the Fuego find fame and fortune in the United States?”

Judging by how it ran in the high-speed European environment, it’s somewhat overqualified for the generally less demanding American driver.

But car enthusiasts should love it. And the price is certainly attractive: $8,400 for the unblown version and $10,700 for the Turbo version. With those good things going for it, the Fuego, which is now in AMC showrooms, certainly seems to be destined for success.

WATER FROM YOUR OWN BACKYARD WELL!

Opelika, Alabama—What can you buy for a nickel and still get some change back? 500 gallons of water, that’s what! As a matter of fact, the electricity to pump 500 gallons from your own backyard well costs only 3 or 4 cents.

With this reliable, convenient source of water you can supply your home, your garden, and with a water well heat pump you can even heat and cool your home for a fraction of the cost of conventional systems!

In the past, the cost of drilling a well made it uneconomical for anyone who could hook on to city water mains. However, as city water becomes more expensive, backyard wells have become more and more popular. To hold the cost of drilling a well to an affordable level, an easy-to-use low-cost machine has been developed for the homeowner who wants to drill his own. Called the HYDRA-DRILL, it is already in use around the world, and an estimated 60,000 HYDRA-DRILL wells have been drilled to date.

The HYDRA-DRILL can drill to depths of 200 feet, which puts you within reach of most of the good fresh ground water in the world. The typical HYDRA-DRILL well can produce over 4,000 gallons of water each day—just compare that with the average U.S. family consumption of 500 gallons of water per day!

The HYDRA-DRILL is remarkably simple to operate. It is completely portable, and can be operated anywhere...even in places a truck-mounted drilling rig can’t get. Yet it can drill most anything the big, truck-mounted rigs can drill, and drilling speeds range up to 40 feet per hour.

FOR FREE INFORMATION about the HYDRA-DRILL and how you can drill your own water well, send your name and address to: DeepRock
FOR PRIZED POSSESSIONS & THINGS THAT STICK OR SQUEAK.

NEW TEFION® Wet Lubricant ... superior lubrication and rust protection for expensive tools, firearms, sports equipment—even motors and garden tools.

NEW TEFION® Dry Lubricant ... clean, non-staining lubrication for cameras, fine furniture, antiques, musical instruments—even windows, doors and zippers.

Keep 'em handy in home, auto, boat and shop

*TeFlon is a trademark of DuPont.

Motorize your bike.
Get over 200 mpg!

Forget expensive mopeds!

- 2-HP or 1.3-HP/Up to 45 MPH
- Fits most bikes
- Fast, reliable—fun
- Allows free pedaling
- Installs easily
- Satisfaction guaranteed

Free Information and rebate offer!
Cell toll-free
1 800 821-7700
Ext. 10018 (anytime)
In Missouri call
1 800 826-7056
Ext. 10018 (or write)

Bumble-Bike
Dept. IR
P.O. Box 118
Havana, FL 32333

Get Your COLLEGE DEGREE
at Home in Spare Time

- Business Management
- Accounting
- Engineering Technology

Hybrid or modular program

FULLY ACCREDITED

Send for FREE FACTS!

NEW MONTH IN PM

- Secret spy plane that watches the world's hot spots: Story of the highest flying airplane by the builder.
- New motorcycles that give blinding performance.
- Test of the world's biggest outboard.
- All about building traditional stone fences.

SUBSCRIPTION SERVICE: Popular Mechanics Magazine will accept receipt from the reader of a complete new or renewal subscrip-
tion, order, undertake fulfillment of the order or to pro-
vide the first copy delivery to the Postal Service within 10 to 20 weeks. If some period of time cannot be done, you will be promptly notified of the issue date that will begin your subscrip-
tion or renewal. If you require further information or have some question about your service, please address all such inquiries to:

Popular Mechanics, P.O. Box 10054, Des Moines, Iowa 50340. To assure prompt reply, please enclose your mailing label when writing to us or when renewing your subscription.

Next month in PM

SECRET SPY PLANE: The world's highest flying airplane, built by the builder, is a secret top-secret plane designed to spy on the world's hot spots. It can fly at altitudes of more than 20,000 feet, providing the builder with valuable information about the situations unfolding across the globe.

NEW MOTORCYCLES: A new line of motorcycles has been introduced that offers blinding performance. These motorcycles are equipped with high-speed engines and advanced suspension systems, allowing riders to experience a thrilling ride.

BIGGEST OUTBOARD: The world's largest outboard motor, which is now on the market, can propel boats to speeds of over 60 miles per hour. Its powerful engine is capable of generating an enormous amount of torque and thrust.

BUILDING STONE FENCES: Traditional stone fences have been a popular choice for homeowners for centuries. These fences not only provide aesthetic appeal but also offer durability and longevity.

Popular Mechanics
P.O. Box 10054, Des Moines, Iowa 50340

YES!

Please enter my subscription to
POPULAR MECHANICS for:

☐ 1 year $9.97
☐ 2 years $18.97

Payment of $_______ below is enclosed.

Bill Me

Initial here

Name (Please print)

Address

City State Zip

Your first copy will be on its way to you in six to twelve weeks. Watch for it!

A publication of the Hearst Corporation.

CHANGING ADDRESS?

If you're planning to move, please let us know at least eight weeks before changing your address. Attach current address label and fill in your name and your new address. This will serve to insure prompt service on your subscription.

Send old label with your name and new address to:

POPULAR MECHANICS
P.O. Box 10054, Des Moines, Iowa 50340
or call toll-free: 800-447-5470

State of Iowa residents call: 800-447-5472

NAME (Please print)

NEW ADDRESS

CITY STATE ZIP CODE
How Havoline Supreme can help you get the most out of your car.

Proven protection up front. Backed by improved mileage.

Whether you change your own oil or someone else does, there are some important things you should know about Havoline Supreme.

First of all, Havoline Supreme has a Texaco-developed, balanced additive system with a built-in, special friction fighter. And its multigrade rating offers the convenience of all-year-round, wide-temperature range protection.

Havoline gives you proven protection.

The final test of a motor oil comes under actual driving conditions. Havoline Supreme has proven it delivers the kind of protection needed in tough, high-speed state trooper cars and severe stop-and-go driving in New York City taxis.

Havoline helps save gasoline.

Fuel economy tests proved it. Compared to a conventional motor oil, Havoline Supreme, with its special friction-fighting additive, helps save gasoline.

Havoline is diesel tested.

If you own a diesel, we have good news. Havoline 10W-30 has the API-SF/CC rating required by most engines like yours. And it's been proven in punishing diesel-powered taxis.

Listen to an expert.

Top Indy 500 driver Tom Sneva calls Havoline Supreme a “very sophisticated oil...one that a prudent car owner should use on a regular schedule.” Shouldn’t you?

You can trust your car to the products with the Star.
INTRODUCING THE
BENCHTOP WORKSHOP.
BIG TOOL CAPABILITY AT LITTLE TOOL PRICES.

It's a whole new idea in power tools from Shopcraft® All the precision of stationary tools. For a whole lot less.

In fact, Shopcraft BenchTop Tool prices start where quality portables leave off. So you get a lot more capability for just a little more money.

Shopcraft tools are tough, remarkably easy to use and they fit right on your workbench.

10-Inch Band Saw So you can do precise mitering and intricate cutting with ease.

3/8 & 1/2-Inch Drill Presses Give you the precision you need for dowel pinning and counter boring.

Wood Lathe With variable speed to help you shape, sand and turn beautifully.

4-Inch Belt Sander The power you need for satin smooth finishes without hand sanding.

5 & 6-Inch Grinders To keep your tools sharp and true.

Look for the remarkable BenchTop Workshop at your local hardware or home center. Or call us at 314-634-4040 for the name of the nearest dealer and a free color brochure. The BenchTop Workshop. Big tool capability at little tool prices. Only from Shopcraft.
second shutter speed at F/8 with a 400 ASA-speed film. A half-moon requires an exposure four times longer—1/4 second. Though the moon is in motion, relative to the Earth, exposure times are short enough to produce a sharp image. But if you want to get photos that take you right into the moon’s craters, mountains and valleys, you will need much higher power—and that calls for a telescope with a motor drive (see Backyard Voyage To The Stars on page 86 for more on what these drives do).

The sun

Extreme caution must be exercised in any solar photography. Be sure to use special filters to prevent blindness or camera damage. A beginner should seek expert help.

A solar eclipse is often regarded as one of nature’s grandest spectacles. The next major eclipse will occur in Indonesia on June 11, 1983. (If you’re interested in seeing or photographing it—with expert guidance—you can write to Sciencefiction Expeditions, Dept. PM, 3 East 64th St., New York, N.Y. 10022.)

The planets

Planets are such tiny objects, as they appear in the sky, that a telescope is an absolute necessity for photographing them with any sort of detail. Venus, Mars, Jupiter and Saturn are within the grasp of amateurs with conventional equipment—the others are too far away, too small or both.

The technique (which can also be used for high-powered lunar photography) is simple but demanding—it’s called “eyepiece projection.”

The lens is removed from the camera. The camera is held in a lightweight sleeve above the telescope’s eyepiece. In effect, the telescope and eyepiece become the camera’s lens.

Exposure times range from a fraction of a second to a few seconds. Start with 1/4 second and photograph in steps to 10 seconds. But expect a high failure rate. Be happy with even one perfect photo out of 36. Vibrations in the mount or motor drive, slight misalignments, atmospheric disturbances—all these variables will be challenging to overcome.

Surprisingly, some of the best photos of this type have been taken in metropolitan areas under smoggy conditions. City lights don’t affect short exposures and, because of inversion layers, smog may mean a steady sky.

Comets

It is only rarely that a comet appears that can be seen in the sky without a telescope (Halley’s Comet in late 1985, for example). Then a camera and tripod—with the star platform described here—will be enough to capture the image with only a 45-second exposure.

Faint comets, however, require longer exposures. The camera may be mounted piggyback on a telescope, as detailed below.

Galaxies, nebulae, globular clusters and other heavenly phenomena require patience, skill—and a certain amount of equipment.

With a telescope, high power and detail are both available. A 6-inch telescope, for example, has a focal length of 48 inches or 1,200 mm, if it’s one of the popular F/8 variety. This focal length makes such a telescope a superpowerful “long lens.”

There are two ways of using such a telescope with a camera. The first is called piggybacking. Most telescopes have an optional mount that lets them serve as a driving mechanism for a camera which is mounted on their tube. The mass of the telescope will support a camera’s heavy telephoto lens.

But most camera lenses can’t use the actual telescope as a lens. Instead, they use a method, called “prime focus,” in which the camera is attached to the telescope through the eyepiece tube. (In some telescopes, it may be necessary to move the mirror; instructions are usually included with the telescope.)

Either method requires that the telescope be guided. This is because deep-sky photos can take as long as two hours to expose. Even the best motor drives have some movement which can smear the image. An eyepiece with an illuminated cross hair is used along with electronic or manual slow-motion guidance to stop the motor drive from wandering.

Long exposures can make film behave strangely. Color balance goes out of whack and the emulsion stops recording the image. To minimize this problem, film is often treated in one of two ways. One method uses a “cold camera” which keeps film at low temperatures—but this is quite expensive.

A recent discovery is called hyper-sensitization. You can get at-home kits to treat film or buy already sensitized film.

Final hints

Process your film normally, and do not “push” the development. And be certain that the first and last photos

(Please turn to page 170)
CAPTURE THE STARS ON FILM (Continued from page 169)

on a roll are of “normal” subjects (people or places). Otherwise, a lab technician may have difficulty in figuring where your frames begin and end. What a disaster it would be to have a constellation shot split in half and returned mounted as two slides!

Bracket your shots extensively for short exposure work. And make certain you try constellation, comet and deep-sky photography only on moonless nights and away from city lights.

You might also buy a copy of Kodak’s Astrophotography Basics. It’s 40 cents from your dealer or direct from Eastman Kodak Co., Dept. 454, Rochester, N.Y. 14650.

Astrophotography is one of the most rewarding facets of a truly heavenly hobby.

BUILD A STAR PLATFORM

Here’s a simple-to-build Star Platform that will enable your camera to follow the apparent motion of the heavens. A special motor which turns at one revolution per day lets you use long exposures (45 seconds on fast color film for constellations, around three minutes for deep-sky objects) without images streaking.

Construction

Drill two 5/16-in. holes in the tee plate, as shown on template. Bend the plate with three 90° bends, as shown. Screw a 1/4-20 nut over the cord through the plate hole; connect a plug. Loosely screw the second 1/4-20 nut down the motor shaft (over the threaded shank). Tighten the nut against the mount.

With a sturdy tripod, focus your camera on the North Star and lock tripod’s pan-head adjustment. Remove the camera and attach the Star Platform to tripod (the motor’s axis will now point to the North Star) by threading tripod’s screw into soldered nut. Gently attach your camera on a ball and socket mount (see parts list to the platform—do not forget your counterscrew) (a piece from shaft side) or they’ll strip. Tighten ball and socket set screw if so equipped.

Plug in platform motor once you’re positioned camera to photograph any object in the night sky. Don’t expect to see the motor move, since it is very slow—R.L.

PARTS LIST—STAR PLATFORM

1/4-20 brass bolt, at least 1/2-in. long
1/4-20 brass nut (2)
1/4-in. machine screws and nuts, 1/4-in. long (2)
5-64, flat tee plate (Stanley No. 995-12 or equivalent)
Ball and socket camera mount
Two-pronged electrical plug
Synchronous geared motor (should turn one revolution per day and have 1/16-in. -dia. ¥ 7/8-in. length shaft). This motor is $12 postpaid from Criterion Scientific Instruments, 820 Oakwood Ave., Dept. PM, West Hartford, Conn. 06110.

The text details how to use a template (above) to drill and bend flat tee plate.
Home building, maintenance, and repair... energy conservation, hobbies, and more!

The HOW-TO BOOK CLUB shows you hundreds of ways to do-it-yourself... and save money too!

Select 6 exceptional books for only $2.95 (values to $132.65)

Join Now, Get a Work Apron FREE!

Heavy-duty work apron free when you join!

7 very good reasons to try How-To-Book Club

- Reduced Member Prices. Save up to 75% on books sure to increase your know-how
- Satisfaction Guaranteed. All books returnable within 10 days without obligation
- Club News Bulletins. All about current selections—main, alternate, extras—plus bonus offers. Comes 13 times a year with dozens of up-to-the-minute titles you can 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.
- Continuing Benefits. Get a Dividend Certificate with every book purchased after fulfilling membership obligation, and qualify for discounts on many other volumes.
- Bonus Specials. Take advantage of sales, events, and added-value promotions.
- Exceptional Quality. All books are first-rate publisher's editions, filled with useful, up-to-the-minute info.

HOW-TO BOOK CLUB
Blue Ridge Summit, PA 17214

Please accept my membership in How-To Book Club and send the 6 volumes circled below, plus my free work apron. I understand the cost of the books selected is $2.95 (plus shipping/handling). If not satisfied, I may return the books within ten days without obligation and have my membership cancelled. I agree to purchase 4 or more books at reduced Club prices during the next 12 months, and may resign any time thereafter.

1105 1159 1172 1173 1179 1204 1227 1244 1279 1281 1285 1287 1307 1315 1316 1320 1321 1328 133 1359 1365 1368 1371 1375 1376 1381 1385 1390 1395 1400
1404 1407 1413 1414 1421 1427 1432 1436 1440 1444 1448 1452 1456 1460 1464 1468 1472 1476 1480 1484 1488 1492 1496 1500
1504 1508 1512 1516 1520 1524 1528 1532 1536 1540 1544 1548 1552 1556 1560 1564 1568 1572 1576 1580 1584 1588 1592 1596
1600 1604 1608 1612 1616 1620 1624 1628 1632 1636 1640 1644 1648 1652 1656 1660 1664 1668 1672 1676 1680 1684 1688 1692

Name ___________________________ Phone ________
Address __________________________
City ____________________________ State __ Zip ____
(Valid for new members only. Foreign and Canada add 20%)

PM-662

Main Striped 4 of 4
BACK-YARD VOYAGE TO THE STARS

bit wobbly and the scope wasn’t as easy to use as the C-90. The Dynascope RV6, however, made by the same company, was a great buy among Newtonians at $299.

The other four scopes are made by Edmund Scientific, an amateur science mail-order house that provides a great range of products. The 6-inch Edmund gave us excellent views of the planetary surfaces. Standing on the steadiest of mountings, it was one of the easiest telescopes to assemble. You might wince at the $347 price tag, but it wasn’t out of line for the optics.

Big mirrors, big light

The other Edmunds were less spectacular viewing instruments, largely because their mirrors are less than 5 inches across. The larger the mirror, the better the scope. A 4-inch scope would yield lighter images of the same magnitude as the 3½-inch scope.

Large mirrors also have better resolving power—they are better at splitting binary (double) or triple stars, and they provide much more detail of planetary surfaces.

While the three other Edmund scopes provide less mirror than the leader, they have many features to recommend them to the beginner. All three are lightweight and need little or no assembly.

The 2001, Edmund’s most popular device, is a perfect field telescope for the novice. Shaped like a basketball, it comes with a carrying strap and weighs 10 pounds complete. Its 4½-inch mirror is ample for startup. The 2001, similar to a Newtonian in design, is a “rich-field” telescope. This means it can show a wider field than other scopes. Of course, this comes at some sacrifice of detail. The 2001, for instance, gave us a view of Jupiter comparable to a good set of binoculars. Yet it gave us brilliant views of wide-area wonders, such as the “seven” stars of the Pleiades constellation, which resolve into scores of luminous star clusters.

The Edmund F10, which also has a 4½-inch mirror, has features that the less expensive 2001 doesn’t, such as a large, sturdy tripod and a long focal length for sharp magnification.

Among the smaller scopes, the Edmund F8, with a 3-inch mirror, is a bargain at $199. Its short focal length ratio of 1/6 made distant stars quite bright. The focal-length ratio expresses the mirror size divided by the distance from the eyepiece. With this ½ scope, then, the distance from the mirror to the focus point is two inches. Short focal lengths provide brighter images and wider fields of view.

Magnification’s no big thing

Many a beginner has been taken in by claims of very high magnification. But in astronomy, magnification is relatively unimportant. In fact, there is such a thing as too much magnification. The lens placed in the eyepiece magnifies whatever the mirror is reflecting. To stop up the size of the image, however, the lens spreads out the collected light over a larger area. Thus, the object, while growing larger in your field of view, also grows dimmer.

With stars, nebulae and tiny planetary moons, magnification beyond a certain point will blot out the image entirely. For Newtonian and catadioptric scopes, you should allow no more magnification than 50x for each inch of mirror. Thus, a 4-inch telescope should have no more...

(Please turn to page 174)
As you can see, you can have a lot of fun in your Volkswagen Pickup.
Or if you unload the fun?
You can have 1,000 pounds of almost anything in your Volkswagen Pickup.
Because we built it with a sturdy unitized body surrounding a tough double-walled bed.
But with all that heft can it still be fun to drive?
Yes.
You see we also built it with front-wheel drive, independent MacPherson front struts, and a dual diagonal braking system.

Not to mention VW’s fuel-injected overhead cam engine that can take this pickup from 0 to 50 in just 8.8 seconds.
Which means on top of everything else it gives you something you usually don’t get in a pickup.

Pickup.

Nothing else is a Volkswagen.

VW
than 200x magnification. The exception is the rich-field scope, which shouldn't have magnification of more than 10x per inch, unless you're willing to sacrifice that wide field of view for a clear picture of one object.

All the telescopes we tested came with at least one excellent eyepiece. Edmund packs only one eyepiece with each scope. Company president Robert M. Edmund told us: "Generally, when companies pack more than one eyepiece, you're paying for frills you may not want. And those extra pieces are figured into your instrument's price." Although all the extra lenses packed with our test scopes were useful, Edmund is correct about the extras adding unnecessary cost.

All the tested scopes, except the Edmund 2001 and F6, came with clock drives. These motors rotate the telescope automatically and imperceptibly to let you follow a specific heavenly body as the Earth rotates away from it.

Another feature of crucial importance in the better telescopes is setting circles. To find a heavenly body, you refer to a star atlas, a map that uses coordinates of right ascension (similar to longitude), and declination (similar to latitude). Good setting circles should be clearly marked with right ascension and declination coordinates. The Celestron, Dyna-max, Dynascope and Edmund pedestal mounts had excellent setting circles.

Free looks first

Before you go hunting for a telescope, find the nearest amateur astronomers' society. There's at least one in every state, and if you can't find a listing in the phone book, call the astronomy department of any nearby university. All astronomical societies have monthly stargazing parties to which the uninitiated are invited.

This summer promises a lot of interesting viewing. There are after-midnight meteor showers in June and late July into early August that you'll be able to see with the naked eye. But on July 6, you'll want at least a good set of field glasses, or even better, a good telescope to see a total eclipse of the moon, which will be visible throughout the continental United States. When the Earth comes between the sun and the moon, the mountains and valleys of the lunar surface resolve in your lens with a clarity you'll never forget.
POLICE CARS DON'T PULL ANYTHING. WHY DO THEY USE OIL COOLERS?

THE SAME REASONS YOU SHOULD.

To Save Money — City and State officials know it saves money rather than cost money to use engine and transmission oil coolers.

Heat — Your Car's Greatest Enemy. Today's down sized cars run hotter due to emission controls, smaller engines and higher RPMs. Heat problems develop when you carry extra passengers... extra baggage... drive in stop-and-go traffic... drive on ice or snow... drive in hot temperatures... climb steep grades... and do towing.

Over 11 Million Transmissions Failed Last Year.* 9 out of 10 were caused by overheating.

Low Cost Protection. You wouldn't think of owning a home without insurance and yet the risk of burning up your car's transmission and engine is greater. Repairs can run as high as $600-$1500. You can buy transmission and engine insurance by installing a Hayden Oil Cooler for as little as $34.95.

Quick, Do-It-Yourself Installation. If you can change the oil in your car, you can make the installation yourself in a half hour using Hayden's patented Quick-Mount and Quick Connect. Complete illustrated installation instructions come packaged with every oil cooler.

Beat The Heat. Free Offer. Purchase any Hayden Trans-Cooler™ or Duo-Cool™ at your local auto parts store, automotive chain store, RV dealer or repair shop and receive a Trans-Lite™ Hi-Temp Warning System absolutely FREE ($19.95 value. Offer ends Sept. 1, 1982).

Limited Offer**

Purchase a Trans-Lite direct from Hayden for only $16.95 prepaid.

Name _____________________________

Address ____________________________________________

City __________________ State ________ Zip ______

**Offer expires December 31, 1982. CA residents add 8% sales tax.

For free product brochure, write:

HAYDEN INC.
1531 Pomona Road, P.O. Box 848, Corona, CA 91720
5 in 1 WOODWORKING MACHINE

(2 HP EXTRA HEAVY DESIGN)

REGULAR PRICE $419.
NOW ONLY $999.

SAVE $251. Today
Special offer good thru the 30th of the month
ONLY $999
CALL NOW!! (1-800) 421-2467
Toll Free Information
in California call collect (213) 649-0761

VERY IMPORTANT
The only machine built with:
A. ALL CAST IRON TABLES
B. HEAVY DUTY DESIGN
C. 3 H.P. ELECTRIC MOTOR
D. BUILT AS AN INDUSTRIAL MACHINE
ONE PLACE FOR ALL YOUR NEEDS...

MAIL NOW!!!

☐ VISA ☐ MASTERCARD ☐ MONEY ORDER

YOUR NAME ____________________________
ADDRESS ________________________________________
CITY ____________________________ STATE ______ ZIP ______
PHONE ( ) ___________ BEST TIME TO CALL ______

PLANT:
MASTER WOODCRAFT CO.
Div. of American Machine Co.
800 SPRUCE LANE DRIVE • P.O. BOX 669
HARBOR CITY (Los Angeles), CA 90710
Dealership Available

3-Wheeling to Independence!

Call 1-800-257-7955
for Free Catalog

One Hand Operation— Rear Differential Drive
CYCLE-CHAIR, the NEW ALUMINUM ELECTRIC BIKE that is different and safer. It’s so easy to handle, you control on, off, forward, reverse, speed, steering, and braking with just ONE HAND!
Use CYCLE-CHAIR indoors as well as outdoors. Share your bike with a friend, travel to the store, or take it to the bank. Be independent, and get around. Its light center of gravity and aluminum frame makes CYCLE-CHAIR the lightest, strongest, safest 3-wheeler on the market today. Costs only pennies to recharge at home.
Send for free booklet and special offer on CYCLE-CHAIR, PEDALPOWER electric bike motors, speed pedal tricycles or call toll-free 1-800-257-7955, in N.J. 800-232-6550.
30 Day Trial - Money Back Guarantee

MAGNA-LUX
MULTI-PURPOSE MAGNIFIER LAMP

by

Listed
Arm Reach 39½" by

Now you can enjoy a utility lamp with a clear vision magnifier. Mounts anywhere or comes with an optional table base. Excellent for hobbies, reading or any type of bench work in the home or office where viewing details requires magnification. Flexible arm movement permits free use of hands. Made in USA.

• 3½" dia. 3-flap lens
• 40 watt, A/15 bulb included
• Full one year warranty only $39.95 plus 54-Shipping
• Optional table base plate $13.00
Postage Incld. Shipped separately

Mail to: Hampton Marketing Corp.
54 Commerce Dr., Farmingdale, NY 11735
Money Back Guarantee

BURGLAR • FIRE PROTECTION
Protect Your Life, Home, Business, Auto, etc.
Our catalog shows how to install your own Smoke Alarm and Dwell Phases. We offer FREE engineering service.

GAS SAVER
Time tested easy to install
15% to 40% increase in MPG & Performance
Preheat & Expand your Gas safety.
For std. adj. gas carb.
ORDER NOW
State present MPG on order for proper size.

MAGNET SCREWDRIVER
Fits in Pocket. Enclose 1.50 plus 25 postage to:
LIPCO
Box 147, Dept. P
Towanda, Ill. 61776
556 EASY LAWN AND GARDEN CARE
Caring for your lawn and garden need not be difficult according to Wheel Horse. All it takes are the right tools for the job. 28-page magazine illustrates their full-range of lawn and garden tractors and the jobs they do. Free

557 BACKYARD BEAUTIES
A series of do-it-yourself backyard projects are described and illustrated in a new brochure from Koppers Company. Contains drawings and construction details for a picnic table, lounge chair, garden gazebo, storage shed, sun trellis and more. $1.00

558 FOR A CLEAN SWEEP
Polaris Vac-Sweep. America's best-selling automatic pool cleaner, offers a copy of Nancy P. Bruning's "Swimming for Fitness," a copy of the independent laboratory test report on Polaris, a general information brochure and $50 trade-up information. Free

559 THE GRASS IS ALWAYS GREENER
Lawn Care, edited by Scott, the lawn and garden people, contains seasonal checklists, how-to articles and the latest information on lawn and garden care. Now in its 33rd year, a 2-year subscription to this colorful publication is available . . . Free

560 BUG OFF!
New Muskol brochure provides complete information about the original "full strength - DEET" insect repellent. Gives you up to 10 hours effective protection against mosquitoes, black flies, chiggers, ticks and gnats. Free

561 THE TELLING OF THE TILLING
Complete information package describes the uses and features of the Masport Home Gardener® tiller. Combines lightweight design, versatility and maneuverability to handle all your gardening chores. $1.00

562 BE A STAR BUILDER
Countrywide General Store offers an information package about its STAR-PLATE building method: Construct a geodesic design mini-dome that can be used as a greenhouse, gazebo, garden shed, or any of dozens other uses. Free

563 QUICK AND EASY HOUSE PAINTING
An informative new brochure from Wagner identifies common painting problems and the correct solutions. Discusses in the 16-page, illustrated brochure include surface preparation techniques, safety tips, paint selection advice and other hints. Free

564 WOOD APPRECIATION
Wood reverts, wood reflects. Booklet describes tips on finishing and refinishing interior and exterior wood finishes. Color chart and name of nearest dealer are also provided. From Minwax. Free

565 IDEAS SET IN CONCRETE
Transform your yard into an outdoor entertainment area in just a few summer weekends. Sakrete Cement gives you step-by-step instruction for 18 different projects in this 16-page booklet. 75c

576 FEEL STRONGER, WORK LONGER
Dri-Deck® is an interlocking, vinyl floor tile that forms a light, portable surface. Soothes the aches, pains, and discomfort of standing. And, with its colors to choose from, adds good looks as well as safety to your shop. Sample and brochure from Kendall Plastics. Free

577 THE FIREPLACE THAT CAME IN FROM THE COLD
Majestic would like you to know that its Warin Majic fireplace has been rated 41-43% efficient by the Wood Heating Alliance. Two brochures offer full-color performance report and do-it-yourself installation planner, including chimney system. $1.00

578 RESILIENT FLOORING
24-page illustrated booklet gives helpful advice on shopping for modern vinyl floor. Information on no-way surfaces, cushioning, installation and upkeep. Flus, how to decorate and important questions to ask the salesperson. From Armstrong. Free

579 MAKING A REAL ENTRANCE
A ThermoTru replacement door system can give your house a whole new look. In addition to acquiring an eye-catching "entrance" you can achieve energy savings and more security. 4-color, illustrated brochure. Free

580 THE RENOVATOR'S INNOVATIONS
48-page color catalog of hard-to-find hardware, plumbing and lighting products that will add a distinctive touch to your home. Most are made of solid brass, wrought iron, oak or porcelain. Many are authentic reproductions . . . all newly made. From The Renovator's Supply. $2.00

581 MAKING THE MOST OF SPACE
Compact range-sink-refrigerator combinations can solve your space problems. King Refrigerator offers an illustrated catalog describing its kitchen units. Free

582 HERE'S INEXPENSIVE LUXURY
Complete Thermasol Health Spa fits into the same space as a standard size bathtub. Includes a combination tub and whirlpool system with steam bath and shower enclosed with acrylic walls, ceiling and sliding glass doors. Illustrated brochure. $2.00

583 SUPER POWER
The Fox Super Shop is a multi-purpose power tool. Seven basic woodworking and metal working tools, including table saw, disc sander and wood lathe. Owner's manual illustrates each function and its many features. 50c

584 POWER WHEELS
Bike Motor and Go-Kart catalog offers discount prices on fuel efficient front wheel and rear wheel motors. Complete Go-Kart and mini-bikes and parts to build your own kart. From Northern Hydraulics. $1.00

585 TOOL CHEST FOR A MASTER
Compact tool chest looks like a museum showpiece, but is durable enough for a professional. For handling ease, it's actually two boxes with well-organized hand tool compartments that allow easy access. Complete plans, including handy dolly, from POPULAR MECHANICS Project Library. $4.75

This Coupon Expires August 31, 1982

Name (Please Print)
Address

(Town)
-State-
-Zip Code-

(Please send cash, check or money order made out to POPULAR MECHANICS. No stamps, please.)

Note: Popular Mechanics processes your request 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.)
11 ALBUMS - 1¢ plus shipping and handling
PLUS THE "GOLD BOX" TV BONUS!
If you join the Club now and agree to buy 8 more selections (at regular Club prices) in the coming 3 years
Yes, just take a look at the superstars and hit acts that the Columbia Record & Tape Club now offers. 'To get any of these records or tapes right away, simply fill in and mail the application together with your check or money order for $1.85 as a record (that's $1.45 for your first 11 selections, plus $1.85 to cover shipping and handling). In exchange, you agree to buy 8 more tapes or records (at regular Club prices) in the next three years—and you can cancel your membership at any time after doing so.

How the Club operates: every four weeks (13 times a year) you'll receive the Club's music magazine that describes the Selection of the Month for each musical interest, plus hundreds of alternates from every field of music. In addition, up to six times a year you may receive offers of Special Selections, usually at a discount off regular Club prices, for a total of up to 19 buying opportunities.

If you wish to receive the Selection of the Month or the Special Selections, you need do nothing—it will be shipped automatically, if you prefer an alternate selection, or none at all, fill in the response card always provided and mail it by the date specified. You will always have at least 10 days to make your decision if you ever receive any Selection without having paid at least 10 days to decide, you may return it at our expense.

The tapes and records you order during your membership will be billed at regular Club prices, which currently are $7.98 to $9.98—plus shipping and handling. (Multiple-unit sets and Double Selections may be somewhat higher.) And if you decide to continue as a member after completing your enrollment agreement, you will be eligible for our money-saving bonus plan.

10-Day Free Trial: we'll send details of the Club's operation with your introductory shipment. If you are not satisfied for any reason whatsoever, just return everything within 10 days for a full refund and you will have no further obligation. So act now!

Special Start-Your-Membership-Now Offer: you may also choose your first selection right now—and we'll give it to you for at least 50% off regular Club prices (only $3.99). Enroll payment now and you'll receive it with your 11 introductory selections. This hal-price purchase reduces your membership obligation immediately—and you then be required to buy just 7 more selections (instead of 8) in the next three years. Just check box in application and fill in number you want.

Write in numbers of 11 selections

| Write in numbers of 11 selections |
|-----------------------------------|---|
| Sand your selections in this type of recording (check one): |
| 8-Track Cartridges | 8-Track Records |
| 4-Track Cassette | 4-Track Concerts |
| 4-Track Capstan | 4-Track Concerts |
| 4-Track Capstan | 4-Track Concerts |
| 4-Track Capstan | 4-Track Concerts |
| 4-Track Capstan | 4-Track Concerts |
| 4-Track Capstan | 4-Track Concerts |
| 4-Track Capstan | 4-Track Concerts |
| 4-Track Capstan | 4-Track Concerts |
| 4-Track Capstan | 4-Track Concerts |
| 4-Track Capstan | 4-Track Concerts |

Special Start-Your-Membership-Now Offer: you may also choose your first selection right now—and we'll give it to you for at least 50% off regular Club prices (only $3.99). Enroll payment now and you'll receive it with your 11 introductory selections. This hal-price purchase reduces your membership obligation immediately—and you then be required to buy just 7 more selections (instead of 8) in the next three years. Just check box in application and fill in number you want.

Here's the 'Gold Box' you've seen on TV—fill it in and get an extra selection

K25/AF

K27/BQ
PM LOOKS AT
PORTABLE BLOWER

The Echo PB-200 is a portable, hand-held, gas-powered blower. Its compact size and light weight make it easy to handle. It also has an attachable shoulder strap.

The blower's wide range of air-stream velocity, from a gentle breeze to a high-speed blast moving at about 103 mph, makes it effective in numerous outdoor cleanup jobs. You can use it year-round for sidewalk, patio and lawn sweeping, light snow removal from driveways and walkways and for removing leaves and twigs from rain gutters. The airstream velocity is controlled by a trigger throttle in the handle. The on/off ignition switch is on top of the handle.

When I tried out the blower, the engine started easily. It uses 20 parts of regular-grade gasoline to one part motor oil. The tank holds 13.5 fluid ounces and fuel consumption is rated at 20.3 fluid ounces per hour.—Rosario Capotosto

SPECIFICATIONS—PORTABLE BLOWER

Model No: PB-200
Dimensions (L-W-H): 8.2 x 11.1 x 14.5 in.
Dry weight: 9.7 lbs.
Engine type: Air-cooled, two-stroke, single-cylinder
Fuel: Premium unleaded fuel
Max. air speed: 106.0 ft. per sec.
Max. air volume: 280 cu. ft. per minute
Price: $129.95
Manufacturer: Echo Inc., Box 578, Northbrook, IL 60062

The fuel tank holds enough fuel to operate the engine for about 40 minutes.
NOW... FOR YOUR HOME, PATIO, YARD & POOL!

ELECTRONIC

BUG KILLER

100% SAFE TO USE
INDOOR — OUTDOOR
Looks Like An Antique
Colonial Carriage Lamp

PRICE SLASHED
$12.95

WORKS ON THE SAME PRINCIPLE AS UNITS COSTING $100 OR MORE

KILLS MOSQUITOES, MOTHS, FLIES, GNATS; WITHOUT DANGEROUS SPRAYS, CHEMICALS, POISONS, OR FUMES AND INSECTICIDES!!!

What a pleasure it is to enjoy outdoor living all summer long without being tormented by pesky insects! Now you can really savor outdoor fun, swimming, gardening, cookouts and even naps outside — free from stings and bites! Yes, you can have the most wonderful summer of your life with this new ELECTRONIC BUG KILLER. It attracts insects having phototropic vision with an almost invisible Blue Light. Then, as they fly to these irresistible rays, they are killed instantly on contact!

100% SAFE TO USE!

This ELECTRONIC BUG KILLER is absolutely safe around children or pets because it uses no dangerous chemicals, poisons, fumes or insecticides. Insects are killed by an Electrified Grid that uses only 3 Volts of electricity. That's 1/100th as much as a small flash light! Such a small shock that birds, pets, children and adults can scarcely feel it — yet it kills every insect on contact — INSTANTLY! Less than 3 pennies keep it going day and night. Indoors or outside! This new model is made of rugged, high-impact material, styled like a charming antique Colonial Carriage Lamp. Just hang it on your patio, in the yard, around the pool or in your home to be free of annoying insects!

TRY IT ON THIS FREE HOME TRIAL!

We'll rush this amazing ELECTRONIC BUG KILLER to you on a 30 Day Home Trial. It comes ready to operate — just plug into any outlet and it's in action. See how safe it is! How it clears your garden or patio of flying insects. You must be 100% satisfied! Otherwise, return within 30 Days for your money back (less postage & handling).

No. 4855 — ELECTRONIC BUG KILLER $12.95 plus $1.55 for postage & handling. SPECIAL: Two for $24.00 plus $2.00 postage & handling. Three for only $35.00 plus $2.25 postage & handling. N.Y.S. Residents must add sales tax.

FOSTER-TRENT, INC., 2345 Boston Post Rd., Larchmont, N.Y. 10538

Please Rush the ELECTRONIC BUG KILLERS as checked below. I must be completely satisfied or I may return within 30 Days for my money back (less Postage & Handling).

☐ ONE Bug Killer $12.95 + $1.55 Postage & Handling
☐ TWO Bug Killers $24.00 + $2.00 Postage & Handling
☐ THREE Bug Killers $35.00 + $2.25 Postage & Handling

N.Y.S. Residents add appropriate Sales Tax.

Name:
Address:
City:
State:
Zip:
Turning a scaled-down wood replica

My wife wanted to restore an old (circa 1760) spinning wheel of the type having a long leg and two shorter legs. The shorter legs were missing and had to be reconstructed. My solution involved making a scaled-down pattern of the longer leg and using it as a guide to turn the shorter legs. You can apply the same technique to turn a scaled-down replica or to make an enlarged copy of any other item.

First, I had to calculate the required length of the missing shorter legs. Based on similar spinning wheels seen at museums and in books, I arrived at the approximate length needed (13 in.).

Next, I made a cardboard pattern for the missing legs in the following manner. I took a photograph of the larger, existing leg. Then I used an old magic lantern (an opaque projector will also do) to project the image onto a white cardboard taped to the wall. When the projected image was the exact size needed for the smaller legs, my wife traced the shape and cut out the pattern.

You can use this technique to make a pattern by taking a slide of the original item and using a slide projector to enlarge the image on the cardboard.

Next, I used the cardboard pattern to turn the legs. Since a woodworking lathe wasn't available, I built the following setup on my metal lathe. First, I measured the exact center between the head- and tailstocks and made a mark there. Then I placed the workpiece in the lathe. After marking the middle of a 1 x 2, I centered it across the lathe from headstock to tailstock (see photo, bottom right). Shims were used to level the 1 x 2, and it was taped to prevent movement.

I thumbtacked the cardboard pattern on top of the 1 x 2, directly over the workpiece. I ground a suitable tool to turn the wood and tightened it in the tool holder. I also secured in the tool holder a length of 10-gauge copper wire ground to a point at its free end. The wire was easily bent into a Z-shape so its pointed end touched the cardboard pattern above the workpiece.

The rest of the job was a matter of setting the metal-cutting lathe at high speed and cranking the tool in and out along the length of the workpiece as the pointer followed the pattern. By making a scaled-down pattern of the larger, existing leg, I was able to reconstruct the two shorter legs of my spinning wheel—without ever having seen the original legs.—Ivan E. Prall

Author, lacking a wood lathe, created the scaled legs using his metal lathe and the setup shown above. The cutting tool is locked in the tool holder; the template to be followed by wire is tacked to a 1 x 2.
STOP WASTING FOOD, Time, Energy, Money
SAVE! MAKE BREAD
Total Juices*, hot soups, all grain cereals, flour, instant dinners, salads, hamburgers, cakes, peanut butter, baby foods, bland diets, purees, party drinks, chopped ice, freeze "ice cream."

“3600” VITA MIX® makes them all INSTANTLY...
SIMPLE AS ONE, TWO, THREE...

1. MERELY PUT FOOD IN
   PATENTED "SPLASH GUARD
   ACTION DOME®
   Allows steam to escape safely
   when using hot liquids! Your
   3600 Juices, Freezes, and Cooks
   without Burning, Scorching or
   Lumping foods.

2. FLIP THE FULL IMPACT
   LEVER
   to activate patented reversing
   motor. Hammer blades smash
   into foods — as they revolve and
   reverse — with tremendous
   HEAD-ON IMPACT. Instead of
   merely pushing them around the
   container.

3. OPEN THE PATENTED
   PRESSURIZED SPIGOT
   serve Total Juice® "ice cream",
   hot soup — over 800 recipes —
   by dish, glass or by gallons. No
   lifting, pouring or lid handling.
   The first time — right at the table.
   Large or small quantities.

Free Recipe Book

TOTAL JUICES!
COOKS!
FREEZES!

The one that throws
NOTHING away!
Now is the time to start saving money
and the nutrition in your food
Use patented “impact” method—not old
separation "throw-away" method.
U.S. Dept. Agriculture handbook says:

extracted
juice only* 30 mg. 345 mg.

pool and
everything* 100 mg. 319 mg.

**Fresh, ripe California
per pound of fresh

Now you can get up to the nutrients
shown above the Vita Mix way.

("Pool and everything" is the VITA MIX® way)

SUPER 3600
STAINLESS STEEL
VITA MIX®
BREADMAKER

The easy way to make home made
bread — not only fresh-baked but
of fresh-ground grain with precious,
fragile vitamin oils retained for that
yummy "3-minute fresh" flavor.
Only VITA-MIX® can grind grain,
mix and knead the bread all in one
easy 3-minute operation.*

No need for old fashioned, oversized
bowls, kettles, dough hooks or stone
grinders that clutter your kitchen
and take so much time.

* 3 minutes for us
* 5 minutes for you if you are new at it

CHECK THESE FEATURES

□ Full 5-Year Free Parts
□ Replacement
□ U.S. Made, Nationwide Service
□ Self-Cleaning
□ Super-Powered Motor
□ Save Food, Time, Money — Now!
□ (n) Listed
□ Heavy Duty
□ 265 MPH Blade Tip Speed—
   Instant head-on impact in safe, heavy,
   stainless steel concussioon chamber
□ No Other Appliance Has Vita Mix®
Features

WRITE TODAY — Phone (216) 235-8640 or outside Ohio call TOLL FREE 800-321-2790
Alaska and Hawaii call TOLL FREE 800-321-8640

Call US NOW — We will RUSH TO YOU A GIANT FOLDER giving you the complete, never-before, exclusive details... plus WHERE TO BUY information ... and SPECIAL PRICE.

SPEED IS IMPORTANT — Supplies are limited. We will do everything possible to prevent slowdowns due to lack of material. WE WILL FILL ORDERS AS THEY ARE RECEIVED... on a strict and fair first-come basis.

SEND THIS COUPON TODAY TO:
VITA MIX® Corporation: "3600" Division, Dept. PMC0682
8815 Usher Road, Cleveland, Ohio 44135

YOUR NAME

ADDRESS

CITY

STATE

ZIP CODE

TEL

PM LOOKS AT NEW ABRASIVE SYSTEM

We recently tried three new sanding products from 3M: a sanding-file kit and two sanding-wheel kits. The kits contain adhesive-backed strips of sandpaper—one each in coarse, medium and fine grits. The line is called Press 'n Sand. You simply press the sandpaper on the tool and begin work. Peel off the paper for replacement. Extra adhesive-backed sandpaper is also sold. The file kit costs about $6. Its contours make this tool handy for sanding curves and angles, shaping wood and plastic or cleaning intricate surfaces.

The large 4½-in.-dia. sanding wheel (approximately $10) attaches to a portable electric drill to strip paint and shape wood or plastic.

The kit that contains two smaller wheels of 1 and 2¼-in. dia. ($7) helps on close work. The Press 'n Sand kits are sold in hardware and houseware stores.—Rosario Capotosto

Contours of the sanding file permit sanding a variety of irregular shapes.

The large 4½-in.-dia. sanding wheel runs cool and cuts at a fast rate.
THE ORIGINAL

4-Wheel Wonder
INDUSTRIAL LOAD CAPACITY
HAND TRUCK & DOLLY

Check these fantastic features!
- 400 lb. capacity in vertical position.
- 600 lb. capacity in horizontal position.
- Heavy-duty steel tubing, metal handle and frame.
- Quick release hitch pins lock handle in place.
- Top plate of thick 16-gauge steel, measures 6 1/2" x 14"...quickly converts to upright cart use.
- Solid rubber, ball bearing, swivel casters...big 3" diameter.
- Large solid rubber, steel hub main wheels...8" diameter x 1 3/8" wide.
- Handles are height adjustable from 36" to 48".
- Heavy-duty construction...total weight 27 lbs.
- Folds up to a compact 36" long x 19" wide x 11" high.

Save time, money, effort, damage and most of all back strain...turn tough jobs to easy ones.

The 4-wheel design and interchangeable handle allows you to use it vertically or horizontally...it's like having an extra worker for every job! Handy men, yard workers, homemakers, office workers, maintenance workers and warehouse personnel will all get a helping hand.

The Ultimate Heavy-Duty Helper! Use it to move furniture, shop equipment, garage items, trash cans, heavy TV sets, appliances, office furniture. Use it as a lawn & garden cart...converts quickly to hold plastic bags for leaves and trash.

Shop and Compare! Before we invented the 4-Wheel Wonder, you'd pay nearly $100 for a cart with all these features. But now you pay a fraction of that! Plus you get 100% guarantee of satisfaction, a full 5-year warranty and free gifts besides! Another outstanding value for you from D.R.I.

All For An Amazing LOW

$29.99
plus $1.99 shipping and handling

Heavy-Duty, yet versatile & compact!

QUALITY ACCEPTED

100% GUARANTEE OF SATISFACTION
You must be completely satisfied or you can return your order anytime for replacement or a complete refund including shipping and handling charges.

PLUS A FULL 5 YEAR WARRANTY
D.R.I. Industries warrants this product to be free from defective materials and workmanship for 5 years from the purchase date and will repair or replace any defective part without charge for 3 years. To make a claim under this warranty, written notification of such defect must be given to D.R.I. Industries in the address listed below. Any product or part requiring repair or replacement should be shipped prepaid to D.R.I. Industries.

D.R.I. Industries WILL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF THIS PRODUCT. D.R.I. Industries' liability under any circumstances shall not in any event exceed the purchase price paid for the products. Some states do not allow the exclusion of limitation of incidental or consequential damages, so that the above limitation or exclusion may not apply to you.

Card No.

SPECIAL OFFER COUPON

TO ORDER: Fill in form below and send with check, money order, or credit card information to D.R.I. Industries, Inc., Dept. WM-602, 11100 Hampshire Ave. S., Bloomington, MN 55438.

SPECIAL OFFER COUPON

SIGNATURE

NAME

ADDRESS

CITY

STATE

ZIP

PROJECT / PRODUCT

4-Wheel Wonder is a trademark of D.R.I. Industries, Inc. Patent pending.
A BEAUTIFUL GREEN LAWN FOR ONLY 10¢

Fertilizing and watering your lawn isn’t enough. It is very important to keep your mower blade sharp, too. A dull mower blade tears your grass, causing the tips to turn brown, and leaving you with an unhealthy looking lawn.

With All-Gator-Grit® Tool Sharpening Kit it only cost you 10¢ to sharpen the mower blade yourself. Our big 7 inch size makes a high speed grinder out of any make electric drill.

It’s fast and easy to sharpen mower blades, hoes, shovels, axes and all your garden tools.

One All-Gator-Grit® Disc can sharpen 20 mower blades. Each kit contains 6 discs—that’s 120 sharpenings at 10¢ each, equals $12.00.

A COMPLETE TOOL SHARPENING KIT for $11.95

(Add $1.65 for ship. & hand. Outside U.S.A. add $3.10 ship. & hand. Ohio residents add 5% sales tax)

Consists of:

Six extra coarse All-gator-grit® Stuck-on Discs.

One 7 inch size Back up Pad and One steel arbor (fits all drills)

Plus FREE BONUS Mower Blade Balancer

VISA or MASTERCARD customers CALL TOLL FREE 1-800-543-7796

15 Day Money Back Guarantee

(Except in Alaska, Hawaii & Ohio)

Send check or money order to: SANDING TOOLS OF OHIO P.O. Box 1677, Dept PM Fairborn, Ohio 45324 (513) 878-3948

ALI-GATOR-GRIT Makes Sanding Fast & Easy!

All credit cards orders, be sure to include account number & exp. date.

Enjoy a roaring fire . . .

the easy way, with PM’s Log Splitter!

What could be more pleasant on a cold, cold day than the warmth of a roaring fire. And, you can have all the firewood you need and save time and money by splitting that firewood yourself. POPULAR MECHANICS LOG SPLITTER experts some 10,000 lbs. of pressure and will easily split 2 ft. lengths of maple and ash logs 12 to 14 inches in diameter. With an I-beam backbone, double-acting, hydraulic cylinder, control valve oil filter, 3-hp. gasoline engine and other features, you’ll find this log splitter easy to build and a fun thing to use. And, you’ll save your back from aching as you split logs the easy way.

Have more time to enjoy the crackling fire in your fireplace. Use it through this year, or start getting ready for next winter. Either way, it’s a very sound investment. Send for complete plans and step by step instructions for just $8.95.

Send a check or money order to PM Plans Library-Log Splitter, Box 1014 Radio City Station, N.Y. N.Y. 10101

SMART IDEAS

If you’re looking for ideas to save time and money — while enjoying what you’re doing — send away for PM’s catalog immediately.

We have plans for shop tools, boats, storage houses, campers, Scuba tow, ACV, log splitter, air compressor, Smart ideas in furniture! Also dollhouses! Projects the whole family can enjoy.

And best of all — we offer a special and unique service — photocopies of past PM articles. What’s more, we tell you the year the projects were published. It may be as early as a 1902 glider to a most recent 1981 solar garden shed. You’ll have fun just browsing through the approximately 900 different plans and projects. You’ll find our GREAT WORKSHOP series listed. Also our SHOP MINI-COURSES. Timely energy-saving ideas! You’ll see it all in our new POPULAR MECHANICS PLANS AND IDEAS CATALOG.

Price $1.00

NEW EDITION

order today!

Send Your Name and Address with Check or Money Order to Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101

Popular Mechanics is a publication of Hearst Magazines a Division of THE HEARST CORPORATION
SALE! $9.77 EACH

Exact Same Clock Sells Elsewhere for $26.95

8 GREAT FEATURES:
- Hours • Minutes
- Seconds • Day
- Date • Alarm
- Snooze Alarm
- Light-up Display

PLUS Fold-Out Easel Back

Actual size — Just 2 9/16”!

Incredible “Everywhere” Alarm Clock

Really amazing — Convenient, dependable, and accurate to within seconds per year! This LCD Quartz marvel will stick-up anywhere... stand on a desk or counter... and travel along with you in pocket or purse. Lots of great features: hours, minutes, seconds, day, date, alarm, snooze alarm, and light-up display. Plus, a handy easel back and a FREE WALL HOLDER for instant stick-up. Handsome, sturdy, super-compact... This very same clock sells in catalogs for $26.95! Now yours for just $9.77 each... Great Gift Idea!

FULLY GUARANTEED
The quartz-crystal mini alarm clock runs at exactly 32,768 cycles per second — We guarantee it to be accurate within two minutes per year. If not totally delighted, simply return for full refund (except shipping & handling). Our policy is to process all orders promptly. Credit card orders are processed upon credit approval. Delays notified promptly. Shipment guaranteed within 60 days. (Dealer inquiries welcome.)

Old Village Shop, Hanover, PA 17331

* SATISFACTION GUARANTEED — MAIL TODAY!*

OLD VILLAGE SHOP, Dept. VZ-7858
340 Poplar Street, Hanover, Pa. 17331

Yes! Please rush my LCD Mini Alarm Clock(s) (7513200) as indicated below, on Full MONEY BACK GUARANTEE.

☐ One Clock for $9.77 plus $1.50 shipping and handling.
☐ Two Clocks for $18.77 plus $2.50 shipping and handling.
Enclosed is $_______ (PA res. add sales tax)

CHARGE IT: ☐ American Express ☐ Carte Blanche
☐ Diners Club ☐ VISA ☐ MasterCard

Acct. No. ___________________________
Exp. Date __________________________

NAME ____________________________ (please print)
ADDRESS __________________________
CITY ____________________________ STATE __________ ZIP __________

☐ Check here and send 50c for year’s subscription to our full-color catalog of fine gifts (2389965X).

FOUND!
IN GUARDED VAULTS!
5,000 ORIGINAL, U.S. GOVT.
MORGAN SILVER DOLLARS
that escaped Govt. meltdown!

Rare Surviving Hoard of Original U.S. Govt. Coins
To Be Released To U.S. Citizens For Only $30 Each
...Acceptance Deadline: June 28

Tonight at midnight, history will be made when the National Monetary Center opens its vaults and releases to the public some of the last surviving ORIGINAL, U.S. GOVT MINTED MORGAN SILVER DOLLARS IN EXISTENCE IN ALL THE WORLD. Yes, a valuable hoard of 5,000 Morgan Silver Dollars...that escaped Govt. meltdown over a half a century ago...and have become one of the rarest coins on the face of the earth.

THE DAY THE SILVER DOLLAR ARMY MARCHED OFF TO WAR!
You see, in World War I, due to severe silver shortages, the U.S. Govt. drafted from circulation and melted down some 270 million Morgan Silver Dollars. In one single action—Operation Meltdown—the Morgan suddenly became one of the rarest coins ever minted. Which is why the release of this hoard of 5,000 original U.S. Govt. Morgans is such a significant event in the world of valuable coins.

FOR THE RELEASE TO INDIVIDUAL CITIZENS ONLY—FOREIGN AND DEALER ORDERS WILL NOT BE HONORED!
Most significant, each of these original Morgan Silver Dollars is guaranteed to contain 412.5 grams of ninety per cent fine silver. To measure 38.1 mm in diameter with weight of 26.7 grams and will be accompanied by a Certificate of Authenticity to this effect for your own insurance purposes.

PRICE GUARANTEED FOR THIS SPECIAL RELEASE ONLY! SUPPLY GUARANTEED FOR ONLY AS LONG AS THEY LAST!
Due to limitations of our available supply, and the acute scarcity of original U.S. Govt. Morgan Silver Dollars still in good condition, we can only guarantee this initial offering price of $30 per coin plus $2 postage, handling and insurance per coin for this special release only.

In addition we must set a strict limit on no more than twenty (20) original Morgan Silver Dollars per order, AND SINCE THIS OFFER IS BEING MADE AVAILABLE TO PRIVATE U.S. CITIZENS ONLY, NO ORDERS FROM DEALERS OR INDIVIDUALS FROM OUTSIDE THE UNITED STATES WILL BE ACCEPTED and unaccepted checks will be returned.

But once again...this is a STRICT LIMITED OFFERING TO U.S. CITIZENS ONLY. All orders will be filled on a first-come, first-served basis, and of course your purchase price refunded in full, anytime within 14 days if not completely satisfied.

SPECIAL COLLECTOR'S DISCOUNTS: 3 COINS for $75 plus $5 postage, handling & insurance; 5 coins for $120 plus $5 postage, handling & insurance; 20 coins for $425 plus $5 postage, handling & insurance. To avoid disappointment or future regret, you must place your orders immediately. ACT NOW!

NATIONAL MONETARY CENTER, DEPT. SWNV-24
Box 37438, WASHINGTON, D.C. 20013

BUILD YOUR OWN SWIMMING POOL
KITS - PLANS - FULL SIZE BLUEPRINTS
You can build an inground pool for 75% or less than retail value. Join the thousands who build each year and save $$$ – Our methods are specially intended for amateurs. Over 20 designs, complete construction blueprints and layout kit for $5.95 + $1.50 postage and handling. Pool kits available on request.

LOREN’S POOL, INC.
400 Lincolnway
La Porte, Indiana 46350
Phone (219) 328-1534

THE QUALITY ALTERNATIVE TO HIGH-COST INSTALLABLE BOATS!
A real savings of thousands! Canoes, dinghies and motorized boats 9½' x 30', 14½' x 30' SPECIAL - small kit $95.00 In stock now. Send to use
FREE color brochure

TRUS-80 COMPUTER DISCOUNTS
- Use Discount Program at Computer Centers
- and Other Radio Shack TRS-80 Equipment
- Factory Price! - No Out-Of-Stock Sales Tax
- Full Radio Shack Warranty - Buy Price and Save
- We Ship Nationwide FREE DISCOUNT PRICE LIST
1-800-257-0425

TGR0A / TRRON Associate Store
1756 W. Thurnell Drive, Belleville, IL 62223
866-901-1100

"PAY" YOURSELF $1000+ TO
BUILD THIS NEW 4-WHEEL HAULER
- 16 or 11 H.P. Briggs & Stratton electric start engine
- automatic torque converter transmissions
- 500 lbs. payload plus two passengers + dump box
- 44½" x 40" x 11" steering wheel, front pedal control
- forward and reverse gear + rear dual hydraulic disc brakes
- Tough Mark Series Haulers lift 500 lbs. of cargo plus you and a passenger almost anywhere. 16 H.P. opposed Twin Cylinder or 11 H.P. Synchro Balanced Briggs & Stratton engine, automatic torque converters (no manual shifting), alternator and electric start. Steering wheel, front pedal accelerator and brake (rear dual hydraulic disc). Forward and reverse gear let you maneuver easily with speeds up to 25 MPH. Dump bed 44½" x 40" x 11" extends to over 4 ft. with tail gate opened. Many accessories.
Build it yourself and SAVE $1000+. Engine mounts in welded and painted frame. Tires mounted on rims. You bolt parts together and pocket assembly costs. Only simple tools needed. Thousands from eight to 16 built have built this强大 Kit.
For FREE color brochure call TOLL FREE 1-800-233-1000 (in Michigan call 616/649-3400 or write:

Heald Hauler
Mark 4 Model H-416
shown with 2000 lb. winch
headlights and knot tamer
Also 3-wheel models and with steel cab

Carl Heald, Inc., Dept. NCM
P.O. Box 1148, Benton Harbor, MI 49022
Build a picnic table you can store indoors

PARKS 12" THICKNESS PLANER

The PAKRS NO. 12 planer is a compact, modestly priced planer with mini planer precision and ruggedness. More than 50,000 in use around the world. Write today for complete details.

THE PARKS WOODWORKING MACHINE CO.
Dept. PM 1501 Kewston St., Cincinnati, OH 45223

BUILD YOUR OWN SWIMMING POOL

SAVE THOUSANDS OF DOLLARS SB WITH OUR EASY-TO-DO KITS
OR MAKE THOUSANDS OF DOLLARS SB INSTALLING POOL KITS FOR OTHERS.

Your own full-size in-ground pool can be installed by yourself and only a helper. Write today for free information.

WONDER INDUSTRIES
Dept. PM P.O. Box 1326, PARAGOULD, ARKANSAS 72455
Phone 501-239-2226 TODAY!

Heavy Duty Log Splitters

Northern Hydraulics, P.O. Box 1221, Dept. PW56
Burnsville, MN 55337
812-949-6810

190 POPULAR MECHANICS
Popular Mechanics
FILE BOXES & SEPARATE INDEXES

No more untidy 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. The FILE BOX stands alone with all twelve issues intact! Line them up by year on your bookshelf and always have a wealth of do-it-yourself information at your fingertips.

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. Turn the File Box any way you choose. Place the year on the side that's convenient for you. Expose all the magazines on the shelf, or keep the solid side in view. It's your choice! Either way you'll have a valuable, convenient and very attractive reference library.

Price for 1 File Box, $2.25
Price for 2 File Boxes, $2.75 each
Price for 3 or more File Boxes, $2.50 each

PM Indexes for the years 1975-1981 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.

Broad category listings help you locate articles on home remodeling, boats, car maintenance, shop projects and many other subjects.

ORDER BY YEAR! PRICE for each index is $2.25.

SEND YOUR ORDER TODAY!
Make Check or Money Order Payable to Popular Mechanics
Please allow three to four weeks for delivery

POPULAR MECHANICS
Box 1014, Radio City Station, New York, NY 10101
REVERSE YOUR DRUM MOTOR CONVERT your cheap drill into an expensive reversible motor. Complete plans $3.25. Hill House Innovations, P.O. Box 175, Donna, Texas 78537

CARPET LAYING INSTRUCTIONS $7.00, W. HAFENREFFER, 311 SOUTH PALMETTO, MARSHFIELD, Mo. 65705

SAVE money on Home Maintenance, 25 proven ways to protect your property investments. Booker $3.00. Ricoh Press, 887 Fenton St., River Falls, New York, N.Y. 10150

ALKOHOL 100 PROOF Make Cheap Whiskey/Brandy with Simple Still. Plans/Pitcher Information Free! Dealz-PM, Box 322698, Kansas, 66012


INGROUD Swimming Pool Kits, From $168.95, For Complete Kit. Free Brochures & Price, Burnett, 4501 Burnhills, North Little Rock, Arkansas 72118

TESLA TURBINE—Here's a simple model turnings project: no polars, no cone, no balances. Run for hours or days. Complete plans, easy to make. Photocopy of article available for $1.25. Send order to: Populac Mechanics, Dept. PM46, P.O. Box 1014, Royal City, Texas 76070

ARTS & CRAFTS

PLASTERCRAFT, CANDLECRAFT, RUBBER MOLDING for Fun - Profit! Make figures from Complete Kit Catalog $1.00 (refundable). Wooley Company, P.O. Box 6894, Phoenix, 85021, Established 1917.

"GETTING Started in Stained Glass" $1.00. Whittemore, 20561, New York, N.Y. 10025

STAINED GLASS Catalog-P. S. $1.00 Supplies, Kits, Tools, Books, Glasses, Sashenzzlia, 171, Nani, Yorx, 10992

JEWELRY Supply Catalogs (Wholesale Catalog 25c), Rochester, 10-1560 Dover, New York 14114

NEW LEATHER company has craft supplies. Send $1.00 (refundable) for latest catalog to: The Leather Company, Dept. PM44, P.O. Box 2486, Charlotte, N.C. 28209


WOODWORKER—Frame patterns for Cross Stitch Best Sellers. 65c. King Crafts, Book 1727C, King City 37021-1727

STAINED GLASS Supplies Complete line, reasonably priced. Catalog $1.50, (refundable) Sunshine Glassworks, 755 Milpore, Dept. CT, Ashtrist, N.Y., 14425

COMMERICAL, CARTOON ARTS & SIGN PAINTING

LEARN PINSTRIPING! E.Z Guide with Instructions. Money back Guarantee $15.95, VDP, Box 3084PM, Habron, Ill. 60038

MODERN Cartooning taught by mail. Write for free brochure, Cartoonman-Inc.—Box 250-38, Bradford, Conn. 06035


CARTOON FOR Fun and Money!!! Free booklet! Cartoons, Box 4016, Centerport, Long Island, New York

3 LESSON cartooning course. Cartoonists Magazine, both $4.00, Harman, Box 30367, Lincoln, Nebraska 65060-3677

LEARN Sign Painting at Home! Tricks Of The Trade, $6.00 Value For $1.00. Eurea Press, Box 931 B., Fitteridge, Georgia

CARTOON PRO! 1st Instruction Free. Simple, Easy Mem. Send Sample of your work with a BASE. Harmonia Studio, 19/2 E 11th. Davenport, Iowa 52803

SIGN PAINTING—Complete line of instruction Books. FREE BROCHURE. Creative Arts, 310 N Broadway, St. Louis, Mo. 63102

MODELS—CARS, SHIPS, TRAINS, AIRCRAFT, AIRPLANES

MODEL AIRPLANE Huge Catalog. $2.00. Big Manufacturing Co., Inc., Monticello, Illinois 61843

RADIO CONTROL—Airplanes, Boats, Helicopters, Sys. Supplies, Big Discount Catalog $4.00 (refundable). Modellers Supply. Box 7185, Montgomery, Alabama 36107

FIRING CIVIL WAR MODEL CANNON Plans Catalog free. Green—PM 52, Box 392, Shaler, Ill. 62579

MAGIC TRICKS, JOKE'S, VENTRILOQUISO FREE Illustrated Venturinick/Poppy Casket Maher, Box 42OP, Littleton, Colorado 80165


PROFESSIONAL MAGIC 1818 Catalog, $2.00. Same day service. Air Institute's Fabulous Magic 3318 E. Charleston, Las Vegas, Nevada 89114

HOBBIES AND COLLECTIONS COLLECT Military Medals. List 50¢. Vernon, Box 387 PM, Baldwin, New York 11510

OLD Time Soldier Medals, Child Set Figures. Write for Free Information and Special Offerings—PM, Box 34922, Longwood, Florida 32750

DECALS, EMBLEMS, PATCHES Patches, Decals, Custom Made Free. Catalog-Embiles, Box 35, Tappan, New York 10983

ANTIQUES, RELICS, INDIAN GOODS AND CURIOS Free list to Serious Collectors. 30,000 Indian Artifacts. Pots, Axes, Beads, Beads, Cadby Trading Post, Box 669, Mutchroster, N.Y. 11758

STAMP COLLECTING U.S. 25 cent mint including Souvenir Sheet. $1.00. Free list, Boods, Box 62, Brooklyn, N.Y. 11229

50 YEARS Old fifteen different United States, over fifty years old—25c with approvals. Jason, Box C-117, New Rochelle, New York 10801

FREE Big Bargain Catalog - New Edition listing thousands of bargains including U.S. & B.N.A. stamps, packets, albums, accessories and supplies. Also fine stamps from our approval list, 25c only when ordering by mail. Return balance promptly. Thank you! Jamestown Stamp Co., Dept. E659PM, Jamestown, N.Y. 14703

1,000 DIFFERENT WORLD - 100 DIFFERENT MONGOLIAN BEAUTIES $3.00. Attractive approvals (pictorials), Cancel service available. ADULTS ONLY. Gouge, Box 1200GM, Elizabethtown, Pennsylvania 17022

TOP! 100 Popular Poland Stamps (all different) only 25c. Mystic, Dept. FS1, Camden, New York 13316

INVEST in Rare Stamps Send For Booklet. Joseph Karchef, Inc., Dept. 775PM, Oriental, N.Y. 11657

FREE Wholesale Stamps and Books. List 10c. Post Box Lists. 4x 3 Plate Blocks $1.00. AMBSCO, Box 20600PM, St. Louis, Mo. 63136

WOW! 50 At Different Germany-1st Super collection of genuine German Covers, Letters, Postcards, Air Mail, Reply Stamps, High Values. Free Big Catalog. Also fine stamps from our approval list. Send your name, address, and request approval. We buy your cover. Return balance promptly. Send 10c. Jamestown Stamp Co., Dept. A926PM, Jamestown, N.Y. 14703

ABSOLUTELY FREE, 50 different British Commonwealth COMMEMORATIVES, Approvals. Goben-Davis, Box 990, Seco, Me. 04072

BREATHTAKING Beautiful. 50 different mint Monaco pictorials commemoratives only $1.00 with mint complete set approvals. Papgoa, Box 139P, Sidney, Ohio 45365

PEONY APPROVALS! Regardless catalogues! Koeber, 4164 53rd St. San Diego, Calif. 92105

UNITED NATIONS 3 Complete Mint Sets 25c. Approvals. Cornet, POB 1500-N, Lake Placid, New York 12946

250 STAMPS MINI WAFLES. 1981 and 1936 - $1.00. Ed Roush, 425 Shapard, Manchester, Ohio 44607

OLD U.S. Stamps on Approval. Chester, Box 153005, Philadelphia, Pa. 19111

WORLD Wide Stamps mounted in books on approval 2c each. TRUST B PAPER COMPANY, P.O. Box 190-7, Jamaica, N.Y. 11435

FREE Surprise collection sent with approvals. Goul, 1784 Main, Elmer, N.J. 08318

FREE 220 United States and Worldwide Stamps. Approvals. Stamps PM, Box 1427, Bellflower, Calif. 90706

100 Different U.S. 25c Approvals. Bradley, Box 425F, Middletown, Va. 22063

BARGAIN 100 Combined-WWII Stamps. 25c. Qualifying Approvals. R. A. Prusky, Box 140, West Brookfield, MA. 01585

2,000,000 Stamps—150 Countries—2 each. Belden Box 4149, Deerborn, R.I.
Subscription price Slashed to $2.97!

Moneysworth monthly has stunned
the magazine world by announc-
ing an offer of full-year subscrip-
tions for just $2.97. This is as little as some
magazines charge for a single issue.

"We're doing this to celebrate our
Tenth Anniversary," a spokesman said,
"and to solidify Moneysworth's position
as America's Number One Biggest Pub-
lishing Bargain. Ever since it began
publication a decade ago, Moneysworth
has consistently lowered subscription
rates, while other periodicals have been
raising theirs. We started out at $10 a
year and now we are offering Tenth An-
niversary Special Subscriptions at the
UNREAL PRICE OF ONLY $2.97!"

Moneysworth, which tells how to get
the most for your money and the most
out of life, is read by an estimated
5,000,000. Its chief competitors are
Consumer Reports, which sells for $14 a
year; and Money magazine, for $17.95.

How to place your order

Readers of this magazine who wish to
take advantage of this unparalleled offer
should send their name and address
along with $2.97 to: Tenth Anniversary
Special Subscriptions, Moneysworth,
P.O. Box 404-PM, New York, NY 10011.

Typical of the savvy, wallet-fattening
titles Moneysworth prints are these:

Recession-Free Jobs
Cars that Are Stunglest with Gas
How to Earn 10½% on Your Savings
Canada's FREE Land Giveaway
How to Qualify for Food Stamps
The Only Diet That Really Works
The Long and Short of Hair Transplants
How to Collect Social Security from the
U.S. and Canada—BOTH
Are Hay Fever Shots Pointless?
Mercedes' New "Lifetime" Car
How to Reduce Exorbitant Doctor Bills
States with Best Unemployment Pay
How to Get a Low-Cost Divorce
The Kinds of Cars Mechanics Own

—H.T. Pinrose; Montgomery, Iowa.
* "Your advice on Social Security re-
sulted in a $3,135 lump-sum cash pay-
ment to my wife and $2,171 monthly pen-
nion. The best investment I ever made
was my subscription to Moneysworth."—
Dr. Herman Hortop; La Grange, Ill.

—"Your article on high interest paid
by foreign banks has enabled me to
retire in style. I cannot thank you
enough."—E. Svenson; Fallbrook, Cal.

—"Your news reports on investments
have brought me, in just months, $12,996
profit, tripling my money. You can bet
I'll be a Moneysworth subscriber for
life."—L. Grey; Ypsilanti, Mich.

—"Your article 'Inaccurate Billing by
the Phone Company' led me to discover
four years of overcharges. I got a $1,750
refund!"—A. DiRienzo; Bristol, Pa.

—"Moneysworth's product ratings
sure stretch the dollar. I bought the
$59m camera you recommended, saving
30%."—R. Goodrich; Tucson, Ariz.

—"Your article 'How to Avoid Paying
an Exorbitant Doctor Bill' saved me
$65. Here's my subscription extension."—
C. Wagner; Yorktown Heights, N.Y.

—"Thanks to your article 'How to Buy
a New Car for $125 over DEALER'S
Cost,' I just bought a Chevey at a saving
that I conservatively estimate at $300."—
Rudy L. Grange; Anita, Iowa.

—"Moneysworth is aptly named. To
paraphrase Churchill, never have so
many paid so little for so much."—Dave
Alpern; Pittsburgh, Pa.

To take advantage

To take advantage of this GIVEAWAY
offer, readers of this magazine should
send their name and address with $2.97
to: Tenth Anniversary Special Sub-
scriptions, Moneysworth, P.O. Box 404-PM,
New York, NY 10011.

(Note: There is a limit to the number of
years that may be ordered under this
special rate. No subscription may ex-
cede three years—at $3.91.)

If ever a publication was accurately
named, it's Moneysworth. This offer is
highly recommended.
A TWO SEAT SPORTS CAR WITH A 7-FOOT TRUNK.

THE 1982 SR5 SPORT TRUCK. Two-seat sports cars are fine...if all you travel with is driving gloves and sunglasses.

But if you like to bring your toys when you go places, take this two-seat sports machine. Its 7-foot trunk holds a dirt bike, a snowmobile...almost any payload up to 1100 pounds.

And inside, the Toyota SR5 Long Bed Sport Truck really is outfitted like a sports car. With bucket seats. Big, blacked-out gauges. Even an AM/FM/MPX stereo radio. All standard.

Start the 2.4 liter 4-cylinder overhead cam engine and the sports car feeling gets even better. You've got power-assisted disc brakes up front. A sporty 5-speed overdrive transmission. Or you can order Toyota's innovative 4-speed automatic overdrive.

And one more thing — mileage you wouldn't expect from a sports car! The Toyota SR5 is rated at 34 EPA Estimated Highway MPG.(24) EPA Estimated MPG. Remember: Compare this estimate to the EPA "Estimated MPG" of other small trucks. You may get different mileage, depending on how fast you drive, weather conditions, and trip length. Actual highway mileage will probably be less than the EPA "Highway Estimate."

The Toyota SR5 Sport Truck. It isn't hard to believe you really are in a sports car. Just don't look back!
Which is the lowest menthol 100's?  
(Hint: it's not Carlton.)

NOW is the lowest menthol 100s. But it's easy to see why some people aren't sure. They've had a lot of confusing numbers thrown at them for quite a while.

Just look at the chart at the right and see for yourself.

The truth is that NOW 100s Soft Pack Menthol at

2 mg tar contains less than half the tar of Carlton 100s Soft Pack Menthol at 5 mg.

And NOW Menthol 100s is by far and away lower in tar than any other Menthol 100s whatsoever.

Which is the lowest 100s menthol?

No need to guess—NOW.

**NUMBERS DON'T LIE. NOW 100s ARE LOWER THAN CARLTON 100s.**

<table>
<thead>
<tr>
<th></th>
<th>NOW 100s</th>
<th>CARLTON 100s</th>
</tr>
</thead>
<tbody>
<tr>
<td>100s</td>
<td>2mg</td>
<td>5mg</td>
</tr>
<tr>
<td>Soft Pack</td>
<td>2mg</td>
<td>5mg</td>
</tr>
<tr>
<td>Soft Pack 100s</td>
<td>Less than 0.01mg</td>
<td>1mg</td>
</tr>
</tbody>
</table>

All tar numbers are av. per cigarette by FTC method.

NOW

**The Lowest**

The lowest in tar of all brands.

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

BOX BOX 100's: Less than 0.01 mg. "tar", 0.001 mg. nicotine, SOFT PACK 85's FILTER, MENTHOL. 1 mg. "tar", 0.1 mg. nicotine, SOFT PACK 100's FILTER, MENTHOL. 2 mg. "tar", 0.2 mg. nicotine, av. per cigarette by FTC method.