

# Popular Mechanics

Best spots for CB  
in your car

Make your home brighter,  
roomier and more fun!

- Low-cost pools
- 6 easy spruce-ups
- 4 dormer designs

COMPLETE  
IN THIS ISSUE:  
72-PAGE  
CAR REPAIR  
MANUAL

New wilderness  
camping sites

Sharpshooting  
cameras  
that focus  
themselves



**WILL A.J. FOYT  
BE FIRST WITH  
FOUR INDY WINS?**  
PLUS Jean Shepherd's  
wry view of the 500

This '49 Plymouth is older  
than its two drivers  
...and running just like new

20 owners tell how  
to keep your car rolling  
1/4 million miles & more!

# In between too



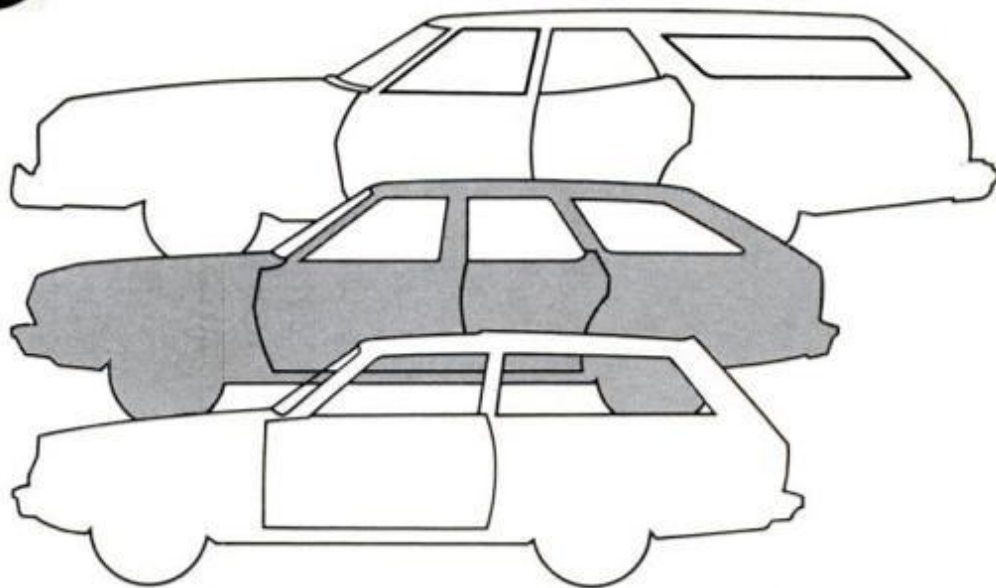
The AMC Hornet Sportabout is just right. It offers the convenience of a 4-door wagon with the economy of a compact car.\*

### **All the Room Most Families Need**

A family of five can ride comfortably in our compact without feeling compacted. But besides being comfortable, the Sportabout is also practical.

There is all the cargo space necessary to fill most families' needs.

# big & too small.



With an in-between-size wagon, you don't need as much room to park between cars. Or to maneuver between them in traffic.

And with the Sportabout's standard economical six-cylinder engine and long driving range, gas station stops are few and far between.\*

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To us at American Motors, and to our dealers, the exclusive AMC BUYER PROTECTION PLAN means a commitment to our customers.

AMC's exclusive BUYER PROTECTION PLAN means that AMC will fix or replace free any part—except tires—for 12 months or 12,000 miles whether the part is defective, or just plain wears out under normal use and service.



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Manufacturers suggested retail price. Destination charges, dealer prep., state, local taxes extra. W/S/W tires (\$36) and wheel covers (\$32) extra.

The following parts and services are covered against factory defects or failure due to wear for 12 months or 12,000 miles.\*

### Parts fixed or replaced free.

	AMC	GM	FORD	CHRYSLER
Engine/Drive train	Yes	Yes	Yes	Yes
Spark plugs	Yes	No	No	No
Shock absorbers	Yes	No	No	Yes
Brake linings	Yes	No	No	Yes
Clutch linings	Yes	No	No	Yes
Wiper blades	Yes	No	No	No
All light bulbs	Yes	No	No	No
Hoses & Belts	Yes	Yes	No	No

### Services provided free.

	AMC	GM	FORD	CHRYSLER
Wheel alignment	Yes	No	No	No
Wheel balancing	Yes	No	No	No
Align headlights	Yes	No	No	No
Adjust carburetor	Yes	No	No	No
Adjust distributor	Yes	No	No	No
Adjust brakes	Yes	No	No	No
Adjust clutch	Yes	No	No	No
Adjust transmission bands	Yes	No	No	No
Adjust & tighten belts	Yes	No	No	No
Tighten nuts & bolts	Yes	No	No	No
Free loaner car	Yes	No	No	Yes
Trip Interruption Protection	Yes	No	No	No

\*BUYER PROTECTION PLAN is reg. U.S. Pat. and Trm Off.

\*Chrysler coverage is 12 months, unlimited mileage.

General Motors has 5 year/60,000 mile coverage on certain 140 cu. in. engines.

\*EPA ESTIMATED MPG: 25 HIGHWAY, 17 CITY, FOR STANDARD 232 CID 6 AND OPTIONAL OVERDRIVE WITH MANUAL TRANS. CALIF. CARS EXCLUDED, YOUR RESULTS MAY VARY.

# AMC Hornet Sportabout

## SPECIAL SECTION:

### 1976 CAR CARE GUIDE

- 117 Cover
- 120 Car Care pays off for them: Over 100,000 miles and driving for a million
- 130 Pinpointing your problem
- 133 The story behind the '76 Car Care Guide
- 134 Section 1. Carburetors
- 139 Section 2. Ignition and electrical systems
- 145 Section 3. Bodies—inside and out
- 158 Section 4. Transmissions and drive trains
- 164 Section 5. Starting problems
- 166 Section 6. Suspension and steering problems
- 171 Section 7. Oil problems
- 176 Section 8. Engines
- 180 Section 9. Brakes
- 184 Section 10. Heaters and airconditioning
- 187 Section 11. Exhaust systems
- 192 Section 12. Cooling systems
- 196 Section 13. Fuel systems and gasoline
- 200 Section 14. Tires
- 202 Section 15. Information wanted

### AUTOMOBILES AND BIKES

- 16 The PM Garage
- 30 Imports and Motorsports
- 68 Detroit Listening Post
- 75 The two faces of Indy
- 92 PM Owners Report: Plymouth Volare and Dodge Aspen

### SCIENCE AND ENGINEERING

- 58 Bucking the pack ice to Prudhoe Bay
- 82 Our newest destroyer: Swift and sneaky
- 239 Supertrees: More wood for an energy-hungry world
- 248 The Bahamas: Beachcombing paradise for flying explorers

### HOME AND YARD

- 52 Silent fill valve replaces float ball in toilet tank
- 84 How to keep vegetarians out of your vegetable patch
- 102 Stay on vacation all summer with a low-cost pool
- 106 Six low-cost home improvements you can make yourself
- 110 How to add light and space with dormers

### WORTH WRITING FOR

Looking for more ideas and information? See page 198

### ON THE COVER

The '49 Plymouth belonging to Ralph Ocon is obviously well cared for. Read about other owners' gems starting on page 120. Photo: Jerry Abramowitz

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

# Popular Mechanics®

MAY 1976 • Vol. 145 No. 5

INTERNATIONAL EDITIONS: Australia, Caribbean, Mexico, Southern Hemisphere

## SPECIAL FEATURES:

**The two faces of Indy** is Jean Shepherd's wry view of the Indy 500 merry-makers who watch the event and drivers who do the serious racing. Among the latter: A.J. Foyt, trying for an unprecedented fourth win. Page 75.

**How to find the best spot for your car's CB.** Here are some installation tips for mobile sets that are mounted in every conceivable place. Page 88.

**Six low-cost home improvements you can make.** Bathroom planter, laundry center, door chime, dimmer switch, timers and yard lamppost. Page 106.

**CAR CARE GUIDE for 1976**—a big special section prepared by PM experts who answer our readers' most-asked questions about car troubles. Page 117.

**Bucking the ice to Prudhoe Bay:** The rugged, man-against-nature struggle to move vast oil-pipeline supplies through freezing Alaskan waters. Page 58.

**Stay on vacation all summer with a low-cost pool.** Practical guidelines you should know when you're buying an above-ground swimming pool. Page 102.

### SHOP AND CRAFTS

- 22 Shop forge you can build
- 112 Build your own fruit and vegetable dryer
- 114 Build this quartet of nesting tables
- 206 Tote bookrack
- 226 Handy drill-press shelf
- 234, 253, 257 Hints from readers
- 256 Bumper-pool cue rack

### ELECTRONICS, RADIO, TV

- 88 How to find the best spot for your car's CB

### PHOTOGRAPHY

- 96 Coming: New cameras that focus for you
- 222 Photo hints

### BOATING, OUTDOORS

- 98 How to camp away from campers
- 109 New outdoor gear

### AVIATION

- 80 A roughneck's best friend is a noisy yellow bird—the offshore helicopter

### EVERY MONTH

- 6 Letters
- 10 Science Worldwide
- 20 The Bicycle Shop
- 24 Appliance Clinic
- 26, 50, 72, 87, 91, 101, 205, 217, 254 It's New Now
- 34 All Outdoors
- 38 Car Clinic
- 48 Homeowners' Clinic

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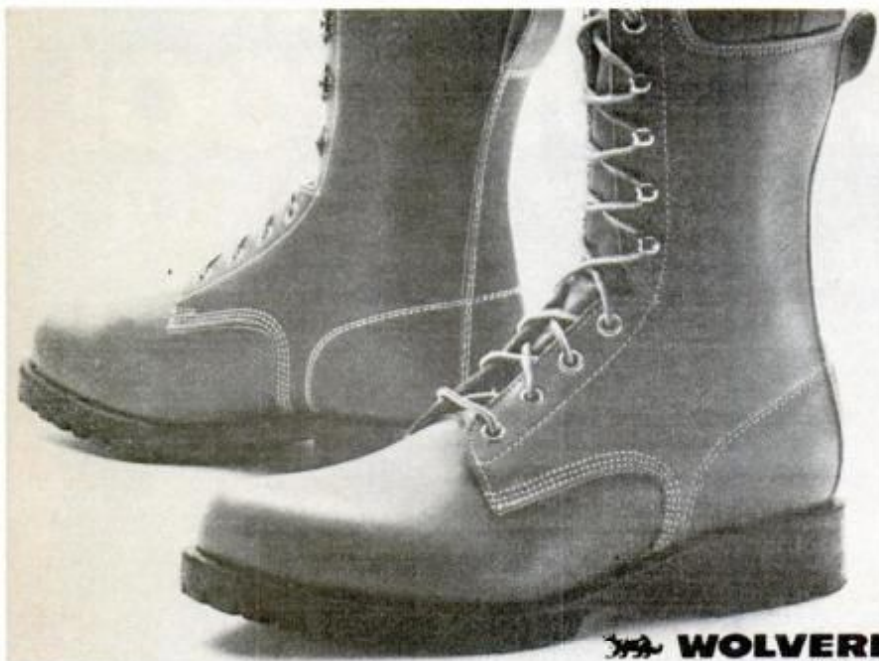
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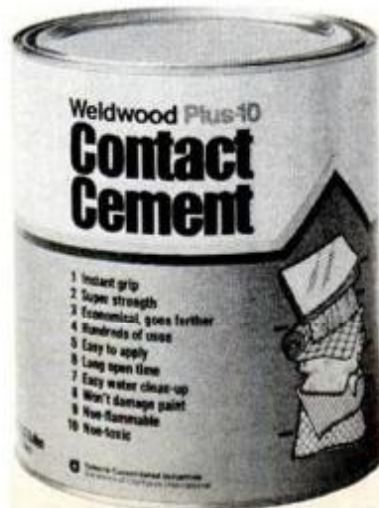
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## When Delco Disc Brake pads start to go, they're good enough to say good-bye.

The Lining Wear Sensor is the early warning device Delco builds into Delco Disc Brake pads. When the pads wear down to a predetermined thickness, the sensor will trigger a high-pitched whining sound.

That's your warning that the lining is worn to the point where service must be scheduled. It's Delco's way of helping you avoid costly damage to the rotors and to your car's front end.

You'll find the Lining Wear Sensor in Delco Disc Brake pads

for General Motors applications. You'll still find plenty of quality reasons to go with Delco Disc Brakes if you drive other domestic or import cars.

Just for one example, consider the eyelet rivets in the brake pad. They permit wear



debris to fall through rather than build up in the rivet hole. This helps prevent rotor scoring and helps extend rotor life.

To complete your Delco Brake Team, go with Delco Drum Brakes. They feature linings with the Delco Crown Ground Finish, precision-built all-new shoes and more.

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**Go  
with the names  
you know.**



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# LETTERS

## FROM READERS

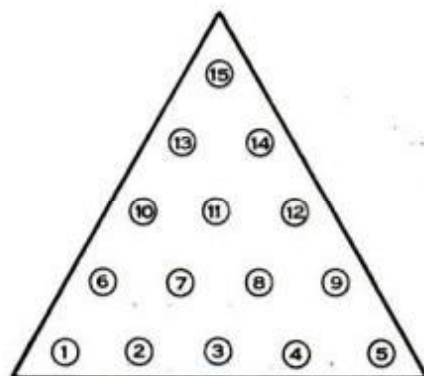
### Tee game madness

When we play the *Tee Game* (page 34, Feb. '76), we end up with two tees instead of only one. Six people have tried it, and none of us can solve it.

Please let us know how you come up with just one tee. The game is driving us crazy!

ARNOLD H. BRUCKER  
CROPSEY, ILL.

*A tee game enthusiast from Rockford, Ill., Harold H. Moderhack, sent us this solution:*



### Suggested moves:

3 over 2	9 over 8
5 over 4	2 over 7
11 over 8	14 over 12
4 over 3	10 over 11
6 over 7	9 over 12
13 over 10	15 over 14
	1 over 6

For an added challenge, reverse the game. Start with one tee, jump a vacant hole and insert a tee into the hole which was jumped until all tees are returned to the board.

STANLEY O. CARROLL  
FALLS CHURCH, VA.

### Improved parts cleaner

You should have entitled your January '76 article *Liquid Dynamite* instead of *Parts Cleaner* (page 91).

In view of the fact that you made no mention of the safety hazards involved in the use of kerosene in an enclosed area, you should remind your readers that kerosene and/or any other flammable or toxic cleaning agent should always be used in a well-ventilated area.

These solvents should always be covered when stored. They should never be agitated in or around flame or any spark-producing devices. An

electric drill has a spark-producing brush and commutator. If an electric drill is used, change its position. It is presently directly below the parts container, which is precisely where the fumes of cleaning agent will displace themselves when the drill is in operation.

RICHARD COUTURE  
SOMERSWORTH, N.H.

To improve on your ingenious parts cleaner, I installed a clear plastic fuel filter on the line from the pump to the outlet in the pan. This filters out the fine particles that don't settle in the holding tank. When it gets plugged, you just reverse it for a short period and dump the particles back into the holding tank or into the trash.

This makes for cleaner fluid for use in parts cleaning and allows it to be used over and over, thus saving petrol.

ROBERT RYAN  
TORRANCE, CALIF.

I would recommend using a small screen over the drain hole. If a small part falls off and goes down the drain, it would be a lot of trouble to recover.

GARY COLSON  
GREENSBORO, VT.

### A 'well-timed' article

Thank you for the article by Ed Hymoff, *War Watch in the Sinai* (page 75, March '76). If you notice a spurt in sales this month, it can probably be attributed to the enthusiasm of the staff of the Sinai Support Mission.

As you probably know, the sensors that the author described went into official operation on Feb. 22, as scheduled, so the issue is particularly well-timed.

ELINOR GREEN  
U.S. SINAI SUPPORT MISSION  
WASHINGTON, D.C.

### Quick cure for misfire

I found Mort Schultz's article *Tracking Down Engine Misfire* (page 106, Feb. '76) very good, but he missed mentioning the simplest possibility.

Before you do anything, check your gas cap and make sure it is not loose fitting, cracked or making a poor seal. A little water in your gas tank



after a rainfall is just great if you enjoy misfire and power loss.

One new cap and one twist can save you a lot of time, trouble and money.

JOHN J. BLAHITKA  
DORVAL, QUE.

### From floor to butcher block

Here is my version of the butcher block that your great magazine published in Oct. '75 (*Build This Handy Butcher Block*, page 102).

The entire top of my table is hard white maple; the wood, which is old gym flooring, was salvaged from a waste wood pile. I removed all nails, planed by hand to remove old varnish and give a good gluing surface. The boards were then ripped to remove tongue and grooves, set on edge and glued side by side with wood dowel rods running the complete width of the top.

The legs are yellow pine 4x4s with routed edges mounted to top with carriage bolts. For preserving the top, I brushed on hot vegetable oil and let it soak in.



Cost of my very hard and solid table was less than \$10.

ARYLYN L. LANGE  
EDWARDSVILLE, ILL.

### Helmets for car drivers?

The point Nile C. Byers Jr. makes in your *Letters* column (page 30, March '76) isn't exactly right. Helmet laws are "big brother" laws infringing on our personal rights of choice of dress, but it seems silly to get worked up about it.

However, when legislators take time to learn the facts and figures, they'll force helmets on car drivers, too. Of both automobilists and mo-

*(Please turn to page 8.)*



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**LETTERS**

*(Continued from page 7)*

torcyclists killed in accidents, 70 percent die of head injuries. So if legislators were honestly concerned about saving lives, they would be trying to save the 70 percent of the 60,000 automobilists killed in 1974 rather than (or along with) the 70 percent of the 3380 cyclists killed in 1974.

The only thing the legislators are doing is age-old: picking on a minority.

TED BEERS  
ARNOLD, MO.

**Shop safety stressed**

As an industrial arts teacher, I have noticed that many of my students find *Popular Mechanics* very informative and an excellent source of project ideas.

Wayne C. Leckey's article, *An Expert's 23 Best Woodworking Tips* (page 110, Feb. '76), offers very good tips with several photographs showing various machine operations. I would like to point out, however, that the photos repeatedly show the operator using the machines in an unsafe and dangerous manner. He is not shown wearing eye protection (safety glasses) or using the blade guard equipped with the machine.

Since much of the industrial arts courses put a great emphasis on safety, I hope that you will become more safety conscious in future articles and photographs.

MICHAEL ANGIULI  
YONKERS, N.Y.

*We certainly don't advocate working without proper safety protection. But to clearly illustrate some of the 23 tips, we had to leave the blade guard off the table saw.*

**Beware of contaminated filters**

The picture of a kitchen strainer being used to filter photographic chemicals in your February '76 *Photo Hints* (page 32) sent a shiver up my spine! Too often such strainers are made to fit the low price range of the old "five-and-dime" stores.

Uncoated steel, tin with joints sometimes soldered, occasionally nickel or chromium-plated—all are possible sources of contamination. Spotting of negatives and prints, as well as unsatisfactory development can result.

If made of stainless steel, the strainer might be safe. But such a relatively expensive construction is difficult to find; even then, the strainer must be thoroughly rinsed immediately after each use. Residues

from evaporation in the many grooves and creases would contaminate the next solution.

E.W. STECHER  
OAK PARK, ILL.

**A Texas-style thank you**

The Texas Auto and Truck Parts Association wishes to express its gratitude for your efforts on behalf of the used parts industry (*You'll Get Real Bargains Buying 'Recycled' Car Parts*, page 70, Jan '76).

It is truly a difficult task to try to change the "junkyard" image so many have of our industry. Only through efforts such as yours can we hope to do so.

JIM SHEW  
DEPUTY EXEC. DIRECTOR  
TEXAS AUTO AND TRUCK PARTS ASSN.

**Reusable cassettes**

In *Snarled and Broken Cassette Tapes Can Be Fixed* (page 95, Jan. '76) you stated that "the easiest way to pull welded cassettes apart is to stand the cassette up on its broad edge, put a screwdriver in the tab hole and hammer on the screwdriver till it opens." This is somewhat impractical, since you cannot use the shell over again.

For this reason, I set out to find a better way of doing it. If you punch a small hole in the tab hole, screw in an awl, and run the awl all the way around the cassette seam, it opens with no break. (You must be careful not to damage the tape.)

With this procedure you can use the shell again simply by gluing it back together.

ED FELTMAN  
RYE, N.Y.

**Misleading how-to**

Your January '76 article on disc brake repair (*Saturday Mechanic: How to Replace Disc Brake Pads*, page 86) was somewhat misleading.

The article states that a set of disc brake pads and other necessary parts to replace pads costs from \$8 to \$13. A set of original equipment or similar quality pads for full-size cars sell for around \$25, plus the hardware or installation kit.

Also, the bolts holding the Delco-Moraine calipers do not usually have hex heads as shown. It is, therefore, misleading to say and show that these bolts can be removed with a socket, open end or box end. The necessary tool for this job is a 3/8-in. Allen wrench or an Allen socket adapter.

HARRY G. HILL  
MILWAUKEE AREA TECHNICAL COLLEGE  
WEST ALLIS, WIS.

# "On the road, I'd be all alone without my Midland Convoy Buddy."

When you get a Midland CB radio, you not only get the finest CB radio for the money, you're in the Midland Convoy and you've got yourself a Convoy Buddy wherever you go. 'Cause the Midland Convoy already has over a million Buddies out there and that's something no other kind of CB can give you.

And, Buddy, you can't find any CBer more eager to help you than your Midland Convoy Buddy. Whether you want to know weather and traffic conditions up ahead, the best eat-um-up on the road, or just want some friendly conversation, there's always a Convoy Buddy nearby to give you the good word.

And when you're in trouble—a flat tire, out of gas, an accident, an injury, or maybe you just get lost a lot like me—

your Convoy Buddies will show you just how friendly this old world can be. 'Cause that's what it means to be in the Convoy. The best people using the best CB equipment for the money, helping each other all across the country.

If you aren't in the Midland Convoy yet, get yourself over to a Midland Convoy Buddy Headquarters. There's a Midland CB radio with the features you want at a price you want to pay. C'mon and join the Midland Convoy. And a big 10-4 to you. We're gone, bye.

## **MIDLAND CB** Communications Division

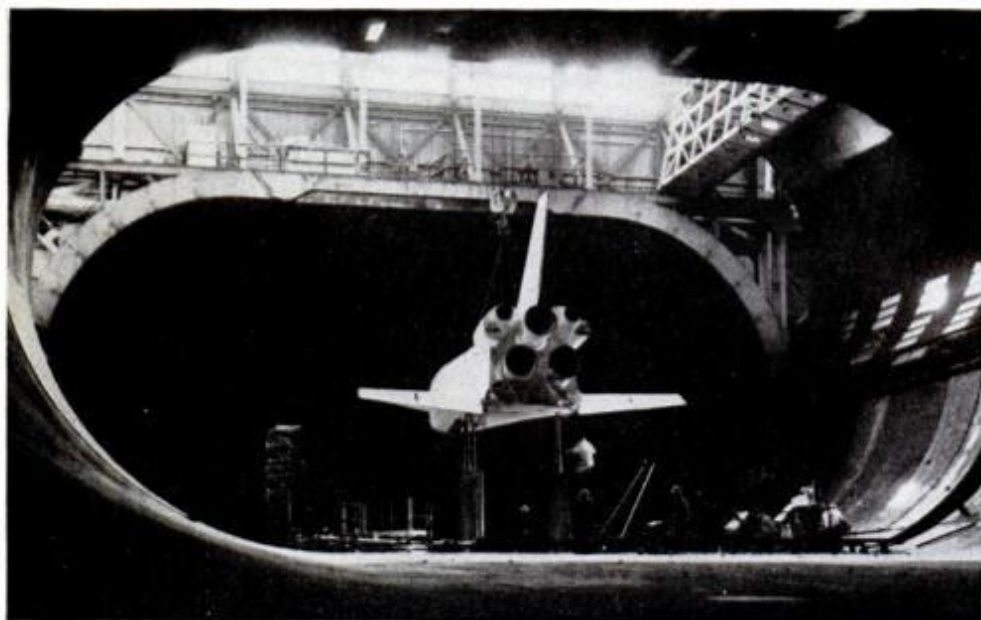
Midland manufactures the widest selection of CB radios in the world. For a free copy of the Midland CB & Scanner Brochure, write to: Midland Communications Division, Dept. PM-1, P.O. Box 12737, N.K.C., MO 64116.

When you get  
a Midland CB,  
You get a  
Convoy Buddy.

*e.w.mccall*



# SCIENCE WORLDWIDE



## Space Shuttle model in tunnel

Though our overall space program is not as ambitious as it was a few years ago, some aspects are still going forward. The schedule calls for the Space Shuttle to become fully operational in four years.

A one-third-scale model of the Shuttle Orbiter is shown installed in the huge test section of the wind tunnel at NASA's Ames Research Center in California. The model, almost 44 feet long, is being tested to gather low-speed flight data in support of approach and landing tests of the first full-scale Orbiter in 1977.

In these tests, the Orbiter will be carried aloft to an altitude of about 25,000 feet atop a specially modified Boeing 747. It will then be released, allowing the crew to fly the Orbiter to the ground. The Orbiter will have a variety of assignments, including the placing of space laboratories in orbit and recovering orbiting satellites for repair or maintenance in space.

After completion of a typical mission, the Orbiter enters the atmosphere at a high angle of attack and assumes a horizontal flight attitude for approach and landing. A two-week ground turnaround schedule is the goal for the reuse of the Space Shuttle Orbiter.

## Maple trees under attack

The Dutch elm disease is no longer the leading crippler of residential

shade trees in the Midwest and Northeast. That distinction belongs to a disease that hits maple trees, according to Harrison L. Morton, a University of Michigan tree pathologist. While some remedies have been found for Dutch elm disease, there is no known cure for the so-called maple decline.

The disease is most common among two popular shade varieties, the Norway maple and the sugar maple, says Prof. Morton. He characterizes maple decline as a chronic condition causing a gradual deterioration of the tree, including scorching or browning of the edges of leaves, and eventual loss of the branches and limbs.

A tree may continue in a state of decline for 10 years or so before it dies. Prof. Morton is pursuing research aimed at finding a cure for the disease.

## Heat wasted in home systems

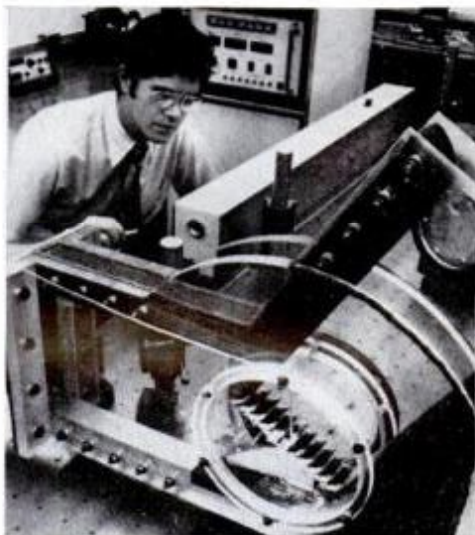
From 35 to 55 percent of the heating value of the fuel used in the typical residential gas furnace system is wasted, according to a study prepared by the Oak Ridge National Laboratory. But the furnace is not the chief culprit.

According to the Oak Ridge engineers, the greatest controllable loss of heat (up to 40 percent) from a forced, hot-air heating system is from uninsulated or leaking ducts—problems that can easily be remedied in most homes.

## Holography used to check design

A holographic testing technique, developed at the Westinghouse Research Laboratories in Pittsburgh, is now being used by the company's steam turbine division to measure the aerodynamic performance of turbine blading.

In the top photo, a researcher uses a laser to photograph turbine-blade flow fields. When air is forced through fixed arrays of small-scale blade seg-



ments, called cascades, the flow approximates the characteristics of steam moving in a turbine.

In the bottom photo, another scientist inspects the flow picture produced by an image reconstructing apparatus.

In essence, the holographic technique is a form of photographic "double exposure," made with illumination from a pulsed ruby laser. One exposure is made with flow through the blading, the other without. The

*(Please turn to page 14)*

Материал защищен авторским правом

# Scout Terra. The first 4x4 pickup of its kind in America introduces the kind of America you've never seen before.

Get out there in a Scout Terra.<sup>TM</sup> The ideal new mid-range pickup.

She isn't just another standard-size pickup with 4-wheel drive thrown in.

Built smaller on the outside, just 184 compact inches bumper to bumper and 70 inches across, to run rings around any full-size pickup.

And built to carry a ton of anything. That's almost 50% more than those little mini-pickups.

You get 11 cubic feet of lockable in-cab storage space as a standard feature, more than any other conventional pickup around.

Terra is built in the tradition of Scout<sup>®</sup> II, the machine that outperformed Blazer, Bronco, Cherokee, the CJ-5 and Trail Duster in Petersen Publications' big 4x4 competition last year. The only 4-wheeler rated excellent in 15 of the 17 engineering and performance categories. And out-and-out superior in the 7 most critical off-road tests. Hill climbing. Handling. Maneuverability. Stability. Acceleration. Gearing. And braking.

Terra is a comfortable, smooth-riding beauty on or off the road, and she's tough. Solid, heavy-gauge steel body. Double-walled pickup box. Long leaf springs all around. 118-inch wheelbase for riding stability.

## Scout<sup>®</sup> the America others pass by.



And a whole lot more. Optional dash-mounted selective 4-wheel drive, just when you need it, automatic-locking hubs, a high-low range transfer case and a full range of power plants. From slant-4 to a couple of big V-8s to a unique new 6-cylinder 198-cubic-inch diesel.

Add to all that a long list of other options and accessories—electric winch, skid plates, radial tires, Rallye package, you name it—and you've got the first pickup of its kind.

Test drive the new mid-range Scout Terra.



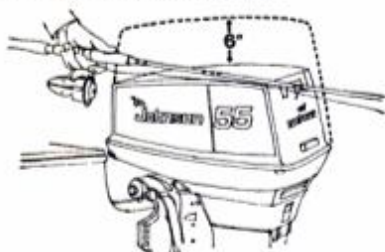
# Johnson's hot-selling, high-performance compacts.

## They perform like they're bigger, use fuel like they're smaller.

The boating public has bought more Johnson 70s over the last three years than any other model we make. High-performance in a compact three-cylinder package makes it the one outboard in the mid-horsepower range that can handle so many different kinds of boats so well.

But if you're a performance buff, our newly sport-styled Stinger 75 has been designed especially for you—to squeeze the most out of the hot hulls available for this power class.

The other member of our hot-selling, mid-horsepower range trio is the Sea-Horse 55—an efficient, two-cylinder package so compact it's a full six inches lower off the transom than comparable horsepower competitive motors. The low silhouette makes it easier to see, fish, and ski over.

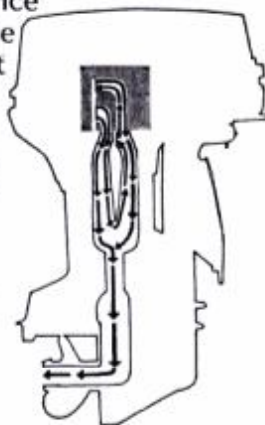


Our Johnson 55, 70 and 75 hp are the outgrowth of America's first multi-cylinder loop-charged outboard. We introduced it in 1968. The high-performance and fuel efficiency of these outboards is the result of many Johnson innovations and developments: exhaust tuning, MagFlash™ breakerless CD ignition, Pressure-Back piston rings, temperature/pressure controlled cooling.

**Exhaust tuned like a racing engine for more power on less fuel.**

The combustion cycle of all our

high-performance engines is made highly efficient by using the energy of exhaust pressure waves. To pull more exhaust gases out of each cylinder, then pack in more of the entering fuel charge. The fresh fuel mixture is cleaner, more powerful. So you get more power on less fuel.

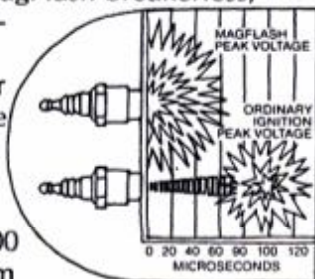


**Our patented Pressure-Back piston rings increase engine efficiency.**

Our ring design allows combustion pressure to push the rings close to the cylinder walls to seal the combustion chambers and keep power from leaking out. These rings seal so well each piston needs only two rings, rather than the usual three. So friction and wear are reduced and the engine runs cooler. You get improved fuel economy. And longer engine life.

**All the benefits of electronic ignition.**

Our MagFlash breakerless, magneto-excited capacitor discharge ignition system zaps a full 35,000 volts from coil to plug in about three millionths of a second. That's 30 times faster than conventional



magneto systems. Spark plug voltage just doesn't have time to leak off. So our spark is hotter, faster. You get quick starts. Smoother idling and low speed running. And long plug life.

What's more, the system has no breaker points or condenser to change, no moving parts to wear or adjust, ever.

**Our patented cooling system makes for hotter performance two ways.**

It's both temperature and pressure controlled. At low speeds, a thermostat keeps the engine warm for smooth idling and running, and better fuel efficiency. At higher speeds, a pressure-sensitive control increases water circulation for a cooler running engine. This gives you more power and fuel efficiency at the high end.

**The business end is all business, too.**

The clean, one-piece gearcase design of our lower units eliminates gaskets and provides maximum strength. Our thru-prop-hub exhaust, besides muffling engine noise underwater, reduces drag directly behind the prop by filling the low-pressure area normally created by the water's spinning movement. The overall result: we use less fuel for power . . . more power for propulsion.

**It all adds up to Johnson performance engineering.**

We know you're interested in saving gas. Although this is relative to boat, load and conditions, here's one example. We took a typical 15-foot semi-V hull runabout with our Sea-Horse 55, put in two people and their gear, and had them run at 25 mph (about three-quarter throttle) until

they drained one six-gallon fuel tank. They ran for just under three hours—equivalent to a day's cruising activity for most boaters.

If you're interested in all-out performance, you might like to know that our Sea-Horse 70s and Stinger 75s have been virtually overwhelming the competition in American Power Boat Association racing events—Family and Sport E classes. And our last year's two-cylinder Sea-Horse 50s were outstanding performers in Family and Sport D classes.

For those *really* into high-performance with race-type hulls, there's a Stinger 75 short-shaft model with a thinner, lower-drag, specially geared lower unit. And a high-compression cylinder head available for this motor adds even more power. The combination gives you a mean machine—and that's the beauty of it.

See our loopers—55, 70 and 75 hp—at your Johnson dealer, where you'll find our 15 power choices, from 2 to 200 hp, plus four high-thrust electric outboards. Or write for free catalog. Johnson Outboards, Division Outboard Marine Corporation, Sea-Horse Drive, Waukegan, Ill. 60085. Dept. PM-56.



**Johnson**  
OUTBOARDS

First in Dependability

**The  
world runs  
more Johnsons  
than any other  
outboard**



reconstructed picture can be used to obtain accurate flow measurements. The conventional method is not as accurate, say Westinghouse researchers, because it requires the insertion of measuring devices—and these devices interfere with the flow being measured.

### How much caffeine in a cup?

If you've wondered how much caffeine there is in your daily intake of coffee, here's how you can figure it out: Five ounces (150 milliliters) of roasted-and-ground brewed coffee contain an average of 85 milligrams of caffeine; five ounces of instant coffee, 60 milligrams of caffeine; five ounces of decaffeinated coffee, 3 milligrams.

One milligram equals about 1/30,000th of an ounce.

These standards were established through research sponsored by the National Coffee Assn. Dr. Alan Burg, a biochemist at Arthur D. Little, Inc., a research organization, surveyed scientific writings on coffee and found little agreement on criteria. In the literature, a coffee cup could be as small as three ounces or as large as eight.

Dr. Burg's suggested standards of caffeine levels per five-ounce cup were obtained from laboratory analyses of nearly 2000 individual samples of 29 different commercial coffee products.

### Robot analyzes blood cells

Said to be the world's first computerized system for analyzing white blood cells, LARC (leukocyte automatic recognition counter) is now being produced for worldwide distribution. The system was designed and tested at the Rush-Presbyterian-St. Luke's Medical Center, Chicago, over a five-year period.

Designer James Bacus, assistant professor of biomedical engineering, describes LARC as "one of the first medical robots—a computer with television eyes that looks at cells and performs a complex visual inspection task. . . . By indicating with exceptional accuracy the percentage of each of six different categories of white blood cells in a sample, LARC can greatly simplify and refine the diagnostic process." LARC accomplishes in an hour what it would take a trained technician nearly a whole day to do.

LARC is tied into a hematology lab computer, which, in turn, feeds into the hospital's central computer. Through this hookup, the results of a white blood cell analysis become part of the patient's medical record

at the same time that the information is sent back to the clinic that ordered the test.

### Metric system shows gains

If his job doesn't require mastery of the metric system, the average American will resist switching to it. That's the opinion of Dr. Anton Glaser, a mathematician at Pennsylvania State University and author of a correspondence course on metrics.

Still, metrication is making progress—with industry leading the way. In the forefront are the auto-makers—the Chevette is said to be 80 percent metric—the computer, farm machine, fastener, cigaret, pharmaceutical and health-care industries.

All 50 states are gearing up to teach metrics in schools while a bill officially committing the United States to converting is making its way through the Senate after being passed in the House.

In addition to the United States, according to Dr. Glaser, the only remaining antimetric holdouts are the nations of Brunei, Burma, Liberia and Yemen.

Dr. Glaser's six-lesson correspondence course is written for the non-technical person and focuses on the needs of everyday life. It costs \$27 and may be obtained by writing to the Department of Independent Study by Correspondence, 3 Shields Building, University Park, Pa. 16802.

### Satellite for forest-fire watch

A new weapon against California's forest fires will come into play in 1976, when a satellite-linked monitoring system goes into action. More than 20 NASA-designed ground stations will monitor conditions throughout the state's important Region One forest area, which contains most of California's redwood forest and a large part of the state's timber resources.

The low-maintenance ground stations, powered by solar and wind energy as well as storage batteries, will provide continuous reports on wind speed and direction, air temperatures, net solar radiation, relative humidity and the moisture content of such flammable forest litter as pine needles and grass.

Every three hours, data from the automatic stations will be picked up by the Synchronous Meteorological Satellite-2 (SMS-2), which is in constant view of the area from its "stationary" vantage point over the equator.

The satellite beams the data to a

station near Wallops Island Va., which automatically relays the signals to National Oceanic and Atmospheric Administration (NOAA) computers in Maryland. The processed data is then sent to another facility at Reston, Va., for transmission back to California.

The complex processing and relay of data will require only 90 minutes, according to NASA. Foresters will use the information to identify the areas where fire hazard is greatest, to deploy firefighting teams to counteract the threat and to plan strategy to battle any fires that do develop.

Experts say that knowing where the fires are probable and how they might act is almost as important as having the men and equipment to fight them.

### Hitting vampire where he lives

Biologists now have an effective way to control vampire bats, according to the U.S. Fish and Wildlife Service. The notorious bats—only slightly larger than a house sparrow—feed only on blood. Each year they cause some \$250 million in damage in Latin America, killing up to a million milk cows and beef cattle. They also have been known to kill horses, sheep, pigs, deer, turkeys and—on occasion—humans.

The vampire feeds at night after its prey has settled down. With razor-sharp incisors it makes two painless cuts in the skin, usually near the neck or feet. After gorging itself, the vampire flies off, leaving its victim slightly weakened and perhaps with a case of rabies.

According to Wildlife Service scientists, vampire bat predation can be reduced up to 95 percent by the injecting of cattle with an anticoagulant—a "blood thinner" that is used to treat humans for heart disease. When a bat bites a treated animal, it ingests the drug and dies within three days from massive hemorrhaging.

### Biggest scope now in action

The Soviet Union's new optical telescope, said to be the world's largest, is now in operation, according to reports from Moscow. Installed on the summit of a mountain in the Caucasus, the instrument has a mirror 237 inches in diameter. The previous champ, the Mount Palomar instrument in California, has a 200-inch mirror.

Initially, according to Russian scientists, the big telescope will be used to study quasars, those mysterious energy sources discovered only in recent years. ★ ★ ★



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Enjoyment.**

I get a lot of it from Salem Longs. A lot of good taste. A lot of fresh menthol. I owe it to myself to get all the enjoyment I can get.

**Salem Longs.**

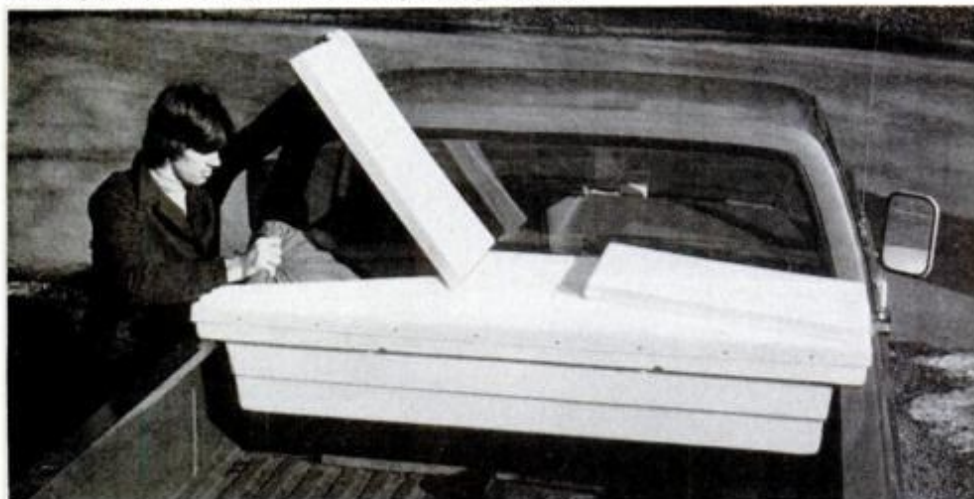
Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

19 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report SEPT. '75

# THE PM GARAGE



## Handy new storage box for pickup trucks



To test Tempo's new Tool/Storage Box for pickup trucks, we had a college student load it for a ski trip and then pack it for college. He reports:

"Installation was quick and easy. It requires drilling four holes into the side of the pickup box.

"In Vermont, weather went from  $-25^{\circ}$  F. to rain, which froze. The locks did not freeze or present any problem. The box easily carried 225 pounds with no sign of cracking.

"In much warmer weather, the unit remained watertight in rainstorms. It's also easy to clean with water.

"The box holds a good deal of gear. It does not block rear vision, yet



rides high enough that I can slide materials along the full length of the bed. The two lids are big, and I like the way they're supported in full open position while I'm loading."

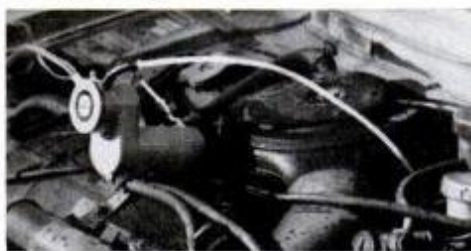
The new Tool/Storage Box, which has a movable, compartmented tray inside, is made of heavy-duty, high-impact plastic. It fits most standard American-made pickups. Price is \$149; the maker is Tempo Products Co., 6200 Cochran Rd., Cleveland (Solon), Ohio 44139.—*J.A.L.*

## For the fastidious



The best use for this 12-volt car vacuum is as a traveling companion. On vacation trips or winters in Florida, it's great. At home, you're better off with your carpet vacuum cleaner. This Osrow Model CV800, only \$7.95, does a respectable job with beach sand and dog hair. The heavy-duty CV1500, a lot better, is \$18.95. Osrow Products, Inc., Glen Cove, N.Y. 11542.—*B.H.*

## Pump out your oil



Draining your oil without a lift is dirty and awkward, and having it done at a garage can be \$5 or so. The Oil Changer transfer pump sucks oil up the dipstick tube quite neatly, getting power from your 12-volt system. You can get one from Gary L. Reed, 8414 Encino Ave., Northridge, Calif. 91324, for \$19.95.

Order it with either a plug for the cigaret lighter or battery clips.

I found the pump has to be primed, using a little of your new oil, but the instructions are quite clear, and it hums away as it cleans out the sump—the long, flexible tube gets right down to the bottom. It would be especially valuable for draining transaxles and other mischievous designs with multiple drain points, and is good for moving oil from or to lawn mowers, outboards, garden tractors and so forth. Solidly made, handsome and compact, it is a good gift for the do-it-yourself sump pumper.—*I.B.*

## Let there be light

Early in life I got hooked on those dramatic advertisements for Eveready batteries. Remember? In each ad there was another exciting and dangerous situation where having a working flashlight saved the day. I still keep an old-fashioned flashlight in my glove box (and in the night table, and in the kitchen,



and . . .), but I've got another compact and efficient source of light, too. It's a Metro Travel 'N' Trouble Lite that operates on 12 volts picked up at the cigaret lighter on a 12-foot-long cord. There are scores of plug-in lights on the market: Some are spotlights utilizing sealed-beam lamps and others, like this one, are lower-intensity units for putting localized light under the car, in the engine compartment, around a campsite or in any number of nighttime situations. The Metro is compact and has the advantage of a magnetic base. The T'N'T uses a No. 12 GE bulb rated at 1000 hours. The light is \$7 and is available from Metropolitan Vacuum Cleaner Co., Inc., 1 Ramapo Ave., Suffern, N.Y. 10901.—*B.H.*

# Do something nice for your home...see 100's of ideas in the **FREE** Heathkit Catalog



### Programmable Electronic Doorbell

A fun to build kit that's a real charmer. When a visitor presses your doorbell, a 16-note tune of your choice plays in pleasant sounding, electronically synthesized tones. Change tunes easily too, to suit any occasion.

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### Hands-free telephone amplifiers

Listen AND TALK while doing chores, or from your easy chair — up to 10 feet away! Our GD-1112 is for use with a standard phone, our GD-1162 with its built-in dialer is a complete telephone.

**GD-1112 \$4995 GD-1162 \$6995**



### Digital Electronic Indoor/Outdoor Thermometer

Let's you know what you're getting into, before you get into it! BIG, easy to read numerals show indoor and outdoor temperatures in either Fahrenheit or Celsius readings.

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## HEATHKIT



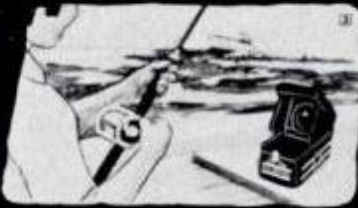
The Phonon Spin-a-matic...  
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  4. NEW — Precision Power Supply
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# THE BICYCLE SHOP

GENE ANSWERS READERS THIS MONTH

## Lowdown on a high wheeler

*Just for fun I bought one of those old-fashioned "high wheeler" bicycles. Now that I have it, I am afraid to get on it. How do you ride the thing?—Harold D. Furlong, Wichita Falls, Kans.*

Carefully. These "Penny Farthings" as they were called in the 1880s, were easy to spill. All the weight is over the big front wheel, and upon hitting the slightest obstacle, these old bikes would throw a rider.

Many modern versions come without brakes, so make sure you install them before riding downhill. You can stop moderately well on flat ground by back-pedaling (the bike has no "freewheel"). Even with brakes, if you coast downhill, put legs up over handlebars so if you take a "header" at speed you will at least go off feet first, not head first.

You mount by putting one foot on the little peg on the main tube (down near the little wheel), scooting along with the other leg to get up speed, then hopping up on the step into the saddle and starting to pedal before the thing falls over. Teen-agers can learn almost instantly if they ride any bike, but most older folk like me pray a lot at first and wear a crash helmet.

## Spoke tightening

*Do you have a chart or information on sequence of tightening spokes?—Lester Atkins, Port Jefferson, N.Y.*

If you are lacing up a new rim and hub, first thread on each nipple three turns on the left and five turns on the right. This pulls the rim over to the right for correct "dishing" (applies to rear wheel only; for front wheels, tighten all nipples four turns).

When all the spokes are in place (rear wheel), tighten left-side spokes till about four threads show, right side spokes till all threads are covered by the nipple.

From here on you'll need a wheel-truing guide. In general, take up on all spokes the same number of turns, starting with the spoke nearest the valve hole, using two nipple turns all around and continuing until spokes show about the same tension. Tight-

en only those spokes needed to bring the wheel into concentric and lateral alignment. If enough readers express interest, I will devote a column to wheel lacing from scratch and another to wheel truing. Both are as much art as science.

## Skipper derailleur

*My wife has a mixte-frame bike. The front derailleur keeps slipping onto the large chainwheel. We've had it readjusted at two bicycle shops but the trouble recurs during cycling. She has to hold the gearshift lever in place to keep the chain on the small chainwheel. What might be the problem?—David A. Gewirtz, Bronx, N.Y.*

I find this a bit strange, because front derailleurs are spring-loaded so, if anything, they move toward the seat tube, and push the chain onto the small chainwheel. This would occur, for example, if the shift lever was too loose. You could also have the derailleur cage cocked, so the cage is not aligned with the chainwheels, in which case the chain could be pushed onto the big ring, particularly if the chain is on a small rear gear. Align the derailleur cage parallel to the rings. Make sure it clears the big ring by no more than 1/4 inch.

Another reason for the chain jump is that when you shift the rear gear from the small to the big gears, the chain assumes a steeper angle with each gear change, with respect to the front derailleur cage. Many new 10-speed cyclists wonder why the chain rubs on the inside of the front derailleur cage in some gears, and they blame it on derailleur lateral travel adjustment. But actually the alignment of the chain is affected quite a bit when you shift up or down on rear gears. The chain can hit the inside of the front changer cage when on the low rear gear, and the outside of the cage when on the high rear gear. To prevent this rubbing, just remember to shift the front derailleur slightly to the left to keep the chain centered in the cage when shifting to a low gear, as for hill climbing, and vice versa. If the cage is cocked, the chain rub could be severe enough to shift the chain to another front chain ring.

## Best bike tools

*Who makes a good set of bicycle tools for the home mechanic? Tools I have seen in some bike shops, from Europe, cost a mint.—Mike Mitchell, Carson City, Nev.*

It's true, bike tools from Europe are ridiculously overpriced, and not all that well made, either. The best tools for any bike mechanic, home or shop, in terms of completeness of line, quality and price are in my opinion made by Park Tool Co., 2250 White Bear Ave., St. Paul, Minn. 55109. Try your local bike store first. Quality is much better than European tools and price is less. The firm makes hub wrenches, bike stands, chain tools, bottom-bracket tools, spoke wrenches, wheel-truing stands.

## Olympic bike racing, anybody?

*I would like to try out for the Olympic bicycle events. Would you please give me your advice on how to get started? What type of bike would be best to start with, a 10-speed, 5-speed or something else? What about training. How do I get into organized amateur racing?—Thomas W. Holder, Macon, Ga.*

Tom, you just asked for a whole book, because that's what it would take to begin to answer your questions. Best advice I can give you is to become affiliated with a local amateur racing club or group, and let them teach you the ins and outs of training, cycling technique and which bike to use. Start by writing to the U.S. Bicycling Federation, Inc., Box 480, East Detroit, Mich. 48021, the governing body of amateur bicycle racing in this country, for information on a local club affiliation. I can't even tell you which bike to buy, because I don't know what kind of racing you want to do. There are fixed-gear bikes for track racing, and short-frame, high-performance 10-speeds for road racing, and super-light machines for time trialing. ★★★

*If you have any questions about bicycling send them to The Bicycle Shop, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.*



# ECONOMY ISN'T DATSUN'S ONLY STRONG POINT.

**America's favorite.** You're looking at America's Number One selling small pickup: Datsun. One reason is excellent gas mileage. 31 MPG hwy, 22 city. (EPA mileage estimate. Manual transmission. Actual MPG may be more or less, depending on the condition of your truck and how you drive. California MPG varies slightly.) Now take a look at some more reasons.

**Strong Points.** Li'l Hustler Pickups are tough all over. To wit: Gritty 2000cc overhead cam engine. All-steel body and bed. Rugged ladder-lattice frame. Durable torsion

bar front suspension. And heavy duty truck tires. Need we point out more?

**6- or 7-foot bed.** Datsun pickups come two ways. Our regular Li'l Hustler comes with a 6-ft. bed. And our Li'l Hustler Stretch comes with a longer 7-foot bed. Either way, you get a lot of truck for the little money.

**Backed by service.** Your Datsun gets plenty of strong backing, too. Nearly 4,000 factory-trained service technicians. Computerized parts network. And our 43 years of experience. We figure the longer your Datsun survives, the longer you'll save.



## Datsun Daves

**AMERICA'S #1 SELLING SMALL PICKUP.**

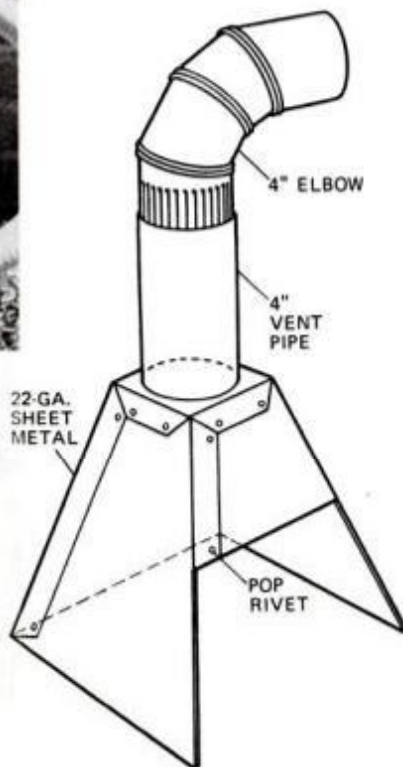
# Shop forge you can build

by Morton E. Milliken



**A**lthough a propane torch heats metal red hot, its flame is too small to bring a large area to white heat. Only hot coals (briquets) fanned with a blower can give you that kind of heat.

I made this \$30 forge with a cast-off barbecue grill, legs from an old kitchen stool, some firebrick and a sheet-metal hood. I purchased the blower (electronics supply houses usually carry them) and a length of flexible exhaust pipe to fit the inside diameter of the blower outlet. The squirrel-cage blower is mounted on a metal flange attached to one leg. Wires from the blower pass through an outlet box containing a dimmer switch. This permits control of blower speed and thus the amount of air into the firepit.



## U-bolt holds pipe elbow

I secured the flexible pipe to the bottom of the barbecue grill by attaching a 90° pipe elbow to the grill with a U-bolt. Then I added a nipple to the elbow to accept the flexible pipe. You could bring the pipe directly through the bottom of the grill, but you would have to cut a fairly large hole. The grill was mounted on the stool legs with 1/4-in. bolts.

I made the hood from sheet metal, a length of vent pipe and an elbow. I used Pop rivets to fasten the hood sections together. You'll need a hood to keep sparks from flying and to prevent stray breezes from dissipating heat.

## Sand retains heat

To use your forge, fill the grill with sand level with the opening of the pipe elbow. The sand keeps the heat from dissipating through the bottom and provides a level base for the firebrick. The firebrick further contains the heat.

Start the fire with lighter fluid. Then run the blower at low speed. Soon coals nearest the air inlet will glow red, then light orange. Increase blower speed and, using tongs, place the workpiece into the center of the almost white-hot coals.

Whether you are annealing, tempering or shaping metal, your forge will provide a steady and reliable source of heat. ★★



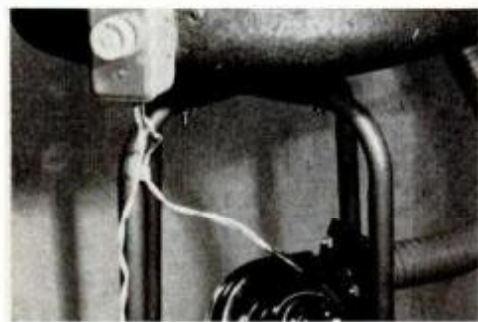
Fasten 90° pipe elbow to bottom of grill with U-bolt; it saves cutting large hole.



Add sand, level with elbow opening, then set four firebrick on edge around opening.



Mound firepit with several handfulls of briquets; light with fluid and match.

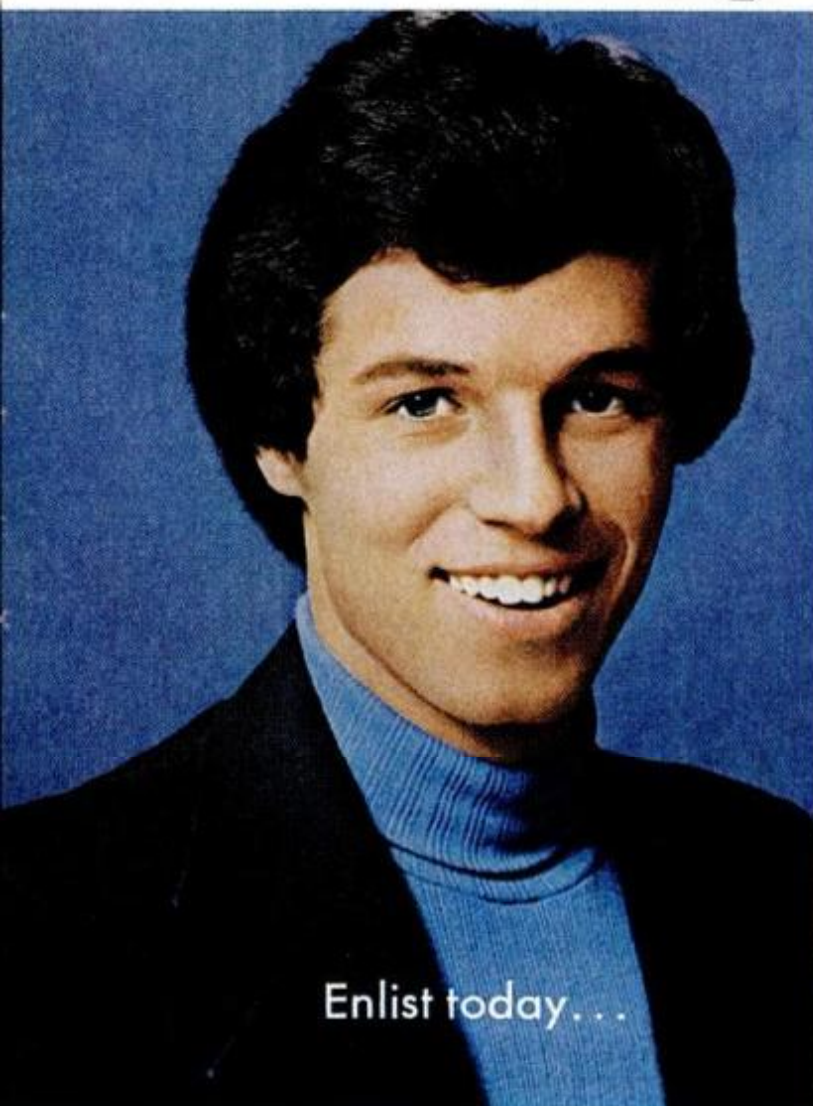


Use light-dimmer switch to control blower speed to regulate air to the firepit.



Keep blower at low speed until most coals glow bright red. Forge is ready for use.

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# NAVY

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# APPLIANCE CLINIC

BY PAUL MANN

## Not so expensive

Last December you wrote of George Waldinger's trouble with a General Electric refrigerator that forms condensation and ice on the outside of the unit. He said a serviceman told him repairs would be "very expensive." You advised that the problem was being caused by ice forming on the inside insulation and told him how to solve the trouble himself. I had the same experience and might be able to help if your solution hasn't proved fruitful.

I called an authorized GE service franchise, which had me defrost the refrigerator for 24 hours. The following day a serviceman removed the doors and freezer liner, rigging a hair dryer to blow hot air into the freezer section. This continued for eight hours, after which the serviceman replaced all the insulation, providing about three times more filler material than was originally installed. Now the top and sides of my refrigerator are nice and dry. Obviously, inadequate insulation caused the condensation.

I was charged only \$15, which is certainly not "very expensive." I'm writing because I hate to see people get ripped-off by unscrupulous servicemen.—Mrs. Edna Nilosek, Claremont, N.H.

We appreciate your sharing this information with us, and it teaches a valuable lesson: Contact a factory authorized service representative when an appliance fails, unless you can make repairs yourself.

## Once is enough

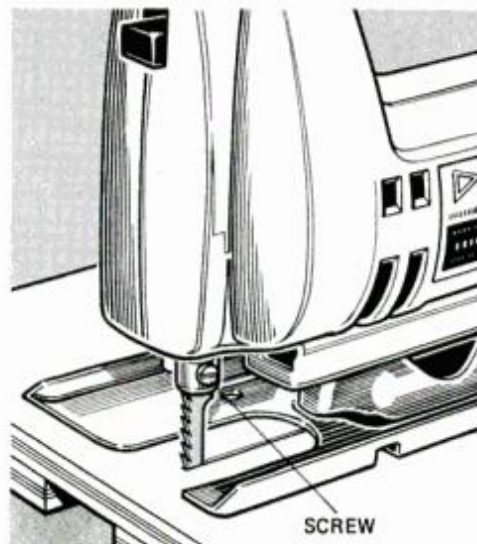
We purchased a Sears electric can opener (Model 232-839500) two years ago. At that time, we asked and were told that the cutter and serrated rotation gear were replaceable. Now that we need them, Sears says "no"—that we will have to send the unit to the factory and pay \$16 plus shipping. The cost of the unit new was \$18. Were we misled by the salesperson?—Alan H. Homans, Columbus, Ohio

Apparently so. The Sears Small Appliance Div. in Hawthorn, N.J., says the two parts are not available. You will either have to ship the unit to the factory or buy a new one. If

you buy a new one, verify sales claims if you're doubtful. When dealing with Sears, simply ask its appliance parts supply center to check if the parts are available.

## Another one for Sears

I own a Craftsman Auto-Scroller saw (Model No. 315.26750), which was top-of-the-line when I bought it in 1970. It is, except for the blade holder, which is a cheap arrangement for such a fine tool. The roll pin which locates the top of the blade has come loose, and the threads



of the screw that holds the blade are showing wear (see the drawing below). Newer Craftsman saws use a more substantial blade holder which clamps the blade securely. Is it possible to fit my saw with the newer blade holder?—Bill Schmidt, Lyndhurst, Ohio

Sorry, the blade holders are not interchangeable. All you can do is replace the holder arrangement on your saw with new parts, which may be obtained from your nearest Sears store. See page three of the instruction booklet which accompanied your saw for the part numbers you need.

## Signed and sealed

I have a Maytag washing machine, Model N2L, which began dripping oil on the floor a while back. A Maytag service representative told me to replace the center plate, which I did. The oil drip stopped for about four months, but has started again. What's

wrong, and how do I correct it?—John Moore, Chicago

One of the seals on the transmission has probably cracked and is allowing oil to escape. Usually the trouble can be blamed on one of two seals—a worm seal behind the drive pulley or the agitator shaft-transmission seal. The worm seal can be replaced without removing the transmission from the chassis, but the agitator shaft-transmission seal cannot.

Replacing these seals isn't a particularly tough job for someone handy, but you need special tools to pull and install seals. These tools cost about \$8 and can be ordered from the same Maytag service facility you patronized before. If you have the service shop replace seals for you, the charge will probably be about \$20.

## Communications breakdown

I have a GE electric knife (catalog No. D1EK4) and have tried to secure a new trigger switch for it. My first correspondence produced a new trigger; the next brought no response. Can you bring about some action so I might get these parts and my knife back in use?—Charles Munks, Harvard Ill.

The terms "trigger" and "trigger switch" are confusing. The control for this knife consists of a switch knob and a contact leaf, two parts, which carry separate part numbers and have to be ordered individually. The part number of the switch knob (which I assume is what you call the "trigger") is XM25X525; that of the contact leaf is XM25X526.

You can't blame a company for "fouling up" if you order parts by mail without the correct name and part number. If possible, take the appliance to a company service facility. GE has an extensive service organization. If you must order through the mail, include a sketch or photo showing the part needed. ★★

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N. Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.



# \$3,699.

## A price that low makes our Fury all the more beautiful.

Think of it. The Plymouth Fury shown below starts with a base sticker price of just \$3,699.\* That's excluding taxes, destination charges and \$71 for white sidewall tires and deluxe wheel covers. But still, compare prices like that to other cars in its class. You'll see that's a beautiful price for this much Fury.

### **FURY: ROOMIEST 2-DOOR IN ITS CLASS.**

Fury is a foot shorter than most full-size cars. But, in a comparison of head, shoulder, hip and leg room, Plymouth Fury offers more total space for six passengers than any other car in its class.

### **GOOD GAS MILEAGE. EVEN WITH AN AUTOMATIC TRANSMISSION.**

**23** mpg. highway  
E.P.A. estimates  
**16** mpg. city

In recent E.P.A. tests, a 6-cylinder\* Fury, even with an optional automatic transmission, got an estimated 23 mpg on the highway and 16 in the city. Of course, your mileage may differ depending on how and where you drive, the condition of your car, and its optional equipment.

\*6-cylinder model as priced and tested not available in California.

### **AND HERE'S THE CLINCHER.**

Chrysler Corporation has a warranty so strong, all you'll have to take care of in your new Fury is normal maintenance like changing filters and wiper blades. Our warranty takes care of everything else. Here's what it says: For the first 12 months of use, any Chrysler Corporation dealer will fix, without charge for parts or labor, any part of our 1976 passenger cars we supply (except tires) which proves defective in normal use, regardless of mileage.

The beautiful '76 Fury. Get to know it better at your Chrysler-Plymouth dealer.

## **PLYMOUTH FURY**

*The more you get to know it,  
the more beautiful it gets.*



IT'S NEW  
**NOW**



### Light air-cushion vehicle for modest zapping around

Early hoverships had their problems, but this latest version is said to provide practical sea/land transportation over virtually any terrain. It's 19 feet long, 7½ feet wide and can haul an 800-pound payload of passengers or cargo. Its fuel capacity of 24 gallons will carry it over land, water, mud, swamp, snow, ice or combinations for as far as you need to hover in a day. Dubbed AC-800, the craft operates on a single standard water-cooled V8 engine that drives two centrifugal fans. Air is directed by ducts and hydraulic gates to provide lift and directional power. Air Cushion Industries, Ltd., 9 Lime Bank Rd., Box 660, RR No. 5, Ottawa, Ont., Canada K1G 3N3.

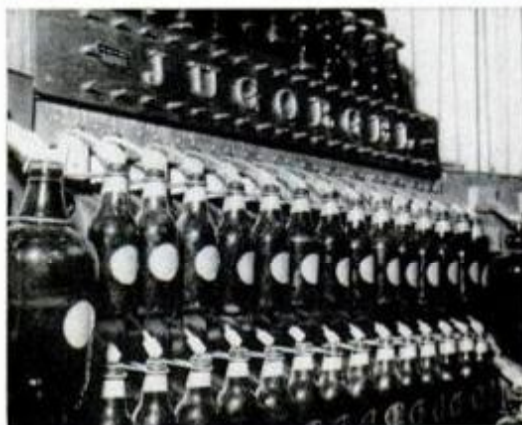


### Aerosol spray you can fill yourself

This two-piece aerosol—a disposable propellant cartridge combined with a separate, removable glass jar—lets you spray your own paint mixes and other liquids. You just fill the jar with any sprayable material, attach the cartridge and press the nozzle-control button on top. After each use, the jar can be removed, cleaned and filled with another liquid for a different job. The propellant and jar package costs about \$2. Refill propellant cartridges are also available. Precision Valve Corp., Box 309, Yonkers, N.Y. 10702.

### How to 'play' old bottles

It took Justin Kramer three years to build this 88-bottle, 88-key "Jugorgel," but now his bottle "pipe organ" is in demand—in many cases by bottle makers and large users of bottles. Notes on his creation are produced by filling the bottles with water to different levels and blowing air across the tops. Cost? About the same as a conventional pipe organ of similar range. Justin Kramer, Inc., 1028 West Eighth Pl., Los Angeles, Calif. 90017.



**65,000 more technicians needed by 1980\***

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\*U.S. Dept. of Labor Bulletin 1824

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DIAGONAL

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# IMPORTS AND MOTORSPORTS



## New Datsuns

It's nice to see something really different from the Japanese. The new front-wheel-drive F-10 Datsuns aren't that radical, but you won't mistake them for any other look-alike cars either. The station wagon, above, and the coupe are the two models in the F-10 series, and they'll be in showrooms next month. The F-10 uses the same 1400-cc engine as the popular B-210, but mounts it transversely. The new car is also seven inches



shorter than the B-210. Five speed is standard on the coupe, and fuel economy up to 41 mpg is specified by the EPA.

Datsun's also adding a new pickup in its Li'l Hustler line. The Deluxe Cab is shown below. The passenger compartment is 9 inches longer than



that of the standard pickups, and with that opera window, you can't miss it.

## New Lancias

The Lancia Scorpion and the Beta HPE (for High Performance Estate) have joined the Beta coupe and sedan that made their appearance in the United States last year. The HPE

(\$8420) is essentially a hatchback version of the coupe, and is a handsome package indeed. Like the Beta sedan and coupe, the HPE and Scorpion are powered by Fiat's dual overhead-cam, 1.8-liter, four-cylinder engine and use a five-speed gearbox. I find the Scorpion most intriguing since it's a very luxurious mid-engine sports car. Visually, the \$11,000 Scorpion is stunning: Lines are clean,



black matte finish is used nicely, thermoplastic bumpers front and rear look good and the black roof retracts into the roll-bar for open-car driving. Under the skin, the engine is mounted transversely and ahead of the rear axle for a 50/50 weight distribution, suspension is independent coil spring all around, disc brakes are on all four wheels and steering is rack and pinion. The Pininfarina-styled car is 156.1 inches long on a 90.5-inch wheelbase, height is just shy of 47 inches and weight is 2370 pounds.

## New record

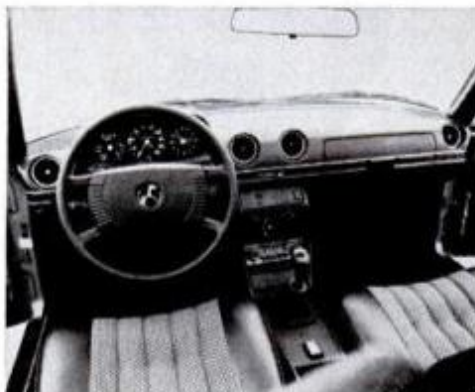
Records are made to be broken, but for now Honda's got the highest mpg figure among all cars tested by the Environmental Protection Agency. The five-speed hatchback milks 47 miles from a gallon on the highway cycle (and 35 in the city for an overall 40 mpg). Let's see how long that record stands.

## New Mercedes

A new Mercedes-Benz has made its debut in Germany. These pictures



from photographer Hans Peter Seufert show how similar the car is to the 450SE/SEL (S-Class) both outside and in. There are nine models in the range in Europe: the four-cylinder diesels, 200D, 220D, 240D; and the five-cylinder 300D; the 200, 230, 250, 280 and 280E are the gasoline versions. Eventually, the "small" M-B, with its lower waistline and faster styling, will replace the cars that are currently designated by the 200 to 280 numbers. Actually, the



cars in the new line are no smaller than the models they'll replace, but they're lighter, and they have all the S-Class engineering features. We'll have more on the new range when plans are set for their U.S. introduction.

## And some oldies

There's a time when your car stops depreciating year after year, and starts *appreciating*. That's when you stop calling it the old heap and start treating it with respect. There are a lot of people in the old-car game, as you'll find out if you get a copy of Old Cars newspaper's latest annual. The *1976 Car Club Roster and Information Booklet* is a comprehensive listing of antique, classic, vintage and postwar collector car clubs. There are more than 2000 clubs listed in the roster including regional and

*(Please turn to page 32)*



Oldsmobile's answer to expensive European luxury sedans.

Omega Brougham.  
Priced under \$4000\*.

It stands to reason that if a foreign car is going to be priced thousands of dollars more than an Omega Brougham, you ought to be getting a lot more car for your money. Let's just see how these cars stack up against each other.

	AUDI 100LS SEDAN	SAAB 99GL SEDAN	VOLVO 244 SEDAN	OMEGA BROUGHAM
SHLDR. RM. (F/R)	55.5/55.4	53.0/52.9	54.3/54.2	56.3/56.6
LEG ROOM (F/R)	41.3/34.5	39.4/37.1	38.4/38.9	41.8/32.8
HEAD ROOM (F/R)	38.4/36.5	37.8/37.7	37.6/36.8	38.9/36.2
EPA MILEAGE† HIGHWAY/CITY	MPG 30/20	MPG 30/21	MPG 27/17	MPG 25/17
ENGINE & TRANSMISSION	114-Four 4 Spd. Man.	121-Four 4 Spd. Man.	130-Four 4 Spd. Man.	250-Six 3 Spd. Man.
PRICE*	\$7,100	\$6,498	\$6,595	\$3,914

\*Manufacturers' suggested retail prices for the models shown (including prep charges and available equipment specified on Omega Brougham). Tax, license, destination charges and other available equipment additional.

†Source: 1976 EPA Buyer's Guide. Remember, These mileage figures are estimates. The actual mileage you get will vary depending on the type of driving you do, your driving habits, your car's condition, and available equipment. For California EPA figures, available power trains, and prices check your dealer there.

While being priced a lot less, Omega Brougham still offers room, comfort and gas economy comparable to expensive European sedans. What's more, its low \$3914\* price even includes this available equipment: bucket seats; sports mirrors; floor shift control and super stock wheels. And you can even add steel-belted radial tires (\$69) and still keep the price under \$4,000.

Check out an Omega Brougham Sedan today. We think our combination of price, luxurious appointments and Oldsmobile quality are going to win you over.

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*Oldsmobile*

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Sharp Finger (Above)  
Drop Point Hunter (Below)



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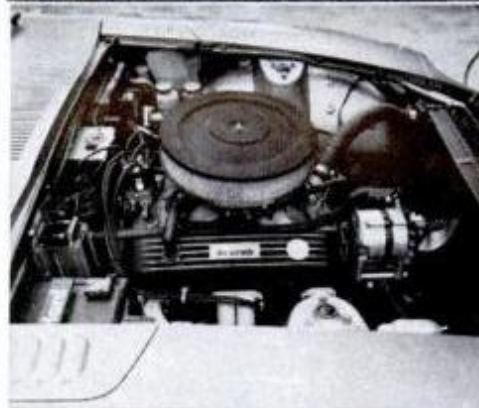
## IMPORTS AND MOTORSPORTS

(Continued from page 30)

chapter groups of national organizations, and a state-by-state listing of independent car clubs. It's fascinating. It's \$2 from Roster, Old Cars, Iola, Wis. 54945.

### Boss Z

Some people don't know how to leave well enough alone: Drop a 327-cu.-in. Chevy V8 into a Datsun Z car? It's being done on a commercial basis by Scarab Engineering in San Carlos, Calif. (Box 1326). That engine swap gives the little Z a full 350 hp which snaps you to 60 in 5.6 seconds. When they change a Z to a Scarab they also redo the interior and lay on 12 coats of hand-rubbed acrylic lacquer. Ah, only in California. . . .



### Alfasud racing kit



The Alfasud hasn't been introduced here yet (we hear that the little Alfa Romeo will be here late this year). But in Italy there's already a racing program under way for the Alfasud TI models. It's hoped that the Alfasud Trophy, as it's called, will be a farm league for promising young drivers. The racing kit shown is from Auto-delta, Alfa's motorsports division in Italy. ★★

## METALWORKING



Books From ENGLAND  
on tools and things to do in your shop

### CALDWELL INDUSTRIES

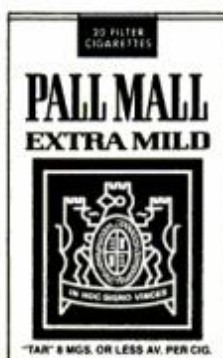
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tar.



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At only 8 mg. of tar, Pall Mall White is lower in tar than 98% of all cigarettes sold today.

If you smoke 2 packs a day, Pall Mall Extra Mild will save you 2800 milligrams of tar every week (compared with the best selling filter king)!

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\*PALL MALL EXTRA MILD... "tar" 8 mg.—nicotine, 0.8 mg.

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\*Av. per cigarette by FTC Method.

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

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

# ALL OUTDOORS

WITH BILL McKEOWN



## Boats called back

The Coast Guard program requiring builders to recall defective pleasure boats has totaled 142 notification campaigns so far, involving about 35,000 boats since the action started in 1972. Latest CG statistics show that 109 campaigns covering 27,000 craft have been completed, with the cost of notifying the owner and correcting the fault averaging \$11 per boat. While some defects such as possible malfunction of steering and engine controls were potentially dangerous, a large percentage have been failure to install proper plates showing approved carrying capacity and maximum horsepower, or overestimation of flotation capability.

Any owner with a boat that seems to have a serious defect should discuss it with the Coast Guard and his dealer or manufacturer. If a hull tends to pound like a hammer, bounce like a porpoise, trip on turns or try to throw you out, you may be overpowering it or just have picked a bad design. Usually you can spot these problems if you insist on a demonstration ride before you buy—always a good time to find out in advance what a boat is really like.

## A shot for safety

You'll never shoot anything with the

new shells from Karlyn Manufacturing of Seattle, but the trophy you may bring home successfully with them is yourself. Available in .30-30, .30-06, .308, .270 Winchester, 7-mm Remington Magnum, and .38/357 Magnum rifle and pistol cartridges, these handy little safety items are called Firefly Emergency Firearm Flares. They chamber and fire like any other cartridge, but are claimed to launch a signal flare up to 1000 feet that is visible as far as 10 miles. Normal procedure for abnormal problems afield is to fire three fast shots followed by one of these flares at three-minute intervals to signal for help. Your local ammo dealer should be able to order some for you.

## Long-ball hitting

Want to lengthen your drives down the fairway by 10 percent without hitting that golf ball any harder? Get up high this summer at the famed Sun Valley, Idaho, winter resort, with two championship courses at a 6000-foot elevation. Here, experience shows the thin, clean mountain air adds a bonus distance to every drive. You can also test tennis-ball speed on one of 46 courts with a video-replay instruction system, or hop by helicopter to mountaintop skiing. It usually lasts into June.

## Refund

Some camping outfitters claim their biggest sales come about now when families get an income tax refund. For fishermen, another way to get an unexpected bonus from Uncle Sam this spring is to send \$3.45 to the Superintendent of Documents, Washington, D.C. 20240 and ask for the set of 10 full-color fish prints that were originally prepared for a book called *Sport Fishing USA*. Called "Wildlife Portrait Series No. 2" and measuring about 14x17 inches each, they include paintings of arctic grayling, bluefish, brown, brook trout, rainbow trout, channel catfish, black and white crappie, northern pike, smallmouth bass and striped marlin. In a way, they're a kind of tax refund from the Fish and Wildlife service of the U.S. Department of Interior. In a store they might cost 10 times as much. They're awfully good.

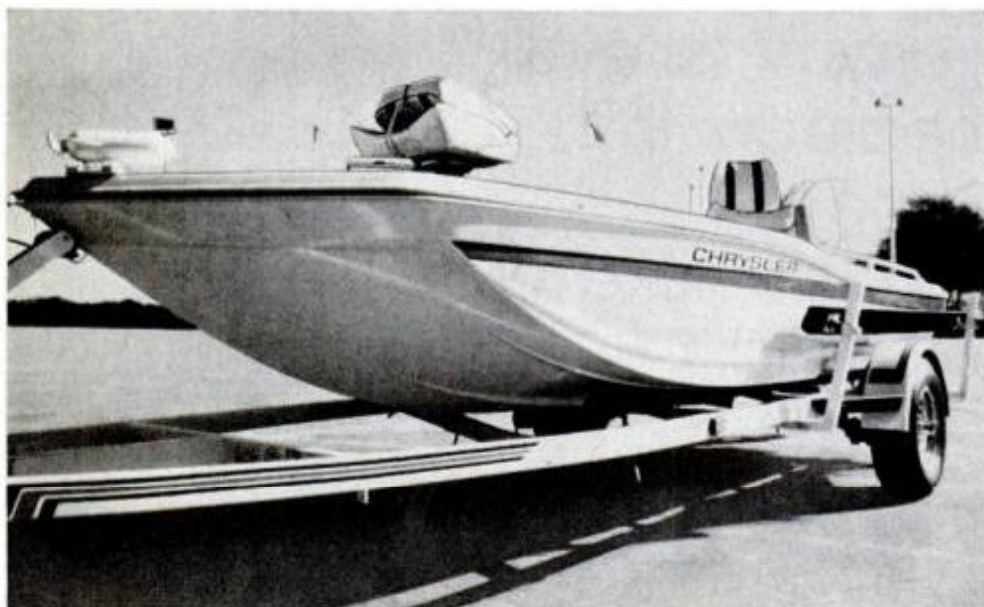
## Underwater eyeful

The first eye-level look at live isopod oddities—oversize crabs that hide below 1500 feet in dark ocean depths—is being scheduled for special showing at the New York City Aquarium June 12 to 20. Oceans Festival '76, sponsored by the New York Zoological Society, will give fishermen a chance to study sharks, whales and game fish in action, query sport fishing, underwater photography and wreck diving experts, and even compete for prizes in bait casting, net mending, fly tying and shellfish shucking contests. The festival is called the first of its kind.

## Getting gear—getting there

Among the neatest of improvements for large outboard motors is switch gadgetry that allows the unit to be trimmed underway for best angle by pushing a tilt-toggle mounted on your throttle lever. It is standard equipment in Mercury's new Black Max, and is also available by mail order for other motors from the extensive catalog of Bass Anglers Sportsman Society, Box 3044, Montgomery, Ala. 36109. If your engine has electric trim, you can mount their E-Z Trim for under \$15 and drive

(Please turn to page 36)



A runabout's sleek lines make Chrysler's new 16-foot Bass Runner 105 a fast fish chaser. Designed for its new Charger 105-hp outboard, the rig has matching trailer.



# The Whammer drives nails 6 times faster than a hammer!

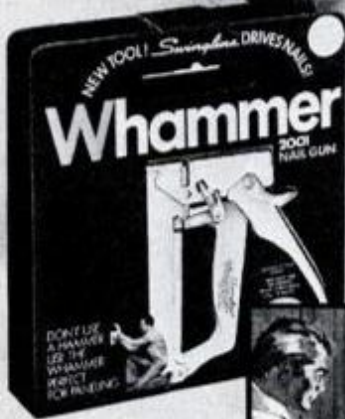
(and countersinks automatically)

Think of what that means:

- Nailing jobs done in 1/6 the time;
- Wall paneling without dents or scratches;
- Quarter-round molding installed without "flying nails;"
- Window and door trim without hammer dents.

In short, the Whammer is the difference between a tough, tedious job and an easy, satisfying job.

No wonder the pros use the Whammer® 2001 Nail Gun.



## Swingline®

The Swingline Co., A Division of Swingline Inc., 32-00 Skillman Ave., L.I.C., N.Y.



NAIL PANELING



NAIL FLOOR COVERING



NAIL MOLDING



NAIL TRIM

SEE YOUR LOCAL HARDWARE OUTLET FOR GREAT SPRING SAVINGS ON THE WHAMMER

## ALL OUTDOORS

(Continued from page 36)

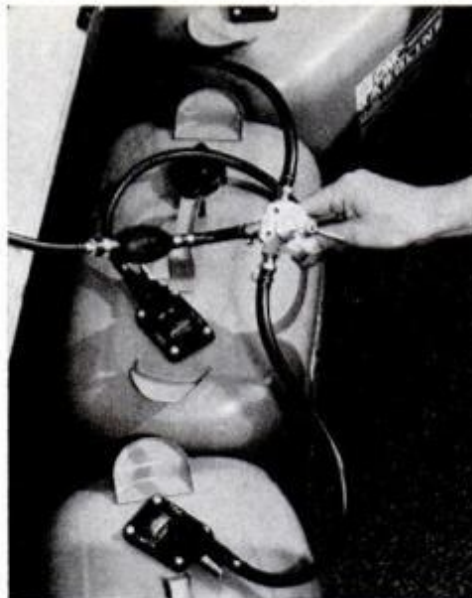
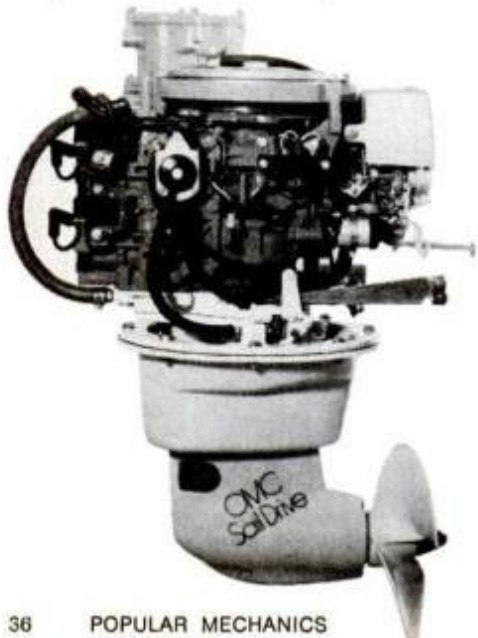
without letting go of wheel or throttle while adjusting for planing angle.

What the *Whole Earth Catalog* was to simplified and back-to-nature living, the *Explorers Ltd. Source Book* is for outdoorsmen. Pick your action—anything from aerial photography to winter bivouacking with stops in between for ballooning, caving, foraging, horse packing, maps, offshore sailing, river touring, ski and snowshoeing, trail biking and survival—and this \$5.95 large-format paperback from Harper & Row has instruction, equipment sources and reviews of suitable books.

It's not every book that will show you 10 ways to harness sled dogs, where to get spray skirts for your kayak, locate a place to buy a bilge fuel bag for your cruiser, under-snow transmitter to show where you've been buried by an avalanche, how to find international diving and bicycle tours, or who sells automatic actuators that will explode open your parachute at the proper altitude in case you forget.

The cheapest way to go on a long-distance hunting or fishing trip used to be to take a charter flight as a member of a sportsmen's club. But recently regulations have been relaxed and there are now thousands of charters on which you can save as much as 60 percent without belonging to any organization. For \$2.50, a postpaid 1976 *Charter Flight Directory* from the Travel Information Bureau, Box 105, Kings Park, N.Y. 11754, lists 25,000 of them. New Civil Aeronautics Board rules also require charter operators to be bonded or to

**Sail drive**, a new OMC Zephyr stern drive that is actually a bottom drive, installs through the hull of a sailboat, gets 15 heavy-thrust hp from two-cycle mill.



**Built-in capacity** from portable tanks is aided by four-way fuel valve at Evinrude and Johnson dealers. OMC accessory feeds 18 gallons from three 6-gal. tanks.

hold your payment in escrow so that if a flight is canceled, you get your money back.

### Where the fish are

Probably the best fishing in the country is found in the Florida Keys, and the best fisherman there is probably a PanAm pilot, part-time guide and full-time perfectionist named Stuart Apte. Stu catches tarpon on a flyline, sailfish with spinning gear, and has 20 world records to his credit. Now he has a book out called *Fishing the Florida Keys* that tells and even charts where the big ones are waiting around this pleasant chain of isles.

Apte describes in detail the techniques that have made him a legend in a region that attracts the tops in guides and sportsmen-experts like Ted Williams. His book is now at newsstands or \$3.20 postpaid from Windward Publishing, Box 370233, Miami, Fla. 33137. And worth it.

There are other great saltwater areas around the coastline from Vancouver and Nova Scotia down to La Paz and Costa Rica. "Panama" is a word meaning "an abundance of fish" in the local Indian dialect, and Stu Apte made six of his record-book catches there. And for hunting, fishing, exploring, photography and river runs from Alaska and Hawaii to Panama and South America, Braniff Airlines has a new booklet, *Outdoor Adventures*, describing 53 trips that can provide exceptional action.

### Cat care

The catalytic converter on your car may cut down air pollution in the city, but it can create even worse problems back country. The system

uses such high temperatures—up to 2000° F.—that if you stop in the tall grass along a logging road, your "cat converter" can start a fire. Particularly later in the season as fields and woods become dry, care should

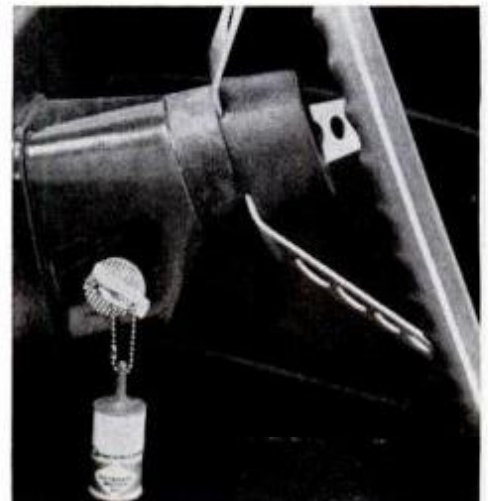


**Fire control** in an engine compartment is claimed for new Fireboy self-contained Automatic Halon 1301 Fire Suppressor; \$150 from Convenience Marine Products.

be taken in choosing where you park or camp. A forest fire can destroy air quality—and everything else.

### Extras along the way

Had enough Bicentennial already? Besides the landmark attractions, there are many less-crowded sites that are right along the way on many RV and vacation trips and would be a shame to miss. The new 52nd annual edition of Rand McNally's *Road Atlas* has added special pages listing them and is available almost everywhere or by mail from the Rand McNally Map Store, Box 7600, Chicago, Ill. 60680. It's a buy at \$3.95. ★★ ★



**Steering lock**, now available on Mercury's Black Max outboard and all MerCruiser stern drives, shuts off ignition, secures the wheel hard over to make towing difficult.

# Ford's new Pinto Pony MPG.



Pinto Pony MPG with optional WSW (\$33).

**It's not how small you make it,  
it's how you make it small.**

Compare	Pinto Pony MPG	vs	Chevette Scooter
Passengers	4		2
Horsepower	92 hp.		52 hp.
Weight	2,558 lbs.		1,931 lbs.
Overall Width	69.4"		61.8"
EPA Mileage* Estimates	38 hwy., 25 city		40 hwy., 28 city

**And compare all Pinto's standard features.**

**Priced about the same  
as Chevette.**

For about the same money as a 2-passenger Scooter, you get more car in the new Pinto Pony MPG. Like standard features on Pony not available on Scooter: Chrome moldings and bumpers. Carpeting. Glove box door. Armrests. Mini-console. Adjustable passenger seat. And inside hood release.

**More that's standard.**

In addition, you'll find molded vinyl door trim on Pinto Pony MPG. On Scooter it's fiberboard. And your exterior color selec-

tion isn't limited with Pony. There's a choice of 16. Scooter only has 4.

**Value you can compare.**

Compare Ford's new Pinto Pony MPG to

**Pinto Pony MPG.  
\$2,895**

Base sticker price excluding title, taxes and destination charges.

\* More about mileage. Since these are EPA estimates, your actual mileage will vary depending on your car's condition and optional equipment and how and where you drive. Calif. ratings lower.

Chevrolet's new Chevette Scooter.

Pinto Pony MPG's more road-hugging weight, wider stance, bigger engine, higher level of standard equipment, high EPA ratings and low price all add up to more car for the money.

**The closer you look,  
the better we look.**

**FORD PINTO**

FORD DIVISION



Материал, защищенный авторским правом

# CAR CLINIC

BY MORT SCHULTZ



## Battery caps

*In the January Car Clinic, you gave a tip on using a booster and jumper cables to start a dead car, saying to remove vent caps from both batteries. Why?—Eine E. Pale, Copalis Beach, Wash.*

So hydrogen gas which may build up inside batteries will dissipate. But be careful. Vapors are explosive, so keep flame away. Smoking could be dangerous to your health in a way never dreamed of by the surgeon general.

## Up in arms

*My 1974 Buick Apollo with 350-V8 engine and automatic transmission is driving me mad. To take off I have to pump hell out of the gas pedal or the engine will die. Picking up speed is no joy either. The engine's been tuned by one mechanic after another, and I've had the carburetor replaced. Every Buick and Chevy dealer who's had the car blames the antipollution controls. Do you agree?—Larry K. Colvin, Chatom, Ala.*

Not at all! However, it's going to take some good detective work to find the cause of your trouble. Here's a list of things to have checked out:

- Vacuum leaking at all vacuum lines and vacuum sources.
- Correct routing of vacuum lines, making sure lines aren't kinked.
- Proper functioning of the vacuum break on the carburetor.
- Proper functioning of the exhaust gas recirculator (EGR) valve.
- Correct ignition timing—should be 6° BTDC.
- Proper setting of the float in the carburetor, and don't forget to include checking of the float drop. The float must be set to manufacturer's specs given in the service manual.
- Seeing that the thermal vacuum switch (TVS) is supplying vacuum to the distributor.
- Making sure the thermo air cleaner is operating properly—that the valve in the snorkel is closed when the engine's cold and opens up when the engine warms up.

## Two-timed

*I've been using unleaded gasoline in my 1970 Chevrolet 350-cu.-in. engine, and it has responded well. Is there*

*any reason why I shouldn't? Is there any reason why cars made by GM which are older than mine shouldn't use unleaded if they run good?—R.W. Sharp, Pilot Knob, Mo.*

Hey, R.W., one question to a customer, please, but I'll let you get away with it this time. Here are your answers, in turn: 1. No; 2. No.

## The whistler

*Several weeks ago, a strange whistle started coming from the engine compartment of my 1973 Ambassador. The noise is heard only when it's cold, and especially when the engine is under load. It disappears when the engine is warm. Almost at the same time the whistle developed (and this is what has me worried), the carburetor malfunctioned and loaded the crankcase with fuel. I spent a lot of money getting everything back to normal, but my friendly whistle is still with me when it's cold. Does this mean I can look forward to more trouble with the carburetor?—Richard Livingston, York, Pa.*

Your carburetor woes haven't anything to do with the whistle, so relax. The whistle is probably coming from a jolly drive belt affected by the cold weather. The colder it gets, the tighter the rubber gets. Squeal can result. Your letter was written in January during one of the most prolonged cold spells in the history of the Northeast. Next time the whistle begins, spray some belt dressing on belts and pulleys. See if that doesn't help. I'll bet my kazoo it does.

Incidentally, there's also a possibility that loose intake-manifold attaching screws or a leaking gasket is causing the whistle. When the manifold cools and shrinks, it causes a slight vacuum leak between the manifold and head. When it heats and expands, it shifts to stop the "whistle." Tighten up on the screws, and see if this doesn't stop or at least affect the tone of the whistle. If it does, you've found your reason.

## On the rocks

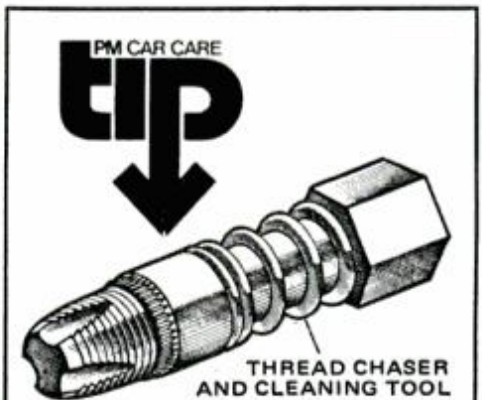
*My 1975 Pinto ran like a charm from the day I bought it last year to the end of the summer. Then, in October and November it turned into a hula dancer. Starting out, it would go*

*great—for one mile. Then it would shimmy and shake for two, at which point it would straighten away and run fine for the rest of the day. A new carburetor and who knows what else was installed since the dealer had the car in his shop 10 times. Can you help?—A woman reader from Indiana who would prefer her name not used.*

Okay, anonymous, have your mechanic check these three probable reasons, if he hasn't done so already:

1. The choke may be releasing too soon because of incorrect indexing of the choke cap.
2. The exhaust-gas recirculation valve may be starting to operate too early—before the engine is properly warmed up and can compensate for the "leaning" effects produced on the fuel mixture by the EGR.
3. The fresh-air heat door in the air cleaner may be stuck, or the temperature-sensing switch in the air

*(Please turn to page 42)*



## What is it?

No, it's not something left over from an old Star Trek flick. It's a thread chaser and seat-cleaning tool, which you can and should buy from your auto parts dealer if you do your own sparkplug work. Its job is to thoroughly clean threads and seats before plugs are installed. It's worth every cent you spend for it. Just once, if you fail to clean the seat of a sparkplug port properly, a particle can lodge between the plug shell and cylinder head. The outcome, at the least, could be a ruined plug. At the most, the cylinder head can be destroyed, and I'm not even going to tell you what that will cost!

Had it with hot taste?

Then put down what you're  
smoking and pick up the  
extra cool taste of KOOL.

Come up to KOOL.



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

# The fun truck that's Ford-tough.



Inside, Ford's toughie is a softie. Roomy cab has style, insulated quiet, fine visibility. Foam seat. Optional air conditioning. Storage behind seat—back is hinged. Armrests standard.



## Good news on the gas gauge.

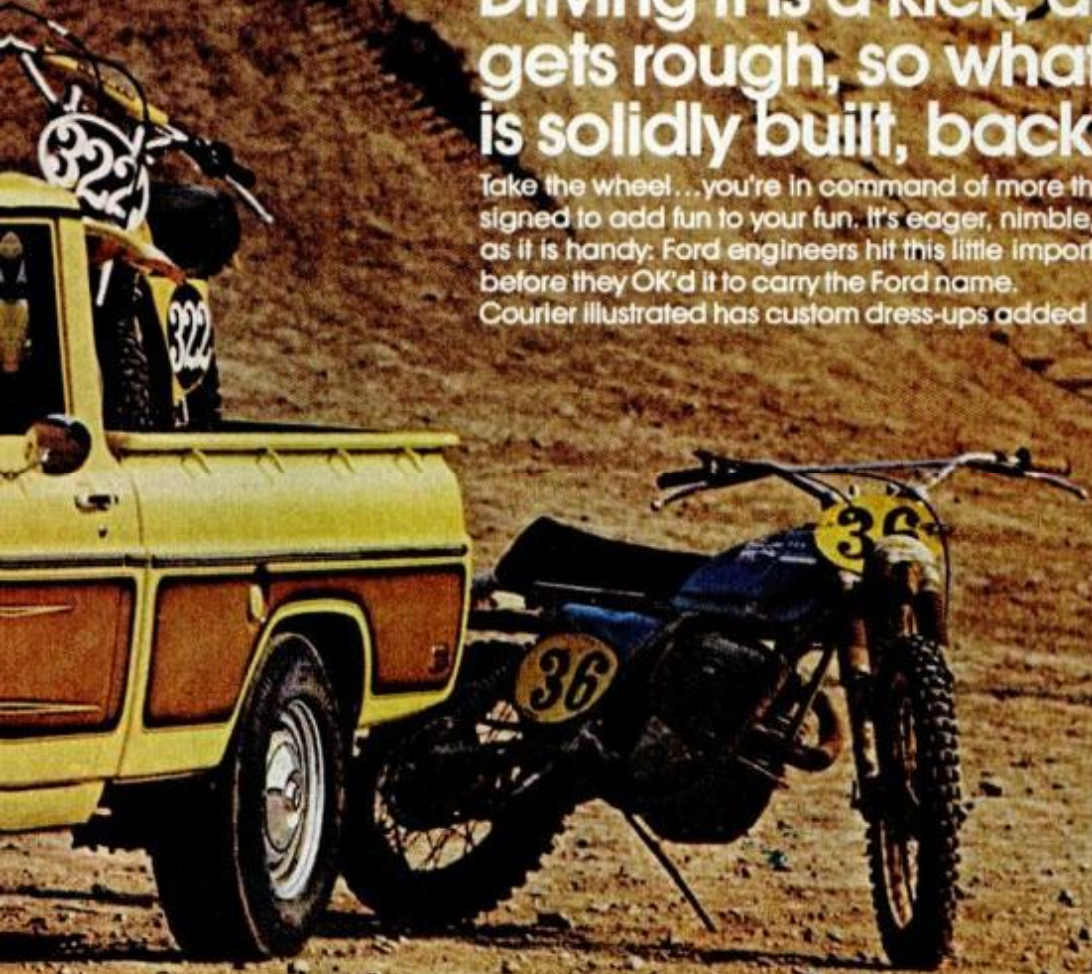
Gas mileage is great, considering the action you get with Courier's modern 1800-cc. overhead cam engine and 4-speed manual transmission. EPA estimates show 25 mpg highway, 19 mpg city—your mileage may vary.

# Gutsy little Courier.

Driving it is a kick, and if the fun gets rough, so what—Courier is solidly built, backed by Ford.

Take the wheel...you're in command of more than just a truck. Courier's designed to add fun to your fun. It's eager, nimble, responsive. And as rugged as it is handy. Ford engineers hit this little import with a lot of punishing tests before they OK'd it to carry the Ford name.

Courier Illustrated has custom dress-ups added by owner.



## Big loads. Big name!

Pile on cargo. Plus people. Up to 1,400 lbs. Courier's rugged. The pick of the imports—and it's from Ford. Try Courier.

Find out more about these fancied-up, free-wheelin' Fords.

Ask about our free 24-page book, "Free Wheelin'," from your Ford Dealer.

FREE WHEELIN'



The gutsy little import.

# FORD COURIER

FORD DIVISION



## CAR CLINIC

(Continued from page 38)

cleaner may not be operating. Have the air cleaner tested.

### Warning from the frozen North

*I'd like to use your column to warn others. May I?*

Sure, go ahead.

*We just incurred an expensive repair to our 1975 Dodge Power Wagon, Model 200. The stamped steel cover on the rear differential was not properly trimmed at the factory and protruded below the main housing. I took the vehicle cross country (isn't this what a four-wheel drive vehicle is supposed to do?) and broke through a frozen puddle, scraping the differential on the ice. The cover pulled out from the housing, oil escaped and the differential burned out.*

*To make a long story short, I got clobbered with a \$400 repair bill although the Dodge service representative admitted that he's seen other Power Wagons with oversized differential covers, leading me to believe the job would be covered by warranty. When the bill came, I got the brush.*

*Wouldn't you agree that a four-wheel-drive vehicle is going to be taken off the road where it's going to be subjected to bumps and grinds, or are we to assume that a 4WD vehicle should be used on hard-surface roads only, the same as fancy cars? What do you think?—James H. Edwards, Chitina, Alaska*

I think you're right, Jim, but that isn't going to get you your 400 bucks back. Your warning, though, should prompt others to investigate the size of their differential covers before they tackle tundra.

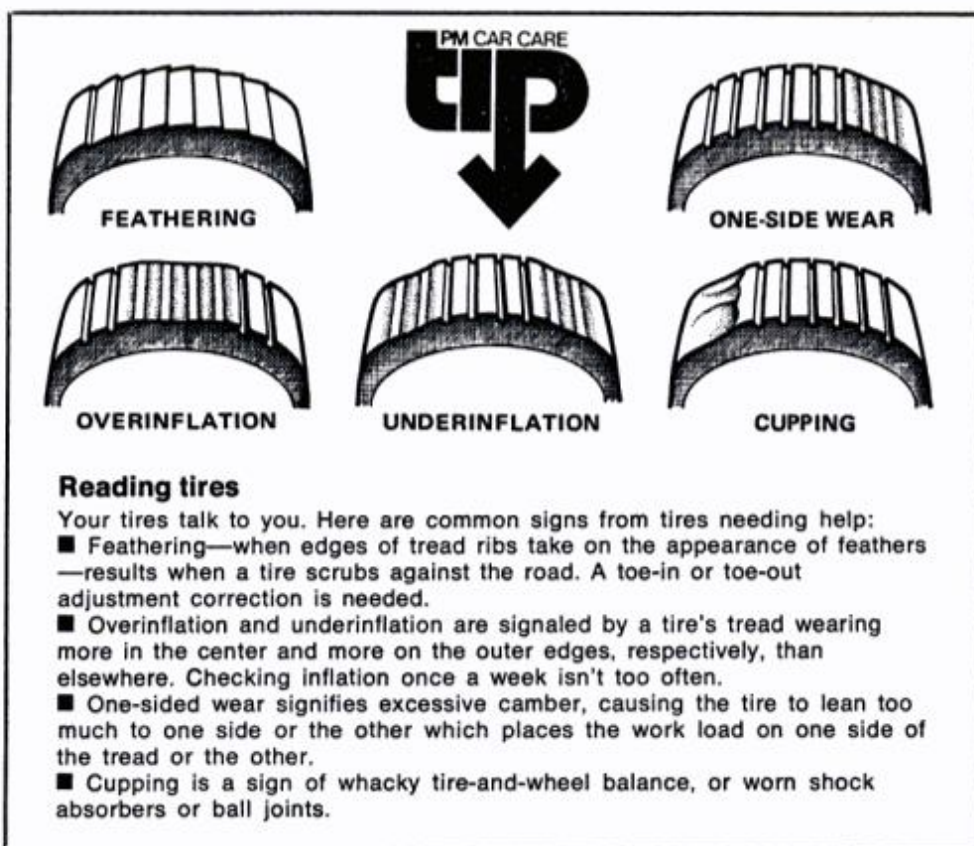
### At the helm

*I can't believe how difficult it is to find a shop manual for my 1974 Ford Courier. Surely somebody publishes one. My gas mileage is falling off rapidly, and I hate to tear into things without a good manual. An address would be very much appreciated.—Mark L. Davis, Boulder, Colo.*

Try Helm, Inc., Box 07150, Detroit, Mich., 48207. Last time I looked, the cost was \$7.

### Quiet—'genius' at work

*If you can solve this one, it would be a miracle. The car is a brand-new 1976 Chevrolet Nova six-cylinder with automatic transmission and power steering. From the moment I took delivery, I've been getting a terrible vibration when parked in Drive gear with my foot on the brake. The steering wheel shakes so bad you would think it was going to fly off. Otherwise the car drives like*



### Reading tires

Your tires talk to you. Here are common signs from tires needing help:

- **Feathering**—when edges of tread ribs take on the appearance of feathers—results when a tire scrubs against the road. A toe-in or toe-out adjustment correction is needed.
- **Overinflation and underinflation** are signaled by a tire's tread wearing more in the center and more on the outer edges, respectively, than elsewhere. Checking inflation once a week isn't too often.
- **One-sided wear** signifies excessive camber, causing the tire to lean too much to one side or the other which places the work load on one side of the tread or the other.
- **Cupping** is a sign of whacky tire-and-wheel balance, or worn shock absorbers or ball joints.

*a dream and even idles as smooth as you please with the transmission in Neutral. Many returns to the dealer have resulted in many adjustments. They are stumped and admit it although they make some reference to faulty catalytic converter. What do you think?—John L. York, Paterson, N.J.*

I think it's time your stumped friends call in a factory field representative. I do not think the trouble lies with the catalytic converter. I just can't see how it could cause vibration, but even if it did, how come only in Drive?

The trouble could lie with the transmission torque converter, in which case the transmission would have to be dropped and the converter replaced. Only a factory man can approve this job under your warranty.

Why the torque converter? Well, it's possible that someone screwed up in production by not balancing the converter properly. Perhaps one of the balancing weights was omitted. I don't know. The only way to find out, failing all other efforts to eliminate the vibration, is to replace the converter—torque, not catalytic.

### Valiant effort

*Since the day I bought my 1974 Plymouth Valiant (six-cylinder engine) I've gotten a bit of a back-and-forth oscillation in the steering wheel when applying the brake pedal. The dealer has been a gem, finally replacing all drums, shoes, etc., but the movement persists. Any ideas?—Andrew Krupcy, Warren, Ohio.*

The key to your problem, I think, may be the fact that you get oscillation on brake-pedal application only. Applying brakes puts a load on front-wheel bearings. If bearings are a bit too loose to begin with, whip could cause some wheel vibration which results in steering wheel oscillation. The solution, then, may be to readjust wheel bearings tighter. Anyway, that's the way it looks from here.

## SERVICE TIPS

■ When your 1975 Monza 2+2 needs a new battery, get the right one. It has a plastic case with front manifold vents. Rubber-cased batteries with top vent caps can lead to hood interference and corrosion to the underside of the hood. The part number for the L4 engine battery is Y87PT; for the V8 engine, it's R87PT.

■ There's a long, involved gem in Ford service bulletin 102 (12/5/75) that can save you some heartache with a mechanic who's forgotten. It deals with Fords, Mercs and Lincolns having 351M, 400 and 460-cu-in. engines that emit spark ping or knock on part throttle acceleration. The cause may be the advancing of spark too far. The procedure tells the mechanic how to fix it. ★★ ★

### 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.

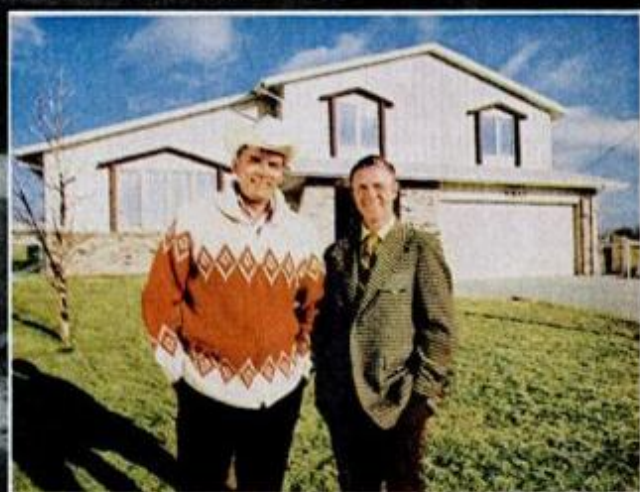


# "In 1973, I insured my house for \$40,000. When it was destroyed in 1975, State Farm paid me \$52,200."

— Jack Horn, State Farm policyholder, Ralston, Nebraska.

"I knew the price of building had been going up. But, when I found out the replacement cost of my house had gone up 30% in two years, I couldn't believe it. Fortunately, I had the automatic Inflation Coverage feature added onto my homeowners policy on the advice of my agent. As it turned out, the Inflation Coverage had increased my policy over \$12,000 in a little over two years.

"I don't know where I'd have been without it. Probably trying to rebuild a \$52,000 house with \$40,000 of insurance..."



Policyholder Jack Horn, State Farm agent Jerry Leffler, and Jack's rebuilt house.

A State Farm Homeowners Policy with Inflation Coverage can help keep pace with rising building costs automatically because it's based on the government's monthly Construction Cost Index. If construction prices go up, so does your homeowners coverage. It's adjusted month by month. And your premium is adjusted only once a year, at renewal time. Check the Yellow Pages and get the details from your nearby State Farm agent today.



**Like a good neighbor,  
State Farm is there.**

STATE FARM FIRE AND CASUALTY COMPANY  
Home Office: Bloomington, Illinois

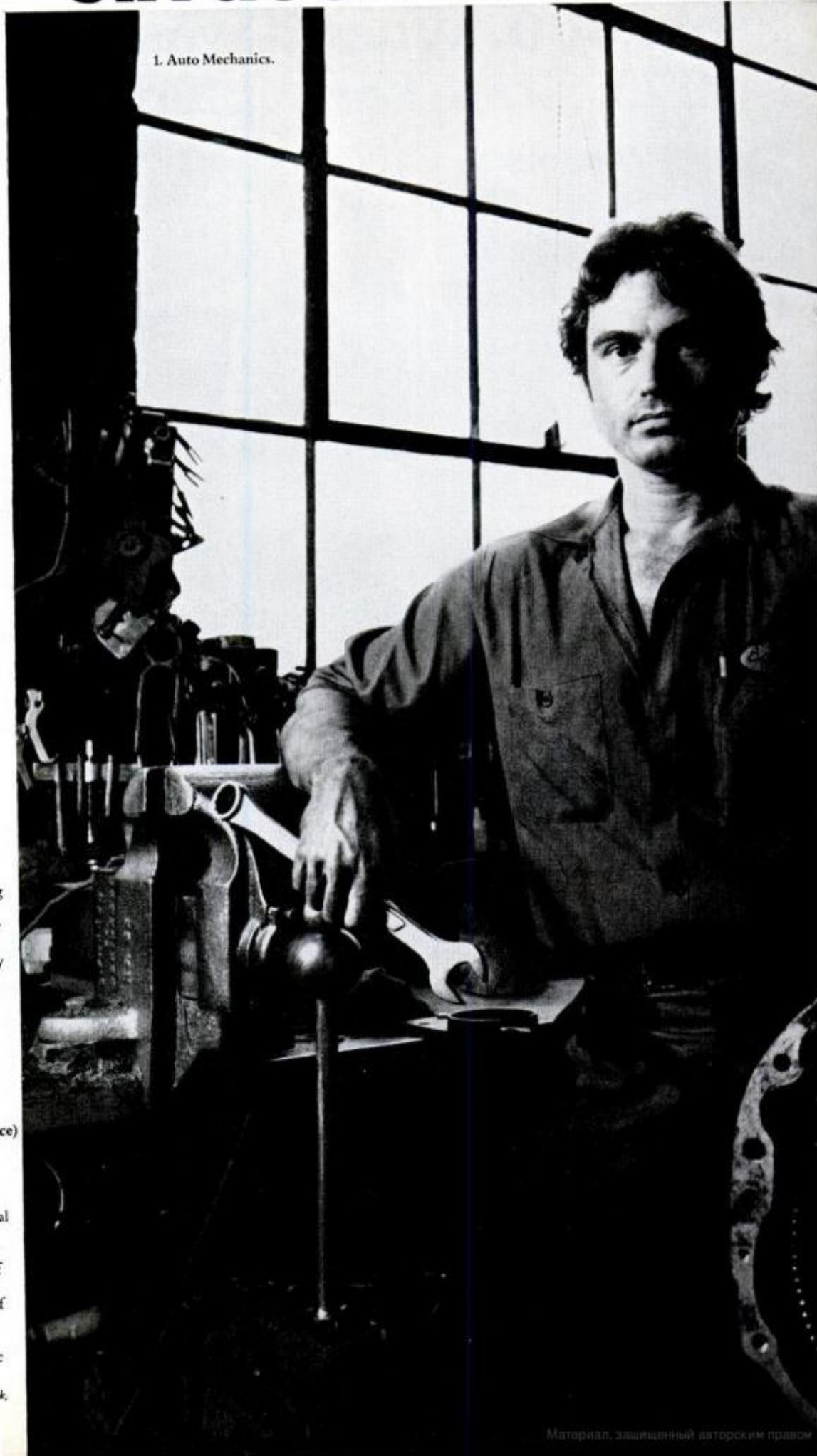
# SIX GOOD JOBS FOR

Read what the U.S. Dept. of Labor\* says about these growing career fields:

- 1. Auto Mechanics.** For entry jobs, employers look for young persons with mechanical aptitude, and a knowledge of automobiles. Generally, a driver's license is required. Courses in automobile repair offered by many high schools, vocational schools, and private trade schools are helpful. Courses in science and mathematics help a person better understand how an automobile operates. Employment is expected to increase because expansion of the driving age population, consumer purchasing power, and multicar ownership will increase the number of automobiles.
- 2. Accountants.** Greater use of accounting information in business management, changing tax systems, and growth of large corporations all point to excellent opportunities for accountants. People planning a career in accounting should have an aptitude for mathematics. Neatness and accuracy also are necessary. Employers seek applicants who handle responsibility and work with little supervision. Employment of accountants is expected to increase rapidly through the mid-1980's as businesses and government agencies continue to expand in size and complexity.
- 3. Engineering and Science Technicians.** Industrial expansion and increasing complexity of modern technology underlie the anticipated increase in demand for technicians. Those interested in a career as a technician should have an aptitude for mathematics and science, and enjoy technical work. An ability to do detailed work with a high degree of accuracy is necessary; for design work, creative talent also is desirable. Employment opportunities are expected to be favorable through the mid-1980's.
- 4. Air-Conditioning, Refrigeration, and Heating Mechanics.** Increases in household formations and rising personal incomes should result in a very rapid increase in the number of air conditioned homes. Air-conditioning in offices, stores, hospitals, schools, and other buildings also is expected to increase. Employers prefer high school graduates who have had courses in mathematics, physics, and blueprint reading. Mechanical aptitude and an interest in electricity are important qualifications. Good physical condition helps in lifting and moving heavy equipment. Employment is expected to increase very rapidly through the mid-1980's.
- 5. Draftsmen.** Those planning careers in drafting should: be able to do detailed work requiring a high degree of accuracy; have good eyesight and eye-hand coordination because most of their work is done at the drawing board; be able to function as part of a team since they work directly with engineers, architects, and skilled workers; and be able to do free-hand drawings of three dimensional objects. Employment of draftsmen is expected to rise rapidly as a result of the increasingly complex design problems of modern products and processes. Prospects will be best for those having post-high school drafting training.
- 6. Electricians. (Construction and Maintenance)** In selecting apprentice applicants or trainees, employers look for young people who have manual dexterity and are interested in learning how electrical equipment functions. Applicants also need good color vision because electrical wires are frequently identified by color. Although physical strength is not essential, agility and good health are important. Employment of construction electricians is expected to increase rapidly through the mid-1980's. Employment of maintenance electricians is expected to increase moderately through the mid-1980's because of the growing amount of electrical and electronic equipment used in industry.

\*Bureau of Labor Statistics, *Occupational Outlook Handbook*, 1974-75 edition.

1. Auto Mechanics.

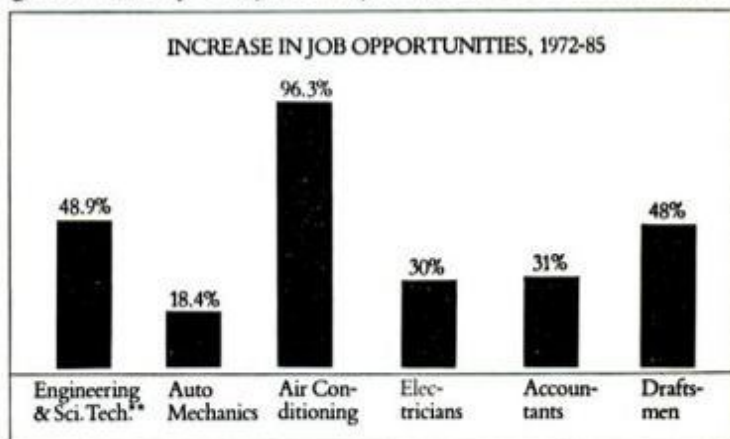


# THE 70's & 80's



If you're looking for a new career, you should keep in mind that some job fields will grow faster than others over the next ten years. (Some, such as barbers, railroad workers, meat-cutters, etc., will actually decline.)

Why do we tell you this? We're ICS—International Correspondence Schools—and we offer career training in fields the government experts say are likely to increase over the next decade.



Source: U.S. Dept. of Labor, Bureau of Labor Statistics, *Occupational Manpower and Training Needs*, Revised 1974.  
 \*\*This category includes electronics and a variety of engineering fields available through ICS, as well as some technical fields which ICS does not offer.

Of course, we can't guarantee you a job—no school can do that. But we can give you the first-rate training you need, especially if you're interested in one of the growing career fields where ICS concentrates its training.

You could even earn a degree without going to college. The ICS Center for Degree Studies is authorized by the Pennsylvania Department of Education to grant the Associate in Specialized Business degree in Accounting and Business Management, and the Associate in Specialized Technology degree in Civil, Mechanical, Electrical, and Chemical Engineering Technologies.

These degree programs are not mere stepping-stones to higher education nor are they primarily intended for transfer toward more advanced degrees. They are practical, career-oriented programs designed to help you reach your objectives without further academic training.

As an ICS student, you study at home, at your own pace. But you're never alone. If you ever want to talk to an instructor, you can call ICS from anywhere in the continental United States or Canada, using our toll-free Dial-a-Question\* service.

Since 1890, millions of men and women around the world have turned to ICS for career training. More than 70 of America's largest 100 corporations (including Bethlehem Steel, 3M, Union Carbide, Weyerhaeuser, International Paper) use ICS training for their own employees.

No one can promise success, but if you *want* more—more money, more security, more day-to-day satisfaction and more future—our free Career Booklet and free Demonstration Lesson can help you get started in the right direction. Just check the box next to the field that interests you most and mail the card or coupon today. There's no obligation.

**ICS** International Correspondence Schools, Scranton, Pa. 18515

Please mail me the Free Career Booklet and Free Demonstration Lesson for the field I have checked below. I understand I am under no obligation.

- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Electrician              | <input type="checkbox"/> Air Conditioning & Refrig.   | ICS Center for Degree Studies   |
| <input type="checkbox"/> Engineering              | <input type="checkbox"/> Automotive Mechanics         |   |
| <input type="checkbox"/> Accounting               | <input type="checkbox"/> Business Management          | Associate in Specialized Business                                     |
| <input type="checkbox"/> Drafting                 | <input type="checkbox"/> Civil Engineering            | Degree in:  |
| <input type="checkbox"/> Electronics Technician   | <input type="checkbox"/> Interior Decorating          | <input type="checkbox"/> Accounting                                   |
| <input type="checkbox"/> TV Service & Repair      | <input type="checkbox"/> Income Tax                   | <input type="checkbox"/> Business Management                          |
| <input type="checkbox"/> Surveying & Mapping      | <input type="checkbox"/> Motel/Restaurant Management  | Associate in Specialized Technology                                   |
| <input type="checkbox"/> Construction Electrician | <input type="checkbox"/> Mechanical Engineering       | Degree in Engineering Technologies:                                   |
| <input type="checkbox"/> Diesel Mechanic          | <input type="checkbox"/> Appliance Servicing & Repair | <input type="checkbox"/> Civil <input type="checkbox"/> Electrical    |
|   |   | <input type="checkbox"/> Mechanical <input type="checkbox"/> Chemical |

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_ City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_ Telephone \_\_\_\_\_

**Veterans:** Taken for career purposes, ICS Programs qualify for VA Benefits.

XA916R

Canadian residents use Scranton, Pa. address for service from ICS Canadian, Ltd.  
 In Hawaii: 931 University Ave., Honolulu, Hawaii 96814.

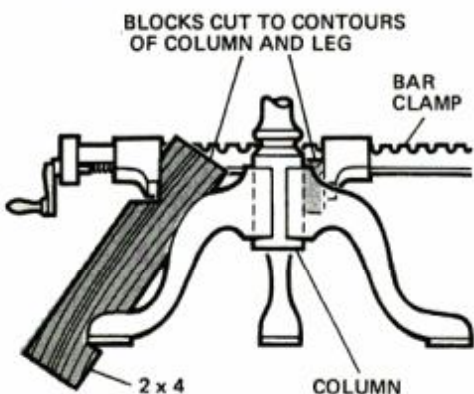


# HOMEOWNERS' CLINIC

## Crooked leg suture

*I've just bought a tilt-top table on a three-legged stand, one curved leg of which is loose. It's doweled to the column and pulls off easily. How do I glue it in place?—John Gable, Marion, Ohio*

You can use clamping blocks, or cauls, one fitting the curve of the leg, the other fitting the column, as illustrated. Fit these closely to the



contours. To avoid marring the finish, line the curved meeting parts of the blocks with felt. Scrape old glue from the dowels and joining surfaces, apply fresh glue, tape the blocks in place, and draw tight with a bar clamp. If the latter won't reach or tilts the blocks, use two bar clamps or a large C-clamp. Be sure the glue is thoroughly dry before removing the clamp.

## Hammering noises in pipes

*I recently replaced my iron-pipe plumbing with copper pipe. Now I get a water hammer, especially at the kitchen sink. Both hot and cold lines have air chambers about 20 in. long inside the wall next to the shut-off valves under the sink. If water is drained at the valves, there's no noise for a day or so; then the hammer develops again. What's the solution?—Fred W. Krebs, Seattle, Wash.*

If draining eliminates the trouble temporarily, it indicates the air chambers may have filled gradually with water through leakage or be of insufficient size. Ordinarily, air chambers are located near the meter and are of the same size or of larger diameter. A chamber so located and increased to a length of 30 in. cured my own similar problem.

Check the new lines for looseness at supports and a tendency to vibrate when water is drawn, which can also cause plumbing noises.

## Odor from septic system

*My septic system gives off an unpleasant odor. I'm quite sure it comes from the roof vents, as breezes from almost any direction fill the house with the odor. Is there any solution?—Robert A. Shellady, Iowa City, Iowa*

Is the septic tank close to the house, and are you sure the tank has no leaks? A leak in the tank located close to the building is often the source of the trouble. Otherwise, your assumption could be correct. If so, the problem really has no simple solution other than extending the vents above the roof ridge. Although it makes for unsightly extensions, I do know of instances where this step has proven effective. Ordinarily, the extensions should rise above the roof ridge a foot or so.

## Percolating water heater

*My water heater is 10 to 12 years old. When I draw hot water, it sounds like a coffee percolator, bubbling, gurgling, occasionally snapping or crackling. What will correct it?—J.F. Mulligan, Phoenix.*

Such noises are generally caused by lime or other deposits on the bottom of the tank. I've succeeded in preventing this trouble by periodically draining the tank and inserting a stiff wire through the drain faucet to loosen deposits, taking care not to damage the tank lining. Then I refill the tank and draw off several pails of water. This drains away loosened debris and cures any tendency to noisemaking. Repeat the treatment periodically as a preventive measure.

## Wood vs. metal cabinets

*My wife wants to install a wooden cabinet in the empty space between our refrigerator and gas range. I prefer metal because of the possible fire hazard. Which is best to use?—R.S. Diblik, Elmhurst, Ill.*

Although there is little danger of actual fire, I would prefer metal cabinets, as they are less likely to be affected by heat, spillage during food

preparation, or warping due to variations in temperature or moisture.

## Topping tall trees

*An evergreen planting in front of my home is growing tall and slender. The five trees are now about 10 ft. high. I'm told these are junipers, but I'm not sure. Can they be topped without damage? Will they die if topped?—Randall St. Johns, Kansas City, Mo.*

Not knowing what type of evergreen you have, I'm hesitant to say with certainty that they can or cannot be topped. Perhaps it would be better in the long run to replace them with a lower growing, or dwarf, variety. If you wish to risk topping, however, cut the trunks at a steep angle to shed water freely. Coat the wound with a "tree wax"—a compound made for the purpose—and tie the branches lightly to form a "peak." I think it's best to do topping in late summer or early fall after all seasonal growth is complete.

## Plant guard

*Soon it'll be gardening time, and I plan to go all out this season in vegetable raising. But cutworms are the bane of my gardening experience. What can I do to foil them?—W.T. Halley, Baltimore, Md.*

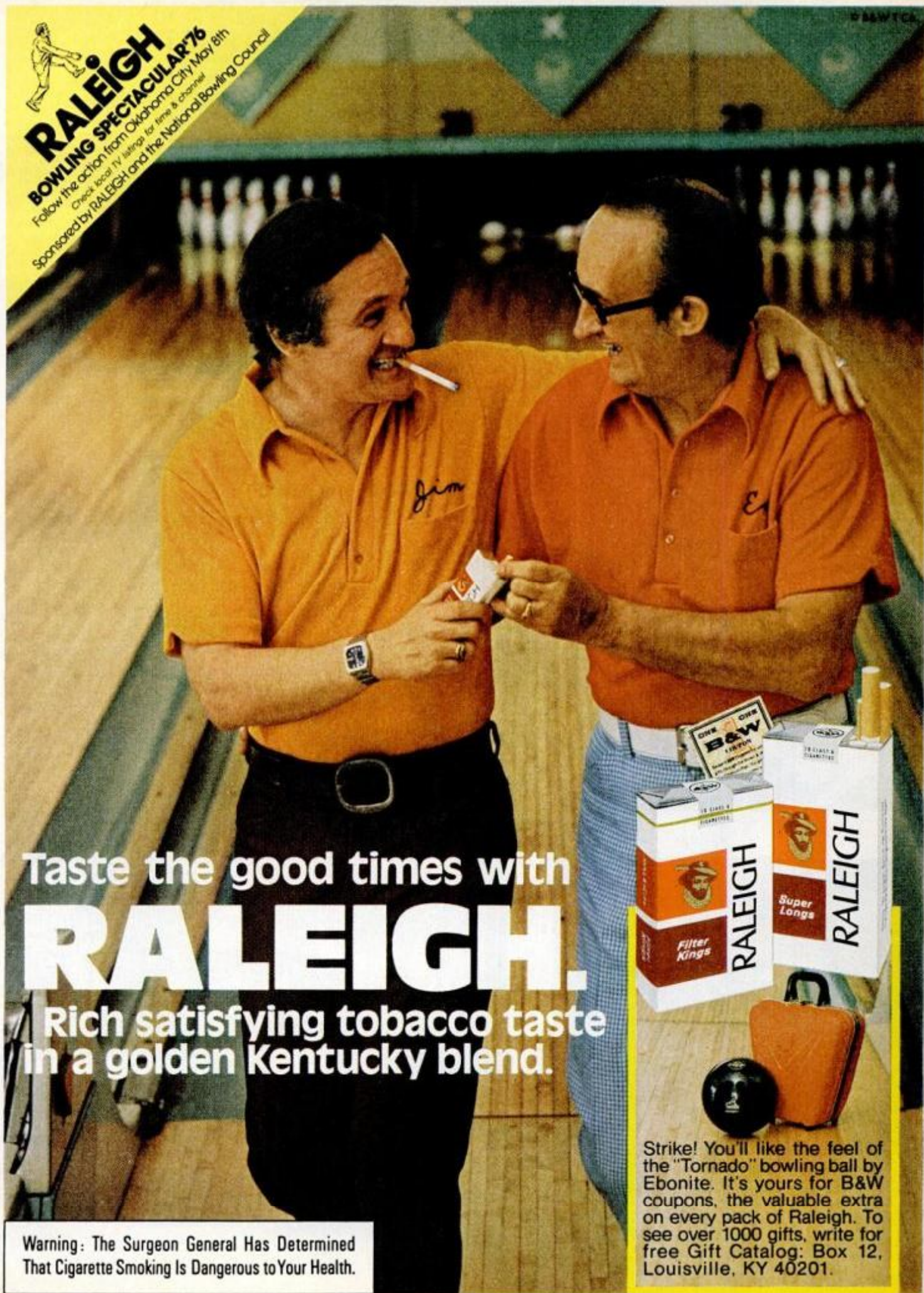


The simplest and best way I've found is that illustrated. Outlay in time and money is minimal, but you'll have to start saving No. 2 cans early if you plan to have many seedlings or transplants. Cut both ends out of the cans. When the seedling appears above ground, press the can down over it to the depth indicated. Leave the can in place until the plant is well developed. ★★

*Do you have a home maintenance or repair problem? Send it to Homeowners Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get PM's Home Care Guide, \$4.49 postpaid. Send orders to PM, Dept. HCG, Box 1014, New York, N.Y. 10019.*

**RALEIGH**  
**BOWLING SPECTACULAR '76**  
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Check local TV listings for time & channel  
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Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

Filter Kings, 16 mg. "tar," 1.0 mg. nicotine; Longs, 17 mg. "tar," 1.1 mg. nicotine, av. per cigarette, FTC Report Nov. '75

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IT'S NEW **NOW**



**Pistol grip with direct linkage**

Rigid linkage from trigger to shutter release, long a feature in pistol and shoulder mounts on movie cameras, can now be had for your 35-mm still camera. Finger grooves prevent slippage, trigger is lockable, and 6-to-1 leverage provides light touch. Grip takes most flash accessories. Price: \$67. Better Pictures, Inc., 1012 Kings Dr., Charlotte, N.C. 28283.



**High-speed hydrofoil missile ships**

Ultrahigh speeds are attained by new 131-foot PHM missile ships built for NATO's fleet by Boeing Aerospace. Secret is a foiled hull that lifts them clear of water. Bridge boasts 360° visibility free of fog and ice—thanks to conductive glass developed by PPG.



**Cool it or park it**

Two-gallon insulated beverage cooler (at left and below) serves as a double-duty boating aid. It keeps juice cold and makes an extra seat. It has a tray under the lid for 12 sandwiches and a leak and rustproof spigot. Covey Corp., Box 1317, Houston, Tex. 77001.



**Kit for a geared mini-crawler tractor**

Mini "cat" for home or farm comes in a kit you can assemble "in a weekend," says maker. It is 5 feet long, 40 inches wide, comes with 12 or 16-hp engine, has an all-gear drive and accommodates most accessories. Struck Corp., Struck Lane, Cedarburg, Wis., 53021.



# Tabex.<sup>®</sup>

## Slow-dissolving germ killer. Chlorinates your pool better...and longer.

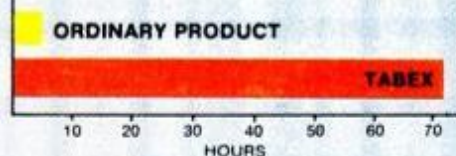
Tabex is the original, patented\*, slow dissolving swimming pool chlorine tablet. Completely different from ordinary granular and liquid pool water care products.

As the Tabex tablet dissolves, it provides steady, continuous, effective chlorination. Tabex gives you more effective germ-killing power, and your pool stays sparkling clean without the chore of daily chlorination! Here's why Tabex is so effective...

### IT'S "SUN-PROOFED."

The unique Tabex formula is stabilized to prevent chlorine "burn-off." With ordinary

In hot sun, Tabex kills germs up to 15 times longer than calcium-type granular or sodium-type liquid products.



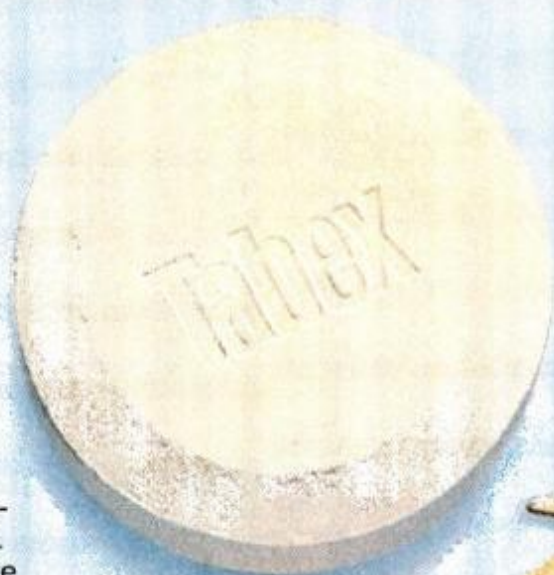
calcium-type granular and sodium-type liquid products, 90% of a pool's chlorine can be lost in less than five hours of intense sunlight.

### NO RESIDUES, NO BALANCING.

Tabex contains no calcium. Tabex leaves no residues or scales, and does not require frequent acid chemical balancing in your pool.

### IT'S CONTINUOUS, LONG-LASTING.

You get up to 60 days' carefree, continuous, effective chlorination from Tabex tablets, when used in an inexpensive Tabex Aquarian™



Chlorinator. Tabex tablets can also be used in your pool skimmer or in a Tabex Float Ring.

### IT'S ECONOMICAL.

One pound of Tabex does the work of three to four pounds of



calcium hypochlorite products, or three to four gallons of sodium hypochlorite liquid products. Over the season, Tabex costs no more!

Tabex tablets, in canisters, jars and pails, are easy to handle and store. No bulky drums, jugs, mugs, or hazards!



Let Tabex germ-killing power keep your pool sparkling clean—longer, easier, more effectively! Ask your pool dealer or use coupon for free brochures on pool care and the Tabex system.

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SWIMMING POOL PRODUCTS  
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\* U.S. Patent No. 3,325,411

# the pro



True Temper hammers and various striking tools have been serving tradesmen and homeowners for many generations. They expect the most from a True Temper tool. That's a trust we don't intend to let down.

Like the #A16 Rocket® hammer shown, every True Temper tool offers built-in quality, proper swing-weight balance and comfortable grip.

One more thing. Professionals and homeowners alike should remember to wear safety glasses and follow good safety procedure whatever the job, whatever the tool you're using. That way, you'll be around to build bigger and better things, for some time to come.

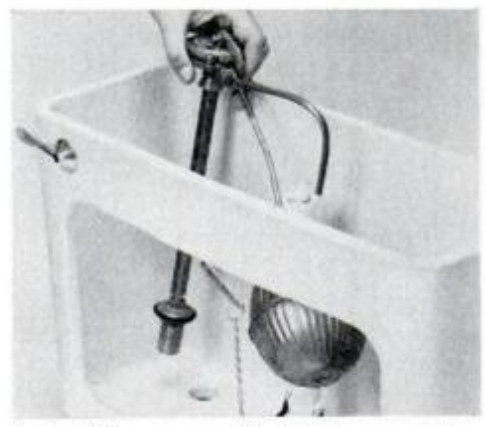
**TRUE TEMPER**  
An Allegheny Ludlum Industries Company

PM PRODUCT REPORT

## Silent fill valve replaces float ball in toilet tank

**A** new toilet-tank fill valve, designed to replace the old-fashioned ballcock and float rod found in most toilets, turns on and off by hydraulic pressure rather than mechanical action. Located on the bottom of the tank, it senses the height of the water above and shuts off the incoming flow when the tank is full. It's silent in operation, installs in minutes, can be adjusted to regulate water height in the tank. Because the parts are plastic, stainless steel and rubber, the valve is virtually maintenance-free.

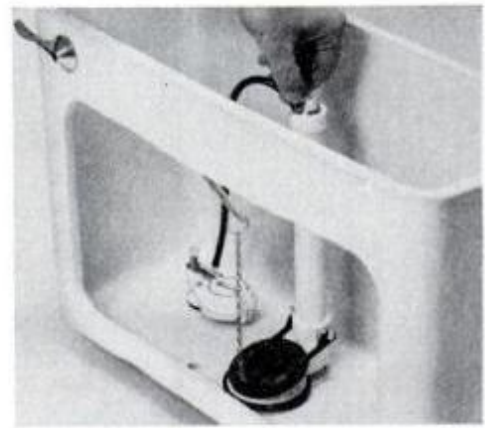
Called Fillmaster, it's made by J. H. Industries, Inc., 1712 Newport Circle, Santa Ana, Calif. 92705, and sells for \$4.59. ★★★



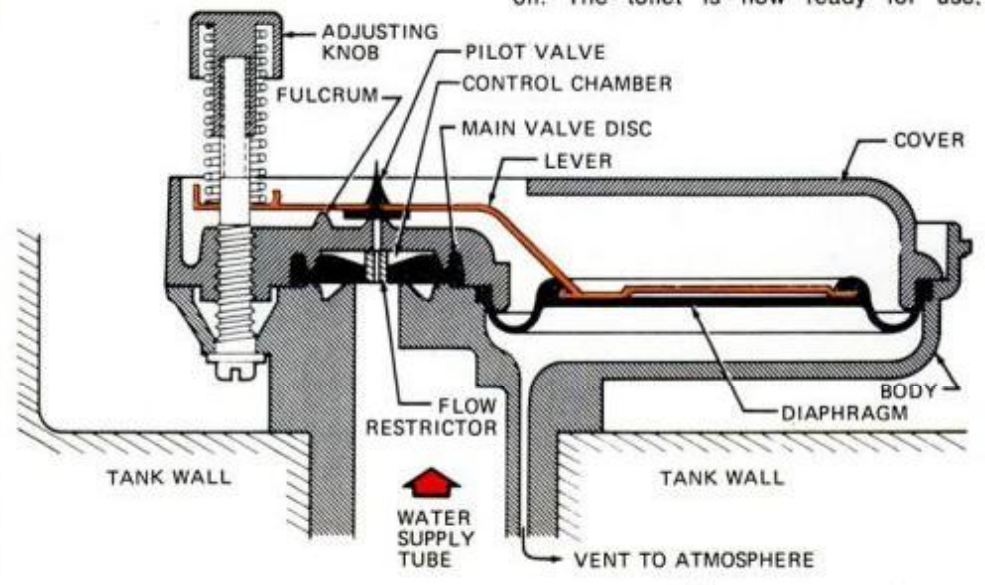
**1. Installing a new fill valve is easy.** Turn off the water supply to the toilet, flush once to empty tank, sponge away remaining water, then remove the old ball cock.



**2. Insert fill valve, then carefully tighten it in place.** Typically, you'll need only a single wrench to remove the old ball cock and install the new device.



**3. Clip the rubber refill tube to the overflow pipe.** Turn on the water supply to the tank. The valve will fill the tank to about 8 in. above the tank bottom and then shut off. The toilet is now ready for use.







# "Unbelievable."

**What would you say about a small wagon with a size and style all its own?**

A wagon that's smaller than the big and bigger than the small. With a load capacity only 100 pounds less than that of a full-sized wagon and over 200 pounds more than that of a subcompact wagon. And with available convenience features like power seats, power windows, and automatic speed control. Aspen's almost too good to be true!

**What would you say about a small wagon that got an EPA estimated mileage of 30 MPG highway and 18 MPG city?**

According to EPA estimated mileage results, the Aspen wagon got 30 MPG on the highway and 18 city. The Aspen coupe and sedan got 27 MPG highway and 18 city. All were equipped with a 225 Six and manual transmission. (Your actual mileage may differ, depending on your driving habits, the condition of your car, and optional equipment. In California, see your Dealer for mileage results.) Very nice, indeed!

**What would you say about a small wagon with a ride that rivals that of a full-sized car?**

A small wagon with a unique new front suspension that gives it a smooth, quiet ride you usually find in bigger cars. Aspen's Isolated Transverse Suspension. It's unbelievable!

**What would you say about a small wagon with a price that starts at only \$3,658?**

That's based on the manufacturer's suggested retail price for the base wagon (not shown), excluding state and local taxes, destination charge, and optional equipment. The Aspen SE wagon, pictured above, starts at \$3,988. That price includes an automatic transmission, power steering, soft vinyl-upholstered 60/40 seats with recliners and center armrest, and much more. Other Aspen prices start at only \$3,336 for the coupe and \$3,371 for the sedan. Remarkable!



## ASPEN

The new Dodge Aspen.  
For a small wagon at a small price,  
it's unbelievable.

Winner of the 1976  
Motor Trend Magazine  
Car of the Year Award.





# Don't stop now, join the Army.

Congratulations. Graduating from high school is a real achievement. You've got a lot going for you now. And that's the best reason for moving ahead right away. Whether that means starting college, looking for a job—or joining the Army.

A good start. The best thing the Army will do for you is put all that fresh talent, education, and energy to work. There are plenty of good job-training courses in the Army. And Army pay is better than ever. \$361.20 a month to start, with a raise in just four months to \$402.60.

Soldier in Europe. Maybe what you want to do now is travel. With the Army's European Option, you can sign up for Europe when you enlist. You'll work hard, but you'll be learning a lot. Changing a lot, too.

Continue your education. You don't have to wait to start college or vocational-technical school. The Army has several educational programs, offered through accredited colleges and universities. Most of the classes are held right on post. And the Army pays up to 75% of your tuition. With one of the programs, Project Ahead (Army Help for Education And Development), you can enlist in the Army and start working on your college degree at the same time.

Join now, go later. One thing the Army offers a new graduate is a chance to recover from a head-bending senior year. With the Army's Delayed Entry Program, you can sign up in June, then take up to nine months to report.

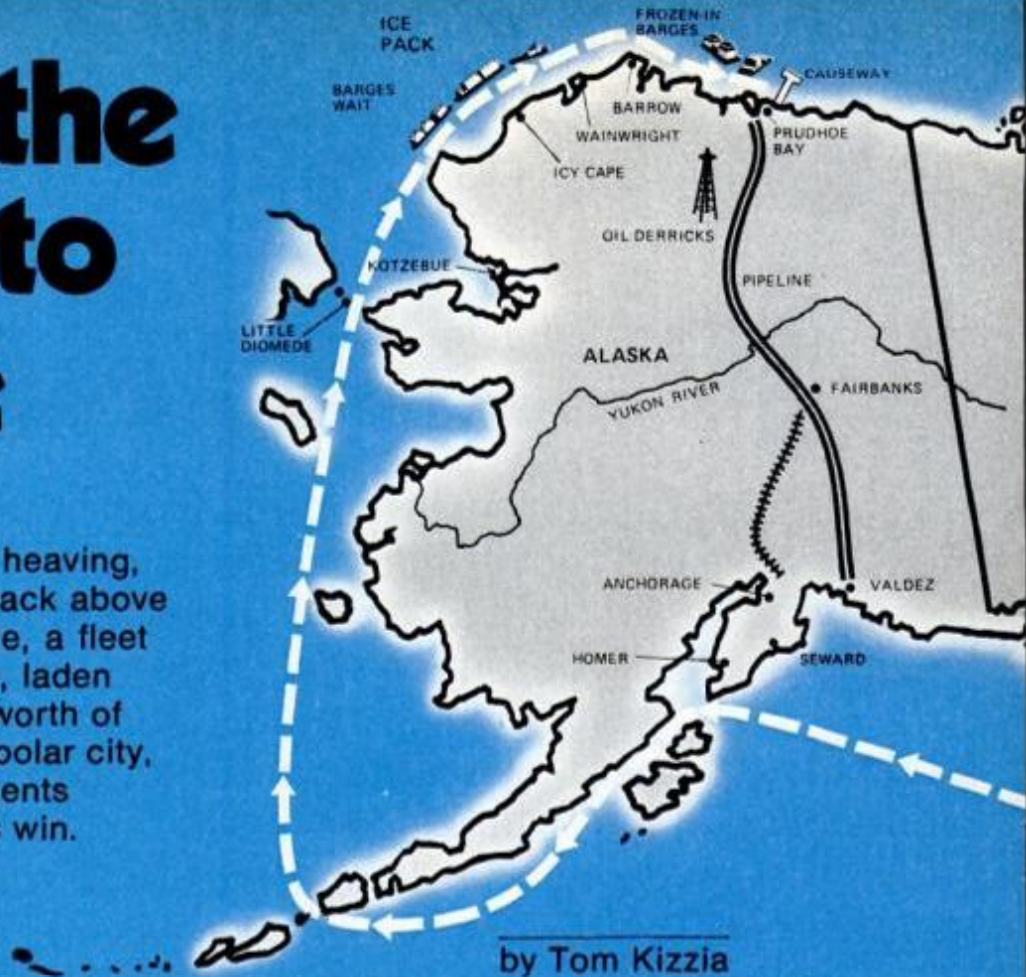
But the main thing you want right now is to keep growing. The Army offers plenty of opportunity to do that. For more information, send the postcard. Or call 800-523-5000 toll free. In Pa., call 800-362-5696.

**Join the people  
who've joined the Army.**

# Bucking the pack ice to Prudhoe Bay

Trapped in the heaving, slamming ice pack above the Arctic Circle, a fleet of giant barges, laden with \$1 billion worth of buildings for a polar city, fought the elements to an ingenious win.

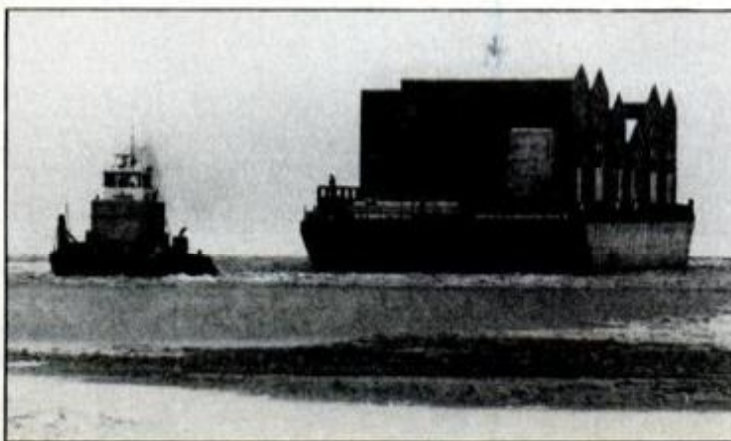
Art: Rodrow Marza Studio



by Tom Kizzia



Barges loaded with everything from soup spoons to eight-story buildings wait for ice to break up (above) so tugs can tow them around Point Barrow to Prudhoe Bay (right).



**H**eaving and jolting like a bulldozer gouging rocky earth, the U.S. Coast Guard's 310-foot icebreaker *Glacier* rammed into an ice prairie that stretched to endless Arctic horizons. Stacks belching, she backed off into churning brash ice, then rumbled forward again under full power. Her beveled bow hit the ice wall, knifed upward, ground to a shuddering halt and broke down through solid seven-foot-thick ice amid geysers of salt spray and crumbling ice blocks. Streaming beneath her rounded hull, the huge chunks were chopped by her twin screws like ice cubes in a blender and spewed into the glittering channel that the ship had carved behind her.

*Glacier*, the country's biggest, most powerful icebreaker, was racing against time last fall to smash a channel through the frozen sea around Point Barrow to Prudhoe Bay, base camp on the North Slope for the northern end of the Alaska pipeline. September had arrived and, with it, icy fog, slate-gray skies, frost and snow flurries—harbingers of a new polar winter.

## Billion-dollar cargo

At stake was a crucial cargo that anxious engineers at Prudhoe had been sweating for for three long months. Normally, easterly "summer" winds blow the pack ice into

*(Please turn to page 60)*

A cowboy wearing a wide-brimmed hat and a red shirt is riding a brown horse that is bucking. The cowboy is holding the reins with his right hand raised. The background is a vast, hazy landscape with rolling hills and a cloudy sky. The overall tone is dramatic and evocative of the American West.

**Come to where the flavor is.  
Come to Marlboro Country.**



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

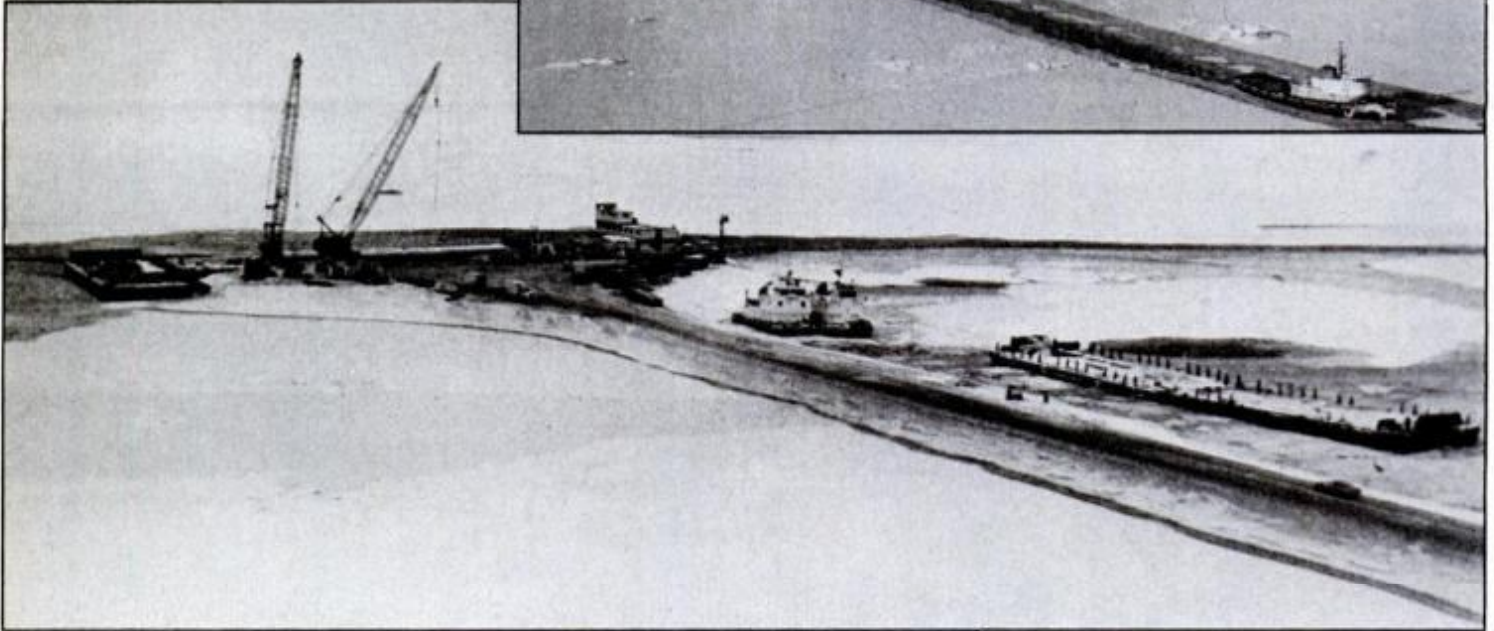
Kings: 18 mg. tar, 1.1 mg. nicotine—  
100's: 17 mg. tar, 1.1 mg. nicotine av. per cigarette, FTC Report Nov. 75

## PRUDHOE BAY

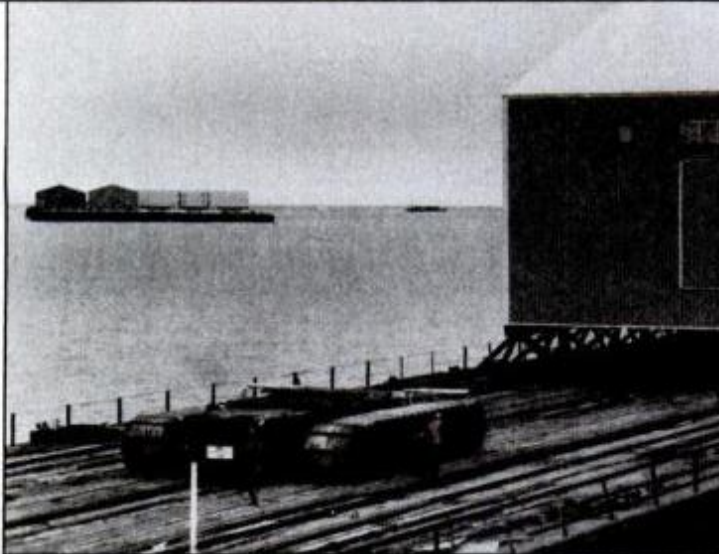
(Continued from page 58)

the Chukchi Sea where wave action breaks it up, leaving a broad high-way of open water along Alaska's north coast. But this year the winds had failed to materialize. Off the Eskimo village of Wainwright, in open water just west of Point Barrow's protecting peninsula, 47 giant

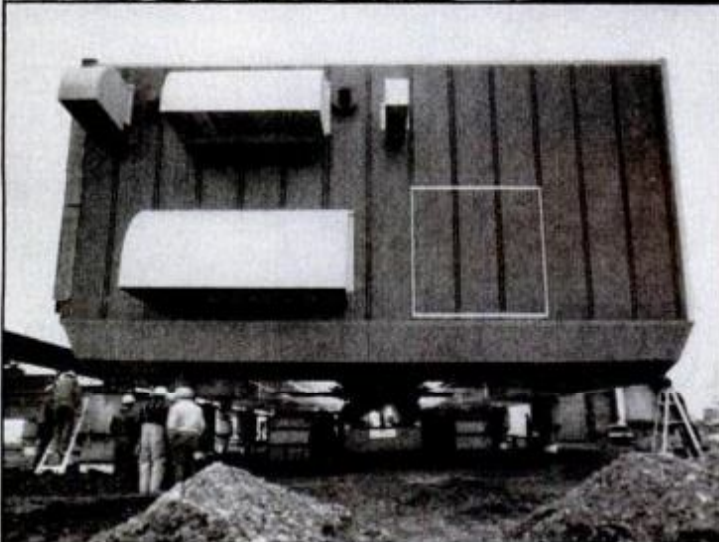
Following path chopped by Coast Guard cutters, tugs towing huge 100-by-400-foot barges plod slowly toward Prudhoe Bay. Lower photo shows docking causeway built at Prudhoe to handle barges too big to come ashore.



**Off-loading** huge modular buildings at Prudhoe Bay is done by transferring them to shallow-draft lighters atop low-slung tracked vehicles the drivers call "underdogs." At dockside, crawlers creep them ashore along causeway to predetermined sites.



**At the site,** the building modules, still riding on backs of two "underdogs," are lowered by crawlers' jacks onto reinforced-concrete pilings, firmly footed in the permafrost. Crawlers can juggle buildings to precise position, then creep out from under.



barges with a billion dollars worth of freight for the Alaska pipeline had been waiting since July 4 for enough of a "lead" through the ice to make the 300-mile run to Prudhoe.

Some of the gigantic barges ranged up to 100 by 400 feet in size. Ten managed to slip through to Prudhoe, then, near the end of August, the worst happened. A violent westerly storm swept in. "For a week it blew," recalls Don Collar, wheelhorse for American Machine and Foundry Co., one of the contract outfits on the pipeline project. "The tugs could only steam straight into it and try to keep the barges off the rocks."

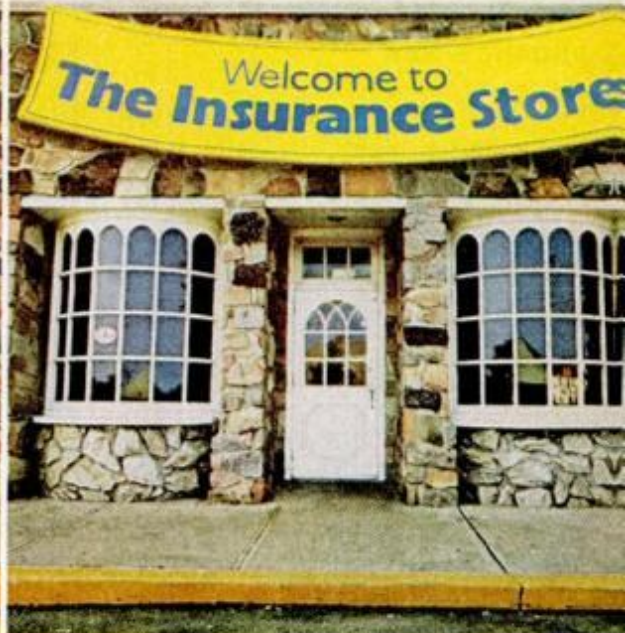
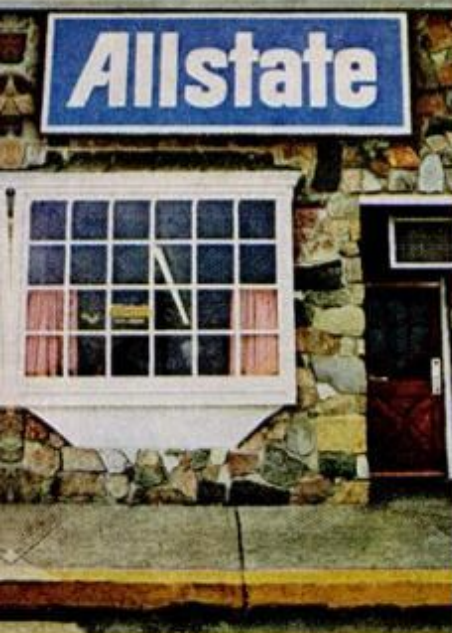
### Four barges damaged

When it was over, four barges had been damaged by ice. "One broke its tow line and wound up on the beach," says Collar. "We had to dig a hole around it and channel water in to float it off."

At that point, 22 barge skippers gave up, turned around and headed for Seward, where they transferred their freight to rail for transport to the pipeline road out of Fairbanks.

Now, in mid-September, 15 of the mammoth barges still waited off Wainwright, loaded with cargo that looked, for all the world, like a floating city. No way could their cargo go overland. Aboard were complete

(Please turn to page 62)



## Which one offers you more?

Take 5 minutes to complete this little quiz.

It compares three of the best places where you can buy property and casualty insurance.

With the correct answers (which are printed below), you can save time and money.

And assure yourself the best protection and service.

**A SF TIS**  
   **Which one offers you a choice of many leading insurance companies?**

Allstate sells Allstate Insurance.

And State Farm sells State Farm Insurance.

But The Insurance Store offers you a wide variety of insurance companies—including ourselves, Continental Insurance.

Some of the companies specialize in automobile insurance. Others, in homeowners insurance. And still others, in business insurance.

At the same time, some of the companies specialize in low price. Others, in unusual coverages. And still others, in a combination of both.

So whatever kind of insurance you need, by shopping at The Insurance Store, you can select the specific companies and policies that best match your needs.

**A SF TIS**  
   **Which one offers you the lowest prices?**

Today no insurance company can ac-

tually promise you *the lowest prices*.

Because each company bases its rates on actual experience with specific insurance classifications in specific geographical areas.

And recent studies show that each company's rates vary widely from one area to another.

But because The Insurance Store in your area offers so many different companies—chances are, it has the one company that best suits your needs and budget.

**A SF TIS**  
   **Which one offers you a unique combined home-and-car policy?**

Only The Insurance Store offers you this unique policy.

It's called the Continental Insurance Personal Comprehensive Protection Plan.\*

And, in fact, it's so comprehensive, it also lets you combine even your hospital, disability income, and mortgage life insurance all into one neat package—with just one premium and one expiration date.

**A SF TIS**  
   **Which one offers you 24-hour Dial-A-Claim Service?**

Of the three places above, only The Insurance Store can offer you 24-hour Dial-A-Claim Service.

It lets you report an accident from anywhere in the U.S. or Canada—any time, any day, toll free.

And it's backed by over 2,000 claims adjusters.

So whenever and wherever you need help, help is always nearby.

**A SF TIS**  
   **Which one offers you an independent agent?**

Unlike the agents at Allstate and State Farm, the agent at The Insurance Store is an *independent agent*.

*Independent* means: While he represents many different insurance companies, he's beholden to no one company.

And so if the company with which he places your business doesn't do what's best for you, he's free to switch to another company which will.

That gives him tremendous leverage to use on your behalf. And use it he does.

To find the *independent* agent who runs The Insurance Store nearest you, just see an agent listed under Continental Insurance in the Yellow Pages.

Having completed this little quiz comparing three of the best places where you can buy property and casualty insurance, you now know two very important things:

Which one offers you more.

And why.



**Continental Insurances**  
featured at  
**The Insurance Store**

## PRUDHOE BAY

(Continued from page 60)

buildings (one of them more than eight stories high), drill site skids, auxiliary pipeline sections, flow stations to funnel oil from wells to the pipeline, reinjection plants to pump natural gas back into the ground for future use, and giant electric generators to produce much needed power for the clattering city of Prudhoe and its 2500 technicians and construction workers.

With those critical supplies delayed, the timetable on the high-priority pipeline would be shot to shreds. Worse yet, they almost certainly would be lost completely should the barges be trapped and subjected to the incredible pressures of the winter pack ice.

It was at that critical point that Atlantic Richfield (ARCO) and British Petroleum (BP), two members of the Alyeska pipeline team, appealed to Washington for help.

### First attempts fail

President Ford called out the Coast Guard, and the *Glacier* headed north to help. Unhappily, within days the big icebreaker smashed a propeller, but kept working the ice as best she could. A second icebreaker, *Burton Island*, was dispatched to assist, along with two cutters, *Citrus* and *Storis*. As fast as they cut ice, the brash congealed and froze in behind them. Without a break in the wind, it looked hopeless.

Suddenly, on Sept. 16, the wind swung tantalizingly northeast, wavered easterly, and the tug skippers decided to make a run for it.

Back in July, when the barge fleet had arrived from Seattle, a total of 23 tugs powered by rugged diesels ranging from 2000 to 9000 hp had two barges each in tow, on tough stainless cable several inches thick. Now there were enough tugs free to provide one for each of the 15 remaining barges with their superloads. All carried entire buildings on their decks. Their hulls were of high-tensile steel to resist ice damage, and the largest carried close to the maximum 12,500 tons. Though even the largest modular buildings weighed only 1360 tons, most were filled up inside with smaller freight.

Don Collar recalls, however, that tonnage was not the big headache. "Our problem was cubic area, not deadweight," he says. "You can imagine the tremendous sail area those towering buildings presented to any kind of wind."

Nevertheless, weight would also become a factor to contend with. The more cargo piled aboard, the deeper



**Ice chewer-upper** is this Bunyanesque version of a portable chain saw. Mounted on a vehicle the size of a D9 Cat, it can slice a fast trough through ice or permafrost.

the barges sank in the water; this would prove a problem once the fleet entered the shallow Arctic Ocean.

By mid-morning on that 16th day of September, the die was cast. With tows snubbed close, bow to stern, the long string of tugs and barges snaked single-file behind the two ice cutters that ran abreast, chopping through the ragged remnants of the slowly receding pack ice. Open water between pack and shore widened as the day wore on, but still the long, shallow shoulder of Alaska extended a mile from shore.

### Ice trap closes

Then, without warning, the wind shifted again, driving the ice back toward shore. Not willing to give up, the tugs, drawing only 12 to 15 feet, moved in toward the shoreline, trying to sneak through the narrowing strip of open water. When it became obvious that the pack would again snap shut against them, pinning them between gigantic floes and the tapering, gravelly offshore bottom, they radioed the *Burton Island* for help, only to learn that, with her draft of 28 feet, she couldn't get to them. With only the two cutters to fend off the relentlessly approaching sea of ice, and a few hours at most before the gigantic trap would be sprung, the tugs swung around with their tows and retreated under full power for the comparative safety of the protected waters off Wainwright. They barely made it.

"By Sept. 20, we told the oil companies that as far as we were concerned it was over," says Jim Lowe,

AMF's top man at Prudhoe. But the tug skippers weren't quite ready to quit, and the oil companies had too much to lose to ignore even chancy leads before winter closed in.

### Pilots spot open water

Finally, on Sept. 26, reconnaissance pilots, now flying daily runs along the North Slope between Prudhoe and Barrow, reported open water nearly all the way. With some doubt, the tugs winched their barges in tight and moved out once more. There were 20-knot winds and sub-freezing temperatures, but as the convoy proceeded, they encountered only one ice floe, less than a quarter mile in extent, on the western tip of Point Barrow. The icebreakers punched a lead through that with ease.

A month earlier, once around the point, the convoy would have had clear sailing. Now, with polar fronts following each other in quick succession, the tugs had to labor through six to eight inches of mushy new ice.

### Barges try sneak run

It was a bizarre caravan. To avoid the pack, still worrisomely visible as an "ice blink" reflection off the slate-colored skies to the north, the barges hove as close to shore as their draft allowed. Along Alaska's northern coast, that still meant keeping at least a mile offshore to avoid the shoals and shallows. Again the two Coast Guard cutters led the way, moving side by side to cut a double lead through the fresh, slushy "pancake" ice, so-called because of the

(Please turn to page 64)



# Chevy Truck value starts under the hood.



## Engine selection is key to operating efficiency.

Settling for too little power can be just as wasteful as specifying too much. Chevy offers a wide selection so engine size can be closely matched to the kind of work you do.

## Two efficient Sixes, four hard-working V8s.

*The 250 Six* is standard in half-ton Chevy pickups. It was extensively redesigned last year for efficient fuel distribution and combustion. A larger 292 Six is standard in three-quarter and one-tons.

*Chevy's 350 V8* with a 2-barrel carburetor is standard on half-tons (except in California, where a 4-barrel version is specified). The more powerful 350-4 V8 is available for half-tons, standard on three-quarter and one-tons. For even heavier loading or towing, a larger 400-4 V8 is offered for 4-wheel-drive models; a big-block 454-4 V8 for all 2-wheel-drive Chevy pickups and Chassis Cabs. In California, see your Chevy dealer about engine/transmission availability.

## High Energy Ignition system.

It's standard with both Sixes and V8s. It provides a spark that's up to 85% hotter than conventional systems. There are no points to require periodic maintenance and no ignition condenser to wear out. The system extends time between tune-ups and helps improve ignition performance.



**YOUR MONEY'S WORTH.  
MILE AFTER MILE AFTER MILE.**

## PRUDHOE BAY

(Continued from page 62)

dislike chunks that form due to wave action on the still plastic, newly forming mass. Through the loosened mush, the barges followed, with the *Burton Island* flanking the convoy a mile farther out.

Occasionally one of the cutters would have to swing a "180" and go back to free one of the barges at the rear where the ice already had closed in again. "The faster tugs and lighter loads went ahead," says ARCO's Tom Brennan, "as close to shore as they could get to take advantage of ice kept thinner by the shoreward chop. They took chances. In some places you could see sand boiling up in their wake, their paddles were so close to the bottom."

At night the tugs stopped and hove to, afraid of running into big ice blocks broken off from the pack—the kind of ice that can punch holes in even stout hulls.

On Sept. 30, the first barge, towed by the 9000-hp tug *Gladiator*, pulled into Prudhoe Bay. The rest chugged in during the next two days. Leaving the barges anchored offshore, the tugs quickly turned and retreated westward with the Coast Guard ships. Clearly, the barges would have to stay put for the winter.

### Drama not yet over

Though everyone cheered the hairbreadth success, the "grande finale" was still to be played. Getting all that giant freight ashore from 1½ miles at sea was hardly a simple routine. "Things that are simple anywhere else in the world are monumental tasks up here," points out George Shaw, BP's module manager at Prudhoe. Despite a half-mile-long causeway protruding into the bay, the seven-foot water depth at dockside was still a couple of feet too shallow for the loaded barges, which had to stand off an additional mile to stay afloat. Engineers had devised and built shallow-draft lighters to ferry the module buildings in.

Low-bodied "crawlers," modeled after those used by NASA to carry Saturn rockets to their launch pads, were designed to creep under the modules and lift them on their backs by hydraulic jacks. The most powerful of the crawlers, or "underdogs" as the drivers call them, can carry up to 800 tons. It takes two underdogs to carry each building.

Despite all the fancy equipment, getting the big buildings ashore required considerable ingenuity. Water was pumped into the huge barges to lower them, so they wouldn't capsize as the modules were hauled off. Each

lighter, also sunk for the same purpose, was refloated once a module was aboard. It was then towed to the dock, itself a sunken barge protecting the gravel causeway behind it from eroding away through wave action of the sea. Each module was trundled ashore over the causeway.

As each building arrived at its permanent site, the crawlers lowered it with minute precision onto reinforced concrete pilings sunk deep in permafrost. A six-foot space beneath the buildings prevents heat from melting the permafrost and loosening the pilings. It also prevents snow from drifting up against the buildings in winter.

### Fighting subzero cold

Throughout the operation, the temperature never rose above -15° F., with a wind chill factor that brought it to -80°. For a while, the lighters were able to work through fresh ice only a few feet thick—until it began to solidify. Then, even with the constant traffic, the channel refused to stay open.

"Then we got the bright idea of using winches," recalls Jim Lowe, who supervised the unloading. For a while, the heavily loaded lighters, like icebreakers, "rode the ice down," but it was slow going. "We finally had to quit when we were only able to winch one lighter 1500 feet in 72 hours," says Lowe. "By that time, 21 of 36 buildings were off the barges, and 90 percent of the smaller cargo was ashore. Despite the setback, determination at Prudhoe was running high.

With part of their cargo frozen in, the oil companies considered building an ice road to the barges atop the sea ice and crawling the stuff in. But the risks were considered too high. The ice wouldn't be thick

enough until after January, and even then—who knew? "Nobody ever moved anything that heavy over ice before," BP's George Shaw observed.

Most of all, the companies wanted to extend the causeway all the way to the barges, but the state frowned on this, claiming it would upset the currents along the northern coast and possibly erode barrier islands. They may also have been thinking of the legal hassles that might develop should someone want to put a drill rig on the end of it after the building was done.

Whether or not the oil consortium got the last of its cargo ashore was still a question as this article went to press. Next year they plan an even larger shipment.

### New barge concepts

But how can a \$50 million delay like last season's be prevented in the future? One concept is a barge that would be pushed by two tugs tucked into stern notches. It would have a sharp, curling bow, like the cutters, instead of a blunt "sled" front. Naval architects are studying the concept—along with other more-far-out ideas including a sort of train of air-cushion-type vehicles that would skim over the surface of the ice. The "ice road" is still simmering in the back of several minds, too.

Despite the most cautious planning, the North country has ways of spoiling everything. Only days after the oil companies' barges had finally reached Prudhoe, the U.S. Geological Survey reported that the tanker route out of Valdez, southern terminal of the pipeline, might be in jeopardy. The nearby Columbia Glacier seems to be in rapid retreat—which could send up to 50 cubic miles of icebergs directly into the path of the tankers! ★★

**Dante's Inferno** at -55° F. is "the scene" at the Alaska pipeline's Prudhoe Bay terminal in the short winter day where all kinds of activity go on around the clock.



# AIR FORCE. 1-2-3-4 WAYS TO START A GREAT WAY OF LIFE.



Air Force people are special. Trained. Talented. Devoted to service and nation. From Airmen to Generals, we're a worldwide community working to make a great Air Force better—and there are at least four different ways you can become a part of that community.

**1** If you become an Airman, there will be many opportunities for self-improvement through education and service. That's why we have a Community College of the Air Force, and some of the best technical training in the world. We know that the better you get, the better we all get.



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**4** Maybe you're Air Force Academy material. If you think so, try for it. It means a top quality education and an Air Force commission.

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## AIR FORCE A GREAT WAY OF LIFE

# DETROIT LISTENING POST



## Fat C post on new GM cars

Although GM execs and a few privileged outsiders (suppliers) who have seen the company's scaled-down big cars coming this fall give them good marks on general appearance and handling, some sources don't like the thick rear pillar on the B body cars. It interferes with vision out of the rear-view mirror. There's no problem if you mount outside mirrors on both sides of the car, but a minus if you don't have an outside mirror on the passenger side.

## Has GM goofed on big cars?

Ford has been needling GM about having moved too fast in reducing the size of its big cars. Ford execs say GM has goofed this time, that GM owners raised on big, heavy cars aren't going to like the trimmer, plainer pieces. "Too much, too soon," Ford contends. This is what's known as Motown-style guts poker. Ford doesn't really know how GM's new-size cars will be received by buyers. Neither does GM for that matter.

When it comes to prophecy, auto company seers have an accuracy rate on a par with Jeane Dixon and Uri Geller. More misses than hits. Ford is right to the extent that the shrinking of GM's big cars will take some getting used to. But that's not to say they will be duds. GM is a year or two ahead of the other companies in dieting down its big cars, and the other manufacturers will eventually go the same route. One way of bluffing the other players in guts poker is to pass on the draw. "I'll play these." You don't improve your own hand by that tactic, but you might make the other players feel somewhat uneasy. That's the Ford strategy against GM.

**Safe family car for the 1980s** shown in Calspan Corp. mock-up. Based on the Simca 1308 built by Chrysler in France, it is being researched for National Highway Safety Traffic Administration (NHTSA), Department of Transportation. Goal of this \$3.1-million project is a safe car at less than 2700 pounds.



## Aspen/Volare "pull-offs"

Chrysler plans to pull at least two more derivative cars off the new body used for Aspen and Volare. Two luxury sports cars using this body are in the works. They will probably be '78 models, but there's a chance they could be midyear '77s.

## Junior Lincoln next year

Ford is shooting for a March 1977 introduction for its junior-size Lincoln. First public showing will be at the Chicago Auto Show. The body is a stretch-out of Granada/Monarch, but with major reworking so the relationship won't be obvious. This is Dearborn's counterattack car to Cadillac's Seville.

Ford will also have a down-sized T-bird this fall. The present T-bird is built on a stretched shell used for Ford's intermediates—Cougar, Elite, Montego and Torino. The new Bird will use this body without the stretchout to save weight.

## Three-door wagons

Compact wagons and vans the auto companies will bring out in 1979-80 may have only one door on the driver's side but two doors on the passenger side and the customary door or slide-down tailgate (not a clamshell) in the rear. This standard layout for vans is a new idea for wagons. GM, Ford and American Motors are considering the configuration for future vehicles.

## Front-drive big in GM plans

Sources working with GM on down-the-road cars predict that by 1980 GM will have front-wheel drive on 60 to 70 percent of its cars. That's 60 to 70 percent of GM's nameplates, not 60 to 70 percent of production.

GM will apparently go to FWD on everything from intermediates down; stay with rear-wheel drive for most big cars. Two big ones, Olds Toronado and Cadillac Eldorado, will continue to have FWD.

## Timetable for Chrysler mini

Chrysler now expects to do the show-and-tell on the subcompact it is bringing in from Europe in December 1977 or January 1978—six months ahead of the timetable it has been talking about. The Dodge and Plymouth versions will be virtually identical except for nameplates.

For the first year, the car will carry a VW four-cylinder engine. Chrysler has confirmed this. The deal with VW appears to be an interim arrangement, to get the car launched, because Chrysler is working on its own four-cylinder plant—also confirmed—and it should be ready before the 1979 model year.

## Detroit vetoes four-wheel discs

Detroit has come to a parting of the ways with foreign automakers on four-wheel disc brakes. While more foreign makes are going to four-wheel discs, domestic manufacturers are cooling off on them. Not because Detroit isn't sold on the superiority of an all-wheels system. The U.S. companies agree with foreign firms that four-wheel discs are the best brakes you can put on a car.

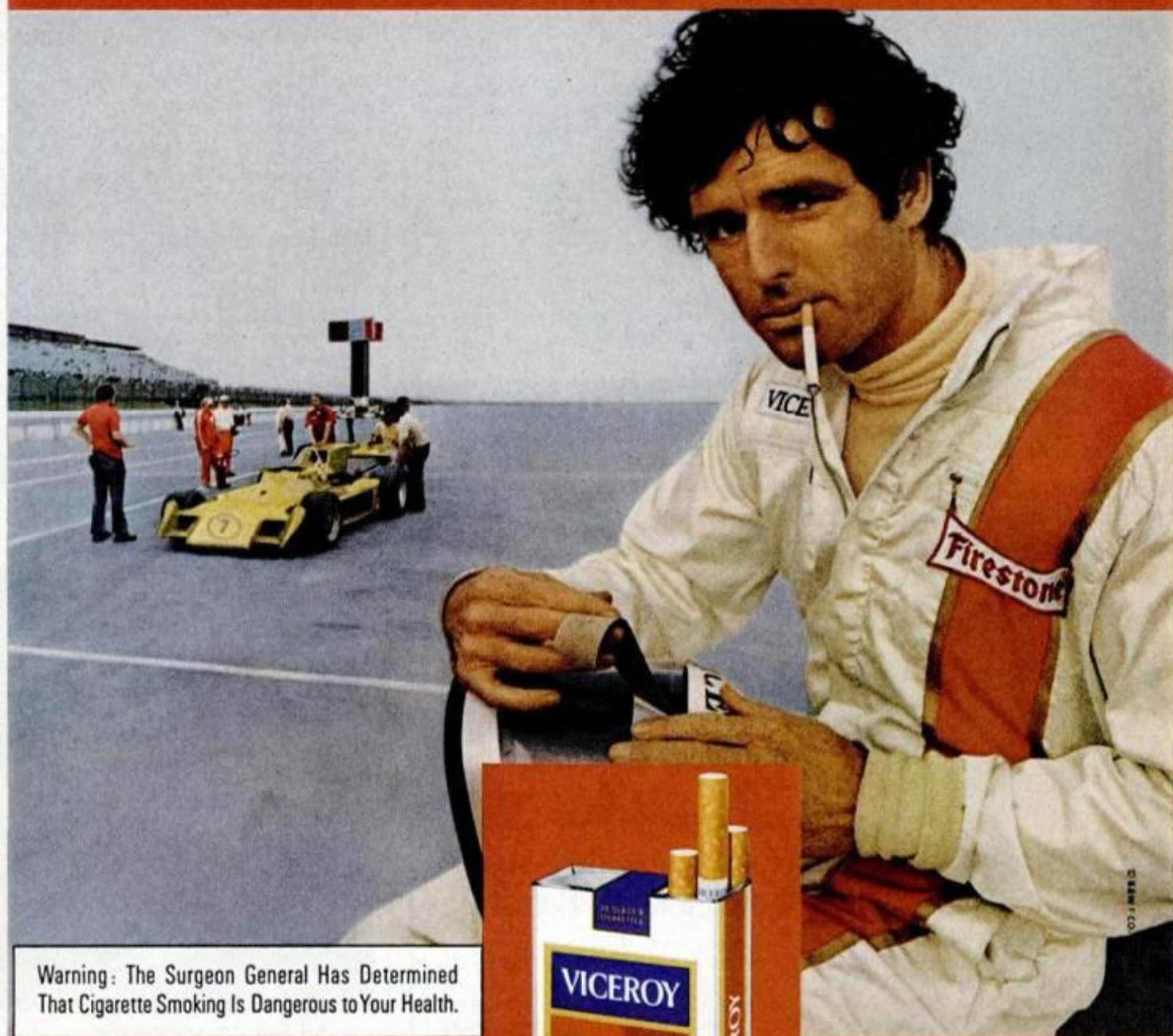
So why is Detroit backing off? Two reasons: 1. They cost a bundle and Detroit doesn't want to add anything to the car that would necessitate a price hike. 2. Small, light cars don't need the braking capacity or braking control you get with a four-wheel system. Front-wheel-only discs are fully adequate for lightweight cars. You may see four-wheel discs on some luxury jobs, but not on most U.S.-made automobiles—not in the next few years, anyway.

## Improved EFI for '77 cars

What happens to a car with electronic fuel injection if an element of the system conks out? Answer: The car quits and sits there. That's one reason Detroit has been cautious about moving to EFI. Bendix, the

(Please turn to page 70)

**“Why Viceroy? Because I’d never  
smoke a boring cigarette.”**



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

16 mg. "tar," 1.0 mg. nicotine  
av. per cigarette, FTC Report Nov. '75



**Viceroy. Where excitement is now a taste.**

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**JOB-FITTED FOOTWEAR**



New — a one year warranty on Thorogood "Wear-Gard" shoes! If the soles don't last for one full year, you get a new pair free. (Same size and style.) Available in both 6" and 8" height in either plain or moc toe.

This new family of Thorogood "Wear-Gard" shoes has been designed for all-day-comfort and year-long durability. Look for the triangle/bar brand on every pair — it stands for "Wear-Gard"—the finest in Thorogood work shoes.

564 — Roan brown leather 8" moc toe boot with cushion-insole, long wearing black gum rubber sole and heel.

**The quality name in work shoes**

Skillfully made by **weinbrenner**

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*"My Heald Super Tryke had 3 times the power, greater top end speed, shorter turning radius, faster start, smoother ride than my friend's (major brand) plus Super Tryke's about \$195 cheaper."*

John J. Pyles, Jr., Venice, LA

A Kit from Heald will get you a rugged work or play machine for much less. Save assembly costs when you build your machine (in 6-12 hours) with our easy 22"×34" assembly chart.

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## DETROIT LISTENING POST

(Continued from page 68)

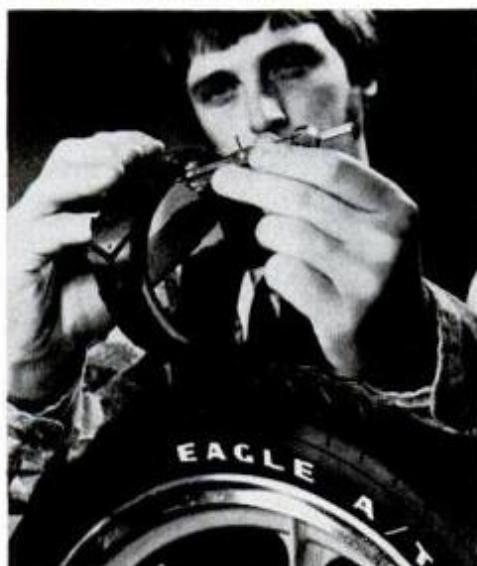
leader in development of EFI in this country, says that concern will not exist on next year's cars. The Bendix unit on '77 cars—Cadillac and Chevrolet's Cosworth Vega—will carry a back-up system that automatically cuts in if the primary unit fails.

Bendix sees no widespread use of EFI on American cars before the 1978-79 models. EFI now costs about four times as much as a sophisticated carburetor. Bendix says that price will come down sharply—perhaps by as much as half—as fuel-injection production goes up. The firm, now installing \$8 million worth of production equipment at Newport News, Va., to build fuel injectors, anticipates most U.S. makes going to EFI by '79.

### Man-bites-dog dept.

A major auto insurance company, State Farm Mutual, faults Detroit for building them better than they used to. It says one reason it costs an arm and a leg to have a car repaired is that the auto companies are putting on better bumpers than the law requires. It wants light, simple bumpers, like those used on Chevette and VW's Rabbit, to cut replacement cost when a car is in a crackup.

### And, an ear on Akron



Greater use of cast wheels for motorcycles is responsible for development of the first tubeless motorcycle tires for street use. In the photo above, a Goodyear engineer checks the depth of an airtight rubber liner that replaces the inner tube. Goodyear's tubeless car tires go back to 1954 so motorists know about the advantages of not having to wrestle with inner tubes. Now motorcyclists will have it easier, too. Goodyear tires come in 10 sizes and are priced from \$45 to \$56. ★★★

# 7 reasons (and more) to buy a new Coleman ...even though the old one hasn't worn out.

Sure, hardly anyone ever throws away an old Coleman lantern (or a Coleman stove). Some of 'em have been around for twenty years or more.

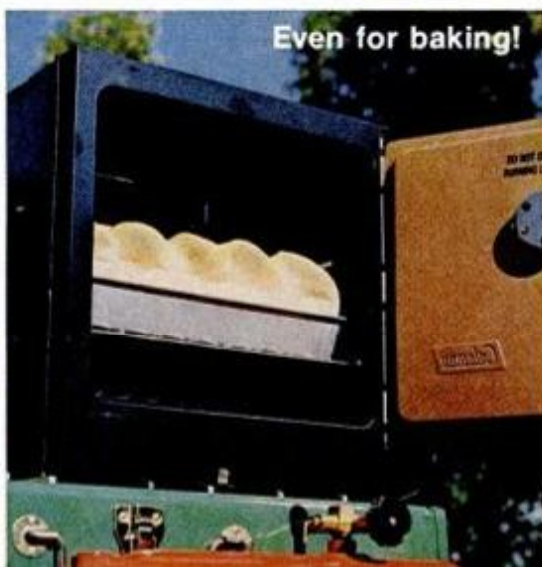
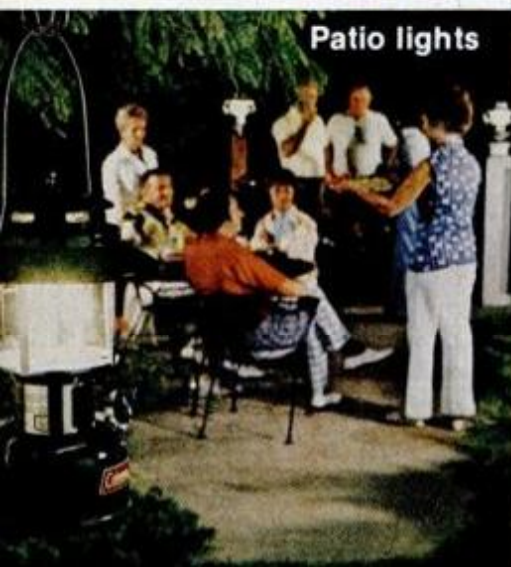
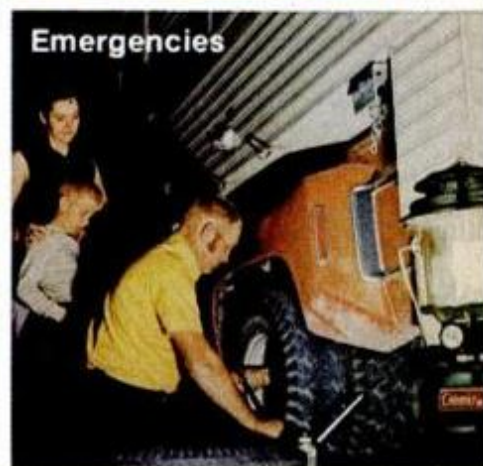
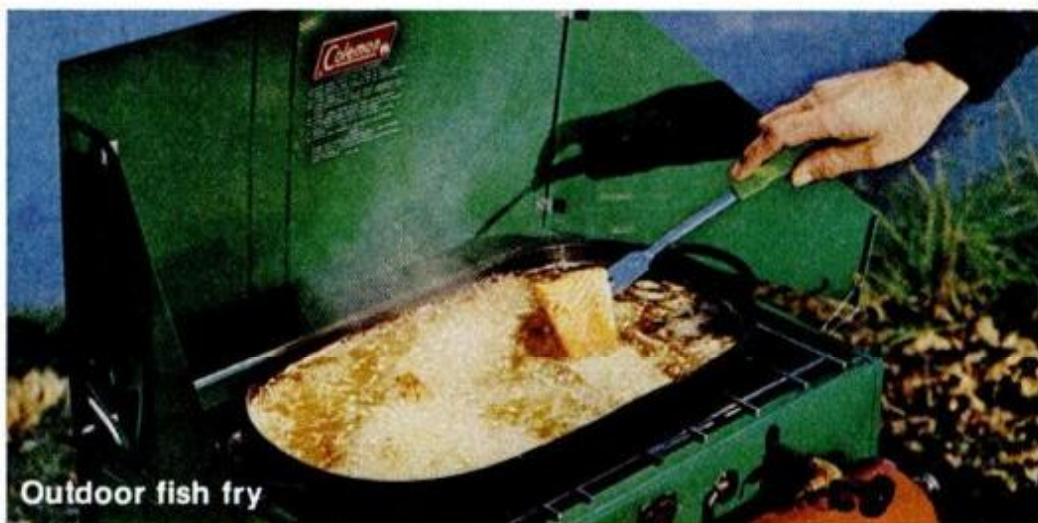
And even though today's Coleman gear looks the same — surprise, it's even better!

For instance, over the past few years we've made seven helpful improvements in our lantern. Among them, it pumps easier than ever. An improved generator lasts longer, with less maintenance. There's a tough automotive-type finish outside. And an interior coating of space-age epoxy that fights rust. We've even printed the

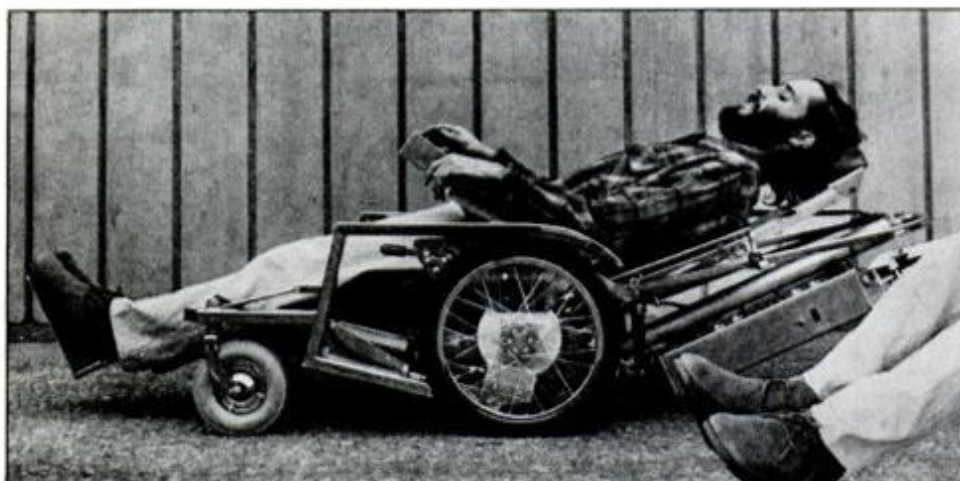
instructions on the lantern for added convenience.

But there are even better reasons. After all, think of all the ways you can use a *second* Coleman lantern. Take it nightfishing while the other is back in camp with your wife. Throw more light around any campsite. Keep an extra one handy in case of power failure. *You* can come up with dozens of other good reasons for a new lantern ... or stove. Just think about it.

**The fun is out there.  
Let yourself go ... with Coleman.**

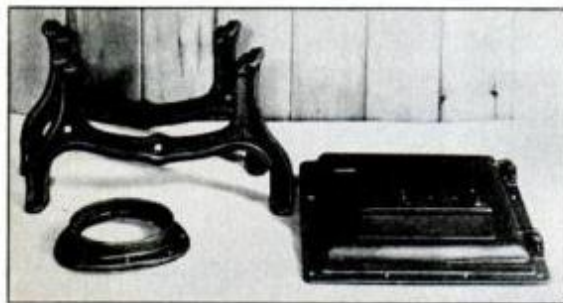


# IT'S NEW NOW



## Electric-drive wheelchair goes up and down, in and out

A radically new electric-drive wheelchair can be lowered or raised 10 to 27 inches off the ground, enabling the occupant to reach fallen objects or even drive a car while sitting in it. As it rises, it narrows from 25 to 21 inches, so the user can pass through narrow doorways. The chair is powered by two 12-volt batteries, controlled by joystick and weighs 250 pounds. It will climb a six-percent grade and go 7 mph tops. Biomedics Lab, University of California, Berkeley, Calif. 94720.



## Build a barrel stove

Those 55-gallon drums that kerosene came in years ago can now be converted into stoves perfect for fishing camps, hunting lodges and workshops. A new four-piece kit provides legs, door with draft and stovepipe flange. Parts are attached to the barrel with sheet-metal screws or bolts to make an efficient wood-burning heater. \$45 f.o.b. L.L. Bean, Freeport, Me. 04032.



## VIP luxury plane cost a dollar (plus a little work)

A dollar to insurers bought the Handley Page turboprop in the picture. But it didn't look this good when Michael Keegan and his 10 mechanics picked it up in a snowdrift it hit at Charlottetown, P.E.I., Canada, made it flyable, limped it home to England and refitted it as a VIP plane.



## Pocket scanner

Scanning monitors that tune in real-life dramas of fire, police, traffic, ambulance, marine, Coast Guard, weather and other public service channels now are mini-packaged. An RCA 4-channel, 2-band pocket VHF Hi-Lo scanner covers 30-50 and 150-174 MHz. A UHF model covers 450-512, including "T" band. VHF model is \$130; the UHF model, \$134.



# Dodge Trucks have got it where it counts.

## **1.** Dodge has the lowest-priced pickup. **1.** Lower than Ford. Lower than Chevy.

If you know trucks, then you know Dodge. You know all about how tough we build our trucks. And you know how well we engineer them. But maybe you didn't know that Dodge makes America's lowest-priced full-sized pickup. The Dodge D-100.\* (Based on comparison of manufacturers' suggested retail prices for 6 cylinder half-ton pickups excluding optional equipment, state and local taxes, destination charges.)

## **2.** Dodge got the best gas mileage. **2.** Better than Ford. Better than Chevy.

Getting great gas mileage is getting to be a habit with Dodge.

In 49 states, a '76 Dodge D-100 with manual transmission and 225/6 cyl. engine beat Ford and Chevy with 25 mpg on the highway, 18 in the city. (Estimated figures from the latest EPA tests.) In California, our D-100 with automatic transmission and the same engine got 23 on the highway, 16 in the city. That beat Ford and Chevy, too. Your mileage may vary, depending on your type of driving and driving habits, your truck's condition and optional equipment.

## **3.** Dodge has the biggest standard payload. **3.** Bigger than Ford. Bigger than Chevy.

Dodge has a payload that can make small work of the biggest jobs. Without beefing it up one bit, you can haul off a whopping 1,505 pounds.



\*Pickup shown - The Dodge D-100 Adventurer, will be priced higher because of optional equipment.



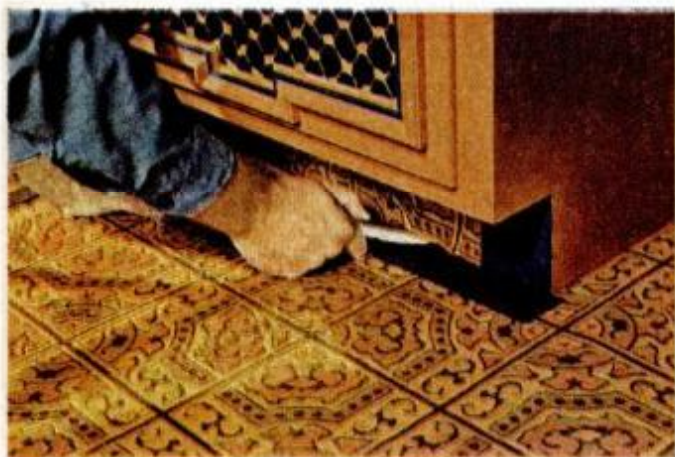
Your wife will love its underfoot comfort.

## Tredway<sup>TM</sup> from Armstrong. The flexible, seamless floor you install with staples.

Now you can give your wife a dream of a kitchen floor—that's not a nightmare to install. It's so flexible, you can fold up enough for a whole room and carry it home.

Because it's 12 feet wide, it will be seamless in most rooms. And when you install it, this same flexibility makes your job even easier.

Tredway is cushioned vinyl, to make it quieter and more comfortable to walk on. And it comes in five richly embossed designs, each in a selection of up-to-date colors, all with the look of expensive glazed ceramic tile.



*Tredway is really easy to install. Here's how:*

First, take up the molding around the perimeter of your room. Second, unroll Tredway and position it against the walls. Fitting and rough cutting couldn't be easier. An ordinary utility knife will do it.

Then you just staple it every three inches around the edges. (In spots where a staple gun won't reach, or over concrete, use a thin band of adhesive under the edge.)

Replace the molding to cover the staples, and that's it. Since Tredway has the unique ability to adjust itself to the dimensions of your room, it will contract and stay taut to hide typical irregularities in the floor below.

*Ask your Armstrong retailer to demonstrate this remarkable new floor for you. Or, send the coupon below for complete information.*



Floor design copyrighted by Armstrong



Armstrong, 7605 Church Street, Lancaster, Pa. 17604  
Please send me brochures showing all the Tredway designs and colors, plus complete installation information.

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Street \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

# THE TWO FACES OF INDY

by Jean Shepherd

With the cry "Gentlemen, start your engines!" the machines—and the merrymakers—roar to life.

**T**he Indy 500 is mid-America's annual Woodstock. A. J. Foyt is its Bob Dylan. Woodstock, for those of you who remember that celebratory happening (and already it's beginning to slip back in time to the land of ancient history and nostalgia), was an immense gathering of starry-eyed Believers. What they believed in, no one quite knew. There was no consensus. It just *seemed* that you should be there, wear funny clothes, bake in the sun or drench in the rain, travel great distances

*Jean Shepherd, radio-TV celebrity and auto writer, has made merry at his share of Indy 500s.*



Man and machine from top to bottom: The legendary turbocharged Offenhauser engine, Bobby Allison conferring with Roger Penske, the Borg-Warner trophy, A.J. Foyt's Coyote being wheeled out of Gasoline Alley and Al Unser ready to leave the pits. At right: the start of the '75 race.



Merrymakers from top to bottom: An old-timer (he's probably seen a couple of Indy 500s already!), the girls strutting their stuff in the prerace parade, people still outnumber the flags, good viewing area behind the pits and the fans get mighty thirsty on a warm race day in May.

Photos: Barry Terzin



to be present, using any means of locomotion available from the thumb to a Ferrari roadster, but to *be* there was all important.

The actual event that occurred was largely lost to the individuals who made up the mob, lost in the milling, the immensities of space, and the fact that that wasn't what you really came there for anyway. True, Bob Dylan was briefly visible, if you could manage to stand on the top of someone's van, or climb a tree, but the illusion of being part of the action is enough for a true believer.

The Indy, as the real fanatics always call it—there *are* other 500s but only *one* Indy—is much like that. To attempt to compare the Indy with any other race in America is like trying to compare Woodstock with your ordinary run-of-the-mill rock concert. It's not that the race itself is any better than any other big-car classic, it's just that it's different, very different.

First, there's tradition. If there is one sporting event in America that has grown year by year, decade by



## Foyt goes for four

**A.J.** is red-hot. When he rolls into the Brickyard with his lucky No. 14 Coyote this month, he rolls in as the defending United States Auto Club (USAC) Champion. This is the *sixth* time he's been entitled to the big No. 1, and in taking the national title he pushed his lifetime Indy-car wins over 50! He'll also take his place on the grid—last year it was the pole—as the "world's best," having just taken the third annual International Race of Champions (IROC) at Daytona.

But SuperTex doesn't look back: When he arrives at Indy, he'll be there just to win another race. If he does, he'll contemplate the history-making feat of being the only driver to win four Indys when the day's drive is over. A.J. doesn't tell you how he plans to win a race—he just wins 'em. Don't be fooled when he draws out a remark designed to lull the likes of Johnny Rutherford and the Unsers running the improved, better-breathing turbo Offy this year: "If it's as good as they say it is, then I'm

Материал, защищенный авторским правом



Art: Ed Valigursky

out to lunch with my V8." Anthony Joseph Foyt Jr. will have something in his lunch bag—no baloney—because, he runs to win.

Foyt's competitiveness is stamped in his personality and in the record books. He hates to lose, because winning is almost all he's known since he started cleaning up on the midget and sprint circuits in the mid-1950s. His first Indy was in 1958; he won in '61, '64 and '67.

Last year, when he won the Twin 200 Champ Car race, he also clinched the

USAC title; it was his 53rd Indy-style victory. Earlier in the year he took the California 500. That win made him the only driver to capture all three events in USAC's Triple Crown: Indy, Pocono and Ontario. His win at Pocono was his second, having taken that race in '73 as well. Then there was the 24-Hours of LeMans in 1967, and then, in stocks, the Daytona 500 in 1972. . . .

A.J. Foyt is the world's winningest driver. All that's left is to win the Indy 500 a fourth time.—B.H.

decade, generation by generation, into anything approaching a true national folk epic, something like Thanksgiving or Christmas or the Fourth of July, it has to be the Indy. When the Indy was first run, in almost exactly the same form as it is today (and that is very important for tradition), the Wright Brothers were young revolutionaries and Thomas Alva Edison was a contemporary force. Teddy Roosevelt was the dynamic John Kennedy of the day, plunging through the trackless wilderness, shouting "Bully!"

The automobile was so new on the scene that millions of Americans had never actually seen one, much less sat behind a wheel. In fact, many automobiles of the day were steered by tillers, the way you steer a lifeboat or a sailing yacht. Arguments raged over which form of power would eventually win out—combustion, steam or electricity. The smart

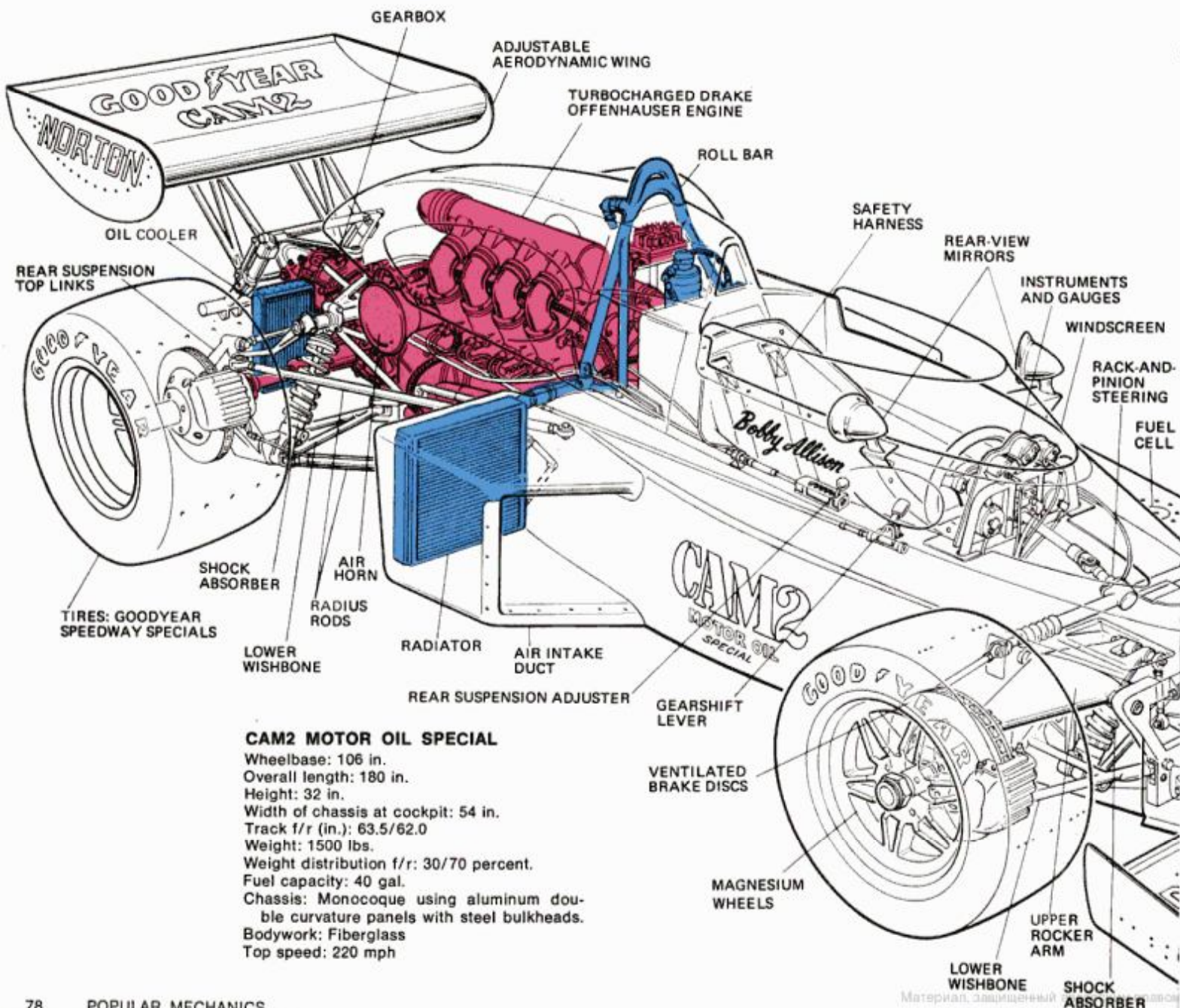
money was on steam—silent, enormously powerful, and somehow romantic since it related the driver to locomotives and ocean-going liners. Henry Ford I ("History is bunk") was almost unknown, except as a race driver who was beginning to sell cars. World War I, for Americans, was years away and gentlemen wore derbies and top hats while ladies sported bustles and carried fans.

Most of the crowd attending that first race actually could remember hearing reports about the death of General Custer out in the Little Big Horn country, which might as well have been on the moon.

The race, which was won by a laconic engineer named Ray Harroun, was run on the same grounds that still resound every year to the roar of the crowd and the boom of lethal machines. Even then there was a wild, circus/fairgrounds atmos-

phere that included a balloon race (incidentally, still celebrated symbolically by the release of balloons just before the green flag falls), and the wearing of fancy clothes by the spectators, and the hawking of souvenirs.

The only other American event that remotely approaches the Indy in longevity, color and tradition is a spectacle that unfolds annually only a couple of hundred miles away—the Derby. *The Derby*. Both are, theoretically, run strictly for the purposes of "improving the breed." In the early days of the Indy, the "improvement of the breed" was a reality, not just a legend. The cars that battled it out were being produced, one at a time, for the gentry. Cars simply were not for ordinary people, any more than a thoroughbred racehorse is for your average walking-around citizen. Stutz battled Marmon; Duesenberg challenged Studebaker



for the glory of taking the checkered flag and proving to the world that they were the best.

Incidentally, in those days Indiana craftsmen built the greatest cars in America, in the same way that Kentucky produced its greatest horses. Auburn, Duesenberg, Studebaker, Cord were just a few of the great Indiana breeds. Fred and Augie Duesenberg, whose work today stands proudly in the world's museums, are largely unknown to their fellow Americans as men, but "It's a doozy" has entered the language. They dominated the Indy for years, and their proudest claim was "You can drive a Duesenberg off any showroom floor and win the 500." And they did just that.

Today's race is startlingly like the very earliest of Indy classics. Four wheels on rubber, a lethal engine, a slit-eyed man behind the wheel, the roaring crowd, the sun, the rain, the

spine-tingling thunder of enormous horsepower, and, of course, possible death.

The machines they drive today, even as the very earliest they ran at Indy, are simply not for your average man. The Duesenberg wasn't; nor is the Eagle Offy. Even though he shunned it, there was something curiously godlike about Ray Harroun. Crowds followed Louis Chevrolet wherever he went, just as today the thousands hope to glimpse A.J. Foyt or Mario Andretti or Bobby Unser as they push their cars out of the garages just before noon along Gasoline Alley, with its peeling paint and ancient wooden huts, out onto the starting grid lineup for the big one.

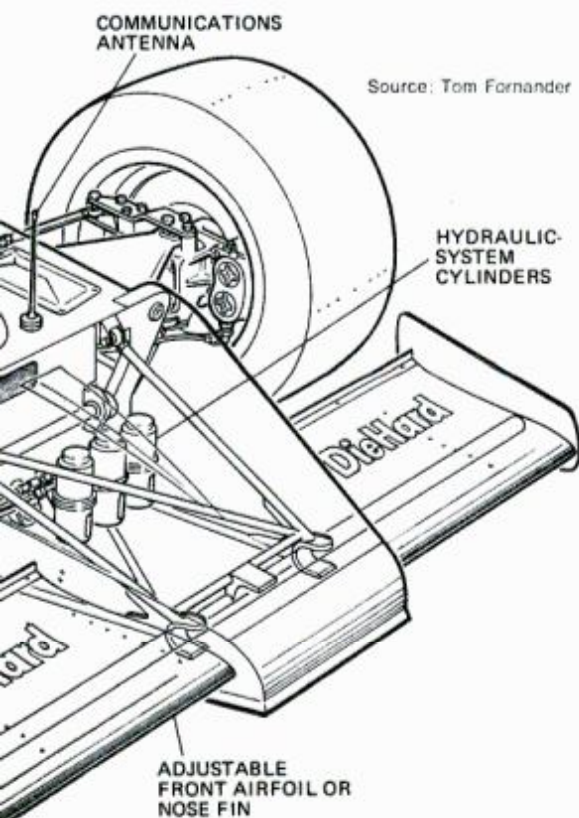
There will be those in the crowd who haven't missed a race for 50 years and more, and there are many more who will be seeing their first Indy this year, but they are all part

of the same celebratory tradition. It's as hard to imagine America without the Indy as it would be to imagine it without the Derby, or the Fourth of July, or the legend of Babe Ruth.

Weeks before the day of the race, the faithful begin to gather from all parts of the land, lining the streets of Indianapolis with their cars bumper to bumper, their sleeping bags, their campfires, their jackets covered with patches, their beer cans, their crying babies and barking dogs, all waiting for that boom of the cannon which announces that the infield is open, to go charging fender to fender like a herd of demented buffalo to get that same spot they have occupied for years, to put up the tent and to pop the first can, and to instinctively celebrate something indefinable in the restless American spirit, the urge to move, to compete, and to eat hot dogs in the sun. ★★ ★



PENSKE RACING'S McLAREN DRAKE OFFYS



Source: Tom Fornander

**W**hen the green is out and the pace car swings into pit row on May 30, the scream of 33 engines will fill the Speedway as drivers jockey for the fast groove through Turn One. On the main straight, before car after car whips into the first turn, engine revs will be reaching a crescendo of 9000 rpm.

Almost all of the cars will be propelled by an incredible 800-hp engine: the turbocharged Drake Offenhauser, a four-cylinder, fuel-injected, twin overhead-camshaft powerplant that displaces a slight 2.6 liters, or 159 cubic inches. It has been improved again for this year and it'll be used by most of the teams, including Penske Racing's two-car entry shown at the left. Both cars are McLarens: The CAM2 Motor Oil Special, cut away to show construction details, will be driven by Bobby Allison, and the Norton Spirit, shown at speed in the photo, will be piloted by Tom Sneva.

It's Penske Racing that still holds the record average speed for Indy, set in 1972 when Mark Donohue was the first to cross the finish line after averaging 162.962 mph for 500 miles.

While most of the engines powering the racers will be Offys, the most prominent cars will be the Eagles of Dan Gurney. The mounts for roughly half of the field will be Eagles from Gurney's All American Racers.

The 33 cars that over 300,000 spectators will see at the Brickyard—from Foyt's shovel-nosed Coyote to the super-side-scooped McLarens—will be alike in many ways and different, too; certainly in their razzle-dazzle colors. In each car will be one driver, alone for 500 very fast miles, with each one determined to win this, the 60th running of the classic race.—B.H.

**S**oon after sunrise each day, the yellow and black helicopters lift off from bases scattered along the Texas and Louisiana coasts, their rotors cleaving misty air as they hover over their pads for an instant. Then, with nose slightly lowered and rotors spinning faster, they sweep out toward the sea to deliver men and supplies to the drilling rigs and production platforms that dot the Gulf of Mexico.

The chopper is the airborne taxi, the delivery truck, rescue vehicle and ambulance of the offshore-oil fields. Most of the copters in the Gulf—and there may be more than 300 operating there on a given day—wear the yellow and black colors of Petroleum Helicopters, Inc., the world's largest commercial rotary-wing operation.

Started in 1949 with three copters, PHI today has a fleet of 235. It takes 485 pilots to fly that many birds and 470 mechanics and other maintenance people to keep them humming. The company's 15 heliports rim the Gulf's north coast from New Orleans to Corpus Christi, Tex. Overseas bases are located in South America, Africa and Saudi Arabia.

Though production in the Gulf has been tailing off in recent years, it

**"It sure beats bouncing around in a boat."** That's the sentiment of most offshore-oil workers when it comes to a choice between the copter and the crewboat in taking them to their rig or platform. The choppers (bottom photo) also handle construction work.



## A roughneck's best friend is a noisy yellow bird

The choppers take oil men to their jobs, keep them in supplies and—when the chips are down—come to their rescue.

by John F. Pearson  
SCIENCE EDITOR





is still one of our prime sources of crude oil and natural gas. In 1974 (the last year for which figures are available) some 8.8 million barrels of oil a day were produced domestically in the United States; of these, 1.1 million barrels came from offshore wells in the Gulf. Similarly, of a daily domestic production of 59.2 billion cubic feet of natural gas, about 11.3 billion cubic feet was piped from the Gulf.

It requires some 10,000 miles of pipelines on the sea floor to carry the oil and gas to onshore refineries and transmission stations. Of the several thousand steel structures that can be seen on the Gulf's surface, over 1000 big production platforms are equipped with helipads. So are the 90 or so drilling rigs usually at work.

All this offshore activity requires the services of about 25,000 workers. Platform and rig crews work a seven-day week, 12 hours a day. After a week's work, they get a week off. All of them aren't transported by helicopter. Many ride crewboats, but an eight-hour trip in a bouncing boat is a lot harder to take than a one-hour flight. With the search for oil moving farther offshore, one-way trips of 140 miles are becoming more frequent.

The copter's speed is also reassur-

ing to the offshore worker. The roughneck or toolpusher in the Gulf knows that if he gets hurt, he can get help in a hurry. On one night a while back, PHI choppers flew five emergency missions, picking up injured workmen on platforms and delivering them to hospitals along the Louisiana coast. (This is an area where many hospitals have helicopter pads.)

### Lifesaving by rotor downwash

Through the years, emergencies of many kinds have tested the skills of PHI's pilots. There was the time, for example, when park rangers near Corpus Christi asked for help in the search for a teen-ager. The lad, a deaf-mute, had been swept out to sea while playing with a small raft.

Pilot Harry Bates took off from the Corpus Christi base, skimming the water as he searched for the boy. He finally spotted him three miles out. Instead of calling for more help, Bates simply hovered over the raft and angled the rotor's downwash so that it blew the raft, bit by bit, all the way back to shore.

A more spectacular test came in 1957, when Hurricane Audrey roared up from the Gulf, causing widespread damage and killing hundreds of persons. PHI copters played an

important role in the moving of offshore workers to places of safety. Later, PHI was called upon to rebuild power lines knocked down by the hurricane. Helicopters proved especially useful in planting power poles in remote swamps and bayous.

In 1960, when Hurricane Donna lashed Puerto Rico and caused severe flooding, PHI choppers were on hand to rescue 216 women, men and children, many of whom were stranded in trees and on rooftops.

Construction work has taken PHI crews to many places away from the Gulf: to Vermont, where they hauled and installed ski-lift towers; to Kentucky for power-line work; to West Irian, Indonesia, to haul machinery and supplies in the building of an access road to a big copper mine located on an 11,500-foot mountain.

The rugged terrain, stiff winds and heavy rainfall that severely limited flying time made this a tough mission. As reported by pilot Dick Lederfine, an especially ticklish chore was the delivery of survey crews to a wooden platform on the peak of a 10,000-foot mountain.

The platform was strong enough to support only the survey crew; the added weight of the copter would have made it collapse. So the pilot had to lower his craft with delicate care, maintaining lift with the rotor while his passengers debarked with their gear. The copter also had to fight constant winds. To top it all, the platform was so small that the pilot, according to Dick Lederfine, had to "line up his landing by watching a rear-view mirror attached beneath the front of his ship."

### Mid-air catch for NASA

PHI has also hauled equipment in the Rocky Mountains for U.S. Geological Survey teams, sprayed crops in the tropics, helped recover spacecraft in the Atlantic. One of the company's proudest claims is that one of its choppers made the first mid-air capture of a scientific payload parachuted from one of NASA's suborbital space vehicles.

But hauling passengers in the Gulf—at a rate of 70,000 each month—remains PHI's main assignment.

PHI operates a variety of helicopters. Twin-turbine, 15-place Bell 212s are the workhorses in the rotation of drilling and production crews. The faster five-place Bell Jet Ranger IIs are used for supervisory personnel who may want to hop from platform to platform. The company also has other Bell models, some Hughes 500s and a number of foreign-made jobs.

The company's operation and

*(Please turn to page 216)*



Some of the Petroleum Helicopter company's birds are based on rigs and platforms in the Gulf. To service them, mechanics are flown from PHI's Morgan City base. The man shown is working on a Bell 47G-4A. The Morgan City layout (also shown), said to be the world's largest commercial heliport, has 46 pads. The air really hums here during the early morning "rush hour."



# Our newest destroyer: swift and sneaky

by John F. Pearson  
SCIENCE EDITOR

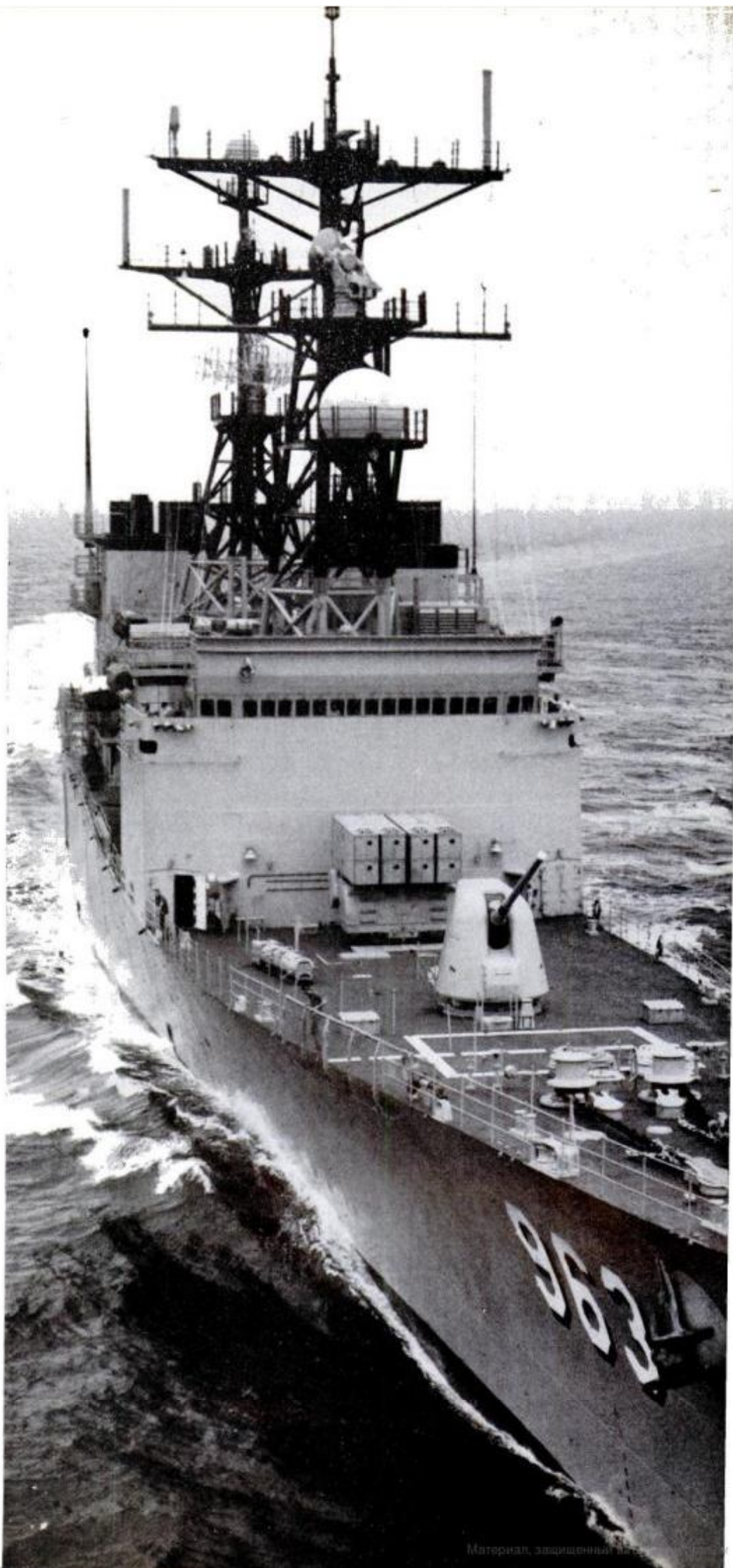
If you served aboard a U.S. destroyer of World War II vintage, you know that life at sea can be a series of gut-wrenching pitches, plunges and rolls—all experienced within the confines of an oversized sardine can.

Well, mates, I'm happy to report that the Navy's newest destroyer is a different brand of tin can. Two days aboard the USS *Spruance* (DD-963) convinced me that the ship lives up to her early press notices. A preview article in *PM* (*First Look at the Navy's New Destroyer*, page 78, July '71) hailed the vessel as the swift, superquiet subhunter needed to counter the growing threat of the Soviet undersea fleet.

The *Spruance* is the first of 30 ships to be built in this class. She is 563 feet long, has a beam of 55 feet and displaces 7800 tons, more than three times the heft of the typical 2200-ton destroyer of World War II.

The *Spruance's* keel was laid in November 1972 at the Pascagoula, Miss., yard of the Ingalls Shipbuilding Div. of Litton Industries, and she was commissioned in September 1975. About a month later, I boarded the ship at Norfolk, Va., invited along as a "ship rider" for a two-day run to Port Everglades, Fla. In addition to the crew, my shipmates in-

**Off Florida coast, Cmdr. Raymond J. Hartbrecht, skipper of *Spruance*, briefs author**





**Complete control** of ship is maintained from bridge. Console (foreground) keeps commander in touch with the status of targets tracked. Speed and direction of the ship are controlled from the console at left.



**Targets** are detected and weapons are fired automatically from the below-deck Combat Information Center. Advanced electronic gear is used here to process the inputs from radar, sonar and communications systems.



**Performance** of the main propulsion engines, electrical generators, oil and fuel pumps is continually monitored in the Central Control Station. Warnings of abnormal conditions are also flashed on consoles.



cluded about a dozen civilian engineers and technicians. They were slated to stay aboard for several weeks, working with the crew to debug systems and equipment as the *Spruance* continued her sea trials in the Caribbean.

The *Spruance* is a versatile, multi-mission ship, able to operate effectively alone or with a carrier task force. Though she can carry out all the traditional destroyer missions—from supporting troops in amphibious assaults to enforcing a blockade—she was designed primarily for antisubmarine warfare.

### Special equipment

She is equipped with the most advanced underwater detection and fire-control systems yet developed. Her main sub detector is installed in a large dome in her bow. This long-range sonar can detect, identify and track multiple underwater targets. The sonar is the first in the Navy to be linked directly to digital computers, insuring swift and accurate processing of target information.

Surveillance gear aboard the ship's two helicopters also helps put the finger on enemy ships. The information not only appears on displays in the chopper, but also on the consoles of the Combat Information Center aboard the ship. This is the "war room," the nerve center where all the target information comes together and where the *Spruance's* weapons—antisubmarine rockets, surface-to-surface and surface-to-air missiles, torpedoes and guns—are electronically fired.

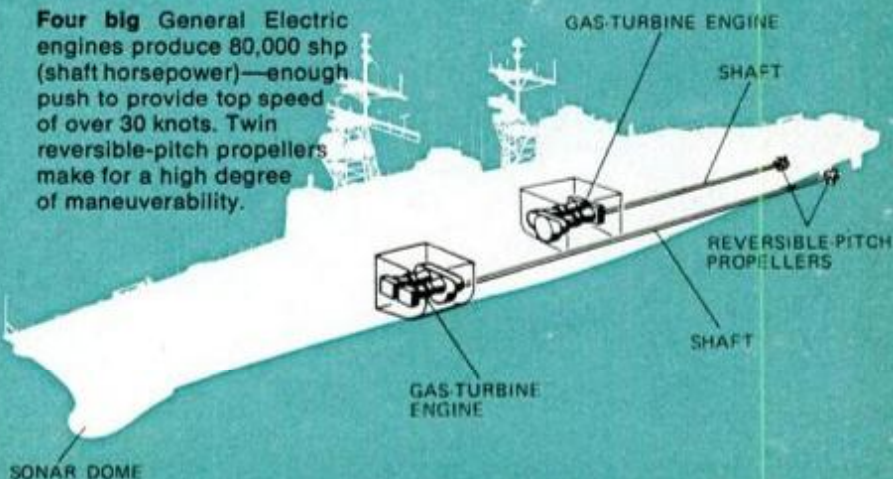
This was one of the few areas that, understandably, was "off limits." Otherwise, I had the run of the ship.

Quiet operation is as essential to

*(Please turn to page 214)*

### Power for go-go ship

Four big General Electric engines produce 80,000 shp (shaft horsepower)—enough push to provide top speed of over 30 knots. Twin reversible-pitch propellers make for a high degree of maneuverability.



# 10 ways to keep vegetarians out of your vegetable patch

Those carefully nurtured greens taste as good to varmints and bugs as they do to you. These tips will help you keep your crop for your own table.

by Glenn Hensley

**Y**our spring garden is bursting through that carefully worked soil and you're watching it grow with increasing anticipation. Already, you can almost taste the good things it promises to provide in plentiful quantity.

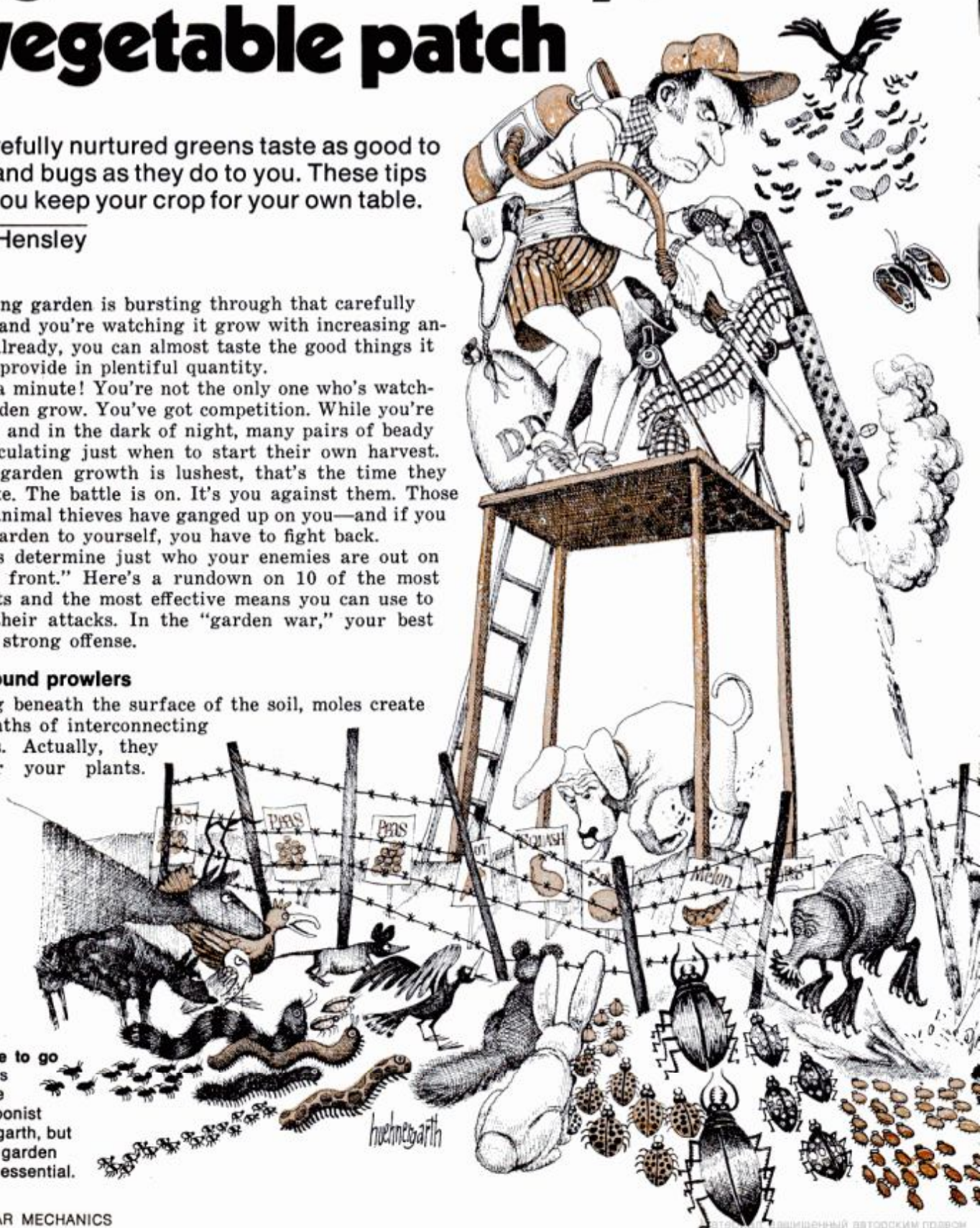
But wait a minute! You're not the only one who's watching that garden grow. You've got competition. While you're out of sight, and in the dark of night, many pairs of beady eyes are calculating just when to start their own harvest. When your garden growth is lushest, that's the time they usually strike. The battle is on. It's you against them. Those pesky little animal thieves have ganged up on you—and if you want your garden to yourself, you have to fight back.

First, let's determine just who your enemies are out on the "garden front." Here's a rundown on 10 of the most common pests and the most effective means you can use to discourage their attacks. In the "garden war," your best defense is a strong offense.

## 1. Underground prowlers

Burrowing beneath the surface of the soil, moles create their labyrinths of interconnecting travel tubes. Actually, they aren't after your plants.

You don't have to go to the extremes illustrated here by famed cartoonist John Huehnergath, but some forms of garden protection are essential.



They want a hearty meal of worms and insects. But in their searching and tunneling, they can dislodge more plant roots in a minute than healthy seed can sprout in a month. So Mr. Mole's pointed portrait should appear on your "most-wanted-out-of-there" list.

Agricultural and conservation authorities say the best mole control is accomplished by trapping. Choker traps and harpoon traps have proven adequate for the task. The best time to trap is in early spring when the first mole ridges appear.

Find the active mole runways by mashing down the ridges where the runs have entered the edge of your garden. Watch to see which ones the moles will raise again. You can assume that the rebuilt runways are in regular use, so start your trapping there. Install either the harpoon or choker-type trap at those points according to instructions that come with the devices. Such traps are easy to set and are available at hardware stores and garden supply centers.

## 2. The 'friendly' cottontail

And now for another "enemy." He's bouncing along the edge of your garden, flashing a fuzzy white tail, and he's looking for just one thing—a free meal, courtesy of you and your garden. Get rid of him or he'll achieve his goal.

Rabbits do more damage to the actual plants than do moles, for a cottontail likes to chomp on stems and leaves of vegetables.

So here's your battle plan: Try wire guards around individual plants if you have the room for them. Hardware cloth, also known as chicken wire, works well. Make the guards high enough so that a rabbit can't stand up on his hind legs and reach his lunch.

Repellents can help you cut damage, too. Area or odor repellents, though, are not very effective. These might include mothballs, creosote oil and similar substances. Apparently a rabbit's "taster" is more sensitive than his "smeller," for taste repellents are much more effective in sending him scotting.

During the growing season, you can discourage rabbits by spraying nicotine sulfate on your garden. Add half a teaspoon of 40-percent nicotine sulfate to one quart of water. You may also wish to try one, or several, of the commercially prepared repellents that are available through garden supply stores. Some of these are:

*No Nib'l* can be dusted on or it can be sprayed. The can has a shaker top for dusting. If you want to spray, mix the contents of the 6-ounce can with 2½ gallons of water.

*Improved Z.I.P.* is sprayed on. Use one quart of the material to 7 quarts of water.

*Arasan 75* is another spray-on repellent. Add one quart Rhoplex AG-33 or Latex 512R to 14½ quarts of water. Mix thoroughly with one pound of Arasan 75. Strain and then stir frequently while using.

*Arasan 42-S* sprayed on works well. Add one pint Rhoplex AG-33 or Latex 512R to 7 quarts of water. Mix thoroughly with one pint of Arasan 42-S. Mix only enough repellent for immediate use as the solids settle after standing several days and you'll have trouble getting them to resuspend. It may be necessary to spray frequently in order to cover new growth.

**Caution:** Do not treat your vegetables after edible portions have started to form on beans, cabbages, lettuce and the like as the repellents may be caught in them and retained. If they are, more than the rabbits will be "repelled."

Make life tough on your rabbit-type moochers. Cleanly cultivate the area around your garden, removing brush piles and heavy wood growth. This takes away a rabbit's natural cover and tends to reduce his desire to hang around for a hand-out. And don't forget that conservationists recommend intensive hunting (where legal and safe) as a measure to keep rabbit numbers within reasonable limits and to reduce damage caused by them.

A final weapon in your rabbit arsenal is a good box trap. Plans for building a simple homemade trap are shown on the following page. This is a humane method because you don't kill the animal. You take the trap far away in the

woods and release your catch without harm.

## 3. Gophers go for food

If you're in gopher country, you know these small ground squirrels "go fer" roots, fruits, seeds and leafy garden vegetation. Their favorite food-hunting sport is digging up recently planted vegetable seeds. They seem to like sweet corn best.

Control measures include the use of poisoned bait. If you expect to use this tricky stuff, you'll be wise to talk to your local agricultural extension service personnel (state college of agriculture people) for advice on handling. When *correctly* distributed, there is little hazard to beneficial wildlife or livestock.

Ground squirrels can be gassed with calcium cyanide, but this, too, is a highly dangerous substance and should be used only with extreme caution. It releases deadly hydrocyanic acid into their burrows (upon contact with air) and that's a powerful gas.

Trapping is your safest method for eliminating ground squirrels. Either No. 0 steel traps or regular wooden-based rat traps can be placed in shallow pits near burrow entrances. Lure your victim to the traps by sprinkling small amounts of grain on the thin layer of dirt covering the trap trigger.

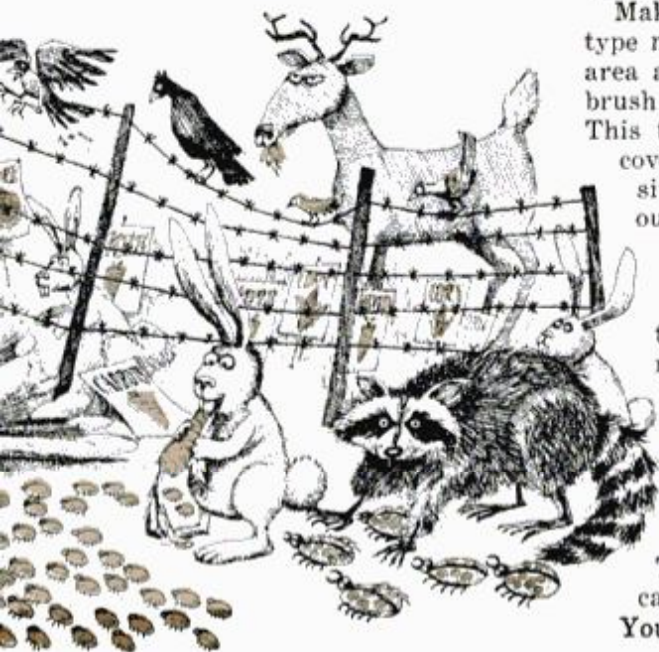
## 4. The masked villain

Raccoons come, all dressed for the part, as they make like robbers and steal from your growing garden. Their black, eye-mask faces may make them look cute, but they can make fast work of eliminating your garden goodies. They like corn, especially when the ears are in the milk stage.

Raccoons are easy to catch with traps that don't kill. However, if you want to go after them with a vengeance you can use No. 2 double-coil-spring fox traps. Several kinds of "sets" are successfully used, but the "dirt hole" is probably the best.

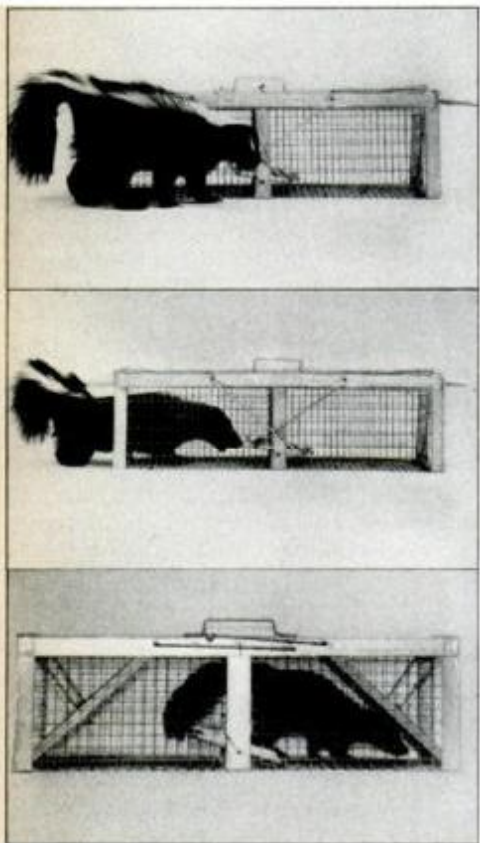
Set the trap about a ½ inch below the ground, one or two feet from the side of a coon trail alongside the garden. Cover lightly with sifted soil. Cover the trap pan with a piece of tissue or canvas to prevent dirt from getting under it and locking it open. Dig a small hole about 6 inches deep and 3 inches across at a slant just behind the trap. Raccoons are attracted to such a set by the use of a gland lure in the dirt hole in winter and early spring and by the use of a food lure the rest of the year. Both lures are available from trapping equipment suppliers.

You can also try using a steel-



cage live-trap, baiting it with some freshly cut corn. If your coons are familiar with human scent, you may catch the culprit this way. In his trap, transport him far enough away so that when you release him, unharmed, he'll have to find someone else's garden to plunder.

Ordinary fencing will not keep raccoons from your garden. If they can't go under it or through it, they'll wiggle themselves over it. However, since raccoons prefer late lunches—in the dark—you can sometimes deter them by hanging some



**Metal Havahart traps** come in sizes that will accommodate anything from a mouse to a fox. For a free booklet on humane trapping, write: Allcock Manufacturing Co., North Water St., Ossining, N.Y. 10562.

lights around the garden. The more movement the lights have, the better, but don't count on this method for 100-percent success.

Oil of mustard is obnoxious to animals—as well as to most gardeners. If you can stand the stuff, you can mix one ounce of oil of mustard and one ounce of household detergent with one gallon of water. Spray applications at three-day intervals may be necessary to stop persistent raccoon raids. Don't spray directly on sweet corn ears, but treat the ground around the stalks late in the evening.

### 5. Opossums aren't choosy

Opossums will eat practically anything. If they're plaguing your gar-

## Bugged by bugs? Here are helpful tips on how to keep them away

The following information was compiled by the U.S. Department of Agriculture and includes many simple home remedies that can be used to keep harmful insects out of your garden.

**Plants that help plants:** Intermixing certain plants with your garden vegetables, called interplanting, can help eliminate many varieties of pests.

- Marigolds rid the soil of nematodes and Mexican bean beetles. Grow them where tomatoes and eggplant are to be planted the next year. Because the poison that kills these pests is produced in the roots of marigolds and released slowly into the soil, its best effects may not show up the first year.

- Nasturtiums deter aphids, squash bugs and pumpkin beetles. Grow them between vegetable rows and around fruit trees.

- Rosemary wards off the cabbage moth, bean beetles and carrot fly. Plant it around the borders of your vegetable garden.

- Sage deters the cabbage moth and carrot fly. Plant it with rosemary, cabbage and carrots, but keep it away from cucumbers.

- Chives help to keep Japanese beetles away from raspberries and grapevines.

- Onions repel most pests, can be planted in and around your garden.

- Mint deters the white cabbage moth and ants. Plant it alongside cabbages and other members of the cabbage family.

- Soybeans shield corn from chinch bugs. Plant them in alternate rows with corn.

- Garlic repels aphids as effectively as a strong garlic breath does humans. Plant garlic cloves near cabbages and fruit trees.

**Homemade insecticides:** Many common household items can be used effectively in the battle against bugs. Here are a few:

- A strong soap-and-water solution sprayed on plants will rid them of aphids and mites.

- Garlic oil spray will fight off onion flies, aphids, thrips and the ermine moth. Onion and chive sprays are also effective against the same pests. (A spray can be made up by chopping or grinding these into fine particles, mixing with water, then straining out the particles to form a clear solution.)

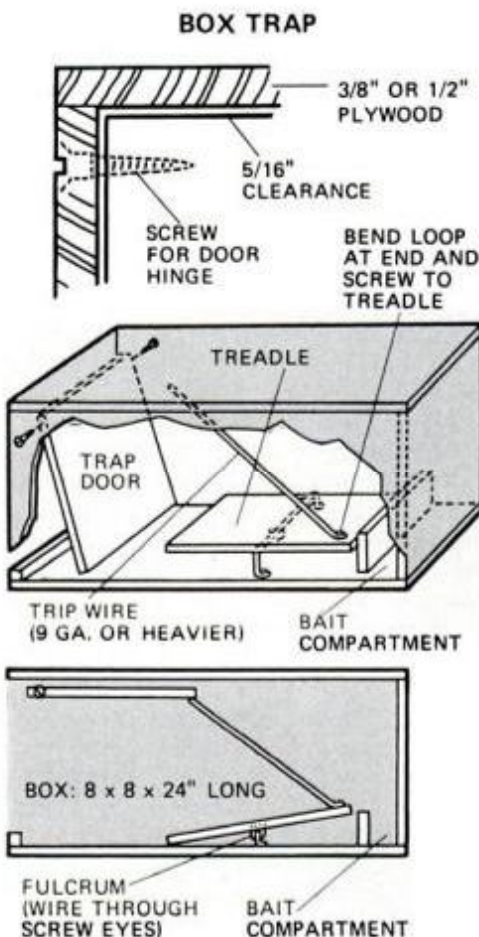
- Mineral oil applied to corn silk

*(Please turn to page 221)*

den, you'll have to trap them. Repellents seem to have little effect on these night prowlers. No. 1½ or No. 2 steel traps, set in natural or artificial openings in their den areas, will "stop them in their tracks." For bait, use meat scraps, fish or moist dog food.

### 6. Pets can be pests, too

Ordinary domestic animals can wreak havoc in your garden when the neighbor's pooch chases your cat through your pumpkin patch. Con-



**Simple box trap** for rabbits and other small animals can be made from scrap wood.

trol? Probably a strong fence, or maybe a permanent leash for both of the villains.

### 7. Would you believe turtles?

Box turtles thrive on tomatoes, especially those found lying directly on the ground. You can foil this mobile-homed nomad of nature by driving four or five-foot stakes alongside tomato plants and then carefully tying the plants up to keep the tomatoes off the ground. A tomato-climbing box turtle is a rarity, even in today's times of advanced technology.

### 8. Scaring away squirrels

Red and gray squirrels have been

*(Please turn to page 221)*

# IT'S NEW **NOW**

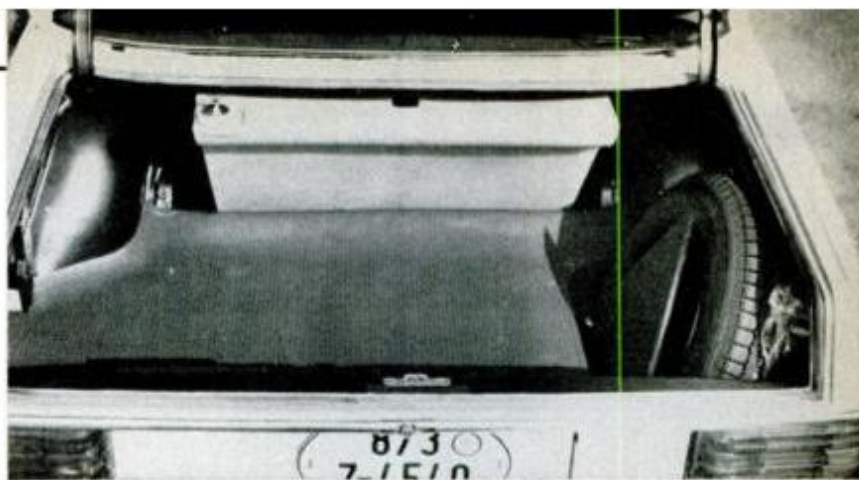


## Making little slides look big

Slip your slides into this pocket-size viewer, peer into the eyepiece—and stand back! The mini viewer gives 5X magnification and has a built-in light source. Result: A 35-mm slide looks like an 8x10 blowup held 14 inches away. It uses two C cells, is \$6. Kalt Corp., 2036 Broadway, Santa Monica, Calif. 90404.

## Anyone for bedroom leaf rakes?

Latest in four-poster beds is this one with living (plastic if you prefer) birch trees for posts. Either way, the price is the same, only with plastic you won't have to rake leaves off the down quilt every fall. \$100 per "post," plus \$500 for the bed. Abraham & Straus, Fulton Ave. and Hoyt St., Brooklyn, N.Y. 11201.



## Fuel tank for foreign diesels

Diesels are a pleasure—but also a pain when you wheel into a service station and find no fuel. Now there's a 25-gallon auxiliary tank of tough molded polyethylene you can install in a Mercedes or Peugeot trunk in an hour. The 20-pound unit tucks away forward of the rear axle for good weight distribution and fills from inside the trunk. Cap and vent are tied into existing systems to prevent spills or leaking fumes. It operates with a manual valve. \$149. Barton Industries, Box 415, Oakland, Ore. 97462.

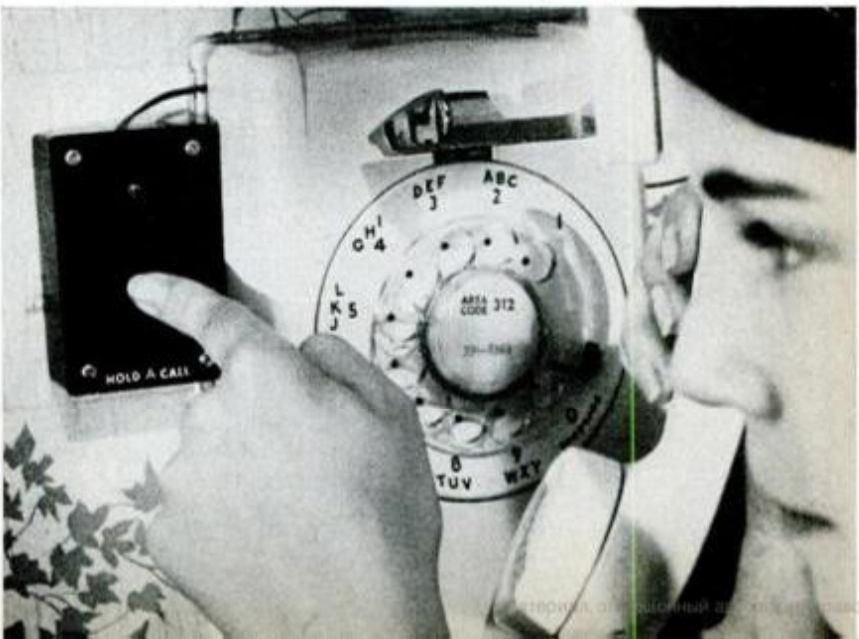


## Seal metal seams with tough cement

Cracks, pits and leaky seams in metal gutters, nonpressure drains, watering cans, storm-window frames and the like can be filled and sealed with a water-based cement. The compound, Elmer's Metal Mender, makes a tough, flexible bond to most metals including iron, steel, brass, copper, galvanized metal, tin and aluminum. It's fast-drying, spreads easily, can be sanded, painted. Borden Chemical, 180 East Broad St., Columbus, Ohio 43215.

## Plain and fancy "Hold-a-Call"

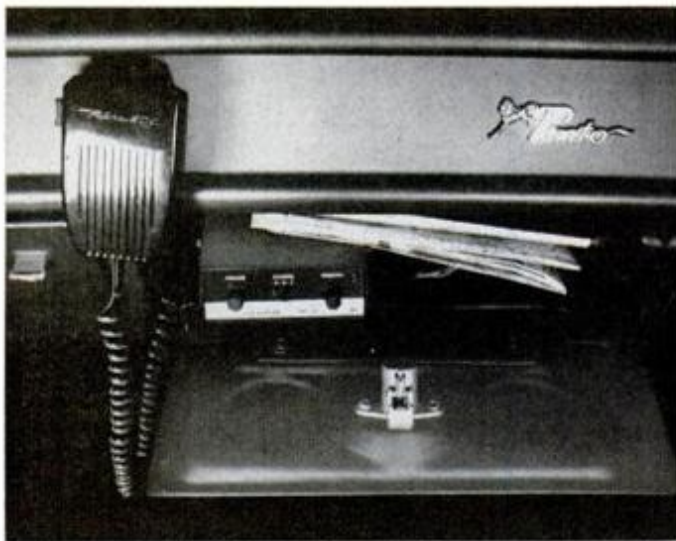
When the call is for someone else, press the button, hang up and alert the recipient. The party being called picks up the nearest phone and "hold" is released. No racing around with phones off the hook and back to hang up. A "music-on-hold" option is available to soothe "holders." Single-line hold costs \$20. Rampart Sales Co., Box 11159, Chicago, Ill. 60611.



# How to find the best spot for

by Anthony R. Curtis

Photos by the author



**Interesting CB installations** include center-mounted set with telephone-type handset hooked handily over rim of dashboard padding (top); small set hidden in the glove compartment (above) to elude thieves (but don't leave a telltale microphone clip nearby as a tip-off; this mike is magnetically mounted); small set in shift-lever notch (right) of mini-truck (but make sure you still have room to shift).





# your car's CB

—plus easy installation hints



**B**ig Bopper, a Pennsylvania CBer whose wife goes by the name of Chantilly Lace, goofed when he mounted a Citizens Band radio in his car. Figuring his wife would like to talk on the radio from her side of the front seat, he placed the set under the dash on the passenger side. But one snowy day last winter, when Bopper was driving alone, he reached over to twist the channel selector and didn't see a car blocking his way. There was just time to avoid it by skidding to a stop against a hillside—and losing a tooth on the steering wheel.

The moral? Safety and convenience, *in that order*, are the main considerations when you're placing a CB transceiver in your car. The set has to be where you can operate it without looking away from the highway, and where you won't bang your head or knees on it when getting in and out or in a sudden stop. But since safety usually means making life



**Mount your set** where the driver can reach it, as in homemade, overhead-van console, (left), or under dash near center (other photos here). Where both a scanner and a CB set are used (upper left), CB should be near driver, since its controls need more attention. Microphone hangers can be attached to CB set's mounting bracket, as shown above, or wherever else on dash you find convenient (upper right).



To protect your set, you can mount it in a sturdy, strongly installed locking device (above). Use cardboard to protect it against scratches during installation (below and above), and cover exposed metal parts of your antenna with clear nail polish to prevent weather damage (right).



convenient for the driver, there's little conflict between the two goals.

### Wide choice of locations

Mobile radios have been mounted in every conceivable corner of a car. For example:

- Behind the front seat in the rear passenger compartment.
- Sitting loosely on the seat or dash.
- In the glove compartment.
- Under the front seats.
- Between driver and front passenger seats.
- Above the windshield.
- Above, on, in or under the dashboard.
- On the transmission hump.

Let's compare them, one by one.

**In the rear-seat area** might be a good location in a chauffeured limousine, where only the passengers would use the set. If the driver is going to use it, though, a radio mounted in back of the seat, with the microphone cord snaked around to the front, may look classy, but it can hardly be safe when you turn around to change channels.

**Unattached radios** sitting on the front seat, tunnel hump or dash will slip around as you maneuver the car or adjust the radio controls. Such units can distract the driver and possibly become flying hazards in a panic stop or collision.

"Invisible" locations in the glove compartment or under the seat are awkward for the driver to reach, as Big Bopper found out. They're not that theftproof, either, since thieves can guess there's a CB somewhere as long as you leave your antenna on the car.

**Between the front seats**, all controls are easily within the driver's reach—but since he can't see the dial without twisting half-way around in his seat, he'll have to select channels by counting the clicks. (It might help to cement markers of different shapes at the most commonly used channel positions.)

**Above the windshield** is where you find many CB sets in vans or trucks (cars usually lack sufficient headroom for this). This is actually a variant of a dashboard mounting; it turns the over-windshield area into a second dash.

Both driver and passenger can have easy access to an overhead set, depending on how far across the car you put it. And if you don't want to

*(Please turn to page 236)*

### Where to get your CB's 12-volt power

Before looking for a power source for your mobile CB, consider whether you want to use a circuit that's always on (so the set is always available, should an emergency arise), or one that's switched off when you turn off the ignition (so there's no chance of accidental battery drain if you leave the set on, and to prevent unauthorized use).

Both kinds of circuits are available under the dash and at the fuse block (which may be under the dash, on the firewall, or in the engine compartment).

Unless it's hard to reach, the fuse block is your best power source because it lets you wire your set to the battery side of the fuse where it won't add to the load the car's fuse is already carrying (your set has its own fuse, either on its back panel or in its power cord). A ring, spade or hook-tongue connector soldered or crimped to your power cord will help you make a solid, secure connection to the fuse block; if its wires are buried, you can also push the tongue of a spade lug into the clip that holds the fuse.

**Make sure your polarity is correct:** Hot wire (usually red) to the positive (+) side of the line, ground wire (usually black) to the negative (-) side—even if the car's ground is positive. If your car has positive ground, you may also have to insulate your CB set from its mounting bracket.

# IT'S NEW NOW

## Built-in fender flasher

When you have to pull over to the side of the road and need a warning blinker, just flip a switch and a rotating flasher pops out from its recessed housing in the left rear fender. Inventor is Rudolf Hoeger, who exhibited it at a recent inventors' fair in Nuremberg, West Germany.



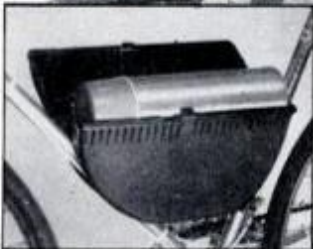
## Slinky sloop is remote-controlled

Claimed to be the world's fastest sailboat, Britain's strange-looking *Crossbow* carries no deck crew. Instead, the hybrid craft has an outrigger pod from which crewmen handle the tiller and some 850 square feet of sail remotely. The 55-foot boat is 20 inches wide, has hit speeds up to 31.9 knots (36 mph).



## Bicycle totes for kids or coffee

With a trend to bike travel, manufacturers were bound to find better ways to carry extra passengers and gear than by expanding a pedal-pusher's overstuffed backpack. For carrying small folk, there's a plastic seat (left) with arm and footrests and safety belt. "Tote-Along" slides onto a baggage rack (included) and snap-locks in place. Huffman Mfg. Co., Box 1204, Dayton, Ohio 45401. A yoke-mounted tote for items like hot or cold drinks and lunch is the plastic "Kopak" with a lockable top (below). Price is \$9.95 from Michael Anthony, Box 1266, Burbank, Calif. 91507.



## Putting the arm on big outboards

A rugged metal "lift" lever 19 inches long comes bolted to an extendible motor shroud gripper that fits almost any outboard motor. The long handle, with nonslip grip, provides enough leverage so women and children can raise even the biggest, heaviest outboards from a comfortable standing position, with minimum effort and strain. Price is about \$20. It's called "Motor Lift." Olson Industries, Box 2520, Sarasota, Fla. 33578.

**O**verwhelmingly, owners of both new Chrysler compacts go for station wagons. Our survey finds a surprising 48.8-percent wagon population among Plymouth Volare owners; 33.6 percent in the Dodge Aspen line.

#### Why so many wagons?

"We need a station wagon," says a New York housewife, "because we have two homes—summer and winter. The Volare wagon does a good job both for passengers and luggage."

Adds a Memphis Aspen owner: "We needed and wanted a smaller station wagon. The Aspen was exactly what we were looking for in terms of size, price, handling ease and comfort."

Styling also played a hand. A Delaware businessman: "It looks real—like a small *big* wagon."

A North Carolina retiree: "The Aspen [wagon] is more car for the price than I have ever seen. The room is unbelievable, and options are unlimited. Chrysler Corp. cars cannot be beat, as illustrated by their 12-month, no-mileage-limit warranty. The Aspen is another example of a Chrysler Corp. winner!"

Another astonishing percentage figure popped up in the engine compartment. No fewer than 73.9 percent of Aspen owners bought the long-lived, 225-c.i.d. Slant Six, as did a resounding 64.0 percent of Volare owners.

Yet economy was *not* the major considera-

◀ The only other U.S. wagon in this size and price class is the AMC Sportabout.

▶ Most owners praise MoPar service; many are long-time buyers of Chrysler products.

◀ Big switch here from the days when everyone was ordering V8s—the bigger the better.

tion in choosing the Six. Apparently owners were looking for that much-advertised, very reasonable balance of size, economy, performance, comfort, handling, option availability and styling. Overall, it appears that's what they got.

An executive secretary and Aspen wagon owner from Montauk, N.Y., sums up his choice of the Slant Six: "I had a 1973 Dodge Coronet wagon with the V8. In looking around for a replacement, I considered four-cylinder wagons too small and eight-cylinder ones too large."

Reports a Kansas schoolteacher about his choice of a Volare wagon with Six: "I wanted a wagon but not a gas-eater. The Pinto was too small, and imported wagons were all too expensive. Also, the service department at our local Plymouth dealer has always treated me well."

States a Kentucky salesman and Volare owner: "The Six combines good performance and pickup with good economy. I'm getting 18 in town and about 25 out on the highway."

Most owners were satisfied with gas mileage, but a few felt it didn't come up to expectations. This was particularly true when owners loaded their cars with accessories. Some 23.5 percent of Volare owners and 16.7 percent of those with Aspens felt they ought to get better fuel economy. "Fooled on mileage," groans one Volare



driver, and another opines: "EPA ratings are a joke—the average driver can't do that well." (See summary charts for owner and EPA mileage comparisons.)

The tremendous range of options undoubtedly plays a fair role in Aspen/Volare sales. Here's an Iowa postal employee: "I'd always driven Cadillacs before—was used to the power options. I found I could get them all on the Volare: six-way seat, electric door locks, power windows, tilt wheel, cruise control, and so forth. So I did, and I'm getting twice the gas mileage of the Caddy plus having more than enough room."

Comfort rates very high in both these compacts, particularly for front-seat riders. All Volare owners (100 percent) and 94.3 percent of Aspen drivers graded front-seat comfort *good to excellent*. No other car in recent memory has won such **land-sliding praise**. And rear-seat-comfort ratings were also quite high, with 91.5 and 80.0 percent again making it *good to excellent* in the Volare and Aspen, respectively.

Handling and styling top the list of qualities owners of both compacts like best. "Handles like a dream, easy to park, very good in snow," says a Connecticut housewife. A Vermont parts manager: "I watched it being unloaded from the carrier, liked my Volare coupe's styling

Overloading with power options, though—especially the Six—produced some grumbles about gas mileage and performance.

Never before have we reported on a car that got this sort of score in the comfort department.



Styling gets no bad marks from any owner, but some say shallow trunk won't let grocery bags stand upright. An unusually large percentage of Aspen and Volare owners opted for station wagons, many moving down from larger Chrysler Corp. wagons.

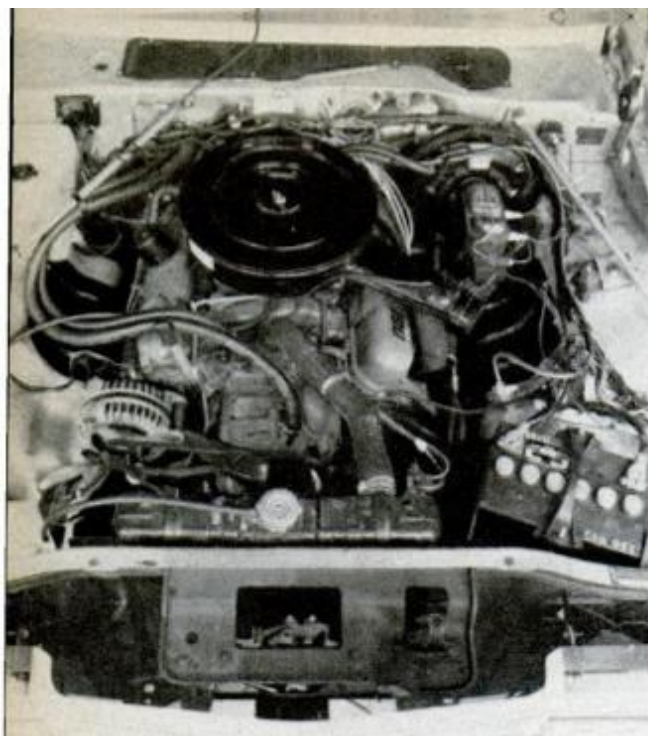
## PM OWNERS REPORT: PLYMOUTH VOLARE AND DODGE ASPEN

# Do Chrysler's new twins strike that fine balance of spaciousness, economy, performance and looks?

by Michael Lamm  
WEST COAST EDITOR

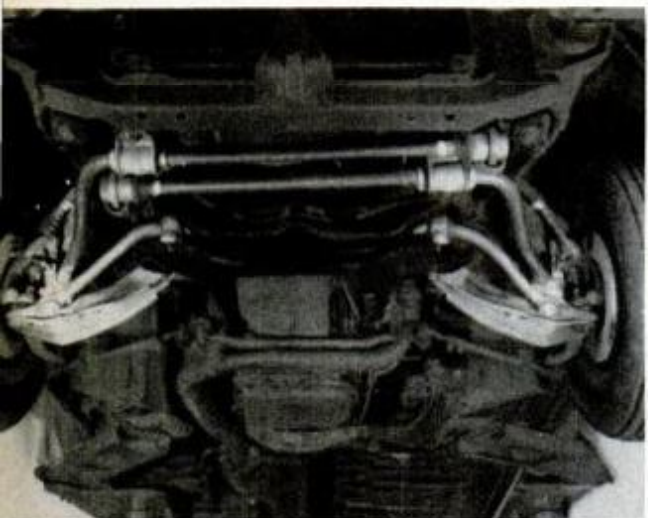
Photos by the author





Chrysler is using a new type of transverse torsion bars in the Aspen and Volare.

With options galore available, 318 and 360 V8s make good sense, yet Slant Six powers most Aspens and Volares. Without many extras, its performance and economy are more than adequate; but when loaded—as many are—gas mileage and acceleration suffer.



Workmanship rates just so-so, many complaints centering on dealer preparation.

New Chrysler compacts use transverse front torsion bars. Front end is well isolated from unitized body. A few owners complain of alignment problems, a few more grumble about disc-brake squeal but all agree Volare and Aspen give fine ride, great handling.

and color scheme, drove it and found it handles extremely well—very smooth running.”

From a Milwaukee insurance clerk: “Excellent handling. Our Aspen holds the road beautifully, takes turns readily, fantastic to steer and park.” An Iowa student: “Handles, drives, and feels like a big car.” A Michigan maintenance worker who drives an Aspen coupe with the Six: “Good acceleration if it’s wound out properly.”

A Colorado highway construction truck driver bought two Aspen coupes—one for himself and one for his wife. His car has the 225-c.i.d. Six; his wife’s the 360-c.i.d. V8. He has some interesting comparisons. “I’m not satisfied with the driving or riding qualities of the Six,” he says, “but perfection is the word for the wife’s 360 V8. Workmanship, too, is better on the 360. It’s a good likeness of a Cadillac. The Six feels harder to drive, and its seats slope back too far. I’d rate the Six as good, the V8 as excellent.”

Workmanship ranks a little higher on the Volare than the Aspen—about five percentage points. Here are typical comments. “Dodge workmanship is better than on many Chrysler Corp. autos, but it’s still not up to Japanese, European, or even Ford quality.”—Colorado Springs police sergeant. “Despite minor carb problems and greasy fingerprints inside, I’d rate workmanship excellent.”—New York claims manager. “Average—I’m unhappy with several areas of paint and body work.”—New York retiree. “Workmanship may be close to excellent; I found only a few things that had to be fixed, like a molding and a new seat-belt retractor.”

Dealer service runs neck and neck for both cars, with 58 to 62 percent rating it good or better. Very few owners do their own mechanical repairs, especially since all Aspens and Volares are still under the one-year/unlimited-miles warranty. Owner comments about dealer service run something like this:

“Dealer usually corrects all defects without complaint. Service is usually excellent but slow.”—Tennessee commerce director. “My dealer’s service department is the main reason I continue to buy Dodges.”—Michigan retiree. “Dodge dealer is very courteous and cooperative.”—Indiana retiree. “Best service I’ve ever had; they even gave me a free loaner.”—Michigan county employee.

## Summary of 1976 Plymouth Volare Owners Reports\*

Total miles driven .....244,472

### Average miles per gallon:

225-cu.-in. Six  
In town (EPA, 17 manual) 16.2  
Long trips (EPA, 22 manual) 20.3  
318-cu.-in. V8  
In town (EPA, 16 manual) 12.8  
Long trips (EPA, 21 manual) 17.2

### Body styles:

Station wagon .....48.8%  
Two-door coupe .....31.4  
Four-door sedan .....19.8

### Engines in above cars:

225-cu.-in. Slant 6 .....64.0%  
318-cu.-in. V8 .....33.7  
360-cu.-in. V8 .....2.3

### Transmissions:

Automatic .....85.9%  
Four-speed overdrive .....9.4  
Three-speed manual .....4.7

### Why did you choose the Volare?

Size .....43.6%

Economy .....25.6  
Styling .....19.2  
Past Plymouth experience .....15.4

### Specific likes:

Handling .....51.3%  
Styling .....41.3  
Ride .....37.5  
Comfort .....32.5  
Economy .....26.3

### Specific dislikes:

Mileage lower than expected 23.5%  
Sloppy workmanship .....18.5  
Noisy brakes .....8.6  
Rattles .....7.4

### What changes would you like?

Better gas mileage .....8.2%  
More trunk space .....6.9  
Better materials .....6.8  
Bigger sun visors .....6.8

### Dealer sales policy:

Good to excellent .....73.0%  
Average to poor .....27.1

### Dealer service attitude:

Good to excellent .....58.8%  
Average to poor .....41.2

### Had any mechanical trouble?

Yes .....50.6%  
No .....49.4

### What type of trouble?

Carburetor .....16.7%  
Brakes .....9.5  
Electrical .....9.5  
Front-end alignment .....9.5

### Did you repair it yourself?

No .....97.7%  
Yes .....2.3

### Dealer repairs satisfactory?

Yes .....65.7%  
No .....34.3

### Workmanship opinion:

Good to excellent .....58.8%  
Average to poor .....44.3

### Comfort opinion:

Front seat, good to excellent 100.0%  
Front seat, average to poor ... 0.0  
Rear seat, good to excellent 91.5  
Rear seat, average to poor ... 8.5

### Number of vehicles owned:

Volare only .....57.0%  
Two cars .....36.0  
Three cars .....5.8  
Four or more cars .....1.2

### Makes of other cars owned:

Plymouth .....36.1%  
Chrysler .....16.7  
Ford .....13.9

### Age distribution of owners:

15-29 years .....16.1%  
30-49 years .....43.2  
50 and over .....40.6

### Would you buy another Volare?

Yes .....78.8%  
No .....21.2

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

"The local dealer is all right, but I live in a **small town**," says an Alabama pulpwood yard supervisor, "and I know all the mechanics personally. The best mechanics won't work for any dealer—they're the independents. Yet the nature of business here dictates that small-town dealers have to do a good job. I've never had any trouble getting adjustments made."

What are some of the major complaints of Aspen and Volare owners?

"Squealing brakes—and they say they can't fix this," groans a New York machinist, and he's not alone. "Gas mileage on this six-cylinder, four-door sedan Aspen is not up to my expectation," grumbles a retired Floridian. "Gasoline spills out on side of car when filling," gripes a Louisiana bank examiner.

An Illinois restaurateur: "Brakes squeal, engine races, rear door out of line, hard to start at times, otherwise okay." A Wisconsin building inspector: "The trunk is so shallow I can't get a case of beer into it." Florida soil packager: "I've found poor workmanship, poor trunk design in coupe, short rear-seat leg-room."

In fairness, "no complaints" and "no changes" came in for very high percentages—no lower than 20 percent in any category in either car. That's pretty unusual, and it does merit mention. Perhaps this Colorado psychologist's statement can balance some of the foregoing complaints. He writes, "I have no gripes, really. The car was delivered beautifully. Only one electrical short in the dash lights. I had no list of complaints for the dealer. It's never happened with any new car I bought before."

Specific praises for the two cars were plentiful and hearty.

"I was first to buy a Volare in this county. I think it's the best car produced in years. Should have been on the market long ago."—North Carolina veteran.

"My Aspen Premier coupe has a good design, sporty looks, comfortable ride, and the reclining seats are great."—Milwaukee city employee.

"Good fit and finish, fine upholstery, comfortable ride, fast pickup, very neat appearance and good styling."—Wisconsin retiree.

"Best handling machine on slick roads that I've ever driven."—Wisconsin electrician.

"I am pleased to have a compact with power

**Small-town service is almost always better than that found in larger cities. That's because mechanics often know their customers personally.**

**Here's a good idea for all car makers—although some do provide extra space in the fuse box.**

**Lot of noise about noisy front discs—something owners have to live with.**

**That's for sure—Chrysler could have used this shot in the arm quite a while ago.**

**Not nearly so many people complained about price this time. Maybe the public is getting used to today's stickers.**

steering and power brakes plus a gas-saving engine. It's just a wonderful car."—Georgia librarian.

Volare owners tend to be younger than Aspen owners. Most people who buy Aspens are over 50 whereas the spread among Volare owners leans slightly toward the 30 to 49 age group. Even so, when finely broken down, Volares appeal amazingly equally to all age groups—more so than most cars.

What changes do owners suggest? As mentioned, a sizable percentage said they like their cars just as they are. Some, though, had constructive thoughts, among them:

"There are no spare positions in the fuse-box for adding a tape player, CB radio and other such kinds of equipment. However, the access door to the fuse box is very good."—Florida office manager.

"Change the mileage claims; seats lean back too far; build a wagon with a tailgate that doesn't rattle."—Alabama RFD carrier.

"The Aspen needs bigger sun visors. The ones on it aren't big enough to block the sun from the driver's or passenger's eyes."—Maine paper-mill worker.

"I'd like small side windows instead of the full panes. Also rear windows that open. The front ashtray ought to be centered more, and it would be nice to have a rear ashtray."—New York accountant.

"There are no front fender liners, so road water, slush, and salt comes up off the tires behind the headlights. It goes out over the front of the lamps and hood—the sorriest bit of engineering I've ever seen."—New York retiree.

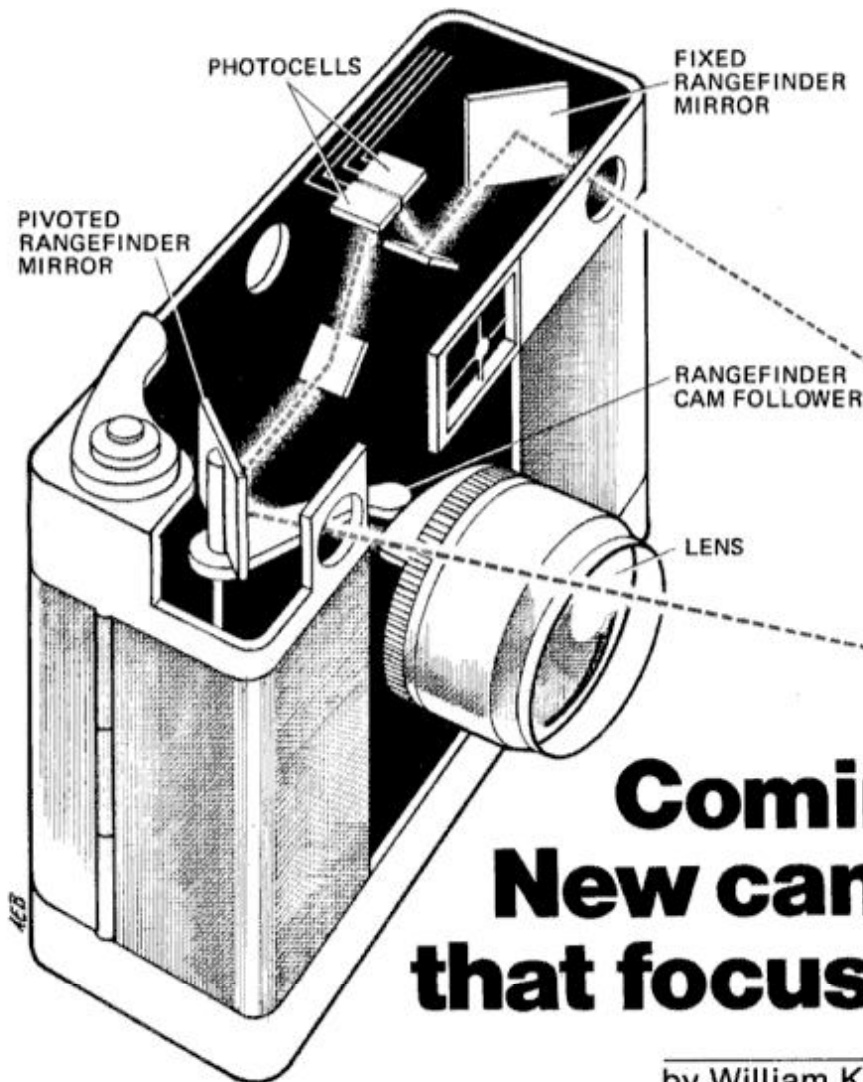
By and large, though, I must emphasize that owners of Aspens and Volares are very happy with their cars. As a Michigan probation officer puts it, "We are really pleased with our Aspen. It's a terrific car for the price; probably the best all-around buy this year. It's a very easy car to handle, with a really smooth, stable ride front and rear. Plenty of legroom, good mileage, reliable, and also, since I drive in bad neighborhoods sometimes, the car doesn't look flashy or expensive enough for kids to steal or strip."

This last statement might sound like an underhanded compliment, but it's genuine and reflects the rather conservative nature of Chrysler's new pair of compacts. ★★

## Summary of 1976 Dodge Aspen Owners Reports\*

<b>Total miles driven</b> . . . . . 329,580	Styling . . . . . 26.4	Average to poor . . . . . 31.4	<b>Comfort opinion:</b>
<b>Average miles per gallon:</b>	Economy . . . . . 22.7	<b>Dealer service attitude:</b>	Front seat, good to excellent . . . 94.3%
225-cu.-in. Six	Past Dodge experience . . . 13.6	Good to excellent . . . . . 61.7%	Front seat, average to poor . . . 5.8
In town (EPA, 17 manual) . . . 16.1	<b>Specific likes:</b>	Average to poor . . . . . 38.3	Rear seat, good to excellent . . . 80.0
Long trips (EPA, 22 manual) . . . 20.3	Handling . . . . . 40.7%	<b>Had any mechanical trouble?</b>	Rear seat, average to poor . . . 20.0
318-cu.-in. V8	Styling . . . . . 38.1	Yes . . . . . 57.9%	<b>Number of vehicles owned:</b>
In town (EPA, 16 manual) . . . 12.8	Comfort . . . . . 33.1	No . . . . . 42.1	Aspen only . . . . . 53.3%
Long trips (EPA, 21 manual) . . . 17.1	Ride . . . . . 28.0	<b>What type of trouble?</b>	Two cars . . . . . 35.2
<b>Body styles:</b>	Economy . . . . . 28.0	Brakes . . . . . 17.1%	Three cars . . . . . 6.6
Two-door coupe . . . . . 41.0%	<b>Specific dislikes:</b>	Carburetor . . . . . 12.9	Four or more cars . . . . . 4.9
Station wagon . . . . . 33.6	Mileage lower than expected . . 16.7%	Speedometer cable . . . . . 10.0	<b>Makes of other cars owned:</b>
Four-door sedan . . . . . 25.4	Sloppy workmanship . . . . . 13.2	Wheel alignment . . . . . 8.6	Dodge . . . . . 29.6%
<b>Engines in above cars:</b>	Rattles . . . . . 11.4	Oil leaks . . . . . 7.1	Plymouth . . . . . 20.4
225-cu.-in. Slant 6 . . . . . 73.9%	Noisy brakes . . . . . 7.0	<b>Did you repair it yourself?</b>	Chevrolet . . . . . 14.3
318-cu.-in. V8 . . . . . 24.4	Quality of materials . . . . . 7.0	No . . . . . 100.0%	Chrysler . . . . . 9.3
360-cu.-in. V8 . . . . . 1.7	<b>What changes would you like?</b>	Yes . . . . . 0.0	<b>Age distribution of owners:</b>
<b>Transmissions:</b>	Better workmanship . . . . . 14.5%	<b>Dealer repairs satisfactory?</b>	15-29 years . . . . . 10.8%
Automatic . . . . . 93.3%	More trunk space . . . . . 7.3	Yes . . . . . 67.7%	30-49 years . . . . . 31.6
Four-speed overdrive . . . . . 3.4	Relocate ashtray . . . . . 7.3	No . . . . . 32.3	50 and over . . . . . 57.6
Three-speed manual . . . . . 3.4	Better gas mileage . . . . . 7.3	<b>Workmanship opinion:</b>	<b>Would you buy another Aspen?</b>
<b>Why did you choose the Aspen?</b>	<b>Dealer sales policy:</b>	Good to excellent . . . . . 50.4%	Yes . . . . . 72.5%
Size . . . . . 33.6%	Good to excellent . . . . . 68.6%	Average to poor . . . . . 49.6	No . . . . . 27.5

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



Rangefinder-type auto-focus system has been proposed by some companies. Here, matched photocells compare images from fixed and pivoting mirrors. When both mirrors are converged on the subject, both photocells receive identical images, and focusing stops. A cam follower moves the pivoted mirror as the lens focuses in and out.

## Coming: New cameras that focus for you

by William Kanner

**N**ow that cameras have automatic exposure control and double-exposure prevention, the only thing that stands between you and roll after roll of technically perfect pictures is something to tell you when you're in sharp focus—or to focus for you.

That may not be an obstacle much longer. Honeywell has announced an auto-focus system called "Visitronic" which they claim is so small and inexpensive it's adaptable to virtually all variable-focus cameras from Pocket Instamatics to expensive reflex cameras, or even to movie and TV cameras.

Other auto-focus systems have been announced over the years. The difference is that Visitronic is actually for sale—not to the public yet, but to camera manufacturers who can incorporate it into their own products. Interested manufacturers have to pay Honeywell \$1000 for even a look at the system, so Honeywell isn't saying yet just how the system works, other than that it's on an integrated-circuit chip containing the equivalent of several thousand transistors and other components.

But despite Honeywell's silence, it's possible to make a reasonable

guess as to how the system works and how it will affect camera design.

### What the chip does

Honeywell's circuit chip senses focus, and sends out focus-control impulses, but doesn't actually focus the lens—that's a mechanical problem each camera manufacturer will have to work out. Running signal lights from such a chip is a far easier, simpler process, so you may see cameras that not only let you focus but tell you whether or not you've done it right, before you see cameras that actually focus for you. And you may see focus-indicating cameras offered as a lower-cost alternative even after self-focusing ones arrive.

How Visitronic senses when an image is in focus is probably based on the principle that an in-focus image has greater contrast than an out-of-focus one. If that's the case, then it must be installed in the light path behind the main lens (or behind a similar lens synchronized to move with it). One way, shown at the top of the facing page, would be to feed the cell a portion of a reflex camera's viewing-screen image via a beam splitter (and a relay lens, not shown, to refocus the image on the cell);

another would be to use a beam-splitter in the reflex mirror to beam part of the image down to a Visitronic cell.

In cameras without reflex viewing, a mirror behind the lens could direct light to the cell, or the cell itself could pop in behind the lens, together with extra optics to refocus the image from the film's plane to the sensing cell.

Visitronic could work on some other principle, though. It could, for instance, be a dual cell which signals "perfect focus" when both halves receive identical illumination. Then the rangefinder arrangement shown above could be used.

In this, two mirrors reflect subject images onto two matched photocells. When the pivoted mirror turns so that it sees the same spot as the fixed one, both light cells register alike. Key the moving mirror's swing to the lens's motion as it focuses, and matched images on the light cells mean the camera is focused.

### How new is auto-focusing?

But other approaches have been explored and patented over the last 40-odd years, even if they haven't quite come to production. Since the late sixties, patents have been issued



—and some prototypes shown—by Kodak, Bell & Howell, Canon, Konica, Nikon and Bolex, among others.

Some of these systems work by sensing contrast, others on the rangefinder principle shown here, or variations of it. Many—especially the rangefinder-type systems—project beams of light for the focusing sensors to work from. Those which use visible light shut it off just before the shutter snaps; others use infrared or ultraviolet light that won't register on the film. Kodak once patented a contrast-sensing system that projected a contrasty grid onto the subject (page 96, Dec. '72), and Polaroid has patented one which projected pulses of sound and sensed the return time of their echoes, just like sonar (page 82, March '71). The latter seemed a bit Buck-Rogersish back then, but National Semiconductor has just announced a single-chip Sonar that could do it easily.

Using yet a different principle, Bell & Howell put a photocell behind a translucent screen whose face was covered with tiny, molded-in lenses. An out-of-focus image projected onto this screen would shimmer like the out-of-focus image on a reflex camera's microprism screen, making the photocell's output fluctuate. When the image was in focus, the photocell's output would settle down, and the camera would stop focusing itself.

### How to shift the focus

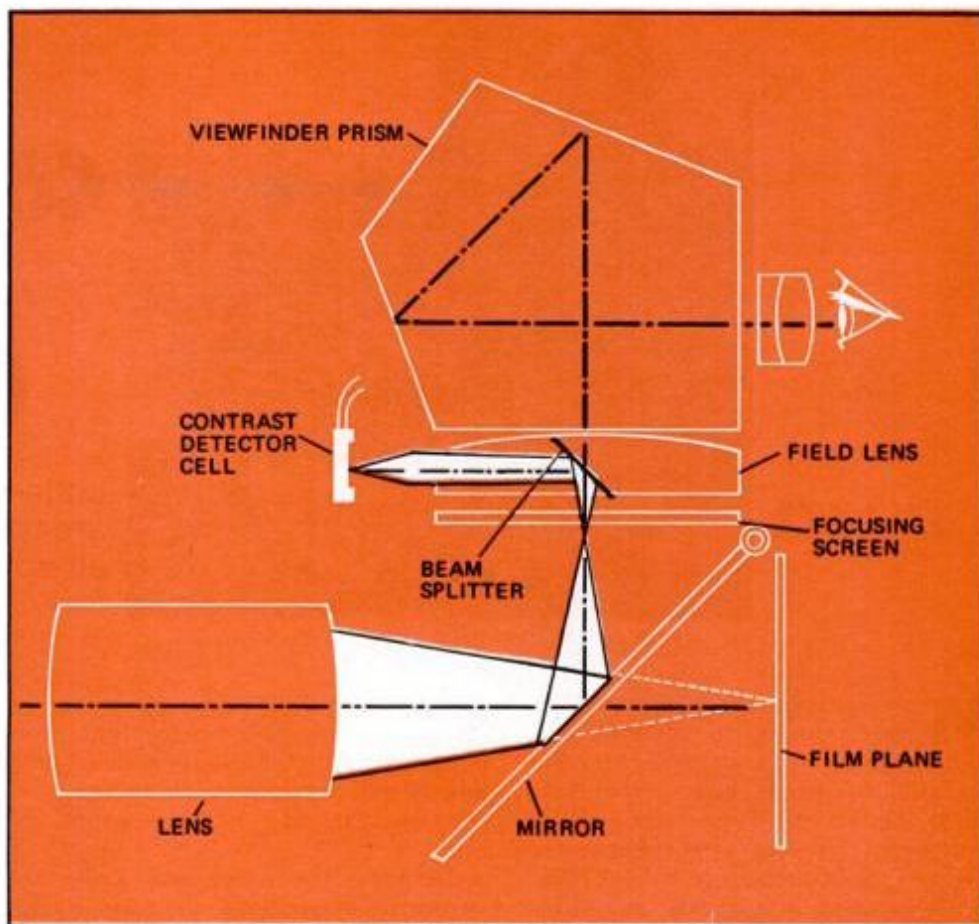
Honeywell makes it quite clear that its chip only provides information about a camera's state of focus; controlling that state is up to the camera manufacturers.

The obvious answer is to use a servomotor to move the lens, just as you move it by hand for focusing. But that takes a pretty powerful motor for many of today's lenses, and heavy, powerful batteries to boot. A simpler way would be to drive the lens with a spring wound by the film-advance lever, substituting people-power for electricity.

But why move the entire lens? Old, inexpensive cameras focused just by moving the lens's front element. Why not the back one, which is easier for the auto-focus mechanism to reach? And some modern lenses focus by moving a few internal elements, again a job a light-duty motor could handle.

You don't even have to move the lens at all. Moving the film plane in and out will do the same job, again with a less powerful motor.

Honeywell has patented still another idea, a sandwich of three glass wedges between the lens and film plane, as shown in the diagram below. The three form, in effect, a sin-



Contrast increases when an image is in focus, so auto-focus cameras could use contrast-sensing cells reading a portion of the focusing-screen image, as shown here.

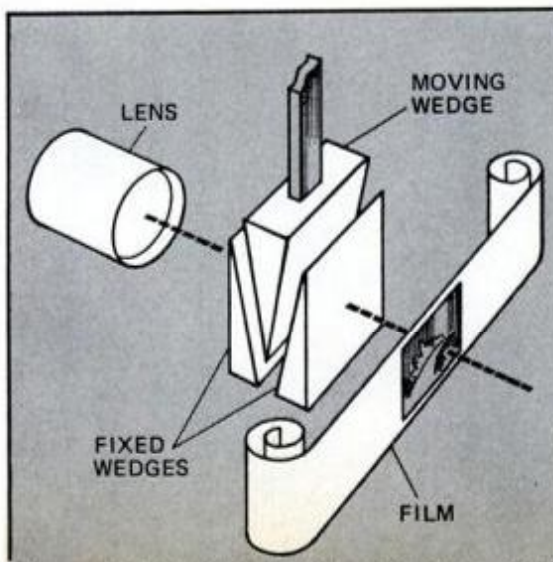
gle slab of glass which slows down the light, effectively increasing the lens-to-film distance. Raising or lowering the central wedge has the same effect as varying the thickness of the slab—or the distance from lens to film. In other words, moving the slab a few millimeters changes the focus. And because it's between the film and lens, the system would work with interchangeable-lens cameras.

(Incidentally, Honeywell's original idea was to vibrate the center wedge rapidly up and down during exposure, which would stretch the zone of the lens's focus—its depth of field. Done that way, auto-focusing—and focusing itself—would become unnecessary. But then you'd be unable

to pull such tricks as throwing unwanted backgrounds out of focus.)

### What's really coming?

Now that auto-focus is available to camera manufacturers, when will it be available to you? Visitronic (and perhaps other) auto-focusing—and certainly focus-indicating—cameras will probably be shown this fall at Photokina, the big, international photographic trade show. Some of those prototypes may be on the market by the spring of next year. Within a year or two at most, you may not have to worry about whether or not your Christmas pictures are in focus. Your camera will assure you that they are. ★ ★ ★



Moving wedge, in one Honeywell patent, varies the effective distance between the lens and the film plane, to change focus. Moving the wedge takes less motor power than moving a large lens—and moving it during an exposure can increase depth of field.

# How to camp away from campers

Little-known, unspoiled wilderness areas have adventure-away-from-it-all appeal. Many are new additions.

by Jack Galub



Union Pacific Railroad—High Uintas photo

They're rugged, but primitive trails offer great vistas.

Many sportsmen consider wilderness camping the ultimate outdoor experience, although fortunately not enough people have tried it to spoil the sport. There are still a number of isolated areas where the stillness is broken only by the roar of a cascading stream, the snap of a branch, the rustle of game. For campers who look to the outdoors for solitude, these spots offer a special kind of escape.

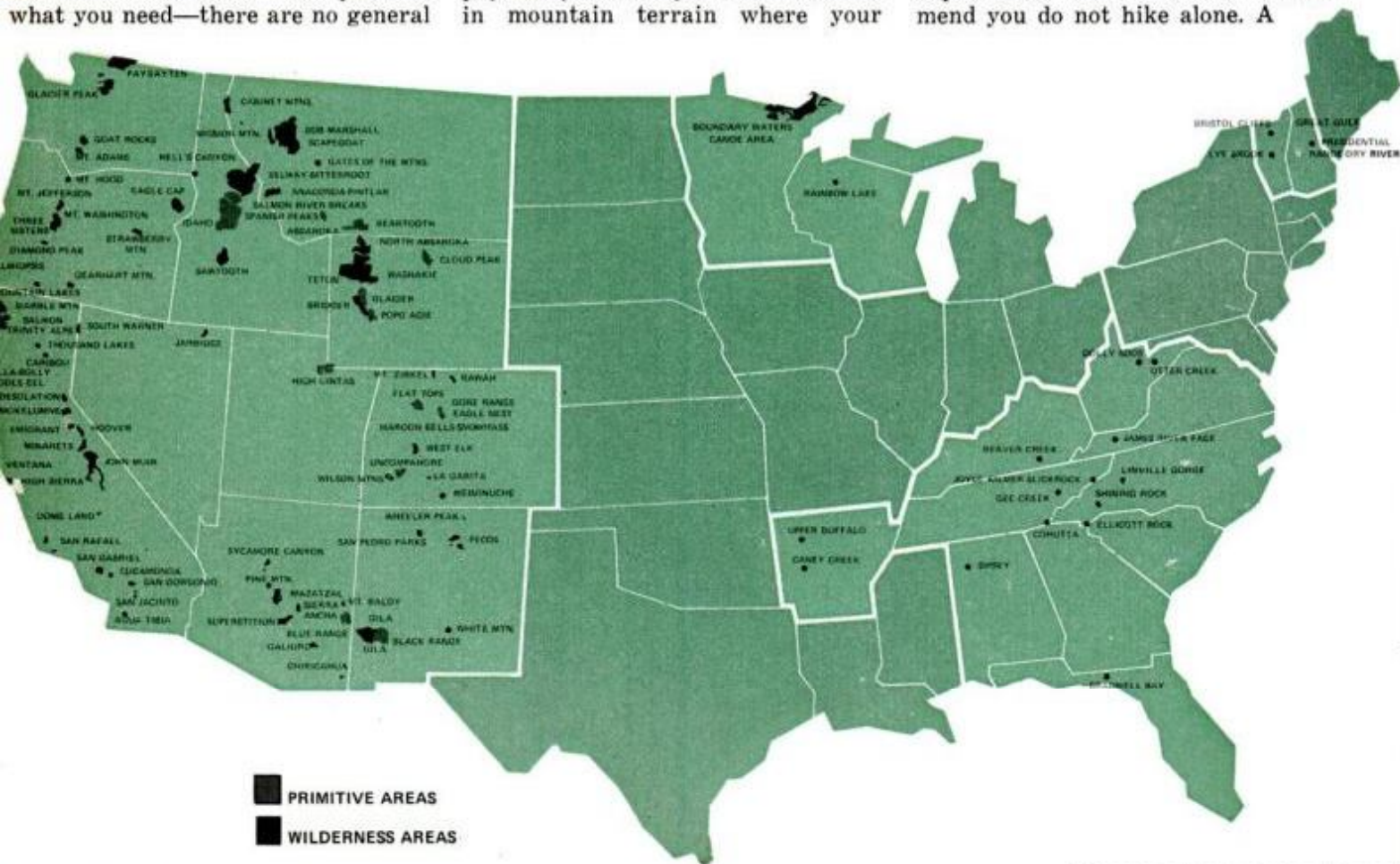
When you go in, you go by foot, canoe or horse. No trail bikes, no four-wheel-drives, no runabouts, no recreational vehicles. You pack in what you need—there are no general

stores, no trading posts, no souvenir stands, no lodges. No neon lights, no blare of transistors, no rumble of exhausts will act as disturbing beacons showing the way back to camp at night.

Camping the wilderness areas is adventurous but not dangerous if you are careful and well prepared. Before you start out, however, you should be certain that you know how to travel, cook and camp with light gear and minimum extras, particularly if you backpack; that you can navigate by map and compass, and that you are physically fit. Many of the areas are in mountain terrain where your

heart and lungs have to work harder than they do at sea level and where, unless you are accustomed to altitude, you may find you move more slowly.

There are presently over 100 primitive and wilderness areas that have been set aside by the federal government to remain completely wild. These national forest categories are very similar; the primitive regions may eventually be incorporated into the wilderness system of the Department of Agriculture. The terrain of all these areas is so rugged that experienced wilderness men recommend you do not hike alone. A



■ PRIMITIVE AREAS  
■ WILDERNESS AREAS

backpack party of at least three provides an extra measure of safety in case one member gets hurt, and also permits the dividing of community equipment and supplies into three or more packs. One hiker can carry the tent while others can share carrying the required food rations and cooking gear.

Map and compass can be keys to a safe and successful trip. While some main trails are marked, signs are kept to a minimum and there are none as you take side paths or move cross country. The Forest Service recommends that you obtain a map, study it, and then plot your progress as you go.

Finding your own way is part of the challenge and the satisfaction, but basic skills should be learned and practiced before you get into the wilderness. "We've had people lost and wandering around with their maps and compasses, not knowing how to use them," one ranger recalls. "We've also had others who just weren't in good enough shape after taking it easy all winter. They'd just fall apart on some of the mountain climbs and have to be carried down." While rangers will assist campers in primitive areas in an emergency, the general wilderness area attitude is, "You're grown up now, so use judgment. Don't push yourself into taking unnecessary chances."

Distances are deceptive out where the air is remarkably clear, and

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**'Use judgment and don't push yourself into taking unnecessary chances' is advice from Forest Service rangers.**

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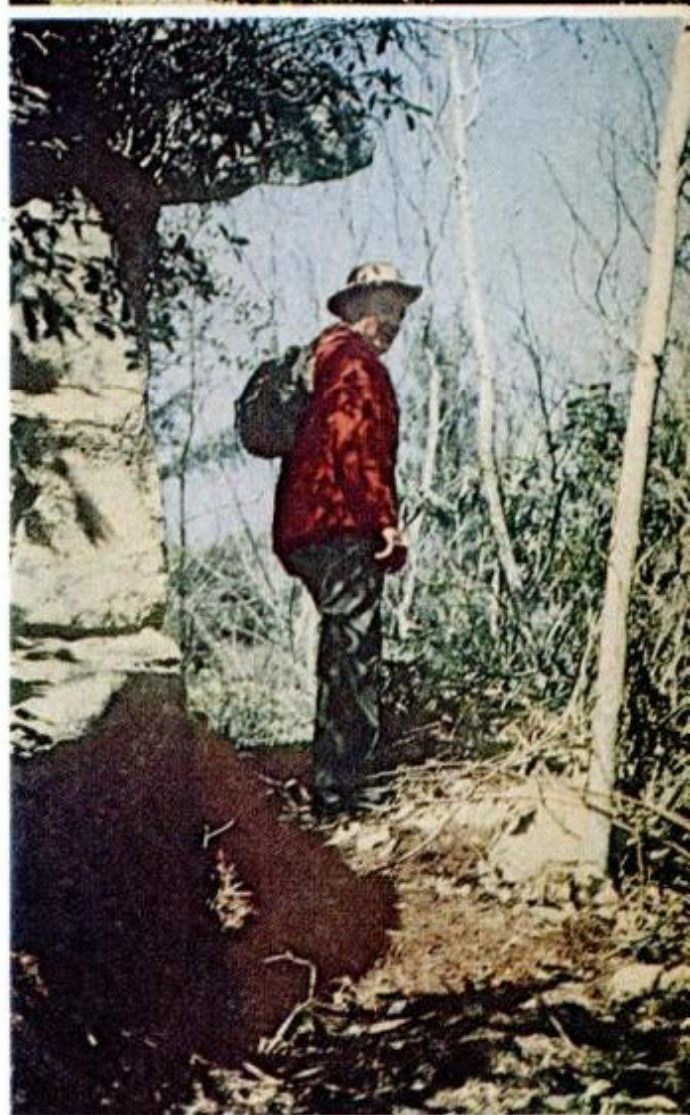
"nearby" streams, valleys and peaks can turn out to be miles away. Mountain weather can also worsen suddenly with freezing temperatures setting in at any time, particularly where the wind blows down from snow-capped peaks. While cotton clothing is lighter, woolens will keep you drier and warmer when the weather turns chilly. The layer system—with wool or wool-blend shirt, sweater and spinnaker shirt or windbreaker—is easier for a backpacker to put on or peel off as required rather than carry a big expedition-weight parka. A head covering can help prevent loss of body heat, and a foldable hat or easily stowed knit watch cap is worth packing.

For wet weather, a lightweight poncho or plastic sheet should be part of your standard equipment. For most areas in summer, a sleeping bag that is comfortable down to 25°F. is suitable when used with a

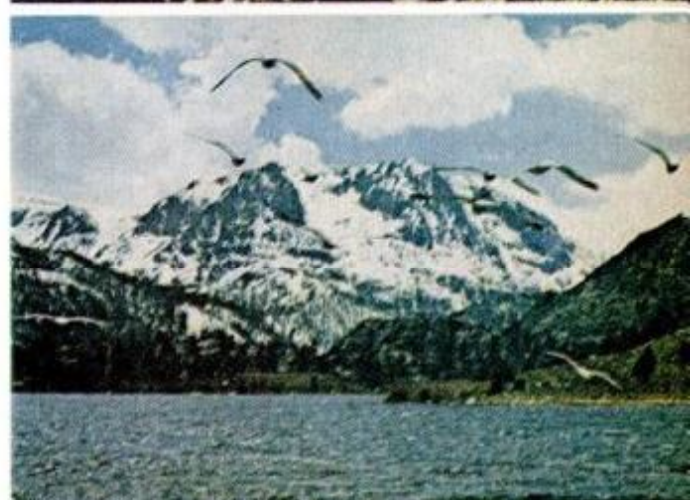
**Remote lakes, tall pine, silent crags provide true solitude, but put primitive-area camper to the test in the High Uinta Mountains of Utah. Altitudes from 8000 to 13,499 feet and over 250 lakes for fishing are found in section of Ashley and Wasatch National Forests.**



**Hiking through undergrowth of the 12 miles where the Linville Gorge encloses North Carolina's Linville River in the Pisgah National Forest, a camper finds no facilities for overnighting but there are spectacular crags and rock formations, as well as dense foliage and 2000-foot elevations.**



**Unrivaled fishing in June Lake, with Carson Peak in the background, is one of the many attractions of the Minarets Wilderness Area in the high country east of Sierra crest in the Inyo and Sierra National Forests of California. Altitudes range from 7000 to 14,000 feet, while temperatures vary from 85° to -15° F.**



sleeping pad. Choose medium-weight hiking shoes that are well broken in and comfortable.

Meals should be planned around basic, easily prepared, dehydrated high-energy camp foods. Canned and bottled foods are usually too heavy to pack in comfortably. Repackage boxed sugar, cereal and dry milk in plastic bags. Water can be a problem; you should carry water-purification tablets when you camp back-country.

Your backpack seems to add weight the farther you hike and it is important to eliminate nonessentials. Don't carry a rifle unless you are expressly out for game during the hunting season. Instead of an ax, carry a good pocketknife or belt knife and a lightweight saw. Firewood is scarce in many wilderness and primitive areas; of course, only dead wood should be used for warming and cooking fires. Small pack stoves are a much better choice.

District rangers estimate that an average stay in a wilderness like Utah's High Uintas Primitive Area is about five days, and note that the amount of litter that can build up during those periods is enormous. The Forest Service encourages a "Pack it in—pack it out plus five (extra pieces of trash)" policy. All unused foodstuffs should be burned along with their wrappers and tin-

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**'Pack it in—  
pack it out plus five  
(extra pieces of trash)' is  
the recommended policy.**

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foil. What doesn't burn to a crisp should be carried back out.

There are almost no toilet facilities in the back country, so spots well away from lakes, streams and trails should be used. Dig a shallow six-inch hole in the top layer of soil and then cover the hole with sod. Similarly, do not use soap or detergents near streams and lakes. Use a container to carry water for washing or shaving.

You will want to carry a camera and film, but choose a small light pocket-size model unless you are a professional photographer. Small flashlight, matches in waterproof container and first-aid kit also rate as essentials. Insect repellent may not be necessary for the area you choose, but it's better not to take a chance. Pack along some of the brand that works best for you.

Every area differs somewhat, so it is best to inquire ahead of time about a camping region that interests you. Here are a number of examples:

*(Please turn to page 208)*

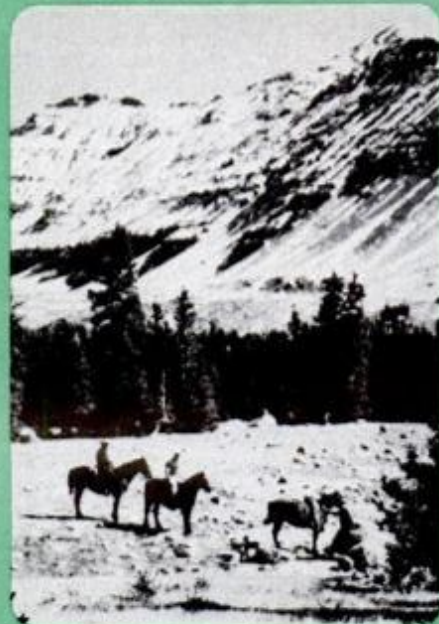
## Wilderness in the High Uintas Primitive Area

**C**onsidered an ideal example of what a wilderness can be—remote, beautiful, unspoiled, challenging and little-known—the High Uintas Primitive Area in northeast Utah stretches for 243,957 acres up over the backbone of the Uinta Mountains and down into the Wasatch and Ashley National Forests. This mountain range, gouged and carved by at least three ice ages, runs east-west instead of the usual north-south.

The slow-moving, grinding ice masses left behind thousands of high glacial lakes—probably only NASA Landsat satellite tapes show just how many. Campers are dwarfed by huge rock crags and spires, natural stone amphitheatres, ridges, canyons, mesas and icy streams that are born above 13,000 feet on high snow-covered peaks.

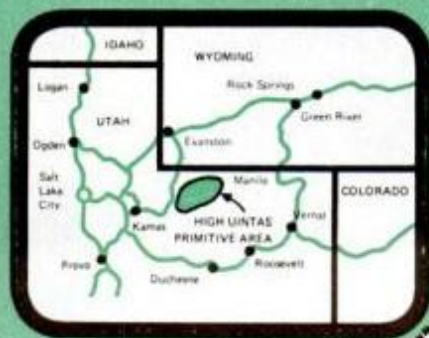
The Forest Service has a number of entry points where you can check in with a district ranger for maps and latest weather and terrain reports. An easy entry point is Kamas, 60 miles east of Salt Lake City. Mile-long Mirror Lake and surrounding campsites, meadows and streams make it popular, and there are 78 smaller lakes within a radius of six miles. Though considered "family country," there have been mountain-climbing fatalities in the vicinity, and the first day can be well spent lounging, plotting trails on area maps and becoming acclimated to the 10,000-foot altitude.

District ranger Steve Scott suggests newcomers pack along sections of the well-marked Highline Trail which winds 56 miles through the mountains to the Henry's Fork entry point in Wyoming. Plan to cover no more than two miles an hour when packing at



these altitudes; temperatures range from a high of 70°F. down to 30° at night and you'll need snowshoes until mid-July. For HUPA hiking, figure you'll burn 5000 to 6000 calories a day and should pack in a dry weight of at least 1½ pounds of high-energy food for each day of camping. A light pack rod can land brook, rainbow and cutthroat trout or arctic grayling.

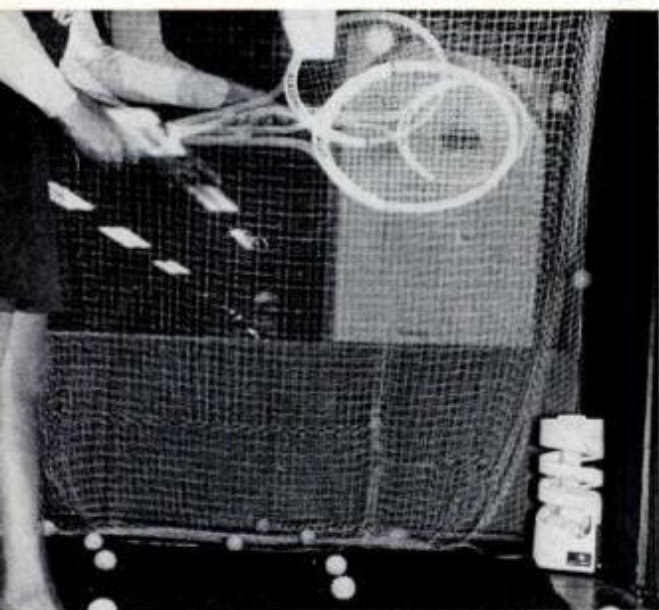
While rangers do all they can, there are places in the HUPA where a camper in trouble can be taken out only by helicopter—a chancy and expensive way to end a holiday. Careful preplanning is important. For High Uintas information, contact the ranger district at Duchesne, Kamas, Dutch John, Roosevelt or Vernal, Utah; or Evanston or Mountain View, Wyo.



- PRIMITIVE AREA BOUNDARY
- - - PROPOSED WILDERNESS BOUNDARY
- NATIONAL FOREST DIVISION
- TRAIL
- HEAVY USE AREAS (MINIMUM SOLITUDE)



IT'S NEW  
**NOW**



**Serve 'em up**

Now you can practice tennis in the game room with a plug-in machine that tosses the balls at you. The "Serves-U-Right" holds 28 balls and tosses one every five seconds for distances of 12 to 16 feet. You drive them into a 7-foot-square nylon net. The price is \$65.95. Omnitec Corp., 8505 Tanglewood Square., Chagrin Falls, Ohio 44022.



**Sticky decor to cheer you up**

Brighten up the children's room, the bath, kitchen—even flowerpots, raincoats or the shopping car—with self-sticking mushrooms, butterflies, flowers and funny animals in cheery colors and patterns. "Rickie Tickie Stickies" are water-resistant, but they can be peeled off any hard or painted surface as readily as they are stuck on. From 3M Center, St. Paul, Minn. 55101.



**Motor-driven skateboard**

A 1-hp motor is said to drive the skateboard at left at a brisk 17 mph. The power pack's output is controlled by a radio transmitter, shown in the right hand of the unit's inventor—Donald Monaco of Modesto, Calif. The skateboard was exhibited recently at the 16th annual Long Beach Custom Car and Motorcycle Show, where the owner demonstrated its speed and maneuverability, as well as its unusually precise control responses.

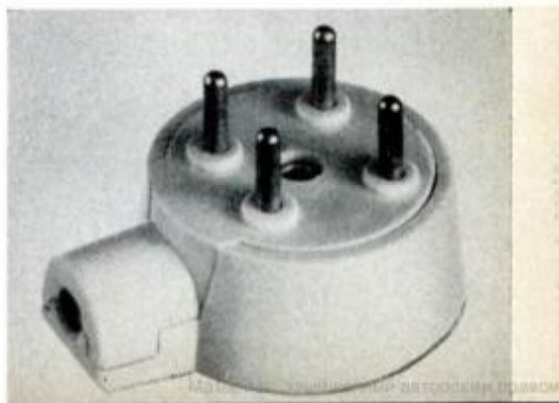



**Sinus soother**

Welder's hood? Wrong. It's an electric sinus heat mask that operates moist or dry to ease head pain. An eye slit allows wearer to work while using it—either for sinus relief, or just as a refreshing hot pack. Essex International, Belton, S.C. 29627.

**No more 'listening in'**

Two tiny integrated circuits in what looks like an ordinary telephone extension plug automatically cut out any other phone on the same line—thus assuring complete privacy when either phone is in use. Known as "Phone Guard," the device costs \$7.95 from Viking Electronics, Inc., 406 Second St., Hudson, Wis. 54016.





Come on in and join the thousands of families that are beating the heat—and those long sweltering drives to the beach—with above-ground pools in their own back yards.

# Stay on vacation all summer with a low-cost pool

by Mike McClintock

Invest a few days this summer and bring a piece of the ocean into your back yard. Above-ground pools are dotting lawns all across the country, and with good reason. Most are small enough to bring home in a station wagon, and big enough to keep your family and friends wet, happy and cool all summer long. Pool designs are pretty much the same, either round or oval, although different manufacturers offer a variety of finishes and assembly hardware. After you've shopped around, you should base your choice on two factors—quality and safety. Here are some guidelines:

### Choose your materials

Select from reputable makers. They will offer guarantees on filter tanks and warranties on pool liners. Stay away from pools with electro-galvanized steel walls. They look all right, but they're not durable. For a good-quality, economical pool, look for roll-formed aluminum

or hot-dipped, galvanized steel walls. Extruded aluminum or steel walls with a copper additive are excellent quality but more expensive. Finishing should include a two or three-coat paint process with a final bonderizer application. A simple guide to quality is that aluminum pools should be embossed for strength and painted to resist corrosion. Steel pools should have corrugated walls, not flat sheeting. If you can't get this kind of information from a salesman, watch out.

### Using your head

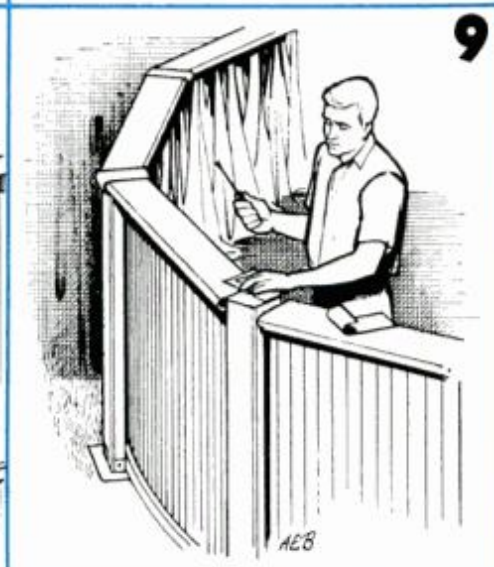
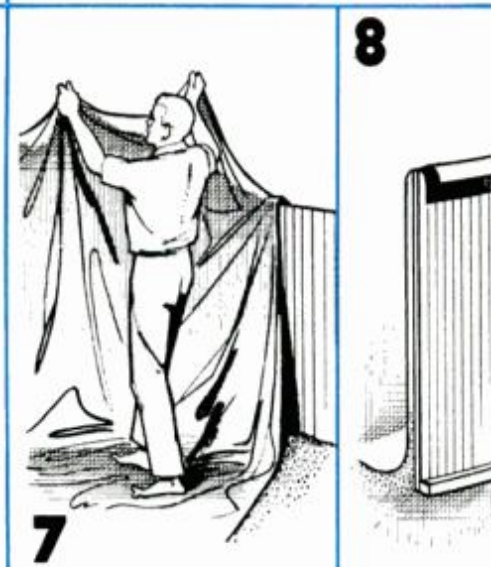
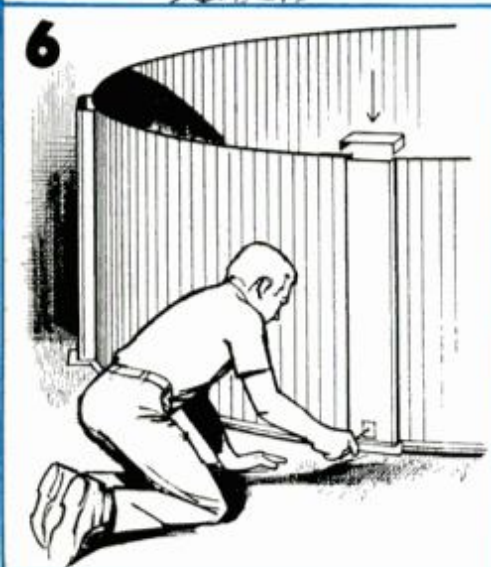
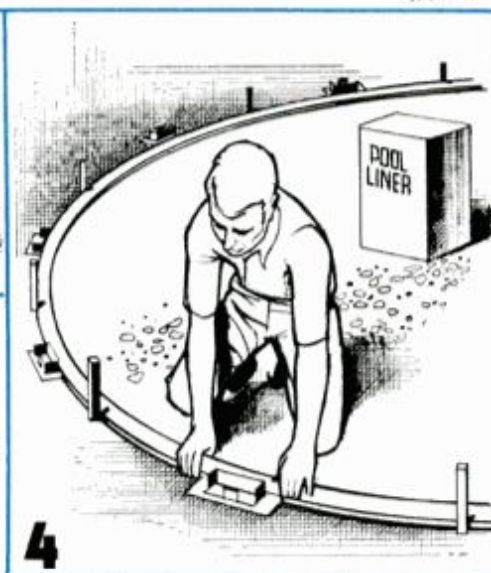
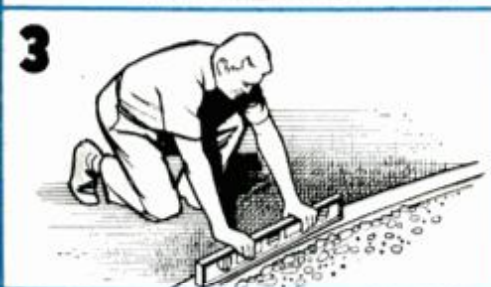
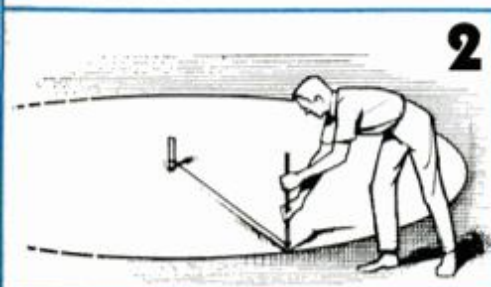
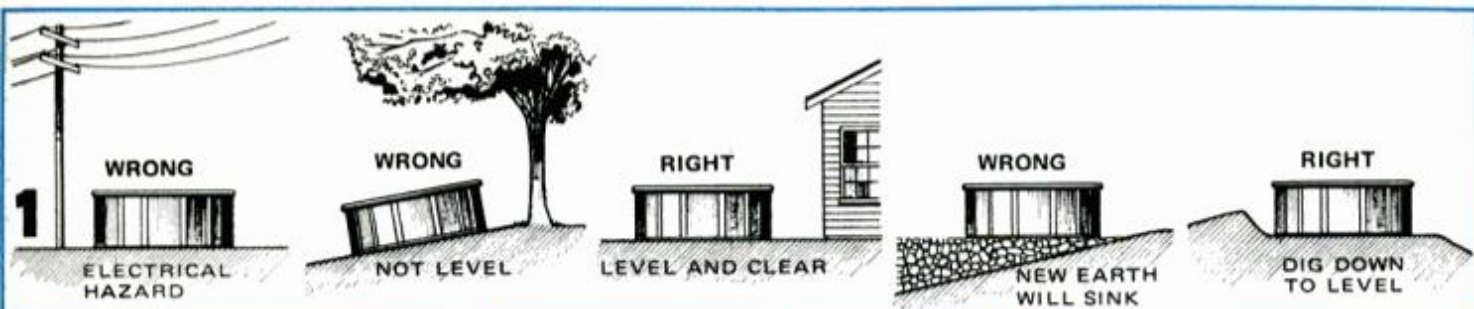
The major responsibility for running a safe pool rests with the owner who must supervise who goes in and how they act. But there are areas you can't control and here's where a good manufacturer should step in to help. Most pool ladders can be easily climbed by children who can't swim once they get to the other side. When you're not around this is a danger. To prevent it, safety ladders



Pools are great for keeping your family cool and calm on blistering summer weekends. You can take a quick dip before dinner or spend all afternoon splashing with the kids. Young children will learn to swim here faster than at the beach, and you'll be able to supervise them safely. The most common complaint about above-ground pools is the stark appearance of the side walls. Good landscaping (lower right) is the answer. Picture yourself (center) catching up on your daydreams, floating lazily under the summer sun.



# Putting in your pool



Art: Adolph Brotman

## 1. Pick the right site

Stay away from overhead obstructions, especially electrical lines. A level site with good drainage is best.

## 2. Circling in

Drive a stake in at the center of your site. Use string to scribe a circle two feet larger than your pool size. Note: Avoid areas where chemical weed killers have been used.

## 3. Your level best

Check for level thoroughly. Use a level on top of a straight 2x4 to increase accuracy. Water in the pool will be level no matter what you do. But if the rim turns out to be uneven, you'll be wasting space at one end of the pool that could have been filled with water.

## 4. The bottom line

Use temporary stakes between the support pads to keep the bottom rim in line as you work. Follow the manufacturer's instructions carefully—you're building the foundation for a large and extremely heavy amount of water.

## 5. The sidewinder

Take my advice and get some help for this step. The one-piece steel wall can be as wiggly as an eel. Use 1x2 stakes to keep the wall steady while you're fitting it into the rim.

## 6. Straight and narrow

Get a good, tight assembly on your uprights. They're the backbone that keeps the wall rigid.

## 7. The lineup

Take off your shoes—they'll wreck the liner. Try for no wrinkles (you'll get a few anyway) and leave an overlap (check the specs for how much) at the top edge of the pool wall.

## 8. The roundup

Make sure you've built up a round cove of earth at the inside bottom edge of the pool wall. If you don't, the tremendous water pressure may force the liner under the wall and tear it.

## 9. Topping off

Installing the rim locks up a job well done.



were developed. The outside steps and frame are hinge-mounted so they can be swung up off the ground out of reach. This is good protection against a child's wandering over to take a dip when no adults are around.

Safety ladders will also help prevent accidents as swimmers get in and out of the pool because they are anchored, usually by two chains, to the edge of the pool wall. Most of them bear a sign saying NO DIVING, a caution that goes for the rim of the pool, too. A ladder without chains is likely to tip with the weight of a swimmer pulling himself onto the step.

### A bad combination

When electricity and water come together, accidents happen. You must decide how to run the electric cord to the pool (don't run the lawnmower over it), but the manufacturer should provide built-in protection against shock hazards. You can help by using a GFCI on the circuit. Another safeguard is to look for a UL-approved label. This means that Underwriters Laboratories has inspected the electrical system. Some dealers may show you a UL tag on the wire, but that's not enough. Make sure the filter pump is tagged as well.

### Installation tips

Most makers provide clear and complete installation instructions. A typical job is shown here to let you know what's involved. Twelve or 15-foot pools can be set up in a day. For larger ones you'll need a few friends and a weekend. Select a site that's as flat as possible. Dig down to create a level surface if you have to. Freshly built-up earth will compress and settle, causing part of the rim to sink with it. Enlist as much help as possible when you're fitting the steel wall

*(Please turn to page 228)*



**Sun dome** above uses aluminum frames to support vinyl that keeps in heat and extends your swimming season. From Fabrico, 1300 West Exchange, Chicago, Ill. 60609. Whirlpool spa (bottom) from American Leisure, 718 N.W. First St., Fort Lauderdale, Fla., is a unique above-ground fiberglass pool with jet-action circulators. Safety ladders from Coleco, 945 Asylum, Hartford, Conn. 06105, have fold-up steps.

### COMMON POOL SIZES

#### Rounds

15'

18'

21'

24'

27'

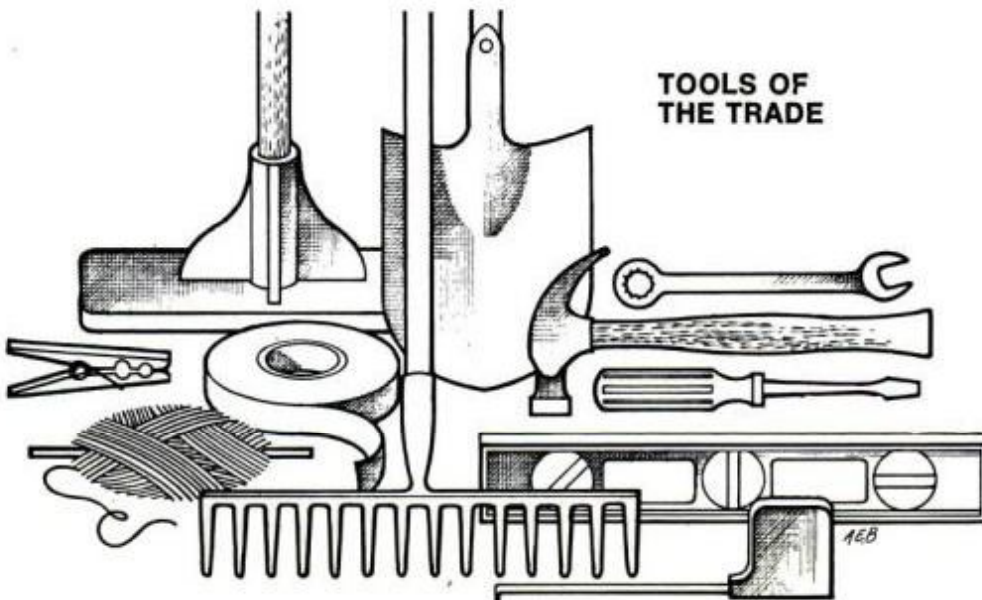
#### Ovals

12 x 24'

15 x 27'

15 x 30'

15 x 41'



### TOOLS OF THE TRADE

<b>Tamper</b>	Packing down fresh earth
<b>Shovel</b>	Removing the sod
<b>Wrench</b>	Bolting the frame
<b>Hammer</b>	Driving rim stakes
<b>Screwdriver</b>	Assembling the uprights
<b>Level</b>	Checking the grade
<b>Tape measure</b>	Laying out the site
<b>Rake</b>	Clearing the dirt floor
<b>Masking tape</b>	Protecting the liner rim
<b>String</b>	Scribing the circle
<b>Clothespins</b>	Holding liner as you go

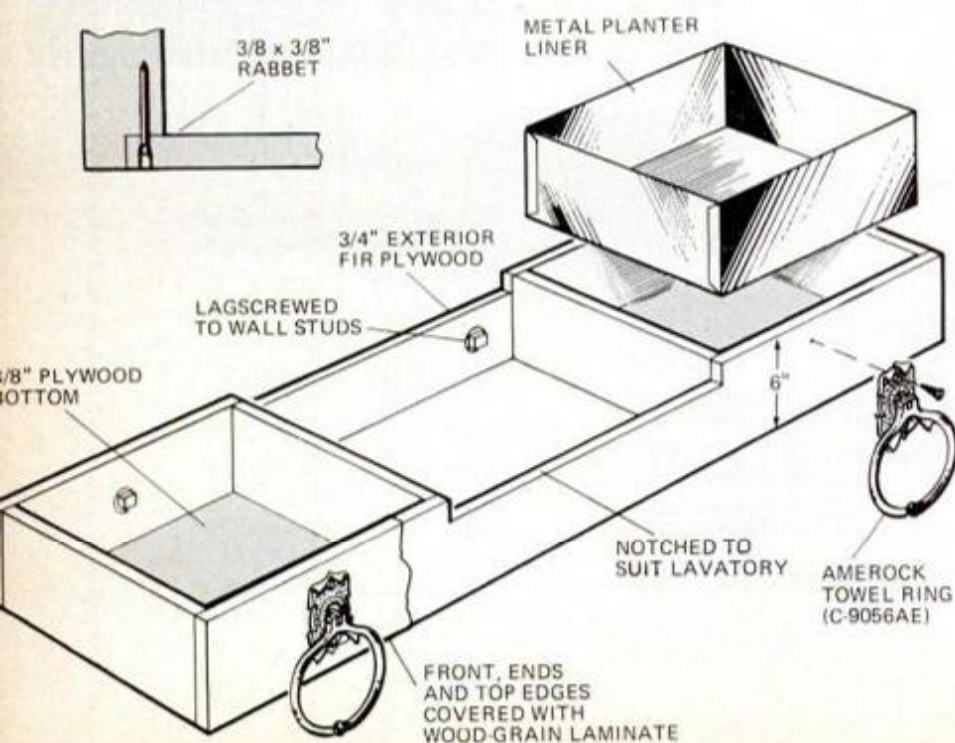
# Six low-cost home improvements you can make yourself

- Decorative planter for the bath
- Laundry center for compacts
- Charming door chimer
- Away-from-home security
- Attractive new yard light
- A dimmer for mood dining

by Wayne C. Leckey  
HOME AND SHOP EDITOR



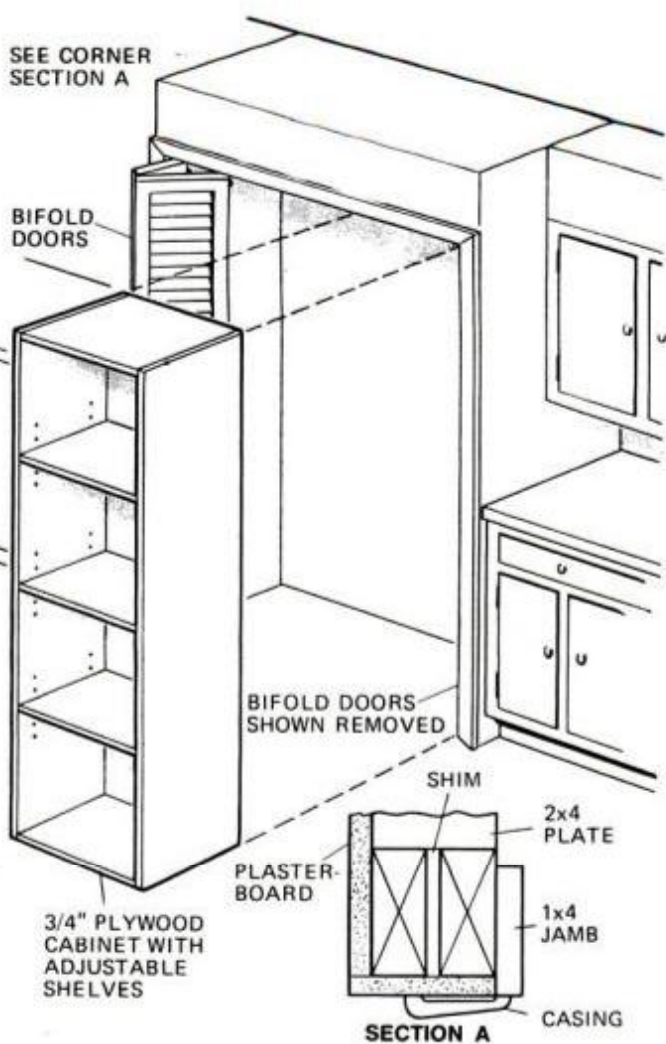
## Decorative planter



**G**reenery does wonders in adding a glamorous look to a bathroom. If you are looking for an attractive way to display plants, here's how it can be done cleverly with a cantilevered planter that actually does double duty in supporting the sink.

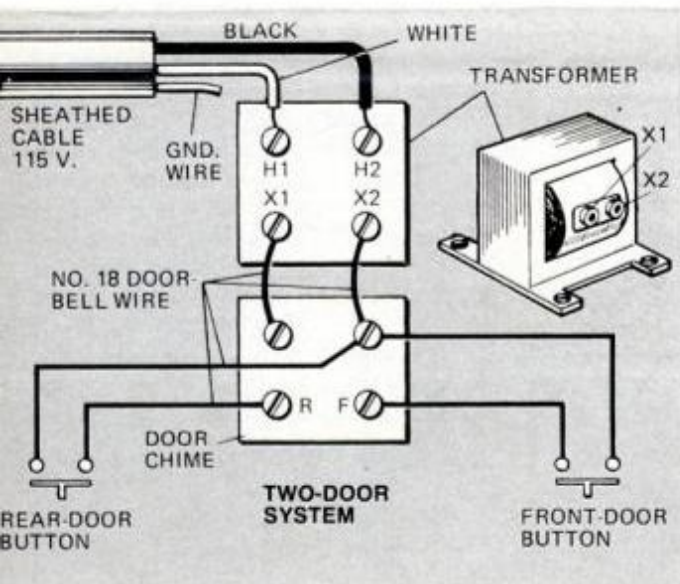
Securely lagscrewed to studs in both back and end walls, an open frame as shown at left will give ample support for the lavatory while providing flanking twin planters for live or artificial greens. If artificial, omit the metal liners and use 2-inch-thick slabs of green Styrofoam to hold your greenery. In each case, the planters are fitted with wood bottoms. You can make the boxlike frame from common 3/4-in. fir plywood and give it a rich, expensive look by covering it with wood-grain plastic laminate such as Formica. Use glue and flat-head wood screws to assemble the frame. Fancy towel rings add to the overall good looks. The original planter was made to support American-Standard's 20 x 30-in. Ultra lavatory in marble china finish.

## Laundry center



**W**hen the wash is done and you'd like to park your rollabout compact washer out of sight, you can do it in this kitchen "garage." The built-in not only accommodates the washer and companion dryer but provides four roomy shelves for storage. When closed, good-looking bifold doors hide it all from view. A space-saver stack rack lets you roll and store the washer under the dryer in a 21-in. space. The floor-to-ceiling, closet-like enclosure is framed with 2x4 studs and  $\frac{3}{8}$ -in. plasterboard, and the freestanding shelf unit is a simple plywood box open front and back. Compact appliances are by Westinghouse.

## Door chime



**I**f you have been wanting to update that raucous door buzzer with a new melodious chime but haven't done so because the thought of electricity bothers you, there's no need to worry. In making the switch from old to new, you are actually dealing with low-voltage wiring that's safe and easy to handle. The job requires little more than unhooking the existing wires and attaching your new chime. The diagram shows how wires from the front and back-door buttons go.



**Door chimes** can be contemporary works of art and striking wall accents. This Sculpture model by Nutone has silver face to reflect light.



## Home security

**10:00 p.m.** Kids in bed, Mom and Dad watch late movie in family room. Rest of house is dark.



**12:30 a.m.** Movie is over, lights go out in family room, on in kitchen where Dad has midnight snack.



**12:55 a.m.** Snack's over, lights go out in kitchen, on in bedroom. Mom and Dad are retiring.



**1:30 a.m.** Junior awakens, makes trip to bathroom, leaves light on for Dad to turn out later.



**Control timer** plugs into wall outlet, lamp into timer. GE unit turns lamp on/off at preset times on 24-hr. repeat cycle.

**W**hether you're away on vacation or just out for the evening, lamps plugged into several automatic timers to go on and off at varying intervals in different rooms will give your home that "someone's-at-home" look and keep would-be intruders guessing. The price of three or four low-cost timers is a small investment toward safeguarding your home. Set to provide a normal lighting pattern around the clock, such timers will help make your home look occupied when it isn't. You can buy automatic timers where appliances are sold.

## Lamppost for your yard

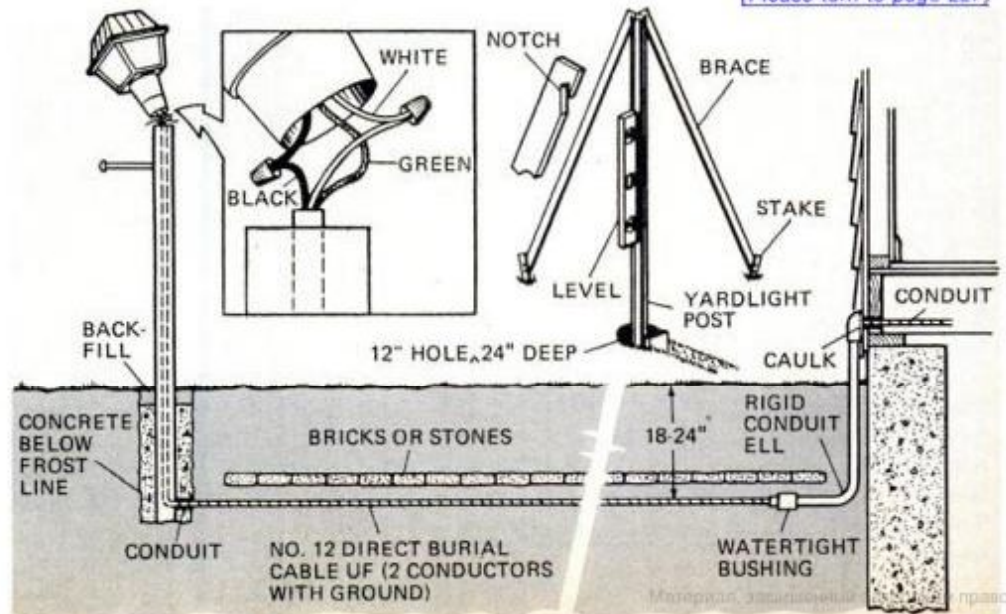


**A** yard light does many things. It bids welcome. It discourages prowlers. It adds nighttime beauty to the yard and lights the way to your door.

Before installing a yard light, check your local building department on electrical code compliance. Then dig a posthole (below the area's

frostline) and a narrow trench to the power source. Once the cable is laid in the trench and up through the post, place the post in the hole, plumb and brace it in both planes with stakes. Fill the hole with concrete mix to about 6 in. below ground level. Let the concrete set 24 to 48 hours, then mount the lamp fixture. Attach

*(Please turn to page 227)*



# New outdoor gear

The latest in upgraded sports equipment is ready to go out with you this spring!

by Bill McKeown  
OUTDOORS EDITOR

Ingenuous new engineering, exotic materials and exciting inventions have come out of the laboratories and into outdoor equipment this spring. Many scientists seem to be sportsmen as well as laboratory researchers.

One space-age material that upgrades performance—and cost—is graphite. Thin, flexible strands of this expensive carbon are now appearing in tennis rackets, golf clubs, fishing rods, even sheathing for masts of boats. Though rods can cost \$150 and blanks \$50 to \$80 or more, the material has proved so successful that some tackle manufacturers are reported to use only token amounts of graphite mixed in with fiberglass. Now there is talk that the industry may have to come up with a definition of what percentage makes a true "graphite" rod. But the best advice may be to buy from a top maker.

The Pederson Div. of Mossberg claims its titanium-alloy golf club shafts (\$125 to \$150 per club) are better than graphite or steel because they can flex without twisting and scattering off-line drives as a result.

Shoppers for guns this Bicentennial year can choose a commemorative collector's item that is useful on the range or afield as well. Winchester and Ruger are among manufacturers producing new-old models—Winchester with a '76 lever-action 30-30 carbine, Ruger with a Colorado Centennial Single-Six revolver with cylinders for .22 long rifle or magnum. Or for a patriotic red, white and blue color scheme, there are tents, backpacks, sleeping bags and even starspangled skateboards and inflatable boats.

A number of sleeping bags and cold-weather jackets are becoming available with synthetic replacements for down. Though not quite as warm, they dry out after a rain and launder more easily. Aspen Alpine Equipment has introduced a clever foam mattress with zipper edging that can turn a single mummy-shaped sleeping bag into a comfortable double (\$52 postpaid) at half the weight.

Even fishing line is being upgraded. Cortland's Polyspin multifilament is reported to stay limp and resist taking a curl from the reel, yet develop a fuzz to warn of wear. Gladding's Teflon-coated fly line is claimed to make casting easier.

Or want to shoot the works? A set of three matched English Churchill shotguns is \$51,500. ★ ★ ★



Directions in and out of the woods are easier with Normark's new Trakker wrist and pocket or lapel compass models. An indicator on the dial can be rotated to show direction of travel. Each is \$7.95.



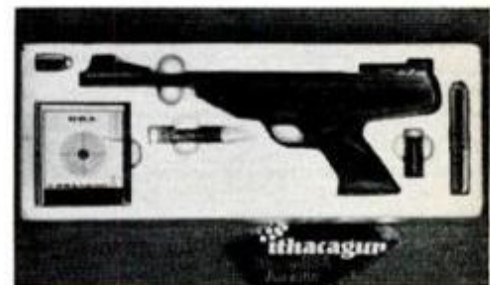
Good-as-new is the claim for balls stored in Tennis Products' TPI-300 Ball Preserver, and our tests show it can add the needed bounce for several hundred extra games if pump-up directions are carefully followed.



Light enough to be backpacked, big enough to sleep two or four, new Hiker's Convertible Igloo and Giant Igloo tents from Hirsch-Weis come in 8 and 11-pound models. Both have waterproof fly for tunnel entrance.



Better water and dirt repellency for back and day packs, sleeping bags and hiking gear is claimed when they're treated with 3M's Scotchgard fabric protector. Spray coats fibers, but lets material "breathe."



Air pistol with reported range of 350 yards and consistent accuracy, British BSA single-shot Scorpion is imported by Ithaca Guns in .177 or .22 cal. High-quality \$70 gun has adjustable trigger.

If you are thinking of converting attic space to an extra bedroom, you'll need to know how to frame a dormer window.



Illustration: Tom Fung

# How to add light and space with dormers

When a family starts outgrowing its house, moving to a larger one is not always the smart thing to do, especially if you have attic space that could be converted into the extra room you need. It's often best to stay put and "move" up and over.

Dormers play an important part in converting attic space into a bedroom or two. They provide not only added headroom that's often required but light and air as well. Dormers can also do a lot to perk up an uninteresting roof line.

Whether you can take on the job

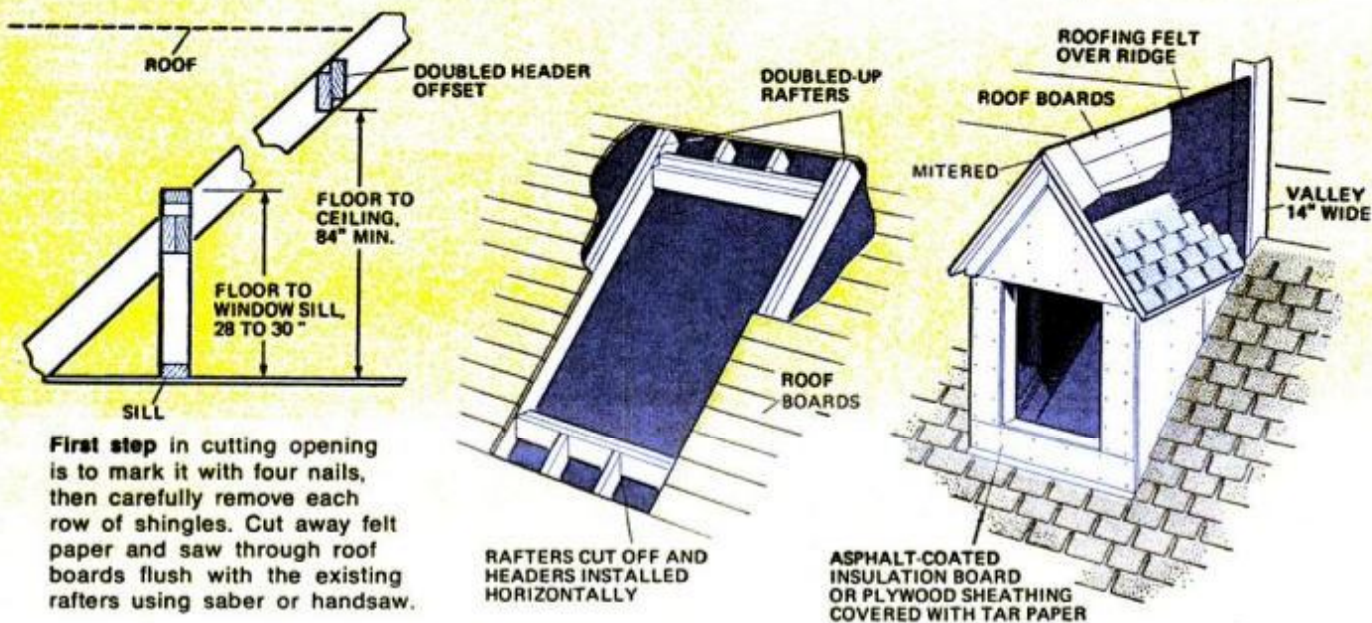
of framing a dormer yourself depends a lot on how handy you are with hammer and saw and in knowing your limitations. With the exception of a large Dutch colonial dormer, the framing of a single-window dormer isn't as difficult as you may think. Weather is a primary concern. Since you must cut an opening in the roof, you'll need clear weather for at least a couple of days. But be prepared for rain with a tarp you can tuck underneath the shingles and weight it down with a sandbag or two.

There are four basic types of dormers, as shown at right. Select the one that best complements the style of your house. Most important is to have it conform to local building codes which you should check before raising a hammer.

First lay out the dormer location carefully, then pry up the shingles within the area and about a foot beyond on all sides. Trim back the roofing paper to within a few inches of the shingle line. Before doing any cutting, double the rafters that will frame the opening, cutting the new

*(Please turn to page 252)*

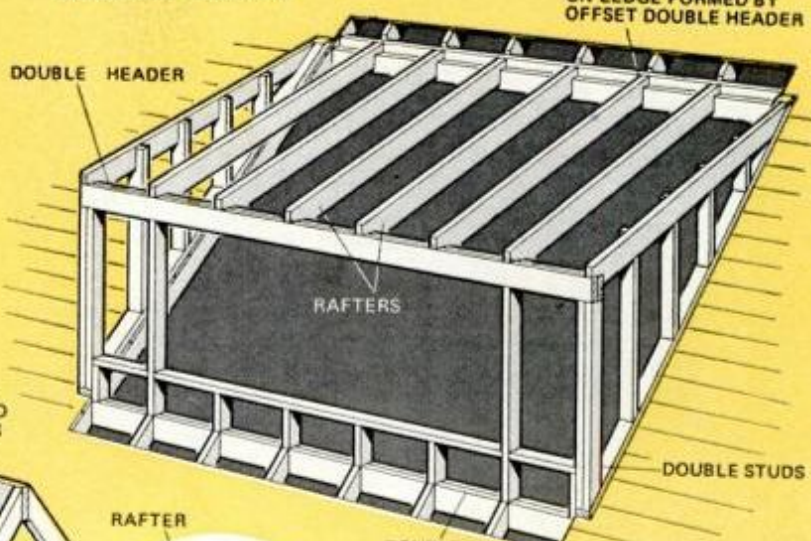
Art: Fred L. Wolff



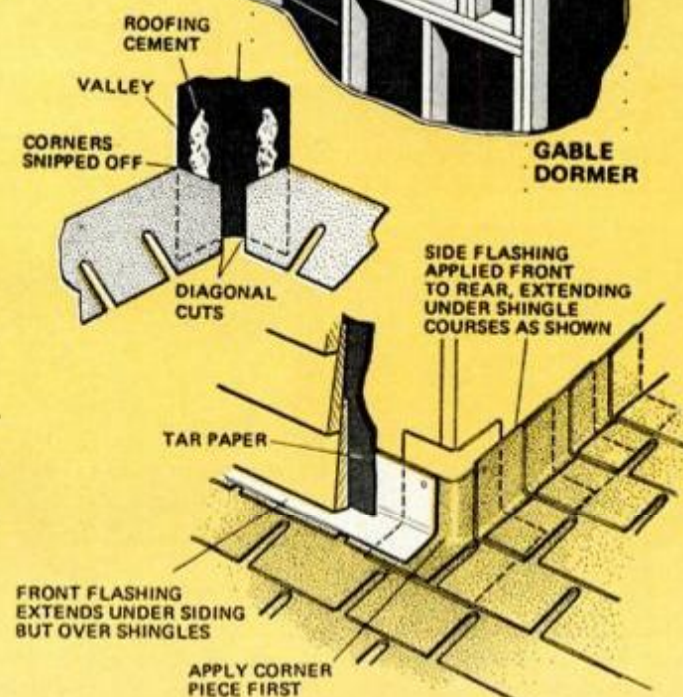
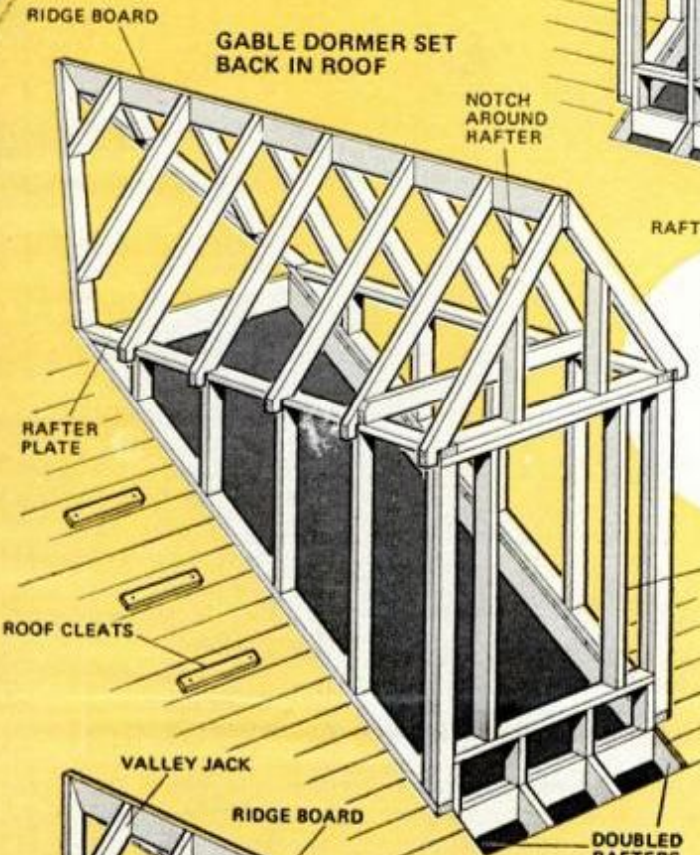
**First step** in cutting opening is to mark it with four nails, then carefully remove each row of shingles. Cut away felt paper and saw through roof boards flush with the existing rafters using saber or handsaw.

If framing a dormer is too much for you to tackle even with the help of a friend, yet your attic remodeling plans require a dormer or two for adequate light and air, you can have this part of the overall job done while you take on the work to be done inside. In seeking outside help, get bids from at least three contractors and compare prices. Ask each one for names of recent customers so you can get recommendations on their work. Insist on a comprehensive written contract with a complete description of the job, materials, timetable and payment schedule.

### GAMBREL OR DUTCH-COLONIAL DORMER



### GABLE DORMER SET BACK IN ROOF



# Build your own fruit and vegetable dryer

by R. S. Hedin



Interior view shows how food trays slide in and out. Two furnace filters at rear of compartment filter air from blower.

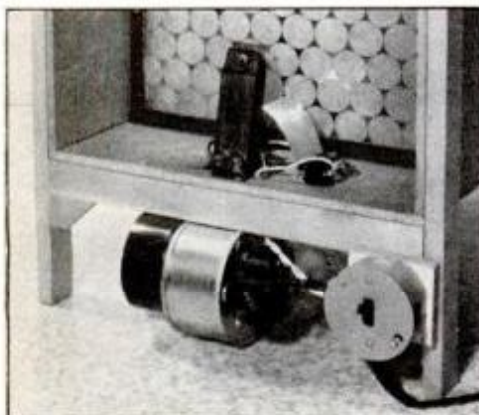
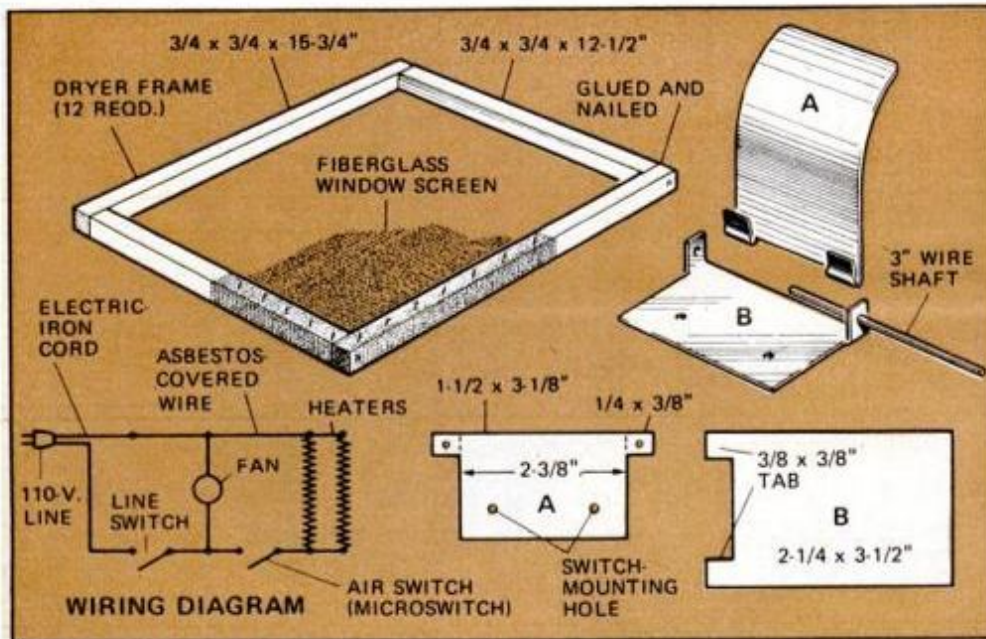
Canning and freezing are the most common methods of preserving foods. However, an old and equally satisfactory method of preserving food is by drying. Most fruits and vegetables can be dried and stored in less space than they'd otherwise need.

This dryer uses a fan and electrical heat to produce the drying atmosphere. Two 600-watt heaters maintain a temperature of about 120°F. and will dry a load in about 12 hours. Electrical consumption is low so the cost of drying a load is only about 22 cents. A bushel of dried sliced apples will store in about eight quart jars. Twelve screen trays provide a drying area of 14.5 square feet. A good book on the preparation and drying of food is *Putting Food By*, published by the Stephen Green Press, Brattleboro, Vt.

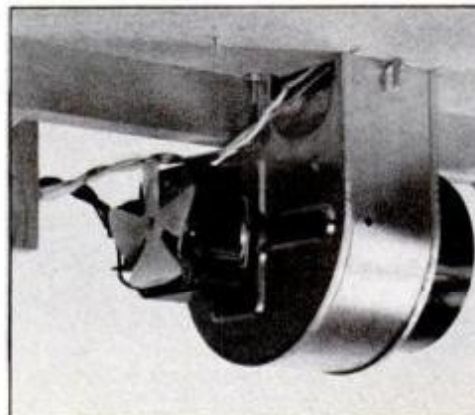
## Construction is simple

To dry vegetables or fruit, you simply spread the food out in a single layer on a screen-covered tray and then shift the trays from top to bottom during the drying period to promote more even drying.

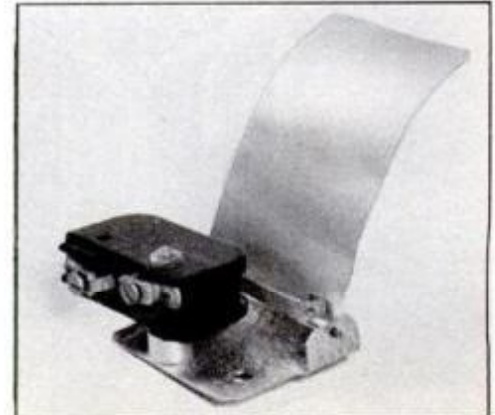
The dryer cabinet is made of 3/8-in. particle board and wood strips glued and nailed together. The front panel is held in place by two screw eyes that act as catches in the panel slots. The panel is quickly unlatched for



Rear view with back removed shows blower and heaters. Air switch is in "on" position.



Blower should have about 70-C.F.M. output. Blower in original was from copy machine.

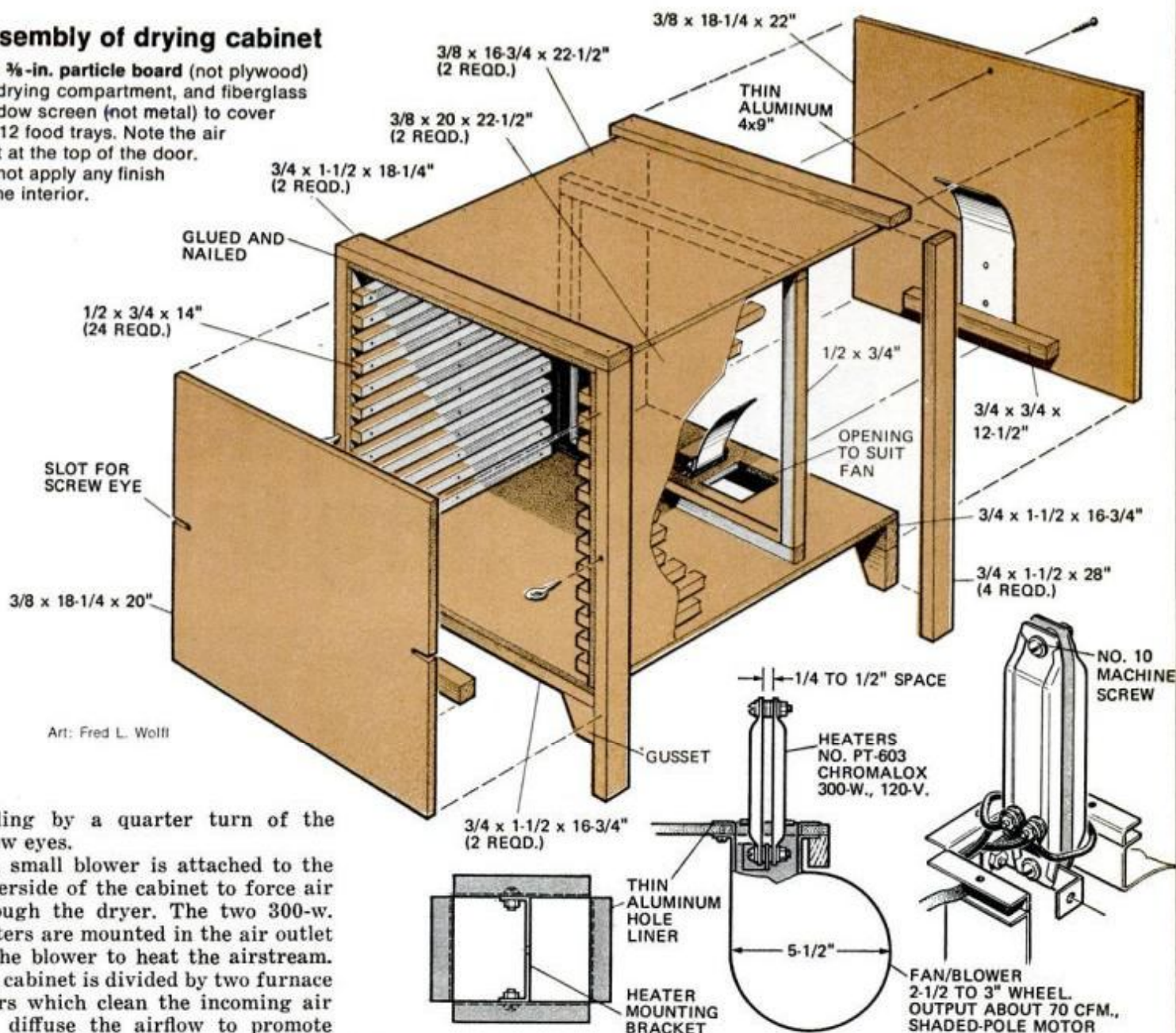


Actuating arm of air switch is bent to contact the curved vane at the hinge flap.



## Assembly of drying cabinet

Use  $\frac{3}{8}$ -in. particle board (not plywood) for drying compartment, and fiberglass window screen (not metal) to cover the 12 food trays. Note the air vent at the top of the door. Do not apply any finish to the interior.



Art: Fred L. Wolff

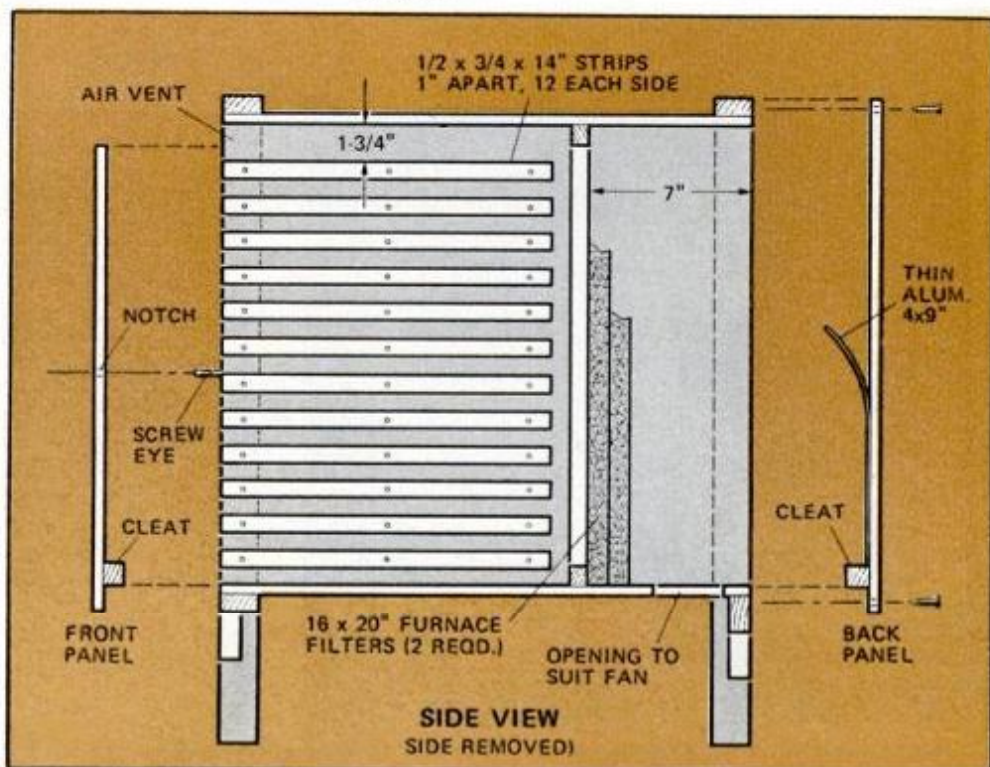
loading by a quarter turn of the screw eyes.

A small blower is attached to the underside of the cabinet to force air through the dryer. The two 300-w. heaters are mounted in the air outlet of the blower to heat the airstream. The cabinet is divided by two furnace filters which clean the incoming air and diffuse the airflow to promote more even drying.

### Safety switch important

The air safety switch, located at the blower outlet, is actuated by the airflow and insures that the heaters will not operate unless the blower is providing air. The switch assembly is located after the blower and heater are installed. Bend the vane and locate the assembly so the airstream will raise the vane to actuate the switch. Be sure the switch opens when the vane falls. In the off position, the vane rests against the heaters. The switch is an important safety feature and should not be omitted. Other kinds of heat control or safety devices could be used such as a thermostat or fusible link. A thin sheet of aluminum is attached to the inside of the rear panel to reflect radiant heat. A bend at the top deflects some of the airflow toward the filters.

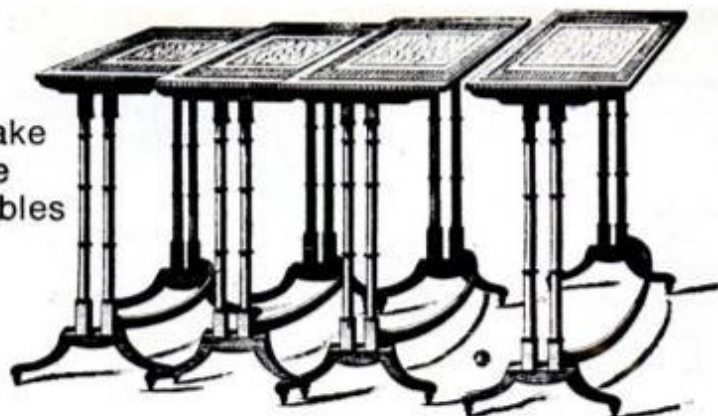
Do not paint or finish the inside of the cabinet as this may taint the food. ★ ★ ★



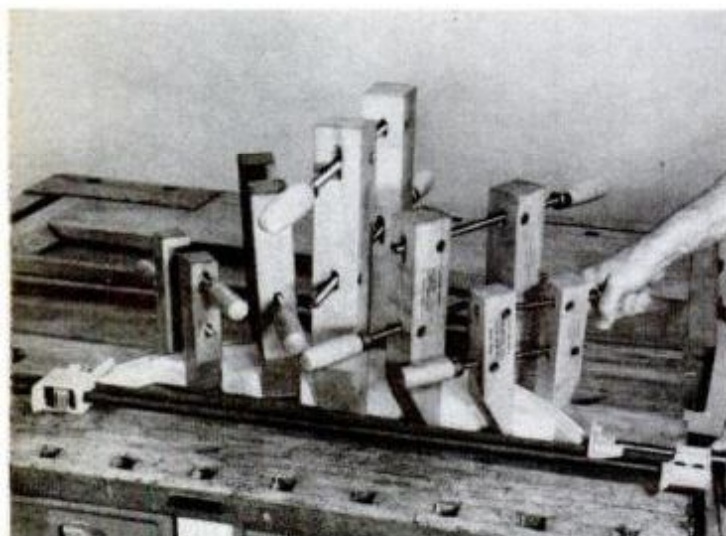
For \$82 you can make replicas of delicate Sheraton coffee tables valued at \$1000.

by David Warren

Art: Fred L. Wolff  
Color photo: Stephen Fay



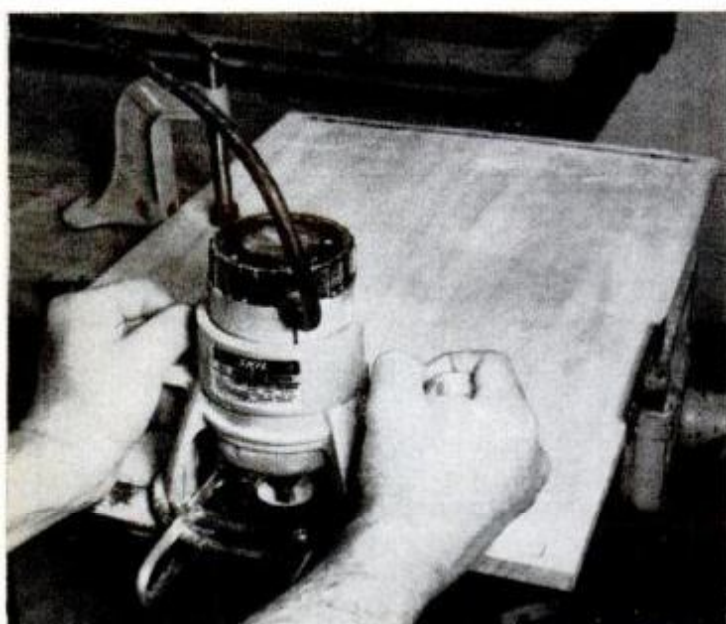
# Build this quartet of nesting tables



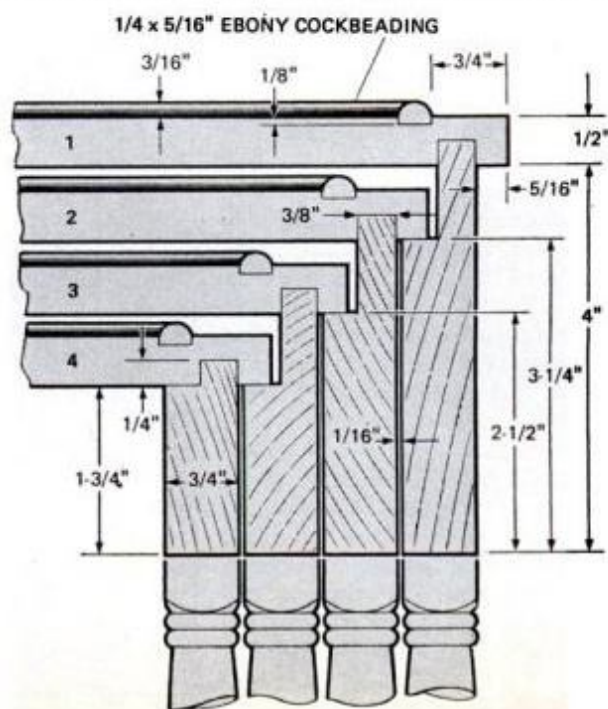
Laminate two-piece stretchers with plastic-resin glue. Slip wax paper between the four stretchers to keep them from sticking.



Use a veneer knife to slice the veneer 60° to the grain. Arrange veneer pieces on strip of veneer tape, then glue to table edges.



Press router guide firmly against edge of top when routing blind dados on underside for rabbeted end rails—an important step.



**D**ating back to mid-17th century, Thomas Sheraton's quartetto tables were among his most popular designs. Today, antique satinwood tables of this caliber command prices exceeding \$1000. Reproductions cost half that. My cost was about \$82.

I scaled down Sheraton's traditional 28-in. height to a modern 26 $\frac{1}{4}$  in. If you decide to build a trio and eliminate the largest table, it will lower the overall height further to 25 $\frac{1}{2}$  in. and, of course, cut your material costs one-fourth.

Satinwood, tulipwood and ebony are available from fine hardwood suppliers. I obtained the  $\frac{3}{4}$ -in.-thick satinwood I needed from Albert Constantine & Son.

### Bend stretcher around former

Start construction by sawing the curved former for the stretchers from a 2x6 scrap. Bending the stretchers to the former is easy if you cut the satinwood pieces about 2 in. longer than required. Choose straight-grain satinwood without knots or a fancy figure to prevent failure of the wood fibers either by compression or tension, and sand every ripple and sawmark smooth. Cut the  $\frac{1}{16}$ -in.-deep grooves for the inlay with a  $\frac{1}{16}$ -in. router bit.

Before laminating the stretchers, prebend the eight  $\frac{1}{8}$ -in. pieces by soaking them in hot water for a few hours. Clamp the pieces to the 2x6 former so the inlay grooves for each set face outward. Keep the wood clamped for a week while it dries. When you unclamp the pieces, the amount of springback may vary. Team up each pair with strips of close-matching curvature.

Then laminate each set with plastic-resin glue and reclamp the four stretchers to the former. Put wax paper next to the former and between each stretcher so they won't stick together. Keep the stretchers clamped to the former for a few days. Cut the stretchers to finish length later—when you fit them into the legs.

### Glue up the tops

Usually there is considerable variation in grain and in color among satinwood boards. To get the top pieces to match, cut the two or three pieces of satinwood needed to make a 15-in.-wide top from the same board. Then, to minimize warping, arrange the top pieces so the annular growth rings curve alternately (they're visible in the ends). When you rout the grooves for the mating splines, hold the router edge guide against the top surface of each piece so they will join flush. Join the boards with plastic-resin glue. When dry, sand each top smooth and cut to finish size.



Sales ticket in Chicago department store listed the originals at \$1400. The fine reproductions shown above were made by the author for a material cost of \$82.

Veneer the edges of the tops next. Slice the striped, tulipwood veneer so it's oversize ( $\frac{5}{8}$ -in.-wide strips) and so the angle of the strips is 60°. Mark the center points on all four sides of each top. Cut a strip of veneer tape 1 $\frac{1}{2}$  in. longer than the side you're veneering and make a fold line in the middle. Wet the tape and stick the veneer pieces in position, arranging them so the angle of the strips diverges at the middle fold.

Similarly, prepare the veneer feather-banding for the opposite edge. Apply plastic-resin glue to the opposite edges of the top. Align the fold mark in the tape with the center mark on the top and, using two 16-in.-long 1x2s as protection, clamp the tape-backed feather-banding in place. When the glue has set, veneer the two remaining sides. Feather-band the other three tops. When the glue has dried, soften the tape with

a wet cloth and peel it off. When the veneer redries, sand the projecting veneer flush. If you sand inward toward the tabletop, the veneer won't splinter.

Saw rails to size, cut the rabbets and sand. Mark the location of the rails on the underside of the smallest top. Rout the stopped dadoes. Fit the rails and glue them into place, being sure they are clamped perpendicular to the top. When the epoxy glue has set, use the top to verify the location of the stopped dado in the next larger top. Each tabletop should slide into the next larger one with a  $\frac{1}{16}$ -in. clearance on both sides, as well as between the tops.

Cut grooves for the ebony cock beading with a  $\frac{1}{4}$ -in. straight router bit. Then square the corners with a chisel. Shape the ebony cock beading with a router and miter each stick to

*(Please turn to page 230)*

# APAA Annual Popular Mechanics/APAA "May is Car Care Month"

Once again, Popular Mechanics and the Automotive Parts and Accessories Association have joined hands to bring you a special "May is Car Care Month" program loaded with tips, information, and money-saving specials to enable you to keep your car in top operating condition. The APAA's involvement reflects its continuing dedication to provide safer, more reliable automotive parts and products. Thousands of retail outlets, manufacturers, and newspapers will be helping to make this year's "Car Care Month" the most valuable ever.

Make the participating retail outlets your "Car Care Month" Headquarters. You'll find them listed in the Directory on page 189. They'll be able to supply you with the many fine products from cooperating manufacturers that you'll see advertised in the Popular Mechanics "Car Care Guide." There's a Directory of Manufacturers on page 188, and The Popular Mechanics and APAA symbols in advertisements and in store

displays will help you spot these quality car care items.

Hundreds of newspapers from across the country will be featuring special "Car Care Month" Sections bringing you even more car care know-how. Look for your local newspaper in the Directory on page 177. Be sure to watch for advertisements and money-saving offers from your neighborhood "Car Care Month" Headquarters, too.

The Popular Mechanics "Car Care Guide", beginning on the following page, is a convenient "magazine-within-a-magazine." It's crammed with all the essential car repair and maintenance "how-to's" you need to keep your car running smoothly, mile after mile. You can remove the Guide easily. First, bend the magazine's pages away from the Guide's front cover. Next, bend the magazine's back pages away from the Guide's last page. Now pull the Guide out. It's ready to be stapled or hole-punched and kept in your glove compartment for instant reference.

Look for the stores and products bearing the APAA's symbol and the Popular Mechanics Product Feature Mark.



# CAR CARE GUIDE

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Popular  
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# CAR CARE GUIDE

## Contents

Car care pays off for them:  
Over 100,000 miles  
and driving for a million!

Pinpointing *your* problem

The story behind the 1976 Car Care Guide

Section 1. Carburetors

Section 2. Ignition and  
electrical systems

Section 3. Bodies—inside and out

Section 4. Transmissions  
and drivetrains

Section 5. Starting problems

Section 6. Suspension and steering

Section 7. Oil problems

Section 8. Engines

Section 9. Brakes

Section 10. Heaters and  
airconditioners

Section 11. Exhaust systems

Section 12. Cooling systems

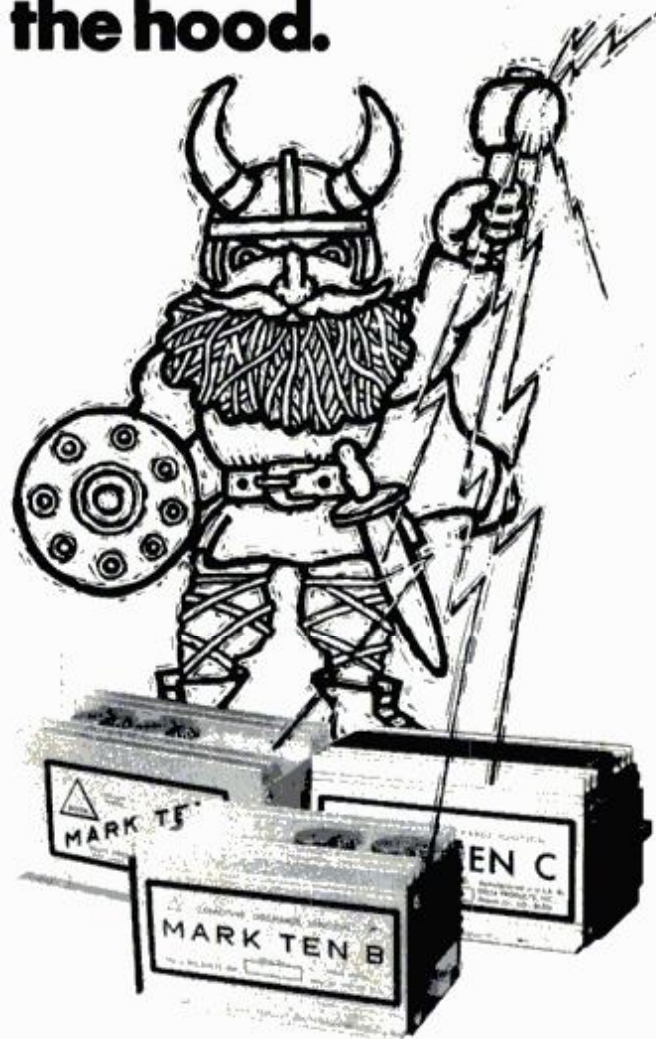
Section 13. Fuel systems  
and gasoline

Section 14. Tires

Section 15. Information wanted

Prepared by the editors of Popular Mechanics  
with technical art by Peter Trojan.  
Pinpointing *your* problem art by Richard Klein

## Mark Ten Electronic Ignitions put lightning under the hood.



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## CAR CARE GUIDE

**W**ant to squeeze 200,000 to 400,000 miles or more from your present car? Nothing to it when you know how.

But there's no single secret or formula. We surveyed 20 owners of super-high-mileage cars and found only two common denominators. The first was *caring* and the second was *setting up a routine* and sticking to it.

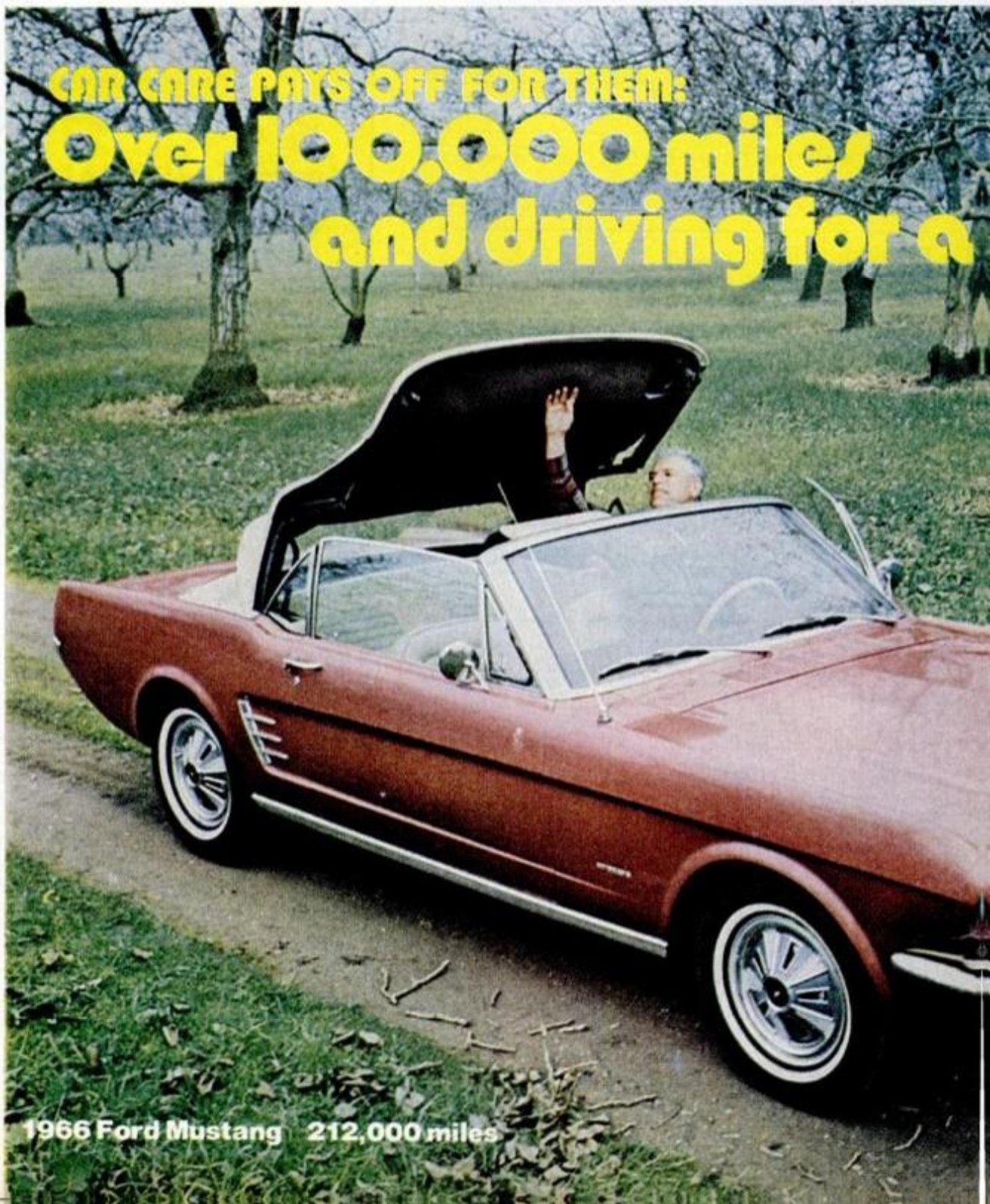
Caring seems to count for more than the routine itself, because maintenance intervals and procedures vary a great deal, we found. No trick, no secret, no additive alone prolongs the life of a car; rather it's a combination of keeping after the little things, catching potential failures before they happen, a general concern and carefulness in driving, plus abiding by a consis-

**Right:** Verne Ridgway of Stockton, Calif., has 212,000 miles on his 1966 Mustang Six convertible, pulls a 15-foot trailer, has done two valve jobs and overhauled the manual trans. He uses additive, changes oil and filter every 5000 miles. **Top:** 1964 VW of Owen Dykema, Canoga Park, Calif., registers 203,000 miles, has had two valve jobs and now burns a quart of oil every 300 miles. Instead of changing oil, Mr. Dykema merely tosses in more,

1964 Volkswagen 203,000 miles

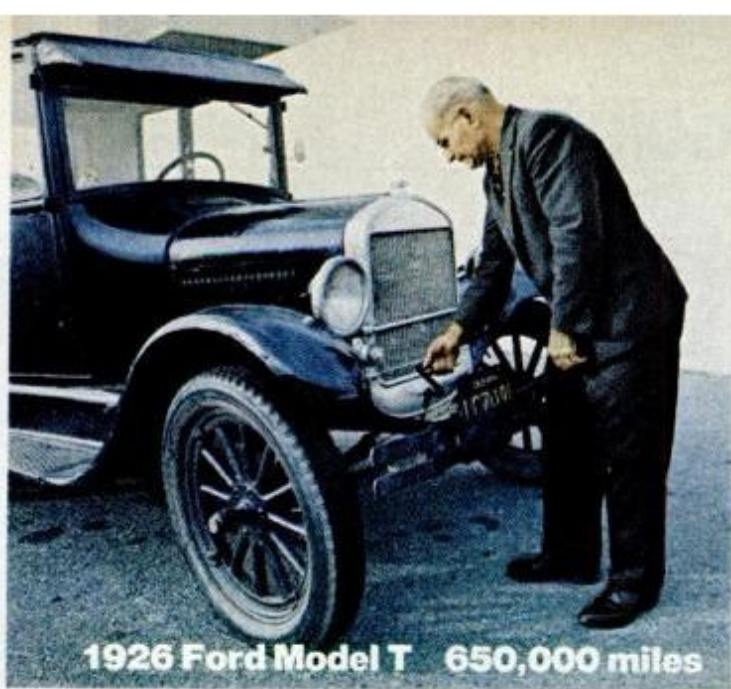


**CAR CARE PAYS OFF FOR THEM:  
Over 100,000 miles  
and driving for a**



1966 Ford Mustang 212,000 miles





**Left:** Mike Tonis, 82, of Sacramento, has owned his T since 1934. Now, at 650,000 miles, he changes oil whenever it turns black.

**Center:** B.Z. Sarason of Reed City, Mich., put 390,000 miles on the Mercedes diesel he bought new in '68, gets 100,000 miles from each set of tires.

**Bottom:** 1950 Plymouth of Frank Allen logged 187,000 miles and still averages 22 mpg.

**1926 Ford Model T 650,000 miles**



**1968 Mercedes 220D 390,000 miles**



**1950 Plymouth 187,000 miles**

# CAR CARE GUIDE

tent regimen of oil changes, lube jobs, minor repairs, tune-ups and parts replacements.

Here, then, are 20 case histories of car owners to whom 100,000 miles means "barely broken in"—people who've successfully nursed their cars to odometer figures most of us would consider impossible. Yet there's no reason why you can't do the same.

**Car: 1966 Mustang Six convertible/manual three-speed. Mileage: 212,000. Owner: Verne Ridgway, Stockton, Calif.**

Verne Ridgway works for the California Department of Motor Vehicles, does all his own maintenance, pulls a 15-foot trailer and enjoys driving. He sometimes drives 300 to 400 miles on a weekend just for recreation.

He changes oil and filter every 5000 miles, and at 40,000 he began including additive

at each change. He drives conservatively, believing in neither jackrabbit starts nor hasty braking.

The three-speed manual gearbox went out on warranty at 40,000 miles and was replaced free. Since then, Mr. Ridgway has done two valve jobs, the last one at 140,000 miles. At 100,000 miles, he installed a new clutch disc preventively. But otherwise he's had absolutely no mechanical problems. One of the reasons, he feels, is that the car has no frills—no power options, no airconditioning, no other extras.

Today, his convertible burns one quart of oil every 500 miles and averages about 22 mpg at 55 mph on the highway. The car looks, feels and sounds new, and Mr. Ridgway gets offers from would-be buyers on the average of one a month. He has no intention, though, of letting his Mustang go.

**Car: 1964 Buick LeSabre V8/automatic. Mileage: 228,000. Owner: Bruce Whalen, Austin, Tex.**

Bruce Whalen has a job with the University of Texas extension service, and this takes him to all corners of the state. He follows Buick's service recommendations—oil and filter changes every 60 days or 6000 miles, with lube jobs every 2000 miles. He maintains the car himself.

At 140,000 miles, the timing chain failed, but other than that the engine has never been touched. The transmission went out at 207,000 miles because the fluid had never been changed, but with the overhaul costing only \$180, Mr. Whalen figures regular maintenance of the automatic would have run him more.

Today, the engine burns a quart of oil every 1500 miles, a fact that Mr. Whalen attributes to keeping the crankcase one quart low. Fuel mileage averages 17 mpg on the highway.

**Car: 1963 Studebaker Wagonaire V8/automatic. Mileage: 190,000. Owner: Michael Elling, Huntsville, Ala.**

Michael Elling takes a rather unusual approach to car ownership. He upgrades his Studebaker whenever possible. For example, he installed disc brakes when

manual three-speed. Mileage: 390,000. Owner: B. Zalmon Sarason, Reed City, Mich.

Zalmon Sarason gets a fantastic 100,000 miles from a set of tires. He buys quality radials each time and credits their longevity with very gentle driving. "With a diesel, you don't do much hot-rod starting," he comments, "and I slow down by downshifting the transmission."

Mr. Sarason is a traveling salesman who drives a lot. He patronizes an independent mechanic who changes oil and filter every 3000 miles.

At 120,000 miles, the engine needed four new pre-chambers, three injector nozzles and valve seals. At 180,000 miles, since the engine was burning about a quart of oil every 100 miles, Mr. Sarason had a new short block installed. At 340,000, glowplugs, injector nozzles, and two pre-chambers needed replacement, and new cam and rockers were installed at 370,000 miles.

Today, at nearly 400,000 miles, the diesel gets 2000 miles per quart of oil, 32 mpg, and Mr. Sarason figures he could sell the car for just about what he paid for it.

**Car: 1967 Buick Electra 225 V8/automatic. Mileage: 197,000. Owner: Willard Auch, Jensen Beach, Fla. Willard Auch**

## THE CLEAN TEAM CLEANS INSIDE AND OUT!

### GUMOUT CLEANS 'EM BEST!

Pour a can of Gumout in your gas tank. It strips gum and varnish from your fuel system as you drive. Use Jet Spray Gumout to clean carburetor linkage, automatic chokes and PCV valves, too. Now you'll get better gas mileage, easier starts, smoother idling, less stalling! Gumout also reduces dangerous exhaust emissions, and won't harm catalytic converters.

discs became readily available; also added power steering and a limited-slip differential.

Mr. Elling hand-lubes the chassis once a month and changes oil and filter every three months or 3000 miles.

**Car: 1968 Pontiac Executive V8/automatic. Mileage: 248,000. Owner: Edward Caniff, Follansbee, W. Va.**

Edward Caniff commutes to Pittsburgh, 80 miles a day. He maintains his Pontiac by the book, with oil and filter changes every 600 miles. The transmission still has its original fluid and works perfectly.

The only mechanical trouble Mr. Caniff has had with this car was a camshaft replacement at about 200,000 miles.

**Car: 1968 Mercedes-Benz 220D diesel/**



## THE CARBURETOR CLEANER

**GUMOUT**

A Pennzoil Product  
Cleveland,  
Ohio 44104

used to travel a great deal in his job as regional sales manager for a large midwestern agricultural equipment manufacturer.

Today he's retired, but he still changes oil and filter every 6000 miles.

Despite pulling an 8000-pound trailer, he's never changed transmission fluid, nor has he had any trouble with the trans. Major repairs have included a new camshaft, timing gear and valve lifters at 133,000 miles, then rings and pistons at 170,000.

The Florida salt air is quickly rusting the Buick's body. "If the body were as good as the engine and transmission," notes Mr. Auch, "it'd be a good car."

**Car: 1965 Oldsmobile Delta 88 V8/au-**

(Please turn to page 125)



## You'll like the price and mileage. You'll also like the car.

Prices start at \$2899\*  
2-Seat Scooter \$2899\*  
The Coupe (shown) \$3098\*

\*Manufacturer's Suggested Retail Price including dealer preparation. Tax, license, destination charge and available equipment additional.



**40 MPG HIGHWAY**



**28 MPG CITY**

EPA mileage with standard 1.4-litre engine, 4-speed manual transmission and standard 3.70:1 rear axle. (Remember—these mileage figures are estimates. The actual mileage you get will vary depending on the type of driving you do, your driving habits, your car's condition and available equipment. In California, see your Chevy dealer for EPA mileage figures on California emission-equipped cars.)



**"Smart Switch."**

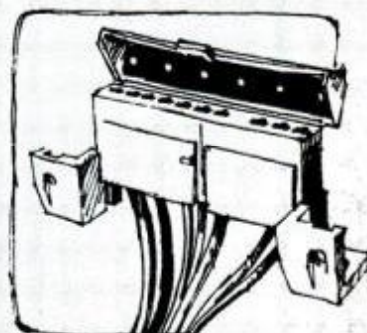
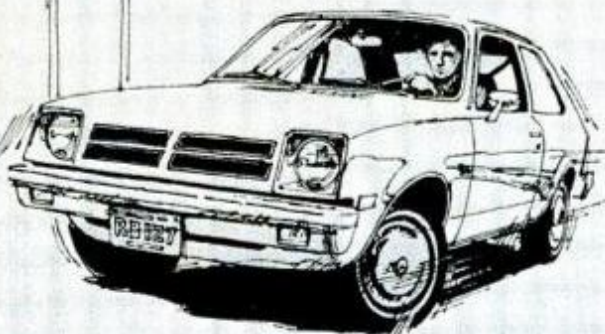
Puts headlight dimmer, turn signal, windshield washers, windshield wipers and lane-change signal all at your fingertip.



### Short turning circle.

At 30.2 feet, Chevette has one of the shortest turning circles of any car sold in the world. You'll appreciate it every time you park, back up or maneuver.

**Rack-and-pinion steering.**  
European-style. Compact and lightweight.



### Diagnostic connector.

Lets you diagnose primary ignition circuit and other parts of the electrical system.



### Freedom battery.

Freedom from worry about adding water or checking water levels. Sealed side terminals resist corrosion buildup.



**6,030 dealers**

That's nearly twice as many as VW, Toyota and Datsun combined. Parts and service are always nearby.



### Room for four.

With space for luggage behind the back seat. Seat folds down for expanded load space, accessible through rear hatch.

# Chevette

CHEVROLET'S NEW KIND OF AMERICAN CAR.

# FREE can of Edge from J/Wax Kit.



**FREE  
OFFER  
FROM KIT.**

(With proof of purchase.)



Get a coupon good for a free, full-sized can of regular or lime Edge protective shave now inside every specially marked can of Kit pre-softened paste wax.

Kit slides on fast and liquifies as it deep cleans. Wipes off easy, leaving a durable, protective shine.

There's no easier, faster way to get a long-lasting paste wax shine.

Look for this offer at participating retailers and send for your free can of Edge today. Offer expires Dec. 1, 1977.

**J/Wax Kit. The No. 1 selling car wax.**

# CAR CARE GUIDE

## CAR CARE PAYS OFF FOR THEM

(Continued from page 122)

**Automatic. Mileage: 319,000. Owner: Hugh E. Cooper, Rochelle, Ill.**

Agricultural engineering consultant Hugh Cooper feels that "regular servicing of the total automobile is a must for economical operation." His service station changes oil every 2500 to 3000 miles,



using additive each time and replacing filters every other change. Mr. Cooper also pours a top oil into his gas tank at irregular intervals.

Tune-ups at 20,000 miles include points, plugs and a carburetor zip kit as needed.

To date, the engine has had one valve job at 188,000 miles, a timing-chain replacement at 298,000 and a transmission overhaul at 195,000. Again, trans fluid and filter had been changed only twice before the overhaul, but now Mr. Cooper changes them every 50,000 miles. The car he traded for this Delta 88 was a 1956 Olds with 196,000 miles.

**Car: 1926 Ford Model T/manual three-speed plus planetary transmissions. Mileage: 650,000 approx. Owner: Mike Tonis, Sacramento, Calif.**

Mike Tonis, aged 82, paid \$5 for this car in 1934. He originally used it to do agricultural field work. He installed a 1928 Chevrolet three-speed transmission behind the Ford planetary gearbox many years ago.

Mr. Tonis changes oil "when it begins to look dirty and thick." He credits the car's longevity to basic over-engineering plus the fact that he never takes it over 35 mph. He does all his own maintenance.

**Car: 1970 Chevrolet Impala V8/automatic. Mileage: 273,000. Owner: Raphael Green, DeKalb, Ill.**

Raphael Green makes travel films and gives lectures around the country. He enjoys driving. He bought his Impala sec-



ond-hand in 1971, when it registered 9000 miles.

The engine has never had the heads or pan off. "I try to anticipate breakdowns," says Mr. Green, "and I usually take the car in to the garage before and after any long trip. I tell them to check everything, and if they find something wrong, I tell them to fix it with the best possible parts. The best are eventually the cheapest."

Mr. Green changes oil and filter between 5000 and 6000 miles, varies his brands of oil and uses no additives. Nor does he over or underfill the crankcase. He now adds a quart every 700 miles and gets 17 mpg. The transmission has its original fluid and works fine. Mr. Green always carries a rather heavy load, never drives very fast, and usually goes for many hours on end. Leisurely long-distance driving, he feels, is much easier on a car than continual stops and starts.

**Car: 1962 Chrysler 300 V8/automatic. Mileage: 195,000. Owner: Dwight Cervin, Granada Hills, Calif.**

Dwight Cervin, an automotive electrician, restores old cars as a hobby and maintains his newer ones carefully. This 300 used to belong to the son of Chrysler president K.T. Keller.

The 300 had 80,000 miles on it in 1967 when Mr. Cervin bought it used. He maintains it by the book—oil and filter changes every 6000 miles. It does burn a quart per 500 miles. He changes trans fluid and filter every 25,000.

The only engine repair needed to date has been a new timing chain at 130,000 miles. The car also has had three of its four ball joints replaced, but otherwise everything is untouched and in good condition.

**Car: 1962 Buick LeSabre V8/automatic. Mileage: 322,000. Owner: Arnold Reimer, Beatrice, Neb.**

Arnold Reimer is a rate analyst for the Nebraska Public Service Commission and drives to all parts of the state. He lubes, changes oil and filter all at 4500-mile intervals. The engine now burns a quart every 600 miles.

At 50,000 miles, the heat riser stuck shut and burned three valves, and at 80,000 it did the same again. Other than that, though, the engine has never needed work. Trans seals have been changed twice, but the fluid gets renewed only about every 100,000 miles. Passing gear presently doesn't kick in. The body is rusting and will determine the car's eventual fate, but mechanically it's amazingly sound.

**Car: 1970 Chevrolet Six/manual three-speed. Mileage: 333,000. Owner: John Becker, Williamsville, Mo.**

John Becker deals in cattle, hogs and grain, traveling some 1000 miles a week for business and pleasure. This is Mr. Becker's second high-mileage car, his first being a 1964 Chevy which he drove to 206,000 miles.

Mr. Becker prides himself on being a



conservative driver. His present car's first set of brakes lasted 285,000 miles because, as he says, "I don't like to use them. My friends say I'd rather run into another car than use my brakes." His Chev's rear linings have never been changed.

Mr. Becker changes oil every 6250 miles. Why 6250? Because all his maintenance revolves around 25,000-mile quadrants, meaning he'll replace oil four times in that interval, filter twice, air-cleaner element once, PCV and alternator at 50,000. He pulls the starter at 75,000 miles for lubing and changes brushes every 150,000 miles. He does all this work himself, including tune-ups at irregular intervals.

The distributor, claims Mr. Becker, has given him the most trouble. He's installed three new ones so far. He ground the valves at 80,000 and 220,000 miles, but otherwise has had no serious trouble.

The six-cylinder engine has burned some oil since new and now uses a quart every 425 miles. He gets 19 mpg on the average and cruises 52.5 mph on the highway.

**Car: 1963 Studebaker Lark V8 convertible/automatic. Mileage: 190,000. Owner: George Hamlin, Clarksville, Md.**

"I can give you the one-word secret to making a car last," volunteers George Hamlin. "Lubrication!"

He did use additive, but now runs SAE 20-50 without an additive, changing at 2000 miles, including the filter. He also lubes the front end at 2000 miles and believes strongly in Ziebarting. The only major work his Studebaker has needed to date has been valve-guide replacement.

**Car: 1962 Chevrolet Impala V8/automatic. Mileage: 231,000. Owner: Steve Garber, Warminster, Pa.**

Steve Garber feels that oil changes and overmaintenance are the keys to keeping his car going so long and effortlessly. He

(Please turn to page 126)



**NEED  
RADIALS  
OR  
BELTED/  
BIAS?  
CHOOSE  
MCCREARY**

*Steel Belted  
Radial*



The 40,000 mile tire with 2 shoulder-to-shoulder steel belts and 2 polyester cord radial plies. Great for handling, traction and mileage.



**SCOT  
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BELTED**

Belted/bias construction with 2 fiber glass belts for strength and resistance to bruises and cuts. Has polyester cord plies for a soft, comfortable ride.



**MCCREARY**

TIRE & RUBBER COMPANY  
Box 749, Indiana, Pa. 15701

## CAR CARE GUIDE

### CAR CARE PAYS OFF FOR THEM

*(Continued from page 125)*

changes oil every 1000 miles and filter every other change. He puts in new plugs every 10,000 miles.

Mr. Garber never changed transmission fluid, and at 190,000 miles, the automatic went out. But the engine has never been apart, even for a valve job. He did put on a timing chain preventively once when the radiator was off.

Mr. Garber, an electronics technician, bought the car new and uses it mostly for commuting.

**Car: 1964 Volkswagen/manual four-speed. Mileage: 203,000. Owner: Owen Dykema, Canoga Park, Calif.**

Owen Dykema bought this car new; does minor maintenance himself: carb rebuilds, valve adjustments, tune-ups and so forth. The engine now leaks and burns oil, so he hasn't actually changed oil in 100,000 miles. He adds a quart every 300 miles, putting in the cheapest he can find.

Major maintenance: He replaced both heads twice due to valve-burning; replaced clutch at 92,000 miles. Transaxle locked up at 201,000, was rebuilt.

Mr. Dykema is an aerospace engineer and does most of his driving commuting. He averages 50,000 miles per set of tires and 64,000 to a set of brakes. He rates himself moderately conservative as a driver, and he averages 29 mpg overall in the Volks.

**Car: 1967 Oldsmobile 98 V8/automatic. Mileage: 218,000, Owner: Frank Gaglio, Port Richey, Fla.**

Frank Gaglio bought this car used in 1970, at which time the odometer showed 47,000 miles. He changes oil and filter



every three months regardless of mileage. The engine burns one quart of oil every 500 miles. Automatic transmission fluid has been changed only once.

Major work includes two sets of brakes, but the heads and pan have never been off the engine. Mr. Gaglio does most of his own maintenance work and puts most of his mileage on the car recreationally. He loves to travel and especially to drive.

**Car: 1972 Pontiac Bonneville V8/automatic. Mileage: 230,000. Owner: Alvin W. Lerch, Fort Wayne, Ind.**

Alvin Lerch distributes film and has a large paper route in Indiana and Ohio, so

his Pontiac sees lots of stop-and-go action. Except for replacing the water pump and alternator, no major work has ever been needed. Trans fluid was changed only once, but there's never been any trouble with the gearbox.

When he's on the road, Mr. Lerch changes oil religiously at 2000 miles. By that time the dipstick shows one quart low. Every other time he'll install a new filter. Mr. Lerch swears by oil additive and includes it with every oil change.

**Car: 1964 Olds Vista Cruiser V8 wagon/automatic. Mileage: 198,000. Owner: Edward Rodgers, Fair Oaks, Calif.**

Edward Rodgers, who works for the state, bought this wagon in 1966 at 40,000 miles. He changes oil at 3500, at which time he drains the filter and pours in additive. Regular filter changes are at 7000 miles. He's lubed the chassis only three times since he's owned the car, does his own tuning, and follows no regular schedule on these. The engine burns no oil between changes.

Heads and pan have never been off, but at 130,000 miles, the transmission went out. "I found out, unhappily, that if I'd changed the fluid, the transmission would probably have gone on forever." He now drains and refilters the transmission at 35,000-mile intervals. On the highway, Mr. Rodgers gets a little over 16 mpg on the least expensive grade of regular he can buy.

**Car: 1950 Plymouth Six/three-speed manual. Mileage: 187,000. Owner: Frank H. Allen, New Orleans, La.**

Commercial photographer Frank Allen bought this Plymouth new and still drives it daily. It's his only car. He changes oil and filter every 2000 miles. Mr. Allen did a ring job at 77,000 miles and a complete engine overhaul at 166,000. On long trips, he still averages 22 mpg.

**Car: 1965 Chevrolet V8/automatic. Mileage: 131,000. Owner: Ron Felger, Sebastopol, Calif.**

Schoolteacher Ron Felger has his oil changed every 2500 miles, with filter every 5000. He looks for advertised oil-change specials by the big department stores and feels that oils are all pretty much alike. Trans fluid has never been changed.

Except for replacing the fuel and water pumps, Mr. Felger's car has never needed work of any sort. Heads and pan have never been off.

So you see the consistent and inconsistent patterns in these 20 examples. Additives, brands of oil, sticking with one brand of oil, quality of gasoline—all these things seem to make little difference. One reason most of our sampling gets away with so few transmission-fluid changes is probably because all these owners drive so conservatively.

Routine remains the important ingredient—routine along with the simple and long-term factor of caring. ★★ ★

# New Horizons In CB Performance

## The Johnson solid-state meter.



Clearly an improvement! Bright ruby red LED readouts let you read signal strength, transmitter power and modulation precisely ... at a glance! All solid-state, it's completely reliable regardless of temperature, dust or humidity. Solid-state metering — exclusive in the Messenger 123SJ.

## Engineer's triumph ... Operator's dream.

Improving what is already the best is the ultimate challenge for the engineer. And the ultimate reward for the CB operator. Now you can experience the incredible interference rejection of the only dual cascaded crystal filtering system in CB — plus a new fully automatic noise limiter and RF-type noise blanker. It's a dream rig you can own! Messenger 323A.



## Johnson sideband. Again!



Nearly 10 years ago we introduced the first CB sideband radio ... now Johnson offers the most advanced SSB performance on-the-air! With color-keyed lights for USB/LSB/AM modes, individual controls for every function, and famous Johnson quality, performance, warranty and service. Viking 352.

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**Mobil**

**1**

Synthesized Engine  
Lubricant outperforms  
premium motor oil

premium motor oil  
Lubricant outperforms



# Why should you spend \$3.95 for a can of motor oil?

**Introducing Mobil 1 synthesized engine lubricant.**

**It's better than conventional oil, no matter how you drive.**

It's a whole new lubrication generation. A unique multiviscosity fluid made with synthesized hydrocarbons from a patented Mobil process.

It can work magic for your engine. This is why.

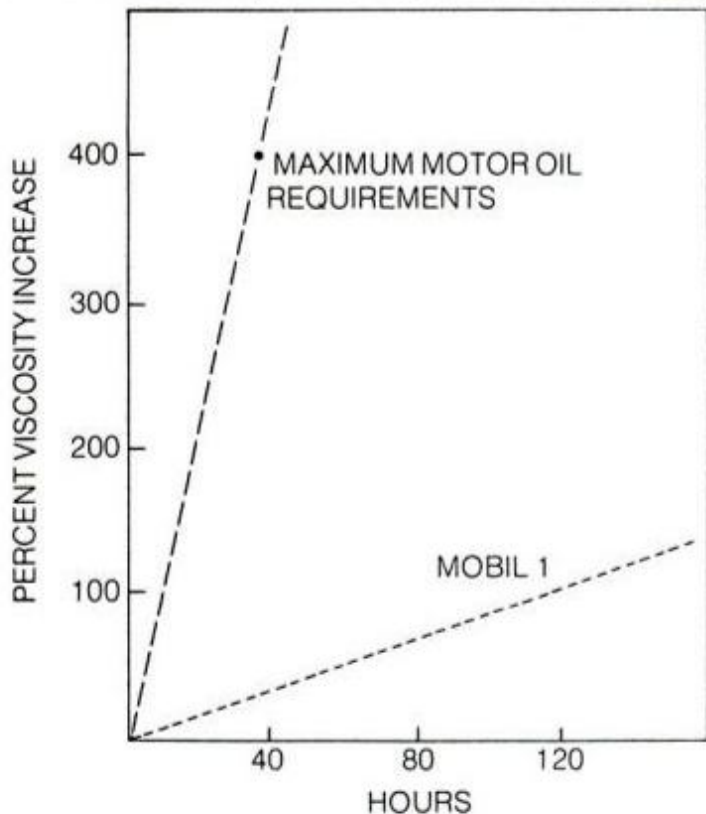
## **Better engine protection.**

Mobil 1 protects valve trains, gears, piston rings and cylinders better than ordinary oils. It's a performance reserve you can count on.

To prove it, we put Mobil 1 in a fleet of highway patrol cars for 12,000 miles. Then, we tested that "used" oil against conventional motor oil in a Pinto engine at 3000 rpm for 150 hours. Even after all its previous use, Mobil 1 protected like brand-new ordinary oil.

## **Better high-temperature performance.**

If you drive fast and hard, you'll find Mobil 1 won't thicken and form deposits to the extent ordinary oil does.



We proved it in the Olds I11C "SE" high-temperature-high-load test (3000 rpm, 100 HP, 300° F oil). Ordinary oils are tested for only 64 hours. But we had to double

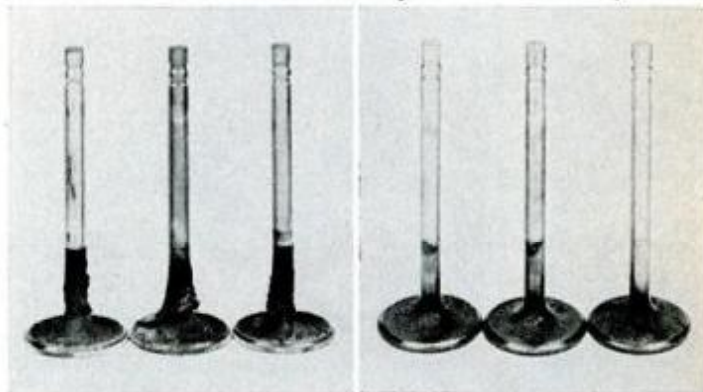
the test length to get even a significant viscosity increase with Mobil 1.

## **Faster cold starts.**

Down where even antifreeze turns to mush, Mobil 1 helps your engine start quickly. Ordinary oils are so thick at -20° F we can't measure their viscosity. Mobil 1 still flows at -50° F.

## **Cleaner intake system.**

Because it's so stable, Mobil 1 forms less deposits on intake area and valves. In a cyclic test on a 6-cylinder,



250-cu.-in. Chevy engine, Mobil 1 gave 78% less buildup on intake valves than conventional oil, after 200 hours of testing.

## **Less oil consumption.**

Mobil 1 isn't used up as fast as ordinary oils. (Provided your engine is in good mechanical condition.) In city and highway fleet tests, Mobil 1 cut oil consumption by as much as 25%. This means a cleaner exhaust stream.

## **A cleaner engine.**

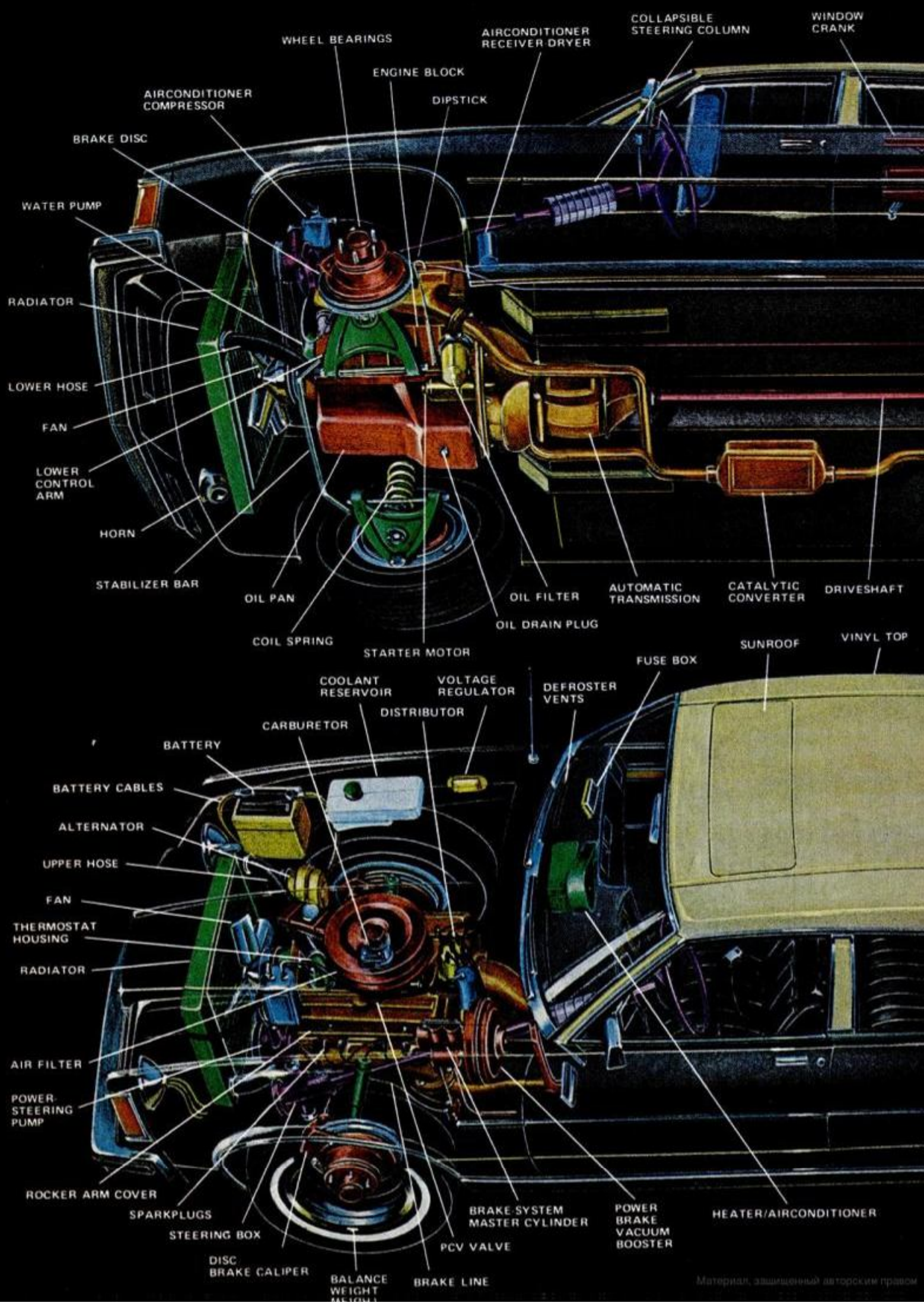
A lot of people say it. We can prove it. Our exclusive detergency additive package is why. Even after 384 hours—double the standard length—in the Ford VC test, Mobil 1 came up better than ordinary oil standards in every way. Less sludge and varnish. No oil ring or screen clogging. No ring sticking.

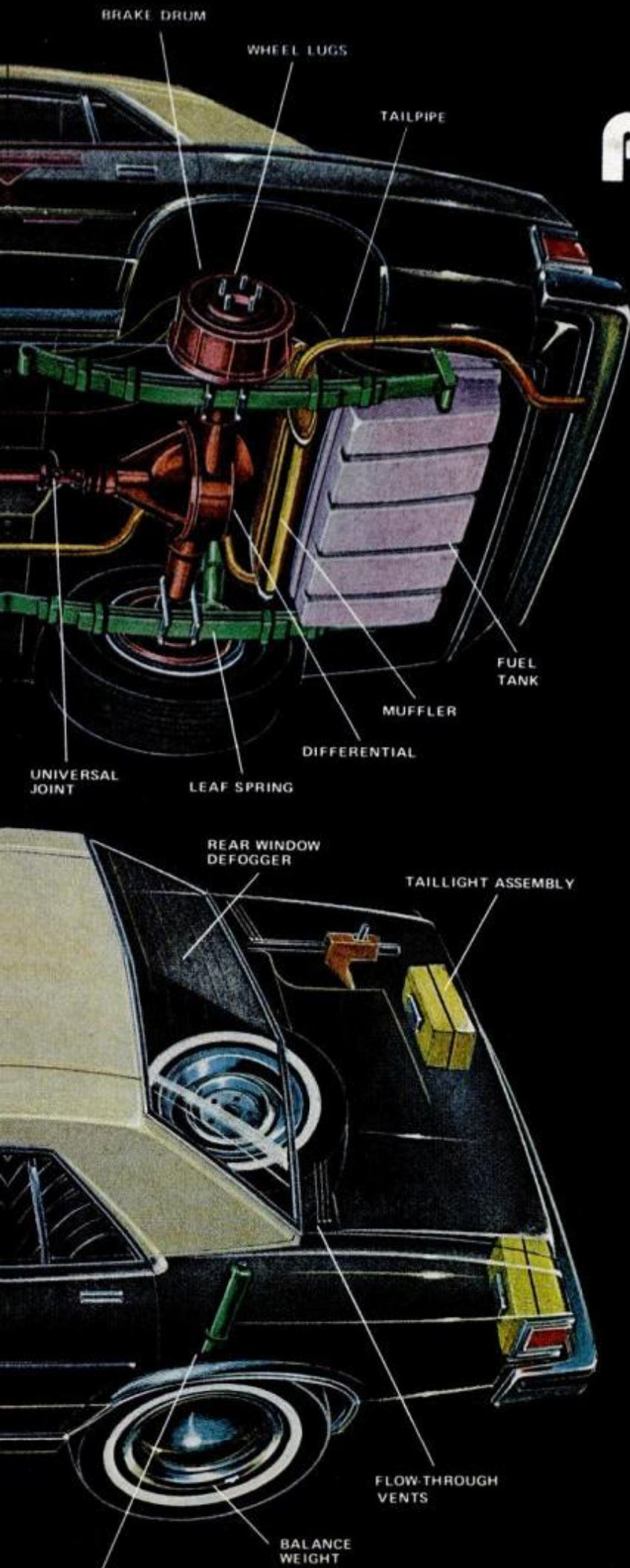
## **Better mileage.**

You can get more miles per gallon, too. Up to 10 miles per tankful for the average car. Sure, you know a million ways to boost your mileage; here's a way to get a little bit more.

That's the Mobil 1 story. And now you know why it's worth up to \$3.95. Or even more.

# **Mobil 1**





# Pinpointing your problem

How is your car running? Do you have a problem that's got you stumped?

Last year thousands of car owners wrote to PM's *Car Clinic* for help with the problems they were having with their automobiles.

On a following page is an explanation of just how we analyzed those thousands of letters and how we've organized this *Car Care Guide* around the results.

The outcome may surprise you. Here is a summary of the findings ranked by the percentage of those who asked about each problem area.

1. Carburetors	<b>18.4%</b>
2. Ignition and electrical systems	<b>9.1</b>
3. Bodies—inside and out	<b>7.8</b>
4. Transmissions and drivetrains	<b>6.1</b>
5. Starting problems	<b>5.7</b>
6. Suspension and steering	<b>5.5</b>
7. Oil problems	<b>5.2</b>
8. Engines	<b>4.8</b>
9. Brakes	<b>4.0</b>
10. Heaters and airconditioners	<b>3.6</b>
11. Exhaust systems	<b>3.3</b>
12. Cooling systems	<b>3.3</b>
13. Fuel systems and gasoline	<b>2.1</b>
14. Tires	<b>0.7</b>

The single largest group of letters (20.4%) asked for information about a multitude of automotive subjects and so we've included as Section 15 an information-wanted discussion.

In the past we've organized *Car Care Guide* the way we've wanted to; this 1976 edition is organized the way you want it.

**Quality.**

**Pennzoil's  
Oil Filter  
is built  
on it.**



**When your car is worth caring for, Pennzoil is worth asking for.**

**T**he two pages of *Car Clinic* column that appear each month in *Popular Mechanics* might be called the tip of a paper iceberg.

The letters we answer on those pages are a handful selected from the hundreds we receive. The rest are retained in file cabinets in the order they arrive. It's impossible to answer each one. We thought about those letters—and the perplexed car owners who wrote them—when we discussed how the '76 Car Care Guide could be of the greatest value to the readers of PM.

The best thing we could do would be to answer all those letters! And that's what we've attempted to do here.

Every letter we received during 1975 was read again, and the car owner's problem was coded onto a computer card. This time-consuming step in organizing the Guide was the job of statistician Bob Winter and PM secretary Susan Joubert. After the computer cards were prepared, it was an easy job to push buttons and get a printout, in percentages, of what problems were plaguing car owners who wrote us. Four and a half minutes on the computer pinpointed all of them!

With the computer printout in hand, the rest was simple. Solving carburetor problems would be Section 1; ignition and electrical problems would be Section 2; and so on. All that remained was for *Car Clinic* author, Mort Schultz, to write the '76 Car Care Guide. The sections begin on the following pages.

**Wrestling** with the computer printout from left to right are PM Editor John Linkletter, Auto Editor Bill Hartford and Car Clinic author Mort Schultz.

# The story behind the '76 CAR CARE GUIDE



## I. Carburetors

Almost one-fifth of the letters received by *Car Clinic* in 1975 (18.4 percent to be exact) were from people with carburetor-related problems. Complaints included excessive fuel consumption, hesitation when accelerating, engine surge, percolation, backfiring and stalling.

Most letters fall into a category we call "carburetor tune-up," because they ask help with problems that can usually be solved (or could have been prevented) by following a prescribed servicing procedure. This is a good place to begin.

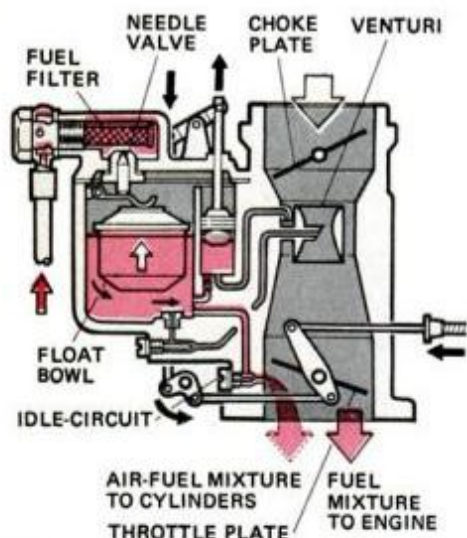
### CARBURETOR TUNE-UP

There isn't too much that has to be done for a carburetor, but what is required is necessary for good engine performance. Unhappily, some car owners neglect the carburetor until they get hit over the head, and even then . . . well, consider this excerpt from a letter:

**"My car rides rough, loses power and has poor fuel consumption. Plugs, dwell and ignition timing are O.K. What's wrong?"**

"What's wrong" is that servicing the ignition system without tuning up the carburetor (and vice versa) is a waste of time and energy. Pity, too, because carburetor servicing is so easy:

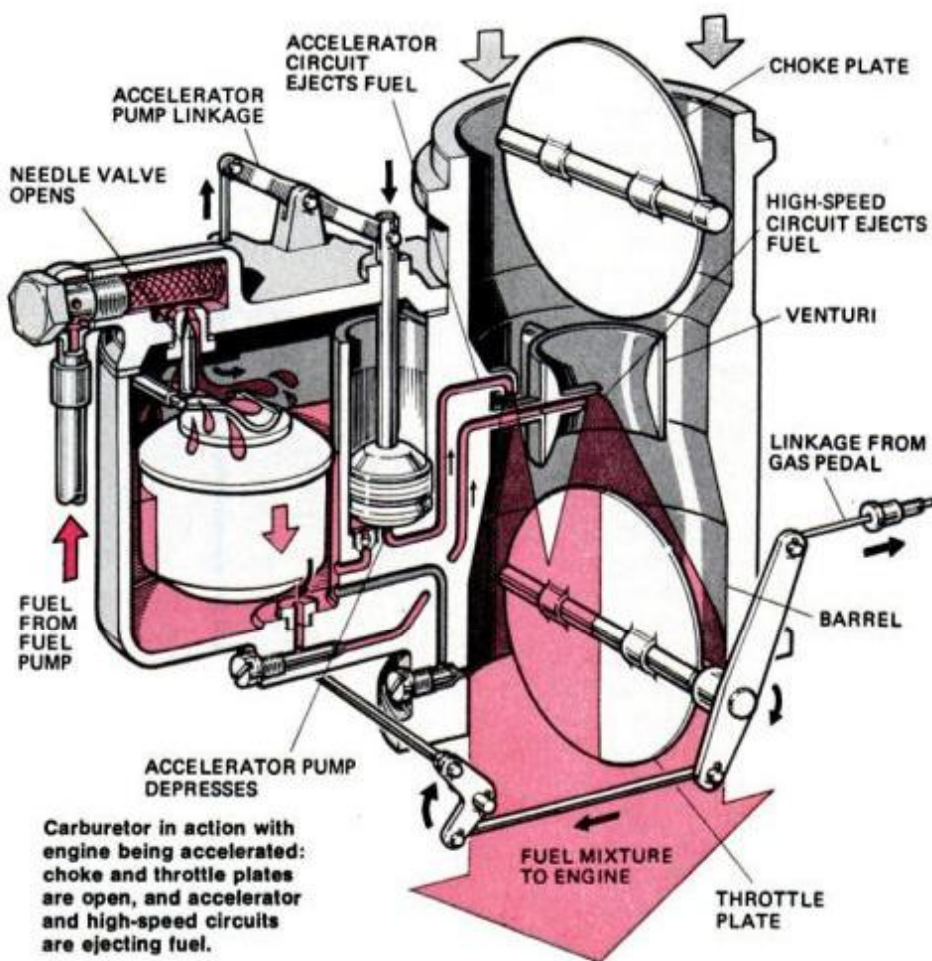
1. Start by simply replacing the air-filter element. It can get clogged enough with dirt to severely impede the flow of air into the carburetor, which disrupts the gas/air ratio. Forced to run on a richer-



Carburetor at idle with idle-circuit nozzle supplying fuel.

than-normal fuel mixture, the engine will surge or stall, and consume more fuel.

To determine whether your car needs a new air-filter element, just shine a drop-light from the inside out. If the element looks dirty, get a new one.



Carburetor in action with engine being accelerated: choke and throttle plates are open, and accelerator and high-speed circuits are ejecting fuel.

2. After checking on the element, test automatic choke operation. Engine cold? Have someone behind the wheel press and release the accelerator pedal as you watch the choke plate, which should close over the carburetor throat.

This is the proper position of the choke plate when a cold engine is first started. A closed choke plate keeps air from entering the carburetor when a cold engine is started, which gives the engine a richer fuel mixture for positive starting.

Have a friend start the engine. The choke plate should open slightly and continue to open until it's soon wide open. If the choke plate sticks closed (fully or partially), the fuel mixture will become too rich for the engine as the engine gets warmer and warmer, and its need for rich fuel lessens. The engine will flood and stall.

In other words, if your engine is hard to start or stalls, check the choke.

To keep the choke working right, or to free it up if it isn't, clean choke linkage with choke cleaner or kerosene, using an old toothbrush to scrub away crusted dirt. Apply cleaner to choke-plate pivots especially, working the plate back and forth by hand a few times.

Test the choke again. Work? If not,

then the system should be taken apart and examined for bad parts, especially a weak thermostatic spring.

3. When you've gotten this far, stop and think a second—how long has it been since the fuel filter was replaced or cleaned? Every 12,000 miles is generally conceded to be a good time, but look in your owner's manual since the manufacturer should have the last word.

A clogged fuel filter leads to engine surge, lack of power or a starting problem. Your carburetor has either an in-line or internal filter. An in-line filter, which is inserted in the fuel line between fuel pump and carburetor (it's visible), is a plastic or metal chamber that can't be serviced—you've got to replace it.

Put a receptacle or rag beneath the filter to catch gasoline. See that the engine is cold—and don't smoke. Slide the filter's retaining clips off hoses and pull the filter from the fuel line. Then reverse the procedure to install a new filter.

Internal fuel filters (they're not visible) are inserted in carburetors at the fuel inlet. Some are metal (bronze usually). They can be cleaned in kerosene or carburetor solvent and reused. Others are paper. A paper filter must be thrown away and replaced with a new one.

Unscrew the fuel line at the carburetor inlet and remove the large retaining nut. Draw the filter and spring from place. Don't lose the spring. You have to reuse it.

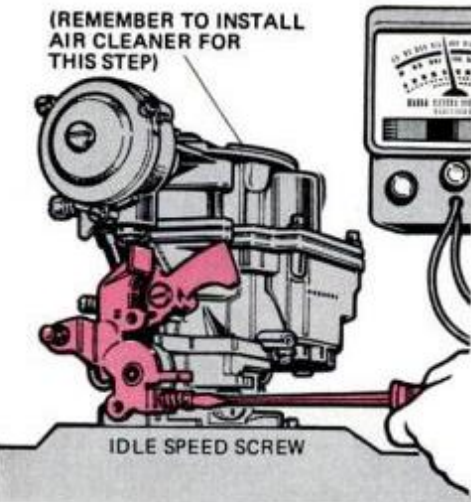
Now it's time to adjust the carburetor, but before you do, reinstall the carburetor air cleaner. Be careful not to overtighten hold-down fasteners since it's possible to crush the sides of the carburetor.

4. When we talk of "carburetor adjustments," we're speaking about the slow-idle speed adjustment (also called curb idle speed and hot idle speed) and fast-idle speed adjustment. A third common adjustment—idle mixture—is important to older-model cars.

**Slow idling speed** refers to the rate of speed at which an engine idles after it is warmed up. If slow idle speed is not set to manufacturer specification, the engine may stall, hesitate on acceleration, idle rough or use more gas than normal.

With the engine warmed up and the choke plate open, connect a tachometer. The typical tach has a black lead that's hooked to a clean ground, and a red lead that's connected to the distributor primary terminal on the coil. This is the terminal that the primary wire going to the distributor is attached to.

Find out the manufacturer's idle speed specification for his engine, and the conditions under which he wants idle speed set (in gear or out of gear; headlights on or off; whatever). This information is printed by some manufacturers in car owner's manuals; it is printed in the car's service manual; it should be printed on the decal glued to a spot in the engine compartment if you have a 1970 or later model; and it is also found in general auto-repair manuals in public libraries, such as *Motor's Auto Repair Manual*.



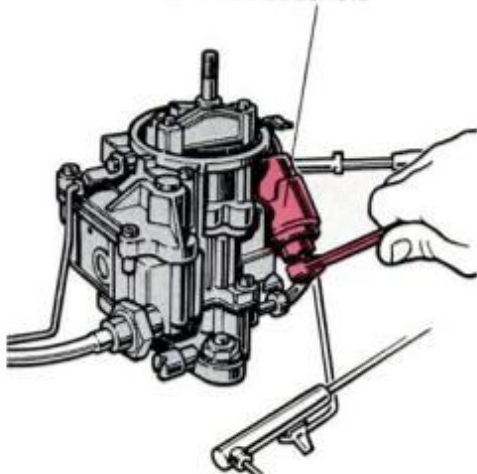
Idle-speed screw is turned to set correct rpm with use of a tachometer.

Start the engine and let it idle. The tachometer should read the manufacturer's idle-speed specification. If not, adjust by turning the carburetor idle-speed screw or idle-speed solenoid. A carburetor usually has one or the other, but in

the event it has both, manufacturer's instructions will tell you which to use to make the adjustment.

The idle-speed screw is turned with a screwdriver. The idle-speed solenoid adjusting nut is turned with a small wrench. Turning the screw or adjusting nut counterclockwise reduces idling speed.

IDLE SPEED SOLENOID



Idle-speed solenoid nut is turned to adjust slow idle speed.

**Fast idling speed** refers to the speed at which an engine idles when cold and first started. The fast-idle mechanism, along with the choke, provides the engine with sufficient fuel to maintain idling at a higher rate of speed, keeping the engine from stalling.

The fast-idle mechanism consists of a fast-idle screw that intercepts graduated steps on a fast-idle cam. The position of the screw against the cam determines engine speed. Here's how it works:

Suppose you start a cold engine. The fast-idle screw meets the highest step of the fast-idle cam. The fast-idle cam is attached by a shaft to the throttle plate. The fast-idle cam, therefore, keeps the throttle plate open partially to provide maximum fast idling speed.

As the engine starts warming up and its need for a richer fuel mixture becomes less, the fast-idle mechanism disengages, and the fast-idle screw steps down one step on the cam. This allows idle speed to taper off. When the engine is fully warmed up, the fast-idle screw is off the fast-idle cam entirely, which disconnects the fast-idle mechanism. The engine will then idle at its normal slow idle rate of speed.

The fast-idle mechanism and its operation bring to mind a letter we received at *Car Clinic*. It said:

**"My car's engine races when I start it first thing in the morning . . . so fast that it shifts with a bang. What should I do about this?"**

First of all, it's possible that the fast-idle mechanism is hanging up. One way to

(Please turn to page 136)

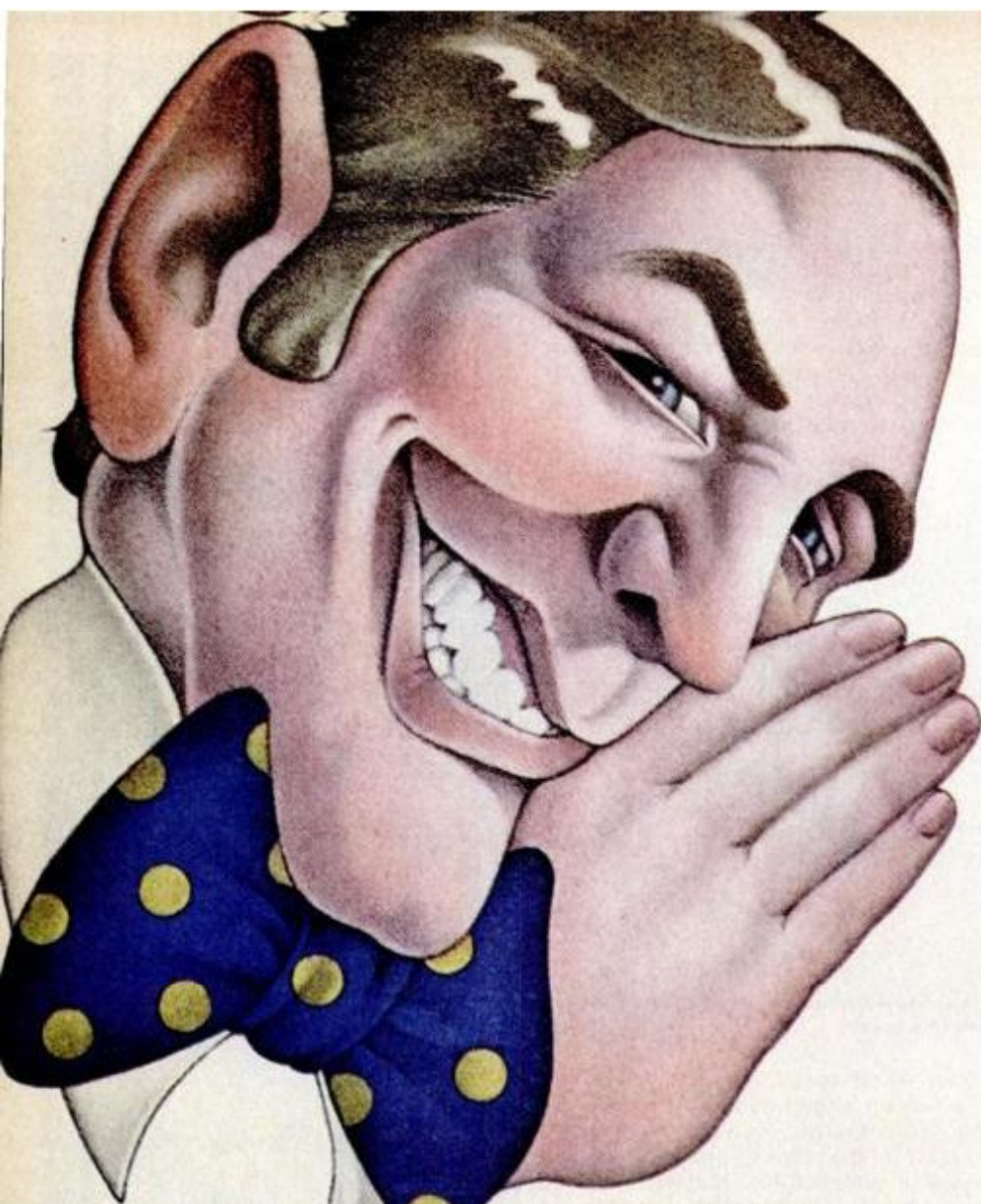
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in the house  
against sticking  
and binding.



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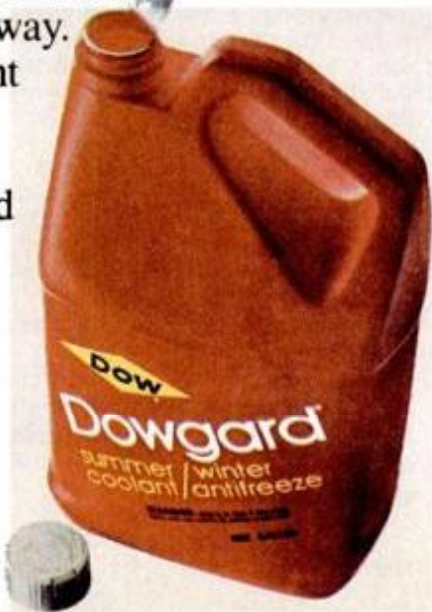
**DID YOU HEAR THE ONE ABOUT THE GUY  
WHOSE CAR WAS ABOUT TO BOIL OVER  
AND HE TURNED ON THE HEATER?**

He wasn't so crazy. You see, if you put on your heater when your car starts heating up, put the car in neutral and give it some gas, the heater will help take some of the heat from the engine and things should cool down.

However, there's a much better way.

Just make sure you have the right solution of Dowgard® Coolant Antifreeze in your cooling system. Because Dowgard offers year round protection against the build-up of corrosive particles. And without a doubt, corrosion's a thing that can block your cooling system and cause boil over.

When it comes to a coolant antifreeze that offers real corrosion protection, there's nothing better than Dowgard. It's a car's lifeblood.



**CAR CARE GUIDE**

**CARBURETORS**

*(Continued from page 135)*

try to cut back on idling speed is to tap down and up on the accelerator pedal quickly. If engine speed doesn't throttle back the fast-idle cam may be sticking.

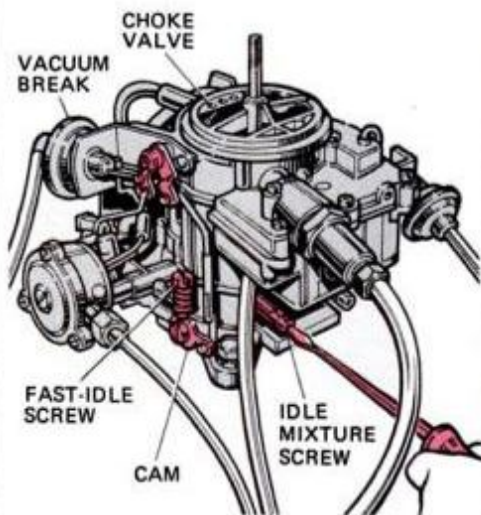
A couple of squirts of carburetor solvent around the cam and working the cam back and forth by hand should take care of this. If not, then it's likely that the fast-idle speed is not adjusted to manufacturer specification.

Fast-idle speed is usually adjusted with the engine running at the slow idling speed specified by the manufacturer. The choke plate should be closed. This can be done by releasing the choke cam.

Now, rotate the fast-idle cam so the fast-idle screw comes to rest on the highest step of the cam. If the screw does not intercept the cam, increase the length of the screw until it does.

Check your tachometer. Engine speed should be at the specified fast-idle speed. This specification can be obtained from the sources mentioned earlier. Fast idling speed is usually about twice that of an engine's specified slow idling speed.

Idle mixture is another adjustment you might have to make to get your carburetor tuned right. Since the 1968 models, idle mixture adjustment screws have been covered by caps to limit travel of the screws. This restriction has been imposed by law to prevent you from setting en-



Fast idle is adjusted by fast-idle screw on top step of cam. Capped idle mixture screw can be turned to get smoothest idle.

gines to run on a richer fuel mixture. The idle-mixture adjustment, as you know, controls the ratio of gasoline to air. An excessively rich mixture creates unnecessary amounts of air pollution.

Although your carburetor's idle-mixture screws are covered by caps, idle mixture may still be set within limits. Turn caps until the engine idles at its smoothest. This should be done after adjusting the slow-idle speed.

One-barrel carburetors are equipped



with one idle-mixture screw. Two and four-barrel carburetors have two.

## POOR FUEL ECONOMY

In every bundle of letters received at *Car Clinic*, there are always some decrying poor gas mileage. In 1975, for instance, fully 4.5 percent sounded similar to this:

**"I get only 10 miles a gallon from my 1969 Chevrolet pickup. I can't afford to drive it. What can I do?"**

You can consider these factors:

- Underinflated tires place a drag on a car, causing it to use more fuel.
- Dragging service brakes and hand-brakes also increase fuel consumption.
- A restricted exhaust system leads to power loss, which is compensated for by the engine using more gas.
- Improper front-end alignment, especially incorrect toe-in adjustment, puts unnecessary friction on a car and leads to an increase in fuel consumption.
- Excessive fuel-pump pressure causes too much gas to be delivered to the carburetor, and hence to the engine where it's consumed.
- Sloppy driving is the biggest single cause of poor fuel economy. The greatest gas robbers are excessive speed, erratic (jackrabbit) acceleration, too much stopping and starting, and prolonged engine warm-up periods.
- A fuel leak anywhere in the fuel system, of course, is a complete waste. To trace leaks, start the engine, let it idle and examine fuel-tank seams, fuel-filler neck seams, fuel line from fuel tank to fuel pump, fuel fittings at the fuel pump, fuel line from fuel pump to carburetor, fuel-line fitting at the carburetor, carburetor assembly bolts, and carburetor-intake manifold seam. Tighten bolts and fittings. If this won't stop a leak, remove the part, replace the gasket if a gasket is used, or replace the part.
- An engine that's properly tuned provides better fuel mileage than one which isn't tuned. Tune-up includes tuning the carburetor as we just discussed. Also the ignition—discussed later.
- A carburetor that has seen many miles of service may be in need of cleaning and overhaul to better your gas mileage. A dirty carburetor or one damaged internally often signals its defectiveness by leaking gasoline.

## HESITATION WHEN ACCELERATING

**"A major problem I have with my '74 Ford is that when I step on the gas it takes a second or so to pick up speed."**

This is what's meant by hesitation on acceleration. It's a problem being experienced by 1.3 percent of today's car owners—or so our *Car Clinic* letters tell us. What's it all about?

From the standpoint of the carburetor and fuel system, hesitation on acceleration may be caused by faulty automatic-choke adjustment, partially clogged fuel filter and a dirty carburetor, all of which we've already discussed; or a bad accelerator pump or inoperative vacuum break, or a malfunction in the thermostatically controlled air cleaner, discussed below. Other causes of hesitation, discussed elsewhere in this *Car Care Guide*, include vacuum leaks and a breakdown in the ignition system.

The job of the accelerating pump is to inject a spurt of gasoline into the carburetor when rapid pickup is called for. This spurt of gas compensates for the rapid rush of air into the carburetor which occurs when accelerating. Were it not for the accelerating pump, the air/fuel ratio would become unbalanced, and the engine would starve for gasoline. Hesitation usually occurs, but in extreme cases the engine might stall.

To test the accelerating pump, warm up the engine, turn it off, remove the carburetor air cleaner, peer down the barrel of the carburetor and activate the throttle lever rapidly a couple of times. Gas should squirt with authority into the carburetor throat. If not, the carburetor should be taken apart and the accelerating pump replaced.

Many engines use a vacuum-break diaphragm mounted on the carburetor to help prevent overchoking. It's a cylindrical chamber connected to the choke.

**"I am trying to do all my own tune-up work, but still haven't tackled the vacuum break. . . ."**

A damaged or improperly adjusted vacuum break will cause hesitation by not permitting the choke plate to open enough or allowing it to open too much, depending on circumstances. To find out if the vacuum break is broken, disconnect the diaphragm hose at the source of vacuum and draw in on the hose with your mouth to create vacuum. The engine has to be cold and the choke plate closed. As vacuum is created, the choke plate should open. If not, replace the vacuum break.

Adjusting the vacuum break requires that you determine the specification, seat the vacuum-break diaphragm and place a correctly sized gauge between the choke plate and carburetor. To close or open the plate to meet the gauge, the choke rod or vacuum-break link is bent.

Cars since 1968 have thermostatically controlled air cleaners, which are characterized by a butterfly plate in the snorkel. If the butterfly plate isn't working, it stays open or closed all the time. In either event, hesitation would be experienced at one time or another.

To check the air cleaner, have the engine cold and look inside the snorkel. The butterfly plate should be closed, sealing off the snorkel. Start the engine. The plate should start opening and attain a full open position when air around the snorkel reaches about 100° F.

## RUNNING DOWN OTHER PROBLEMS

Four other carburetor-related problems experienced by car owners who wrote are surge, percolation, stalling and backfiring.

**Surge** is not hesitation. It is like a throbbing effect as the engine is idling. Chief causes are incorrect idle speed and/or idle-mixture adjustment and a dirty fuel filter, all of which are explained under carburetor tune-up procedures.

Another primary cause of surge is a misadjusted float level. The float controls the operation of the needle valve, through which gas passes from the carburetor bowl into circuits leading to the carburetor barrel. To determine if the float level is correct, or whether it's set too high or too low, the carburetor usually has to come off the engine and the adjustment made with a specially specified gauge.

Another cause is a dirty carb.

**Percolation** is characterized by an engine which starts fine when cold, but is hard to start when hot. You may even smell gas if you open the hood. What happens is that heat concentrated on the carburetor causes gas to boil over and flood the engine. A method that may help get you started when this happens is to press the accelerator pedal to the floor and keep it there as you crank the starter.

**Stalling** has several carburetor-related causes, including a dirty fuel filter and choke failure, both of which we've already discussed. If stalling occurs when the engine is cold only, in addition to an improperly adjusted or malfunctioning choke, the fast-idle may be off.

A peculiar kind of stall is one experienced between 40° to 60° F. following chillier temperatures. This may be the result of carburetor icing. Condensation in the carburetor actually turns to ice and blocks the throttle valve opening. When the engine is started, the restricted gas flow causes stalling, but the problem squares itself away once the engine warms up.

If your car is prone to carburetor icing, add fuel system deicer to the gas tank during seasons when swings in temperature from freezing to 40° to 60° F. may be expected.

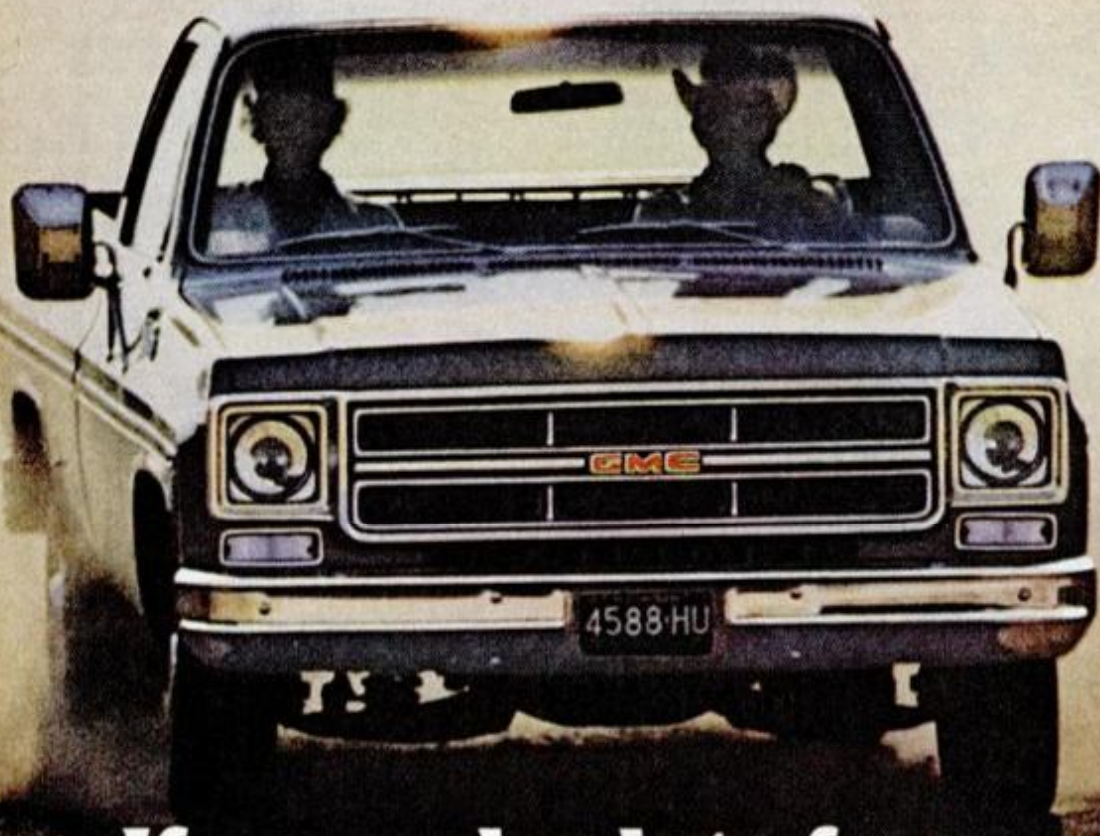
**Backfiring**, if caused by the carburetor, normally results from a fuel mixture that is too lean. If the noise occurs when the engine is first started, perhaps the choke is set too lean. There are two general kinds of chokes: One has the choke mechanism on the carburetor in the form of a stove. It has a cap that is marked and can be set either to the rich or lean side.

Another type of choke has the choke-adjusting mechanism inside a well in the manifold. A long rod connects the mechanism to the choke plate. The choke is adjusted by removing the choke mechanism from the well.

Backfiring is also caused by an ignition problem. Ignition and electrical problems are the subjects of the next section of this *Car Care Guide*, so let's get to it.

**GM**

ARK OF EXCELLENCE



## If you ask a lot of your pickup, ask for a lot of pickup.

Nowadays, a pickup often has to play as hard as it works. And be comfortable. Like the family car. In many cases, it is the family car.

You expect it to be dependable, efficient and beautiful. For a long time.

If you will go see your GMC dealer you can find the kind of do-it-all vehicle you're looking for.

One with 2-wheel drive or 4-wheel drive. One with a regular cab or six-man cab. One with an

automatic transmission or a manual 3- or 4-speed. One with a step-side or smooth-side body. One with special trailer-towing capabilities. One with the proper suspension for carrying a camper. One with the luxurious interior a demanding truck buyer expects—everything from bucket seats to stereo.

The point is, your GMC dealer is an expert in this business of trucks. He can provide you with a pickup that's carefully set up to do what you want it to do. And

you'll be buying a truck that's basically durable and comfortable to begin with.

One that already offers things like an independent front suspension. A roomy cab with double-wall construction in the doors, the roof, and the cargo area.

Look. Ask around. It won't take you long to discover what kind of reputation GMC pickups have. People tend to expect a lot of a GMC. Maybe because it's a lot of pickup.

**THE TRUCK PEOPLE FROM GENERAL MOTORS**



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## 2. Ignition and electrical systems

According to letters sent *Car Clinic*, 9.1 percent of our readers have queries about their electrical and ignition systems. Surprisingly, 5.9 percent are concerned about electrical systems and only 3.2 percent about ignition.

Most questions deal with specific problems resulting from failure of an electrical system component. When it comes to alternators, regulators and wiring, there is little "car care" involved other than assuring that the alternator drive belt is in good condition and adjusted to provide no more than 1/4-inch free play. However, we receive a great number of letters asking questions similar to this one:

**"My problem is that headlights keep flaring up and down, getting dim and real bright. What's the reason?"**

The "reason" may be a problem brewing in the electrical system, which if caught quickly can avert an expensive repair.

### BEAMING UP AND DOWN

The man who asked the question about headlight "flare" could have meant that his headlights were flickering. The two conditions are different and indicate a different cause.

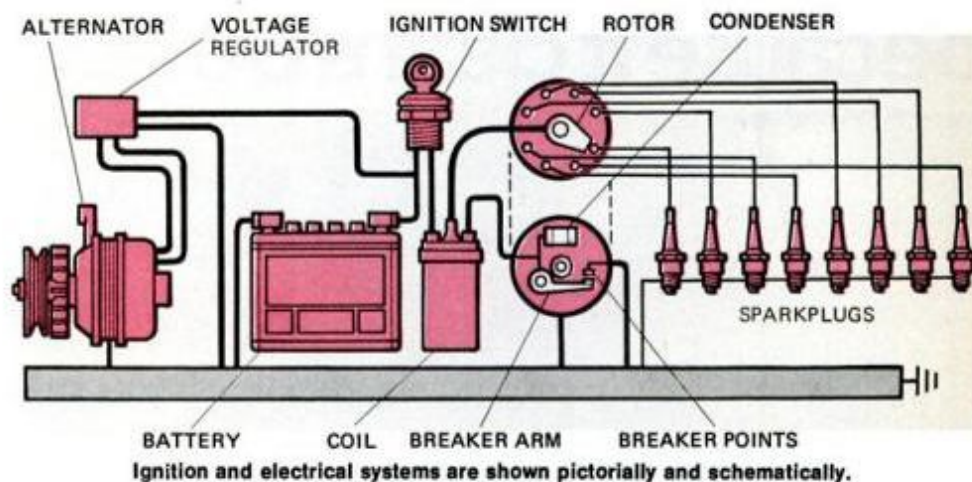
**Headlight flare** occurs with changes in engine acceleration; your lights alternate between bright and dim. A minimal amount of flare is normal. Not normal are lights that get unusually bright as the engine is accelerated from idle. This could signify an excessive charging rate, which is verified by the battery needing water frequently. Battery electrolyte might also assume an odor like rotten eggs. The regulator should be tested before the high charging rate, if it exists, causes complete battery failure and also damage to headlights and other bulbs.

**Headlight flicker** is the change in brightness as the car is driven at a steady rate. The usual causes of headlight flicker are a weak battery and a loose connection in the wiring. A battery is easily tested—we tell you how in the section dealing with starter problems. But finding a loose or broken wire is something else again. It requires experience and a wiring schematic so the more than 1000 feet of wiring can be traced.

### BATTERY QUESTIONS AND ANSWERS

Several letters asked this question about batteries:

**"I drive my car a couple of miles a day only. How can I keep the battery from running down?"**



No way. The alternator charges the battery, and if the car isn't driven sufficiently to allow the alternator to extend a full charge, the battery will often run down and the engine won't start. The only alternative is to hook up a slow battery charger every couple of weeks and charge the battery overnight.

It's also important to keep a battery clean. Remove it from the car every six months. Cover battery vent caps with tape and wash all sides with a baking soda and water solution. Then flush with plain water.

Repeat this procedure until a fresh application of baking soda solution fails to fizz when applied. Wash down the battery holder in the engine compartment the same way. Then clean battery-cable terminals with a wire brush or sandpaper.

When you reconnect the battery, attach the positive (+) cable first, then the negative (-)—reversing the procedure for disconnecting the battery. Make sure that

terminals are attached tightly to the posts. Then coat the terminals with a light smear of petroleum jelly.

### RED EYE

**"That 'idiot light' for the alternator—it comes on and stays on, but my mechanic says the charging system's okay. What's wrong?"**

So wrote a reader from Ohio, echoing a common complaint that was voiced by most of the people who wrote *Car Clinic* about alternator problems. What we told him is that the most likely cause of "red eye" is a loose alternator drive belt—the alternator itself is one of the most efficient units in the entire car.

All drive belts—not just the one serving the alternator—should be examined often for tension and damage. Replace any belt that's cracked, split or glazed. If the drive belt is okay, then test the diode trio, which in many alternators acts as a protective device for the rectifier diodes. A voltmeter reading over .3 volt indicates the diode trio has broken down so residual electricity can pass through to the indicator light, causing glow.

### A MATTER OF JUDGMENT

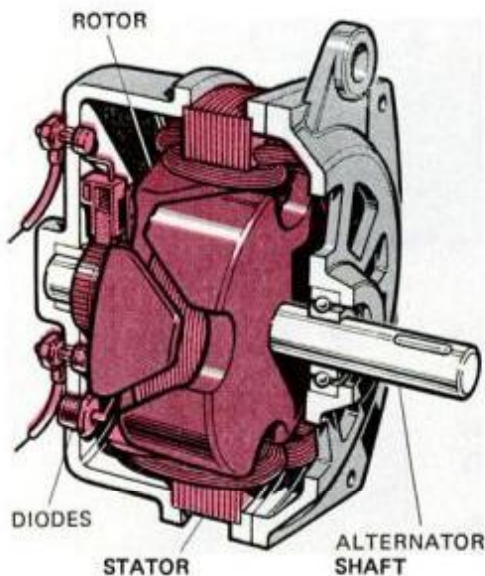
Readers wrote *Car Clinic*:

**"Should I replace alternator, coolant temperature and oil-pressure warning lights with gauges?"**

In the same vein, some wanted to know how to install tachometers.

Gauges have merit. They won't burn out as a bulb might, leaving you in the dark concerning system performance. Furthermore, gauges tell when a system is approaching the danger zone. Bulbs flash only when there's a complete breakdown.

Here are several points to remember (Please turn to page 140)

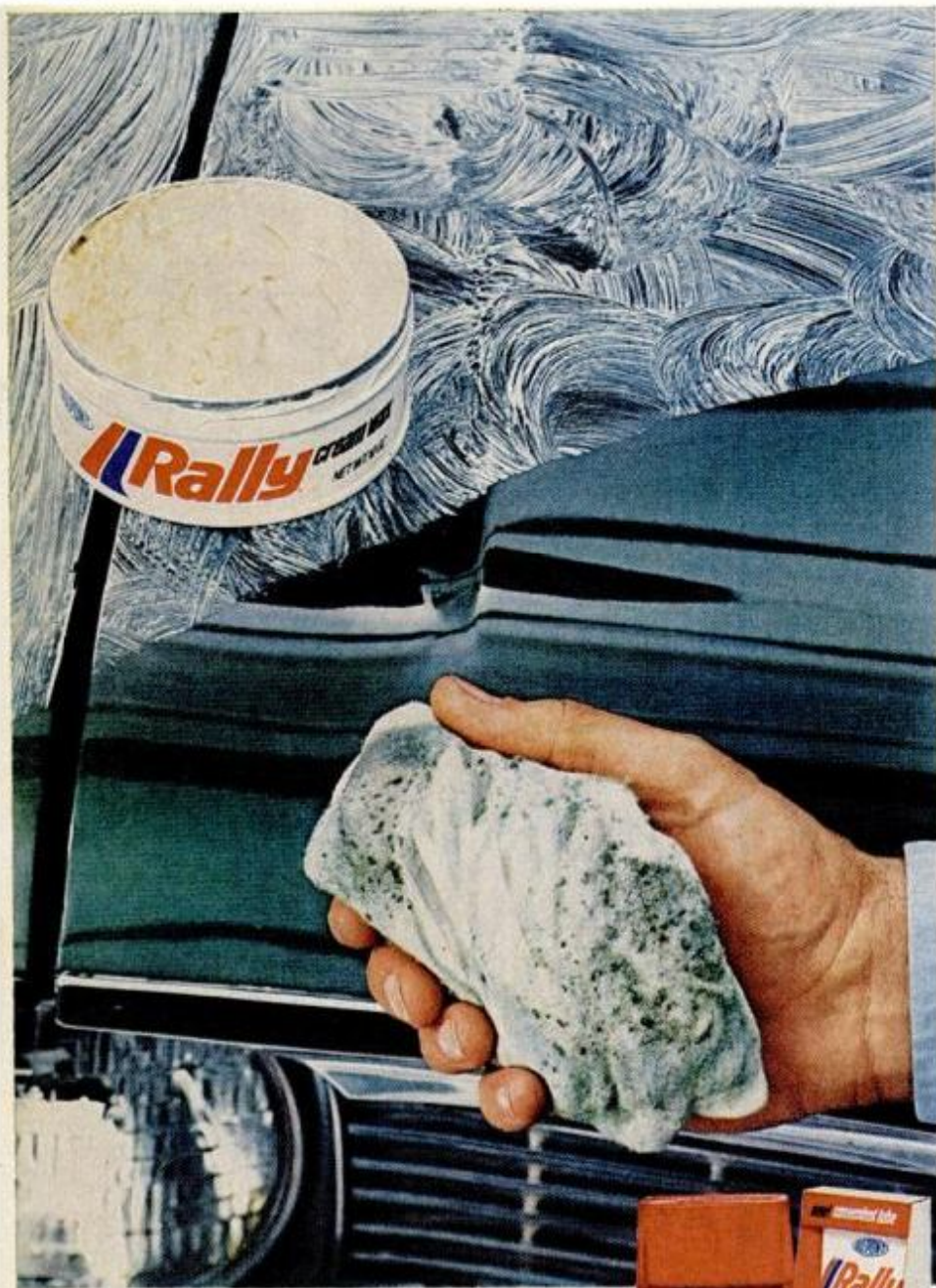


Alternator operation depends on proper adjustment and condition of drive belt. Don't forget to keep some spare belts in your car.

# Rally<sup>®</sup> Car Wax.

## It shines better

## because it cleans better



"Rally" is as easy to use as self-polishing waxes. But "Rally" cleans off road film and dull paint as it puts down brilliant wax protection. Get a cleaner, better shine that stands up to weather and washing. Get "Rally".



New easy-to-use tube

## CAR CARE GUIDE

### IGNITION, ELECTRICAL SYSTEMS

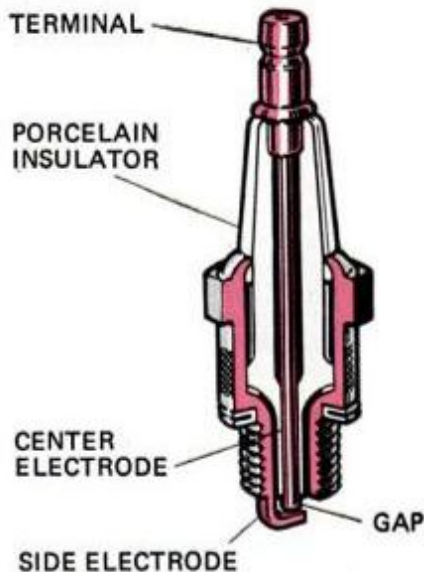
*(Continued from page 139)*

if you should decide to install gauges:

- See that an ammeter is rated the same as your alternator—45 amps., 60 amps. or whatever.
- Determine the normal oil pressure for your engine from manufacturer specifications so the reading you get on your gauge will have meaning.
- See that your coolant temperature gauge has sufficient leeway on the top end to show temperature in the "normal" range when coolant is, in fact, at normal temperature.
- Gauges you buy, including a tachometer, should come with complete installation instructions.
- You will need the wiring diagrams intended for your particular model of car to install gauges and tachometer. Consult the service manual.

### IGNITION-CAUSED PROBLEMS

The number of letters received at *Car Clinic* last year asking direct questions about ignition, including sparkplugs and distributor, was relatively small (3.2 per-



**Remember: New sparkplugs aren't gapped for your car at the factory. You have to do it!**

cent of the total). However, complaints about engine problems that may have been caused by ignition failure formed the bulk of our mail. These complaints included stalling, hard starting, missing, rough idle and lack of engine power. This is why we feel it's important in this *Car Care Guide* to outline the steps involved in tuning up ignition systems.

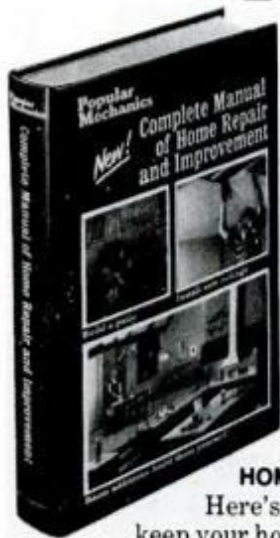
### IGNITION TUNE-UP BY THE NUMBERS

Here are the steps involved in servicing a conventional (breaker-point type) ignition system:

1. Clean and regap sparkplugs, or re-  
*(Please turn to page 143)*

# Complete

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Here's everything you need to know to keep your home in top shape—from "quickie" repairs to room additions, even how to finance home improvements. Professional shortcuts and techniques are explained in simple layman's language and 1,000 photos, drawings, graphs and charts show how to make home repairs easier, cheaper, and better. This big manual—480—pages, 6" x 9½"—is indexed and cross-referenced so you can find instant answers to any home repair problem. **Only \$8.95.**



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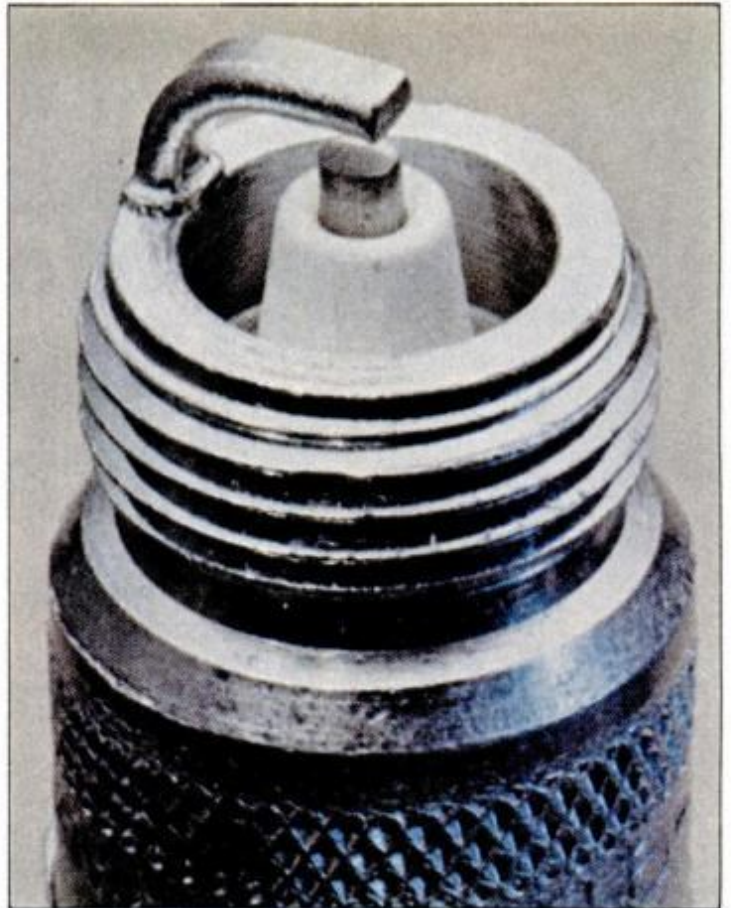
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MX02



# An old plug can cost you more than a new plug.

Of course you're trying to save money. But if you think using a set of spark plugs for 20,000 to 25,000 miles will help make you rich . . . well, read on.

## Your engine is too dependable.

The modern engine is a very forgiving machine. It'll faithfully start and run with spark plugs that are long

past their prime. But while it manages to run with old plugs, it can also be wasting that expensive gasoline of yours at a horrendous rate.

## How much waste?

We're conducting a nationwide series of tests of everyday cars like yours. So far, 3 out of 4 of the cars tested got better mileage when we replaced worn plugs with fresh Champions. And the average mileage improvement was 4.27%.

## So what'll it be. Plugs? Or gasoline?

If it were up to us, we'd sell you some fresh

Champion spark plugs. But it's your car and your money. We just figure a small jolt for fresh spark plugs beats slow death at the gas pump any day.

Whichever way you decide, we hope we've helped you save some money. You've worked too hard to let it go to waste.



**Fill 'er up  
with Champions.**

# CAR CARE GUIDE

## IGNITION, ELECTRICAL SYSTEMS

(Continued from page 140)

place them if damaged or badly worn. Remember to gap new plugs as well as reused plugs to specification.

2. Wipe off and examine the body of the coil. If it's cracked, replace the coil.

3. Replace primary circuit wires if insulation is frayed or brittle. Make sure these wires are tightly attached.

4. Remove the secondary cable from the coil tower. Check to see if the tower is damaged. Replace the coil if it is. If not, clean out the tower. Reseat the cable firmly.

5. Take off the distributor cap, wipe it clean, and check for cracks, chips, carbon tracks, and broken or eroded terminals. Replace a damaged cap. If the old cap is to be reused, clean contacts with a piece of fine sandpaper.

6. Pull one secondary cable at a time from each tower by its boot and clean out towers with your distributor-tower cleaning tool, reseating the cable firmly before going to the next one. Replace the cap if a tower is damaged. Also examine each cable for cracks and brittleness. Replace a questionable set of cables.

7. Remove and examine the rotor, and replace it if it's damaged. Also remove radio frequency shield if there's one.

8. Twist the distributor shaft in the direction of rotation and release. It should snap back. If it does not do this, the dis-

tributor should be removed for overhaul.

9. If you can't get a good look at distributor points, remove the breaker-point assembly from the distributor. Spread points apart carefully. If points look badly

manufacturer spec. Switch the dwell/tach over to "dwell" mode. If the recorded dwell-angle reading is not to spec, make the necessary adjustment.

13. If you're lucky enough to have a distributor which has a little access door, open the door and adjust point gap with an Allen wrench. If there is no access door, turn off the engine, remove parts so you can reach the points and adjust them. If the dwell angle is too great, set points farther apart; if too small, set them closer together. Button up the distributor and recheck dwell angle. You may have to do this a couple of times before hitting the specified dwell setting.

14. Disconnect the dwell/tach and connect a timing light. Find timing marks, pull off and plug the hose from the vacuum advance unit, and start the engine. Aim the timing light straight down on the timing marks and pointer. Pick out the one timing mark specified by the manufacturer as "correct." See if the pointer aligns itself with that mark each time the light flashes. If it doesn't, timing has to be adjusted.

15. To adjust timing, turn off the engine and loosen the distributor hold-down bolt with a distributor wrench. Start the engine, and aim the timing light at the timing marks again. Grasp the vacuum advance unit and slowly rotate the distributor to set timing properly. When timing is on the button, turn off the engine, tighten the distributor and recheck.

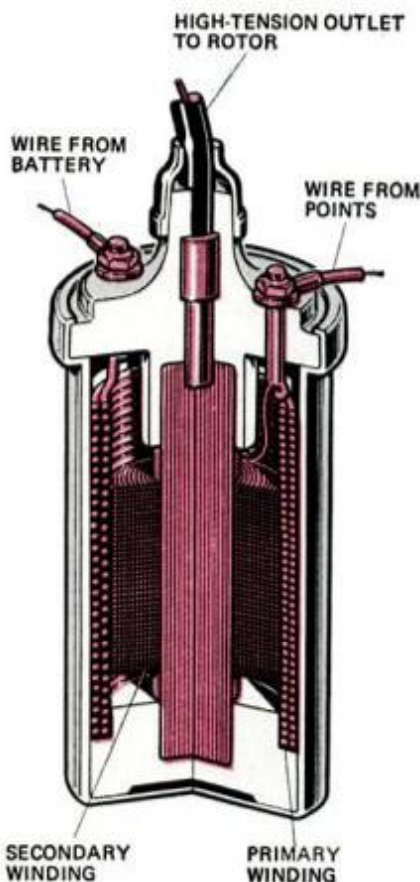
16. Test centrifugal and vacuum advance units before disconnecting the timing light. Aim the light at the timing mark and advance engine speed until the engine is running at 1500 rpm. You should reconnect your tach for this test. The timing mark should advance as engine speed increases and drop back to its original setting when engine speed drops back to idle. If it doesn't, the distributor should be overhauled with attention paid to centrifugal advance weights and springs.

Hook the vacuum hose onto the vacuum advance, aim the timing light at the timing mark and again increase engine speed to 1500 rpm. Timing should advance itself farther than it did when you checked centrifugal advance. If it doesn't, replace the vacuum advance.

## ELECTRONIC IGNITION TUNE-UP

This superb ignition system requires very little care, but what it needs it needs—usually once every 20,000 to 30,000 miles, depending on manufacturer recommendations. Indications that an electronic ignition needs a tune-up are the failure of the engine to start or an engine that runs rough. Here's what to do:

- Replace sparkplugs, and remove and examine the distributor cap for damage.
- Check the rotor for damage (replace it, if necessary), and examine the high-tension wires. If insulation is brittle or frayed, replace wiring.
- Time the ignition system as we explained earlier. You don't have to set dwell. There are no points.



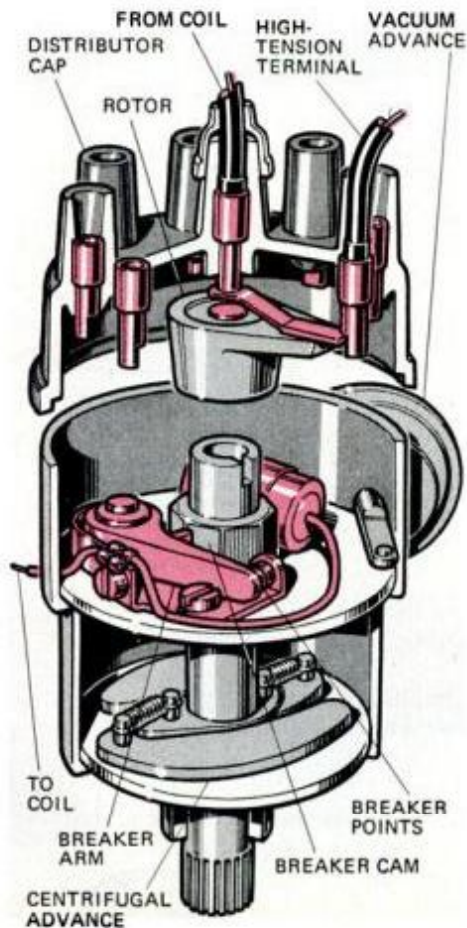
Coil connections must be clean and tight, and the body checked for damage periodically.

worn or burned, replace them and the condenser. If points have a gray tint or are a bit rough, pass a distributor point file between them once and clean with mineral spirits or alcohol.

10. Set point gap to manufacturer spec by placing the rubbing block of the movable point on a lobe of the cam. One type of points is set by turning an adjusting screw with an Allen wrench. The other type is gapped by loosening the mounting screw and twisting the slot which moves the movable point. Before placing your feeler gauge between points, make sure the gauge is clean. Hold it straight. Gap is right when the feeler gauge gives slight resistance as it's moved between points.

11. If your distributor has a wick that lubricates the cam, replace it. If there is no wick, apply a drop of cam lubricant equal to the size of a match head to one cam lobe. Lubrication is very important, but overlubrication damages points. Reassemble the distributor.

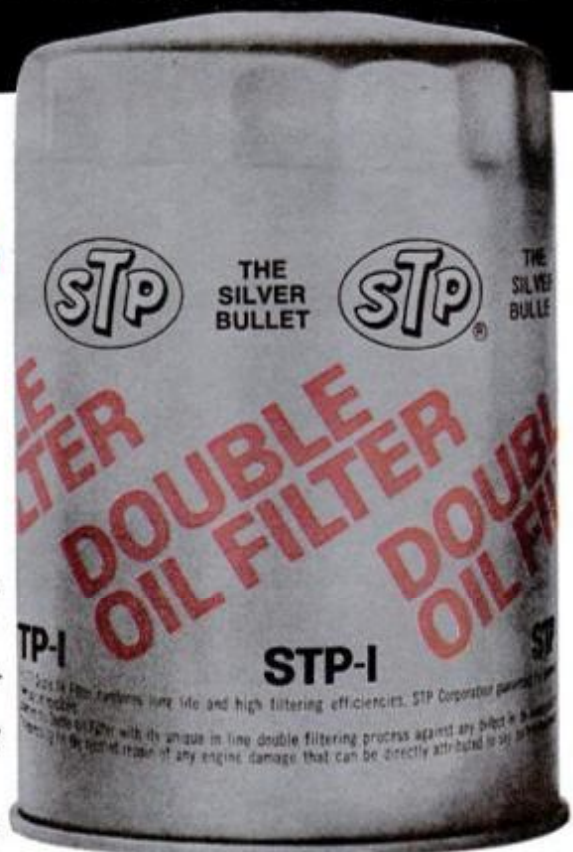
12. Set dwell, which is the amount of time points remain closed, to manufacturer spec. Connect your dwell/tach's red lead to the distributor primary terminal on the coil. The black lead goes to a clean ground. Start the engine, let it warm up and see that idle speed is adjusted to



Distributor is key component in your ignition system. Keep it in top-notch shape.

# Introducing The Silver Bullet.

**STP announces a significant advance in filter technology...a new Double Oil Filter that actually filters every drop of oil twice on every filter cycle. In lab tests, following SAE Oil Filter Test Procedure J-806a, it delivered a better combination of long life and high efficiency than any of the 5 other best-selling filters. Read why it's the oil filter you should buy.**



An oil filter has an incredible job to do. In average driving it filters all the oil in your crankcase approximately once every 30 seconds! In other words, in 7500 miles of driving (at average speed 40 mph), over 28,000 gallons of oil pass through your oil filter.

To handle this tremendous task, STP now introduces a new Double Oil Filter that gives you a better combination of long life and high efficiency than the 5 other best-selling filter brands.

#### The problem with filters.

Grit, sludge, and microscopic bits of metal find their way into every engine's oil. Left there they can play hell with the guts of an engine and can seriously shorten its life.

So good filtration and long filter life are both important. And that's where the problem lies.

Historically, lab tests have shown long-life oil filters to be relatively short on efficiency, while the highly efficient ones have tended to clog up relatively quickly.

Once a filter becomes sufficiently clogged, its by-pass valve opens and oil begins to circulate freely without being filtered at all.

In either case you may have a problem. A filter that isn't filtering with high efficiency. Or a filter that isn't filtering at all.

#### Why The Silver Bullet is superior.

The engineering ideal is to get both long life and high efficiency out of an oil filter.

And none of the 5 best-selling filters comes as close to the ideal as STP's new Silver Bullet.

It contains two filter elements made of different filtering media. One filter nests inside the other and all your oil goes through both filters on every pass through the canister.

This may sound elementary. But the fact is, no other leading filter manufacturer builds a filter this way.

Laboratory tests, certified by The American Standards Testing Bureau, Inc., prove The Silver Bullet delivers a better combination of long life and high efficiency than any of the 5 other best-selling brands.

#### Can a better oil filter save you money?

Like life insurance, good oil filtration is a long term proposition. And we at STP definitely do not recommend that you use a better filter as an excuse for skipping filter changes or as an excuse for extending oil change intervals.

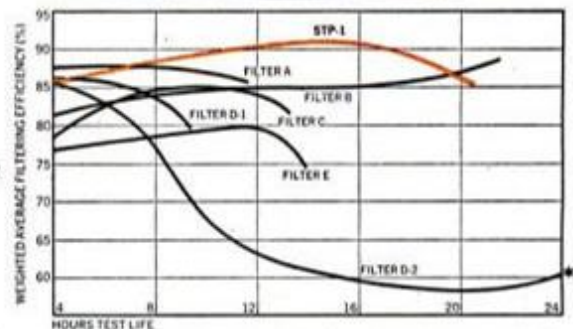
But certain facts can't be ignored. Your car represents a big investment. Dirt and abrasives are bad for its engine.

Install The Silver Bullet and you can be sure you've given your engine the protection it deserves. How much is that assurance worth?

You'll have to be the judge of that.



The outer filter: a 6 foot phenolic impregnated cellulose element. The inner filter: a fiber strand more than 60 feet long, wound on a steel core. Your oil goes through both approximately once every 30 seconds!



Test results, certified by The American Standards Testing Bureau Inc. For a more complete test report write: The Silver Bullet, c/o STP Corp., 1400 W. Commercial Blvd., Ft. Lauderdale, Florida 33310.

\*Test terminated at 24 hours. Lack of pressure build-up was abnormal indicating internal leakage.

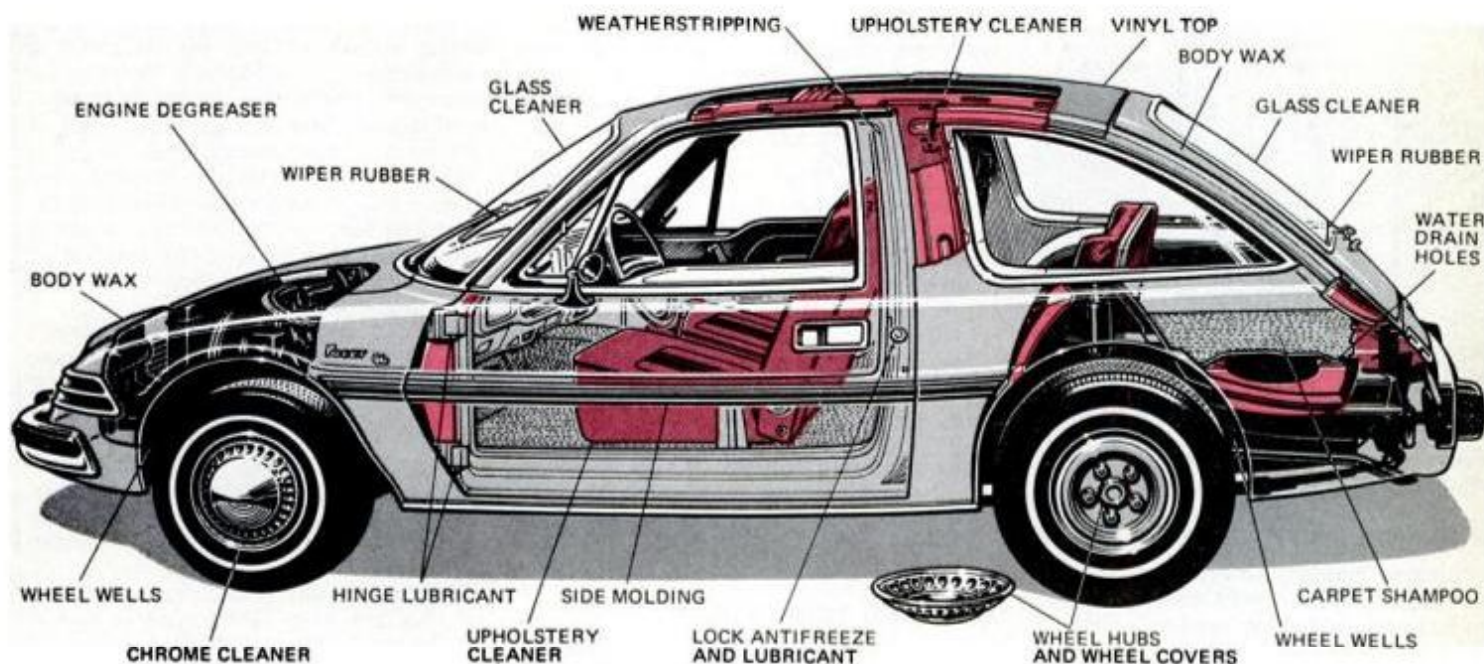


**STP**  
New from STP

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## 3. Bodies—inside and out



Of all the mail sent to *Car Clinic*, 7.8 percent had questions about auto body noise, radios, body leaks, paint and finish—in that order. The remainder, which didn't amount to much individually, asked advice on such subjects as windshield wipers, window smog, safety belts, interior finish, hub caps, horn, speedometer, sun visor, mudguards and door latches. We'll cover the areas of greatest concern.

### FINDING AND STOPPING NOISE

*"My Pontiac has been giving off a rattle since day one. No one has been able to pinpoint its location. Is there any hope? If I try myself, where should I start?"*

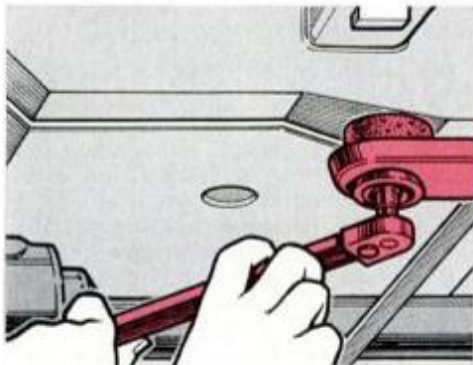
Finding the source of the kind of noise this reader is experiencing is one of the toughest tasks you can face. Fixing the rattle, squeak, groan, whistle or whatever is usually simple.

Drive the car on different road surfaces, over bumps and at different speeds to establish whether noise is coming from the body or chassis. Once you have settled on the body (you've ruled out such chassis areas as engine, suspension and exhaust), establish if noise is being caused by loose body bolts (nonunitized body), broken weld (unitized body), or a loose door or window.

If the car has a nonunitized (or partially nonunitized) body, loose body bolts would cause rattles that are more pronounced when the car goes over bumps. Tighten bolts with a torque wrench to manufacturer specifications, which is usually 25 to 30 ft.-lb.

If the car has a unitized (or partially

unitized) body, a weld that has broken loose would produce a groan or squeak that's amplified when the car goes over bumps. The broken weld should be found and repaired by a repair shop that has a spot-welding facility.



Tightening body bolts with a torque wrench may eliminate an elusive rattle.

### TRACKING DOWN LOOSE BOLTS AND PARTS

Most times body noise is produced by something that's come loose. To find the rattle, start at one end of the car and gently tap every spot from top to bottom with a rubber mallet. Take your time and tap every inch of the fenders, doors, hood, trunk lid and windows.

When you hear a rattle, stop and tighten bolts in the area. Test again. If a part is held by a catch or rides on hinges, lubricate the catch or hinge and test again.

If you hear a rattle when striking the center of a door, there might be something lying inside the door—maybe a bolt that's dropped from place or even a tool

left in the door during assembly. Remove the trim panel and investigate.

Rattles from a window are caused when channel weatherstripping comes loose or wears out, or a window regulator goes bad.

There's another possibility that exists when a door rattles: The door may not be aligned correctly. One way to find out is to look at the gap between the door and the adjacent fender. Now check the gap between door and fender on the other side of the car. If there's an appreciable difference between the two gaps, it indicates that the rattling door should be realigned. Here's how:

- Loosen door hinge bolts.
- Using a pry bar, move the door until the gap between the door and adjacent fender is equal to the gap between the door and adjacent fender on the opposite side of the car.

- Tighten hinge bolts securely.
- Realign the door striker plate by loosening striker plate bolts and taking the plate off. Insert (or remove) metal striker plate shims behind the plate until a clearance of 3/32 to 5/32 inch between striker plate and door lock is obtained. Shims may be purchased from an auto supply and accessory dealer, or from the parts department of a dealer selling your make car.

To get a clear shot at measuring that distance between the striker plate and door lock, clean off both parts and apply a layer of grease or graphite to the striker plate bolt. Open and close the door once or twice. A pattern from the door lock will impress itself on the grease or graphite. Measure from the pattern to the tip of the striker plate bolt to establish the clearance between striker plate

# CAR CARE GUIDE

and door lock (remember, it should be 3/32 to 5/32 inch).

Excessive distance between the two components causes a door to rattle. Insufficient clearance interferes with locking action.



Realigning a car door will require an adjustment to the door striker plate.

## TRACKING DOWN CHASSIS NOISE

Suppose during your road test you determined that noise was coming from a chassis part rather than the body. Chassis parts that produce noise most often are the alternator when it comes loose on its mounting bracket; power steering and air conditioner mounting brackets; motor mounts; suspension parts, such as loose shock absorbers and sway bars; and exhaust system components.

Each should be inspected closely. The toughest noise to find is one produced in the engine compartment. A handy tool you may want to consider buying to help you isolate noise is an auto stethoscope. When placed against a part, it amplifies any noise the part may be producing, leaving no doubt.

## A FEW WORDS ABOUT RADIOS

**"What causes a radio to cut in and out? Mine has started doing this."**

This question asked by one of our readers is typical of the letters *Car Clinic* receives about radios. Another radio problem is interference with reception.

"Cutting in and out" is defined as a radio that is playing normally and suddenly dies—and then comes back on. Don't confuse it with station fade which occurs when you drive away from an area served by a particular station.

Cutting in and out is caused by loose connections or by wires that ground themselves out as you drive along.

Connections to the radio's ground, and connections to the battery, antenna and remote speakers (if any) should be tightened and inspected for integrity. Broken wires should be replaced or spliced together.

Incidentally, if the radio is dead (dial light out) don't rush to have a radio repairman pull it from the car—not before you replace the fuse serving the radio in the car's fuse block and try the radio.

Interference is normally produced by

the car's ignition system. Every car with a radio has a means of suppressing this interference. Some have RF (radio interference) shields in the distributor; some have resistor wires as part of the ignition wiring; still others call for using resistor-type sparkplugs. Resistor wiring is the method that goes awry most often. When it happens, replacing the resistor wire is in order, or you can always use resistor-type sparkplugs.

By the way, if you have a stereo tape player in your car, don't forget to clean the player's head periodically—every 100 hours of operation is the recommended interval. Follow cleaning instructions in the owner's manual. Normally all that is required is cleaning the player head with a cotton swab that's been dipped in alcohol.

**Important:** Never apply any lubricant to a stereo tape player, and don't bring any magnetized tools near the head. If the head becomes magnetized, every tape you insert into the player will be ruined.

## STOPPING BODY LEAKS

About one percent of letters to *Car Clinic* in 1975 dealt with water leaks into the car's interior. A typical question sounded like this one sent by a man in Chicago:

**"Water is leaking into my 1969 Dodge Charger when it rains, entering from beneath the dashboard. How can I keep this from happening?"**

The procedure is: 1. find the source of entry; 2. seal it up.

To find a water leak, the first thing to do is tape a garden hose minus its nozzle to the roof of the car. Put a tin can right ahead of the spout so water coming from the hose overspreads the entire windshield or rear window.

If the leak has been showing up in the front of the car, test the windshield. Chances are the opening is there. If the leak has been showing up in back, water-down the rear window. Be sure the entire expanse is covered with water. Then get inside the car and wait to see where the water starts leaking in.

Have patience. A leak may not show up for a while.

**Very important:** Every 5 or 10 minutes, get out of the car and rock it from side-to-side. This action allows water which is leaking through the windshield and collecting in a seam to untrap itself so it can start dripping into the car's interior.

When you establish without doubt where water is leaking into the car during this test, you should apply windshield sealer around the glass. But this is important:

Do not apply windshield sealer over chrome molding strips. You won't seal the leak, but instead you will "seal" the molding in place. This means that when you finally remove molding to make the

repair properly you will have to exert extraordinary pressure behind the strips to pop them loose. This pressure will probably be strong enough to crack the expensive windshield.

To correctly seal a leak through a windshield, remove chrome molding with a professional-style windshield molding removal tool, which may be obtained from an auto parts and accessories dealer, or from an auto body repair shop.

Slide the tool under the molding until it hits a clip holding the chrome in place. Twist the tool gently until the molding pops loose from the clip. As you get to each clip, mark its location with chalk to facilitate replacement.

Never try removing molding strips with a screwdriver or pry bar. You will crack the glass.

After all strips have been removed, take one of the holding clips to an auto body shop or auto supply and accessories store and get a number of new clips. You should not reuse the old ones, which will become distorted when you remove the molding.

Place a new clip in each spot where an old clip had been. Then apply a generous bead of auto windshield sealer as directed on the package. Make certain that every inch of the perimeter is covered with sealer. Leaving a bare spot offers a gap through which water may enter.

After applying windshield sealer, re-install molding. Place the strips over the edges of the glass and pop them back on the clips.

## OTHER AREAS OF LEAKAGE

Water can leak through windows, doors, windshield wiper bosses, holes in the firewall, drip rails over doors, and fender joints.

Play a heavy stream of water from a hose on every cranny and crack as someone in the car keeps his eyes peeled. If water leaks into the car, seal the particular spot being doused. If water is entering the car through a window or door, the weatherstripping is either loose or worn. Fix or replace it.

## GETTING RID OF BODY RUST

After last year's *Car Care Guide* was published, we received a letter from a reader in Missouri who said, "Following your *Car Care Guide*, I've been saving money doing repairs myself." Then he asked for help:

**"Got a rust spot along the edge of the door. Can you tell me how to repair it and restore my 1966 Mustang to mint condition?"**

There are four methods to choose from:

1. Grind the spot down and/or cut away rusted metal as necessary. Back up the repair with the screening material included with the body-repair kit you're

(Please turn to page 156)

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Valvoline Oil Company, Ashland, Ky.  Division of Ashland Oil, Inc.

# CAR CARE GUIDE

## BODIES

(continued from page 146)

using, and apply body filler. Sand and paint.

2. Grind the spot down, making sure you get rid of all loose, rusted metal, and cover the area with aluminum tape, which comes in four-inch-wide strips. See that the tape extends at least one inch beyond the damage and adheres tightly at all of the edges.

Roughen up the tape with 100-grit sandpaper, apply plastic body filler, shape and sand, then paint.

3. Grind the damaged area and attach a piece of 20 to 22-gauge sheet metal with a riveting tool. Roughen the metal, apply plastic filler, shape and sand, then paint. Pay particular attention to edges. Make sure body filler is feathered into the car's body so edges are sealed.

4. Weld or braze sheet metal to the car's body. This is the permanent way of making the repair.

## MINIMIZING PAINT PROBLEMS

Today's car finishes are better than ever, so there's no reason why the paint on your car shouldn't sparkle for the life of the vehicle. The easiest and least expensive way to preserve the original luster is to wash the car as often as you

can. Washing gets rid of tree sap, road tar, insects and bird droppings, gasoline, industrial fallout and other harmful agents. Always use cold water, never wash in the direct rays of the hot sun, and wait until the metal is cool. Your auto parts and accessories dealer has available car wash compounds and agents

which will remove stubborn tar and other contaminants.

After washing and cleaning—and once a week isn't too often for this important car-care job—you should inspect your car's finish closely. Oxidized paint looks chalky, or gives the appearance of a film hiding the true color of your car. You'll have to use a cleaner to remove the dead paint and a wax to lay on a new protective coating—or you can use a combination cleaner/wax that will do the job in one step.

You've got your choice of a wide range of cleaners and waxes to do the job—from wax-impregnated cloths to sprays, liquids and presoftened pastes. Many car owners have tried all of these types at one time or another looking for the best one to suit their needs. Many car buffs stock several different types of waxes so they can do a quick job or a real elbow-grease job depending on how much time they have.

You should polish one section at a time using a circular motion to apply the wax and making sure to overlap sufficiently. Your cloth will slowly become the color of your car as you rub off dead paint, so turn over the cloth frequently. When the wax is dry, it will haze on the surface and is then ready to be removed with a clean cloth and the surface buffed



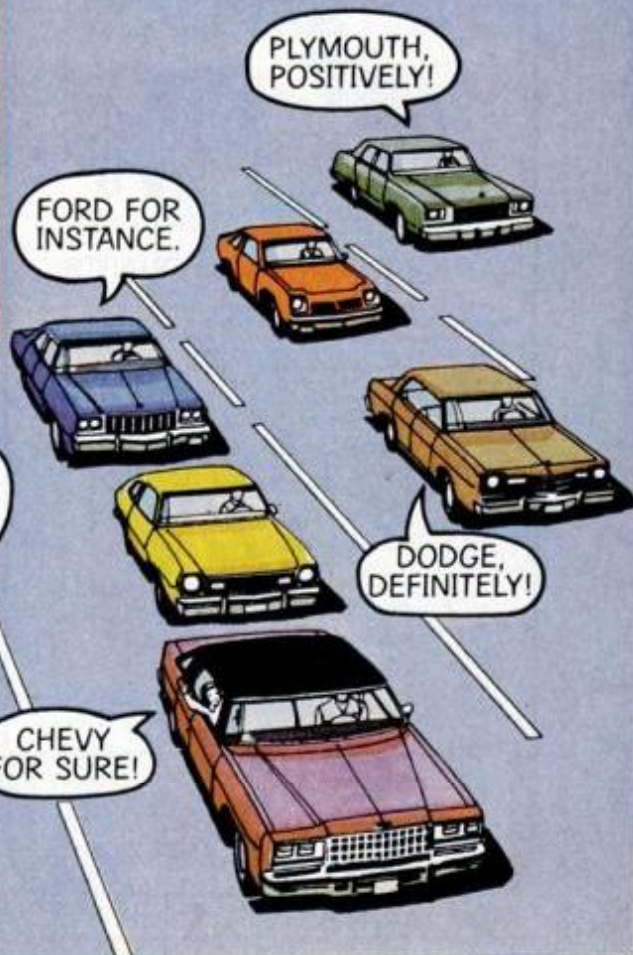
Car washing should be a weekly car-care job—maybe less often if you garage car.

## JOE GARAGIOLA M.D. (MOPAR DOCTOR)

MOPAR REALLY COVERS  
THE BASES.

LOOK TO THE MOPAR SIGN  
FOR FIRST AID FOR YOUR CAR.  
MOPAR HIGH-QUALITY PARTS  
RESTORE TOP PERFORMANCE IN  
PRACTICALLY EVERY CAR  
OR LIGHT TRUCK ON  
AMERICA'S HIGHWAYS.

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Cleaning and polishing removes dead paint and lays down protective finish.

to a high shine. Again, fold the cloth frequently, as it becomes glazed with dead paint.

Vinyl tops need their own special care. Frequent washing is as vital for a vinyl top as it is for the car's paint finish—maybe even more so. A soft-bristled brush is a help in thoroughly cleaning with mild soap. When the surface is clean and dry,

you can use vinyl top dressing on the roof. You can use the neutral, or colorless, product or get the color that matches your vinyl top.

Scratches or cuts in the vinyl can also be repaired now, using one of the repair kits made for the purpose.

**Important: Wood-grain applique should be washed only. Do not polish.**

When cleaning a car, take time to spiffy up the interior. Here are some tips:

- Thoroughly vacuum carpeting. If there is a soiled spot, it may be removed with carpet cleaner. Make sure carpets are dry before closing windows and doors.

- Wash bright metal parts with lukewarm water and a mild soap. Rinse. Do not use metal polishes.

- Remove dust and loose dirt that accumulate on interior seat fabrics with a vacuum cleaner or whisk broom. Soils, stains and spots can usually be cleaned away with a good-quality fabric cleaner.

- Clean seat belts with a mild soap solution and lukewarm water. See that they're not frayed—and use them.

#### TIPS ABOUT OTHER BODY AREAS

As we said at the beginning of this section, *Car Clinic* received letters about body areas other than those discussed so

far. Here are a few points these and other readers may find valuable:

- If new windshield wipers streak, it probably means that arm tension is excessive. You may be able to relieve tension yourself by gently bending the arm, but don't go to extremes. If this doesn't work, tension should be tested with an ounce scale and reset to manufacturer requirements.

- If windshield-washer reservoir is full, but you're not getting a solid squirt of fluid, be sure the little nozzles aimed at the windshield are clear, and also see to it that the filter in the windshield washer reservoir is not clogged. You'll need a pin or small stiff wire to clean out the washer nozzles.

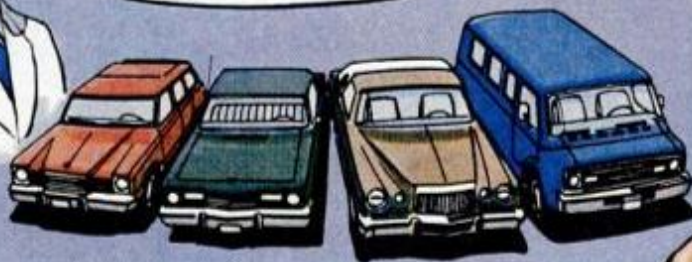
- Window smog is a problem in many cars having vinyl and imitation leather interiors. These plastic coverings give off an agent that coats windows. Try cleaning smog away with a good-quality windshield cleaner or a strong solution of ammonia and water.

- Hub caps that creep and make noise may be silenced by having another two or three lugs welded on them to hold them still.

- Speedometer cables seldom need greasing, but if one begins making noise you will need a service manual to find out how to remove it for lubrication.



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FIRST AID TIP ABOUT SEASONAL CHECK-UPS. A PRE-WINTER AND SPRING CHECK-UP IS RECOMMENDED BY MECHANICS TO KEEP YOUR CAR IN GOOD SHAPE. YOU'LL GET BETTER PERFORMANCE, TOO.

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MOPAR RENEWAL PARTS



## 4. Transmissions and drive trains

The breakdown of problems concerning transmissions showed an interesting fact: The number of readers having trouble with automatic transmissions and those with clutch and manual transmission difficulties are practically equal.

Letters to *Car Clinic* asking questions about transmission and drive train accounted for 6.1 percent of the total. Of these, 2.8 percent dealt with automatic transmissions and 2.7 percent concerned clutch and manual transmissions. The remainder of the letters were divided between universal joints (0.4 percent), differential (0.1 percent) and cruise control (0.1 percent).

### ABOUT AUTOMATIC TRANSMISSIONS

A typical problem was presented *Car Clinic* by a man from the Bronx, N.Y.:

**"Concerning the car's automatic transmission, it shifts rather hard. When it reaches about 20 mph, the shift is jerky. Why?"**

This malfunction and all others relative to automatic transmissions, such as slipping, no upshifting, delayed engagement and erratic shifting, obviously can be caused by a breakdown inside the transmission itself. Tests can be made by a transmission specialist to isolate the problem area. These tests include pressure diagnoses and actually disassembling the unit for visual inspection.

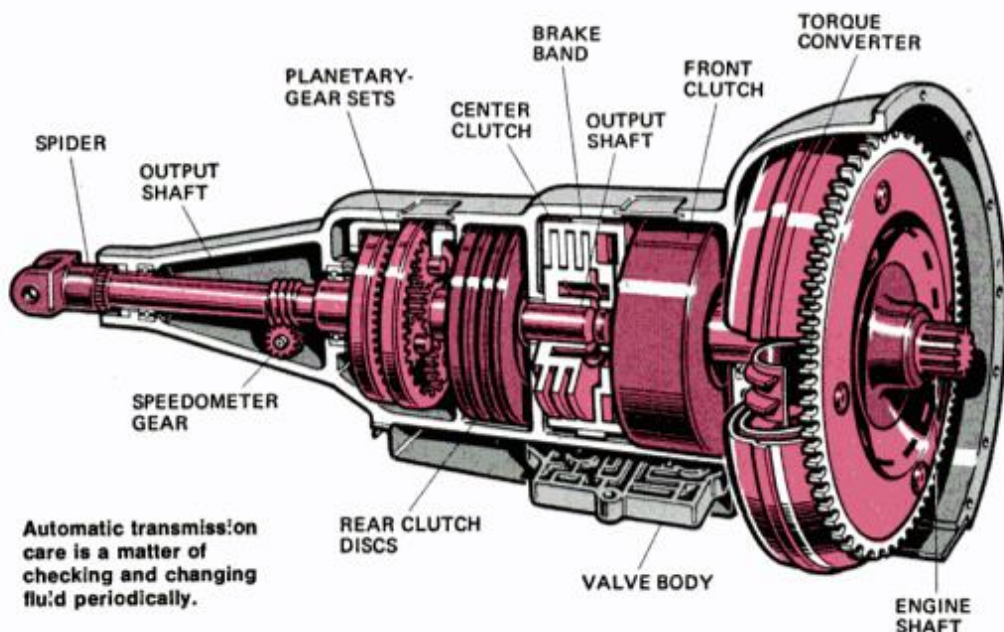
However, before costly procedures are undertaken, you should see if you can cure a problem yourself. Many times automatic transmission trouble is solvable by relatively simple procedures. The following information emphasizes facts about automatic transmissions that may help you resolve a problem without the services of an automatic transmission specialist:

1. Sometimes "erratic" shifting is driver-induced, being caused by applying more or less foot pressure than needed to the accelerator pedal. You can get a good idea of whether a transmission is shifting properly by driving the car in city traffic. A transmission that does not upshift into Drive (high gear) by the time the car has been accelerated to 25 mph is a transmission that is not acting normally.

2. Grinding, knocking, scraping, clicking or a shrill noise from an automatic transmission in any gear and under any circumstances is a sign of serious trouble. An automatic transmission specialist should be consulted. However, a whine is not as definite. A certain amount of whine is normal in first and reverse gears. An abnormal amount is cause for concern. Determining between "normal" and "abnormal" amounts is something you have to do during a road test.

However, any whine in Drive is not normal and should be investigated.

3. Low fluid level causes many prob-



Automatic transmission care is a matter of checking and changing fluid periodically.

lems, including delayed engagement, harsh upshifting, slipping and lack of shifting. It is strongly recommended that at the first sign of any kind of transmission problem you check the fluid level as directed by the manufacturer of your car in the owner's manual.

If transmission fluid is needed, you should install only the fluid recommended by the car's manufacturer.

4. As you check fluid level, notice the color of the fluid on the dipstick. If it is orange, brownish or black (any color other than red) and/or if the fluid has a varnishy odor, clutches inside the transmission are probably in the process of burning out. A transmission overhaul will soon be necessary.

5. A common reason for erratic shifting is a faulty vacuum modulator control, which can be replaced by removing the component from the transmission without removing or tearing into the transmission. This simple replacement should be made before other more complicated procedures are undertaken. Look for the modulator on the body of the transmission.

6. Another thing you should do to try to resolve a problem before consulting a transmission specialist is to tune up the unit. This should be done as often as the manufacturer recommends anyway to keep an automatic transmission operating properly for the life of the car. The following is a rundown of services to perform:

- Drain the transmission by removing the drain plug, if there is one, or by loosening all the transmission pan bolts and allowing fluid to run out of the body around the pan.

- Drain the converter. This is the bell-shaped housing on the front end of the transmission body. Remove the cover and look for drain plugs. Some converters have one drain plug—others have two.

- Examine drained fluid and the inside of the transmission pan after removing it for particles, which if present indicate that transmission parts are breaking down.

- Adjust transmission bands to manufacturer specification with a torque wrench. Make other called-for adjustments, such as the kick-down band adjustment. Specifications and the location of adjusting screws may be found in the car's service manual or in a general automobile repair manual in your local library. One such manual is *Motor's Auto Repair Manual*.

- Wash out the transmission pan with kerosene or some such cleaning solvent until it's spotless. Scrape off old gasket material from the pan and transmission case.

- Unscrew the old filter from inside the transmission and replace it with a new one for *your* transmission. Tell your auto parts and accessories dealer the make and model of your car, and he will see that you get the right filter.

- Reattach the transmission pan to the case, making sure you don't damage the new gasket. Tighten pan bolts firmly.

- Install clean, fresh fluid of the recommended kind, using a clean funnel. Fluid is installed through the transmission dipstick tube. Take pains to see that no dirt is introduced into the transmission. Dirt can damage the transmission.

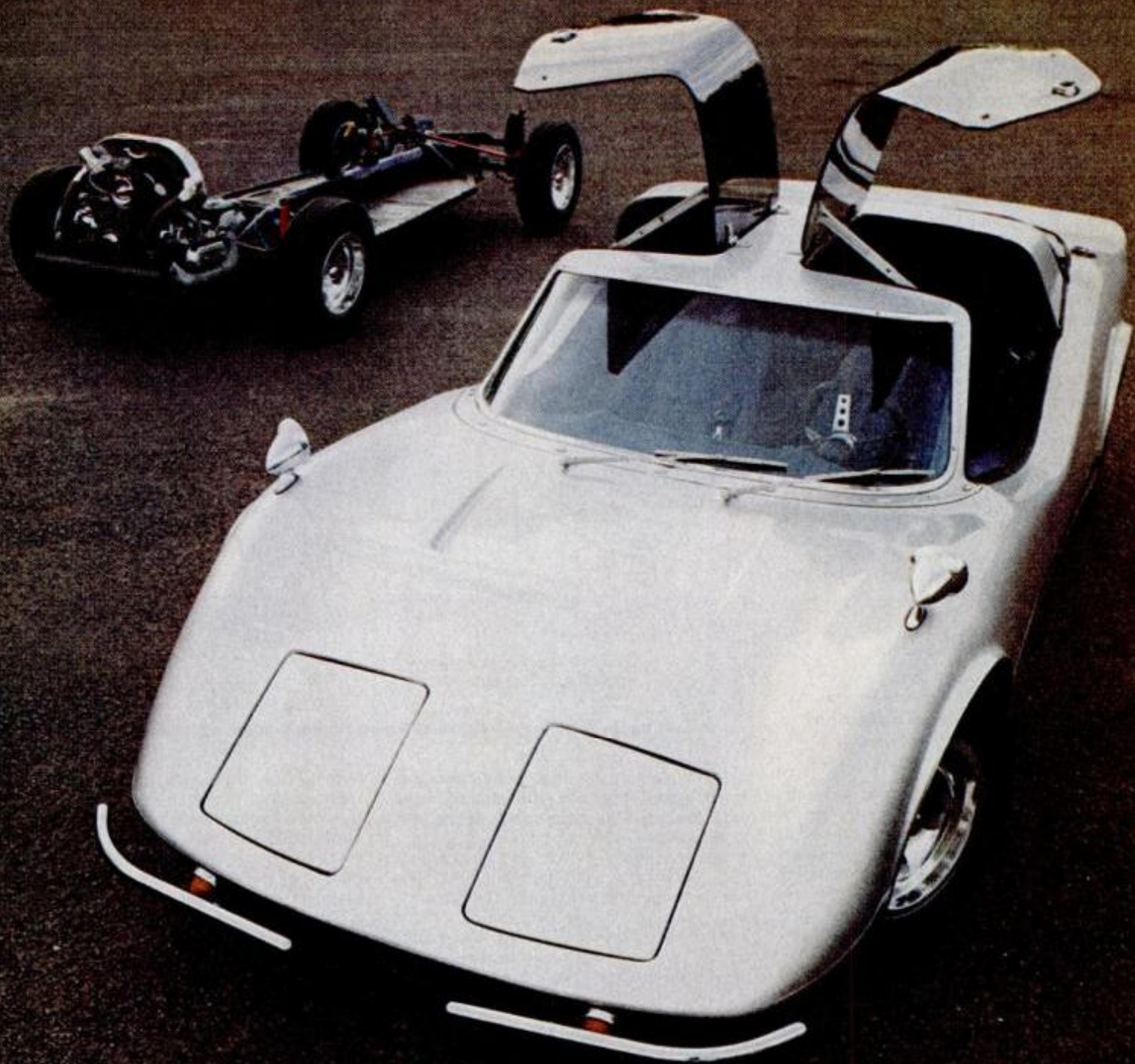
- Check for fluid leaks. Tighten pan bolts to stop a leak.

- Road-test the car to determine if the problem you've been experiencing has cleared up.

- With the transmission warmed up, recheck the dipstick to make sure fluid is at the Full mark.

**Caution:** Do not overfill the transmission with fluid. Fluid aeration will result, lead-

(Please turn to page 160)



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## TRANSMISSIONS, DRIVE TRAINS

(Continued from page 158)

ing to such problems as delayed engagement, erratic shifting, and slipping.

Here's a final tip that may save you a headache in the future:

If your engine won't start and there's no reason why it shouldn't, remember that the transmission is equipped with a neutral safety switch that is supposed to keep the engine from starting unless the transmission selector lever is in Park or Neutral. However, if the switch loosens or breaks down, the engine may not start at all. Or the engine may start with the transmission selector in Drive, Low or Reverse.

In other words, whenever there is an erratic engine-starting condition, remember the neutral safety switch. It's normally found on one side of the transmission or the other.

## MANUAL TRANSMISSIONS AND CLUTCHES

**"The transmission of my Plymouth Duster has become very difficult to shift. The dealer has replaced the clutch pressure plate. What now?"**

Unfortunately, when it comes to problems with a manual transmission and/or clutch, answers are seldom clear-cut. There are, for example, several reasons for hard gear-shifting. Indiscriminately applying one possible solution without first being certain that it's the answer can cost a car owner a lot of money, as it did this reader.

Hard gear-shifting can result from an improper clutch adjustment or an incorrect gearshift linkage adjustment—two possibilities that should certainly be investigated first since repairs are relatively minor and inexpensive to make.

Thereafter the possibility exists of damaged synchronizer stop rings or a bad synchronizer clutch sleeve, as well as clutch failure. In this reader's case, he paid for a new clutch, which didn't work. Now his transmission will have to be removed and opened up so an inspection can be made for damaged and worn parts.

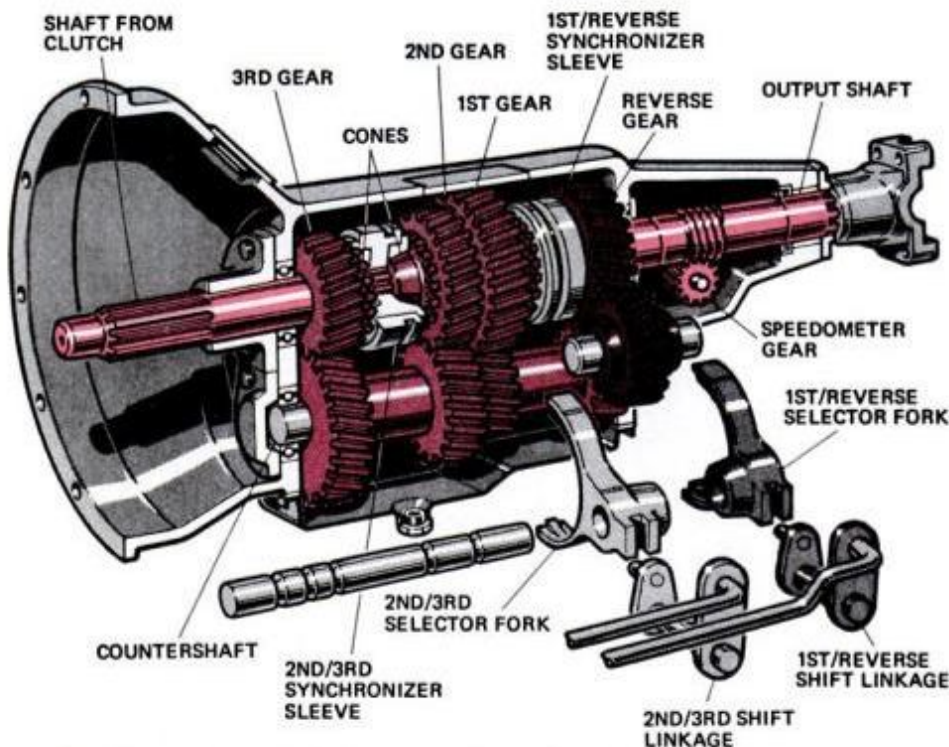
Clutch damage is more common than manual transmission damage. Furthermore, clutch failure can be put off indefinitely by proper clutch maintenance. There is nothing to do in the way of manual transmission maintenance other than being sure that the transmission is kept properly filled with lubricant.

## USING THE CLUTCH

Driver misuse kills clutches faster than any other cause. By driver abuse we mean resting your foot on the clutch pedal. Riding the clutch keeps the clutch partially engaged, causing extreme and rapid wear.

Ways to avoid unnecessary clutch wear are the following:

- Never place your foot on the clutch



Manual transmission care includes changing lubricant, adjusting linkage and clutch.

pedal except when you are shifting gears.

- Whenever you use the clutch, make sure the pedal is depressed all the way to the floor—never partially.

- Avoid using a clutch as a brake on a hill. Never play with the clutch as you rev the engine to keep your car from rolling backward. This will kill the clutch and waste gas. Rather, depress the clutch pedal fully and use your brakes—that's what they are for.

## ADJUSTING THE CLUTCH

When a clutch adjustment is made, the amount of free play is maintained. Free play refers to the amount of movement in the clutch pedal before the clutch disc engages. As a clutch is used and normal wear occurs, the amount of free play is reduced. If this free play isn't reset to a desirable adjustment, the clutch will wear more rapidly and might even sustain physical damage.

Consult your car owner's manual to de-

termine how frequently the manufacturer recommends that you make the clutch free-play adjustment. Usually, this is either 6000 or 12,000 miles. If you cannot track down a recommendation, adjust the clutch every 6000 miles. Frequent adjustment will not cause damage.

The adjustment from car to car is made differently. For example in the illustration at right, the locknut is loosened at the clutch fork and the pushrod is adjusted for a specified free play of 1/8 inch.

Consult the car's service manual or a general auto reference text for the method of adjusting the clutch in your car.

## HOW TO RECOGNIZE CLUTCH PROBLEMS

When a clutch fails, one of four conditions is created most often. They are called slip, drag, chatter and creep.

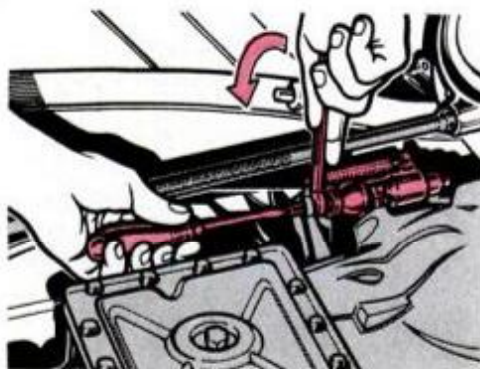
A slipping clutch is apparent when car speed doesn't keep pace with engine speed. The car lacks power, especially when ascending hills. A slipping clutch, which is often mistaken for an engine defect, causes an engine to use more fuel and may result in overheating.

To determine if your clutch is slipping, park on a level pavement, set the hand-brake, depress the clutch pedal and shift the transmission into first gear with the engine idling. Press down on the accelerator pedal slowly while releasing the clutch pedal. The engine should stall. If not, the clutch is slipping.

Adjust the clutch's free play. If this doesn't stop slipping, the clutch will have to be disassembled and repaired.

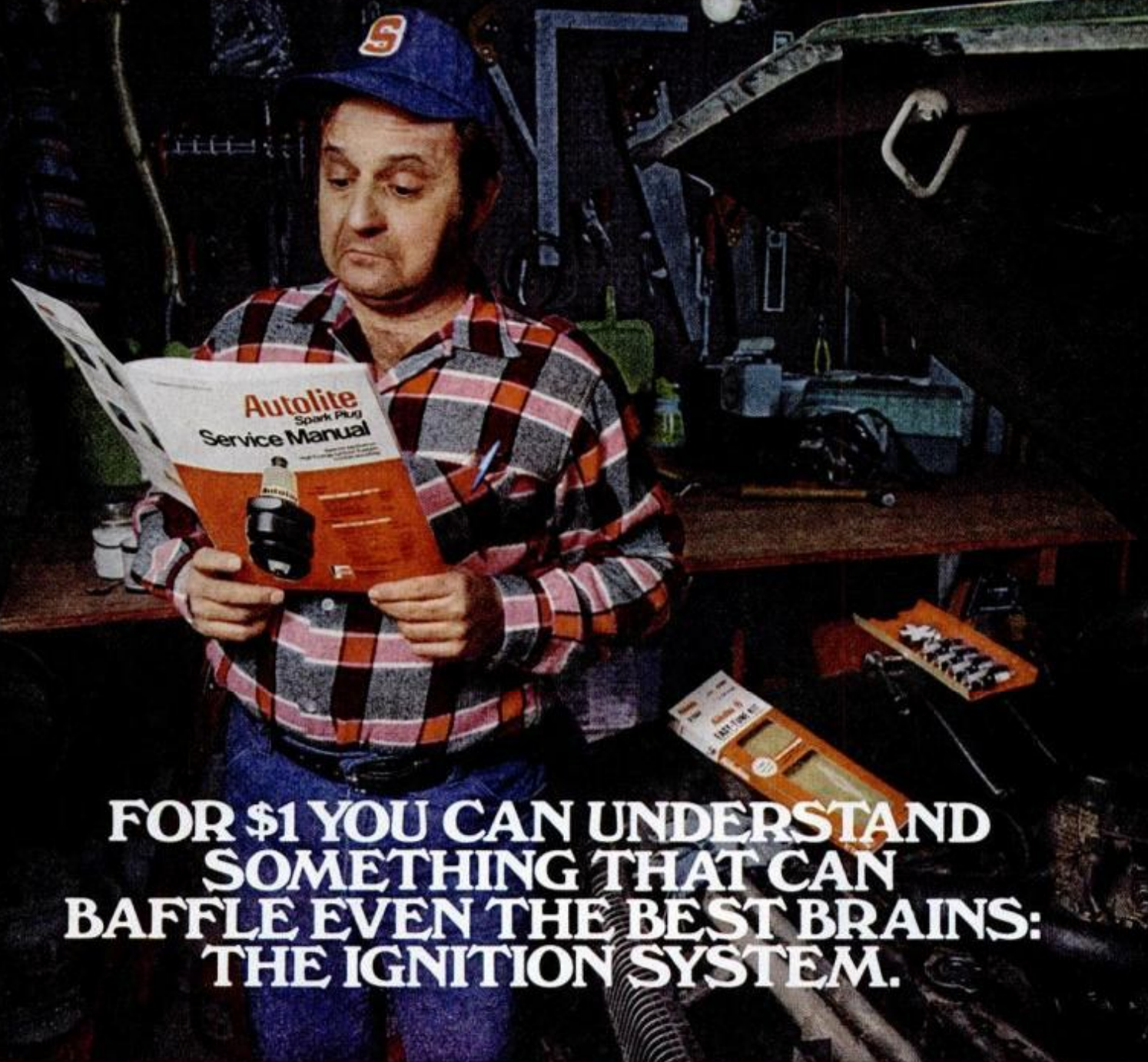
To test for clutch drag, let the engine idle with the clutch pedal depressed. Shift into gear. Then shift into Neutral and,

(Please turn to page 163)



Clutch adjustment is simple, but varies from car to car; check your service manual.





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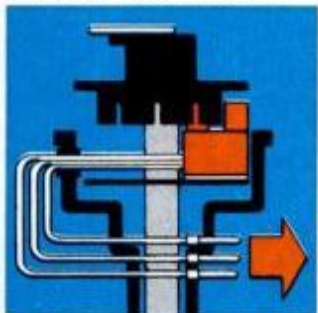
# Mallory's easy installment plan



Install infrared module



Insert shutter wheel

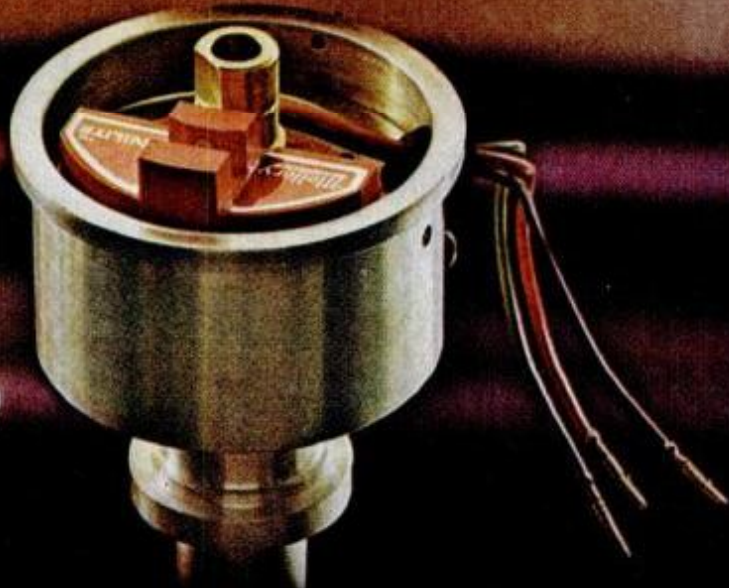


Connect three wires

step  
one

step  
two

step  
three



Install a Mallory Unilite Electronic Ignition Conversion... easy as 1-2-3! Finally an electronic ignition conversion kit you can install easily and quickly. Unilite. That's Mallory's new electronic conversion that fits right inside the distributor. No special tools required. No brackets to mount. No holes to drill. No tangles of wire to connect. All you do is install the module where your old points used to be. Insert the shutter wheel. Connect three wires. It's that easy.

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like conventional points, the Unilite infrared beam never varies. It's totally unaffected by wear, dirt or moisture. So there are no parts to replace. No hassling with frequent tune-ups and adjustments. Instead you get peak tune. Which means quicker starts, longer plug life and maximum gas mileage. Need a new distributor? You can also get Mallory's Unilite Ignition System completely housed in the new Unilite Distributor. Mallory's Unilite Ignition System makes other systems old-fashion.

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**UNILITE™**

# CAR CARE GUIDE

## TRANSMISSIONS, DRIVE TRAINS

(Continued from page 160)

keeping the clutch disengaged, depress the accelerator pedal part way down. Shift into gear again. If there is a grinding noise as you shift, the clutch is dragging. Make a free-play adjustment, but then an overhaul has to be considered.

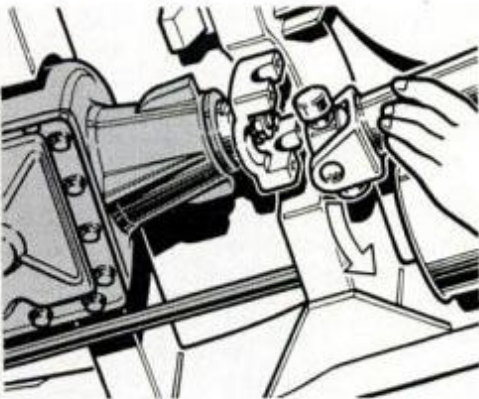
Clutch chatter needs no explanation. The clutch actually makes a ra-ta-tat as you release the pedal. Clutch chatter can be eliminated only by overhaul, since chatter results from a worn or damaged clutch disc assembly, grease or oil on the clutch disc facing, or a misadjusted clutch housing. Be aware, however, that chatter may also be produced when engine mounts are broken or loose.

A car will creep when a clutch grabs—that is, the clutch engages suddenly, and the car moves abruptly as the pedal is released to a partially engaged position. Overhaul is suggested.

## A WORD ABOUT UNIVERSAL JOINTS

The third largest number of letters in the "transmission and drive train" category received at *Car Clinic* last year dealt with universal joints.

Vibration is one way a worn U-joint has of making itself known. The other way is by emitting a clunking noise when the car



Universal joint is serviced after the drive shaft is disconnected from rear end.

is being driven at about 10 mph in gear.

You can verify the existence of a bad U-joint by jacking up the car and grabbing the driveshaft near each of the universals. Try rocking the shaft back and forth. If there is any play, tighten up on the U-joint flange bolts. Test again. Now if there is play, remove the driveshaft and replace the U-joint.

To remove the driveshaft in most cars proceed as follows:

- Remove the U-joint flange bolts on the rear U-joint.
- Scribe a mark across the U-joint and flange so you can accurately realign the driveshaft later when reinstalling it.
- Drop the rear of the driveshaft until it just clears the differential.
- Draw the shaft to the rear carefully, pulling it off the transmission output shaft.

# Satisfaction guaranteed or your mechanic back.

As the world's largest maker of do-it-yourself test and tune equipment, we know how much money you could save by doing your own tune-ups. We also know you may be squeamish about trying; you're worried.

We understand. When people throw around terms like "points," "plugs," "compression," and "timing," a tune-up can sound just a bit less complex than brain surgery.



Actually, though, it's a routine affair. If you can read, you can tune your own car. And save big money in the process.

To show you how, we've written a booklet, "Tune-Ups." If you're an amateur mechanic or have rarely looked under the hood, "Tune-Ups" will take you, step by step, through a first-rate tune-up of your car.

No miracles, mind you. You'll get your hands dirty; and you'll make some mistakes on your first tune-up. But your car will survive,

and you'll soon be zipping through tune-ups in little more than an hour. You will also have the satisfaction that comes from doing the job yourself.

"Tune-Ups" is available, at a very small charge, from your local RAC retailer. He can also supply you with all the RAC test and tune-up equipment you'll need for a lifetime of tune-ups—for less than you probably pay your mechanic for *one* tune-up. For the price of two or three tune-ups, he can supply you with a more sophisticated RAC tune-up kit that will put you in a class with the "Pros."

We know you can tune your car as well as your mechanic does; and possibly better, because nobody cares about your car as much as you do. But should you try your own tune-ups and disagree, we guarantee one thing—and with the price of tune-ups these days, your mechanic will be happy to take your money again.



**RAC** Rite Autotronics Corp., 3485 S. La Cienega Blvd., Los Angeles, Ca. 90016

## 5. Starting problems

Of all the *Car Clinic* letters, a good-sized 5.7 percent were related to engine-starting problems. About 3.9 percent blamed the overall starting system, while 1.8 percent pinpointed the starter motor.

Engine-starting problems are not, of course, caused only by malfunctions in the car's starting system. The ignition and fuel systems are often at fault and should be tuned up (see sections on Electrical and Ignition, and Carburetor for procedures).

However, suppose you find yourself in the same spot as this reader from Toronto:

**"What causes an engine to make just clicking noises when an attempt is made to start it? A complete, careful engine tune-up has been done without the condition being rectified."**

Whether or not an engine tune-up was done in this case really doesn't matter, because failure of the engine to start is assuredly being caused by a breakdown in the car's starting system. That system consists of the battery, battery cables, starter relay, starter solenoid and starter motor. In some cars, a neutral start (safety) switch is also used (see an explanation of this component in the section on Transmission and Drive Train).

### OVERCOMING BATTERY PROBLEMS

In this case, the clicking and the reason the engine isn't starting can be traced to the battery, starter relay, starter motor or faulty battery cables. Nine times out of 10, the battery's to blame.

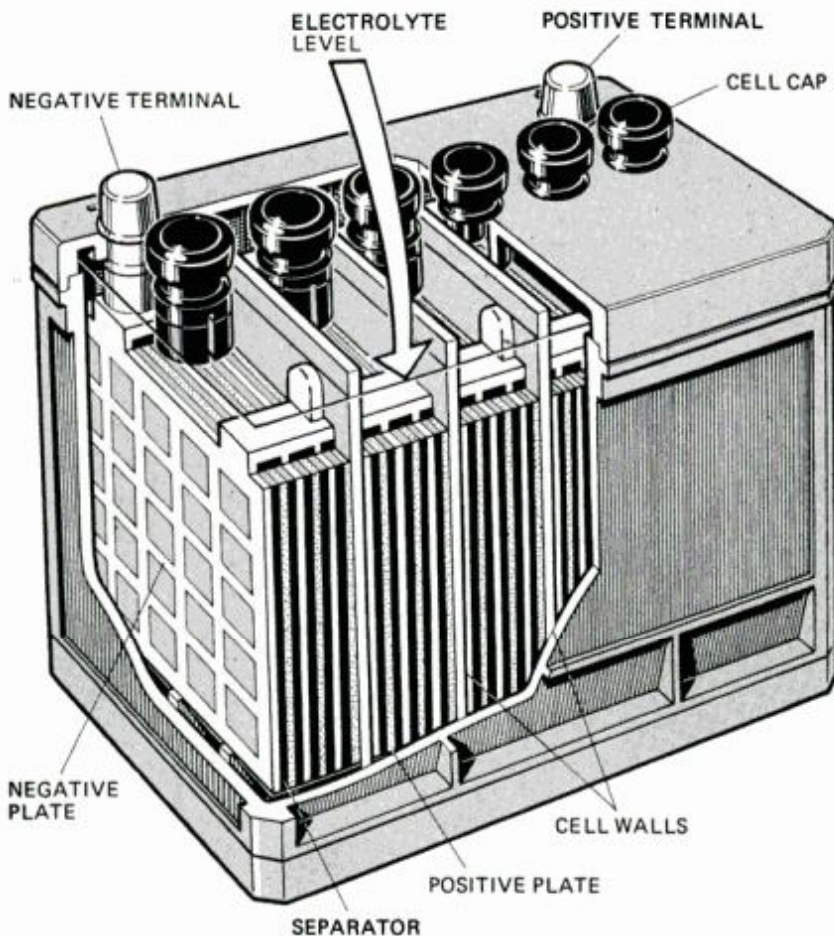
Other signs of a weak battery are failure of the engine to make any sound at all when an attempt is made at starting, and an engine cranking too sluggishly for it to start.

Unless the battery has an absolute dead short, you will be able to start the engine by using a booster battery. The run-down battery should *not* be indiscriminately discarded at this time. It should be tested. It may need just a recharge.

Boosting may be done by using the battery in another car, providing that car's electrical system is the same voltage as yours (12-volt, for example). Or you may use a separate booster battery that you keep on hand for emergencies. In either event, you need jumper cables. Get a good set. They are worth the extra money.

Boosting from another car's battery necessitates certain precautions to prevent damage and injury, so let's review the correct procedure (the same procedure, with modification, should be followed when using a booster battery that is not in a car):

1. See that the two cars are not touch-



Fully charged battery with clean terminals is the best quick-start insurance.

ing, which would create a ground.

2. All components that are electrically operated should be turned off in both cars.

3. Set handbrakes and place automatic transmission in P and manual transmissions in neutral.

4. Remove vent caps from both batteries and cover electrolyte ports with cloth. This is done to allow hydrogen gas which may build up during the boosting process to escape, thus protecting batteries from possible internal damage.

5. With the ignition keys of both cars turned off, connect one of the jumper cables to the positive (+) terminal of the good battery. Then connect the same jumper to the positive (+) terminal of the weak battery.

6. Connect the other jumper cable to the negative (—) terminal of the booster battery, and then to a ground on the disabled car, such as to the engine block.

7. Start the engine of the car which possesses the good battery, and then crank the starter of the car possessing the weak battery. If the battery is, in fact, weak the engine should start.

8. When the disabled car starts, disconnect the cable from ground and then from the negative terminal of the booster

battery, followed by the cable between the two positive terminals.

9. Replace vent caps.

**Caution:** Hydrogen gas. Keep sparks and flames away.

### TESTING BATTERIES

Batteries may be tested with a battery hydrometer. It tests specific gravity, which is the weight of battery electrolyte in relation to that of pure water. Electrolyte readings have to be interpolated for a temperature of 80° F., which a temperature compensating scale does automatically.

Test with a hydrometer as follows:

- Check battery electrolyte level, filling cells to the level mark if acid is low. If you add water, charge the battery for about 15 minutes at a rate which will induce gassing or drive the car for a half hour before testing specific gravity.

- Draw electrolyte into the hydrometer from one cell and return it to the cell. Do this a few times to stabilize temperature. Now, draw a sample from the cell so the float in the hydrometer rides free. Record the reading.

- Return the electrolyte to the cell from which it was taken, and proceed to

record readings from each cell in turn.

**Caution:** If electrolyte should drip on the car, your skin or clothing, wash it off at once with baking soda solution. If it gets in your eyes, flush with water and see a doctor immediately.

Compare readings. If any cell shows .050 specific gravity points less than any of the others, that cell has shorted. Replace the battery.

A fully charged battery has an overall specific gravity of 1.260-1.280. If specific gravity is less than 1.230, charge the battery using a slow battery charger. The battery has outlived its usefulness if it isn't able to maintain a specific gravity of at least 1.200 in every cell.

**"My battery is healthy in warm weather, but fails me every couple of days in winter. Why does this happen?"**

Because the battery isn't able to meet the demands of the higher load imposed on it by cold-weather starting. If a battery seems to fail constantly in cold weather, a battery load test should be performed.

This test is done with a battery tester consisting of a voltmeter, ammeter and carbon-pile rheostat which puts the battery under a load that should be three times the ampere/hour rating of the battery. The amp./hour rating should be stamped on the battery's case.

For example, a load of 180 amps. would be required to test a battery that's rated at 60 amp./hours. A 12-volt battery under load should have the ability to deliver a minimum of 9.6 volts. If it doesn't, the battery will continue to let you down in cold weather.

### CABLES NEED CARE, TOO

**"Sympathize with me. I discarded a good battery only to find that a \$1.50 battery cable was letting me down. Foolish, huh?"**

This reader's plight is repeated by others whenever engines turn over sluggishly, giving the impression that the battery has gone dead. Cables are seldom considered. Yet, remember that cable failure is as prevalent as battery failure. Thus, when a starting problem arises which appears as if it's starting-system-induced, do the following:

- Remove battery cables from battery posts (ground cable first) and clean terminals and posts thoroughly with a battery-cleaning tool.

- Flex each cable back and forth over its entire length, looking for cracks and brittleness of insulation. Replace suspicious-looking cables.

- At the grounded end of the ground cable, see that the connection to ground is clean and tight.

- At the starter relay and/or starter motor, see that cable connections are clean and tight.

- Reconnect cables to the battery **tightly** ("hot" cable first). If a terminal

won't tighten, it is probably chewed up. Replace the cable.

If starting failure persists despite all efforts, keep in mind that a cable could be damaged internally. A cable resistance test should be performed with a voltmeter or ohmmeter. A voltage drop of 0.1 or more for either cable denotes excessive resistance. Replace *both* battery cables if one has to be replaced.

### STARTER MOTOR PROBLEM? NO!

Of the 1.8 percent of the letters sent to *Car Clinic* last year about starter motor "failure," 1.6 of them read something like this one from a reader in Louisiana:

**"When my car is warmed up, it won't restart. Sounds like a weak battery. It goes ugh-ugh-ugh. Battery and starter have been replaced. No trouble starting when it's cold. What now?"**

This is a very common complaint with older cars. As carbon builds up inside an engine, the compression ratio may be increased beyond normal limits, imposing an excessive load on the starting system that it's not able to handle. An indication is if this same engine starts normally as soon as it cools down.

The presence of carbon and, hence, excessive compression can be determined

ers who wrote us last year), look for a carburetor percolation condition. This could occur when an engine which has been running is turned off and restarted soon after. Heat beneath the hood may cause gasoline in the carburetor fuel bowl to boil and overflow, flooding cylinders.

Starting an engine that percolates may be facilitated by pressing the accelerator pedal to the floor and keeping it there as you crank the engine.

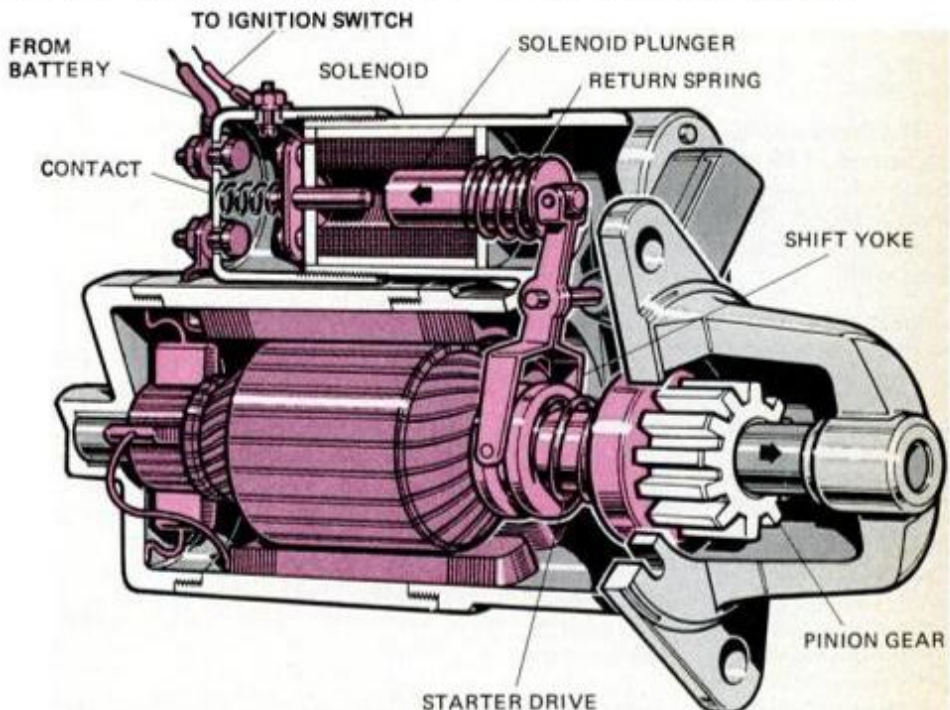
### STARTER MOTOR PROBLEM? YES!

How can you tell if you truly have a malfunctioning relay or starter motor?

When a starter relay fails, the engine won't start in a way that resembles a battery breakdown—that is, the engine will crank sluggishly, make a clicking sound, or make no sound at all.

To test the starter relay, which is mounted in the engine compartment, usually on a fender well or firewall, connect a jumper cable across the relay's two large terminals. Try starting the engine. A start now tells you that the starter relay has broken down and should be replaced.

Of all the components in a car's starting system, the starter motor is the most reliable. But when it gives an indication of having failed, you should remove it from the car for bench testing.



Starter motor and solenoid are the most reliable components in your starting system.

by making an engine compression test with the engine warmed up to normal operating temperature. If overall compression is in excess of manufacturer's specification, you have found the reason for your hot-engine starting problem. A carbon-and-valve job is in order.

By the way, if your engine cranks briskly when hot, but still won't start easily (another common complaint of read-

Starter-motor trouble is indicated:

- If the starter motor spins (whines), but the engine won't start.

- If the starter motor engages the flywheel (it makes a "clunk"), but the engine won't start.

- If you hear clicking or the engine cranks sluggishly, and all other parts of the starting system we've discussed have been tested, test the starter motor.

## 6. Suspension and steering systems

**S**teering and suspension were subjects of 5.5 percent of the letters we received at *Car Clinic*. The greatest number asked for help in solving shimmy (vibration) and wheel tramp conditions. Thereafter, noisy steering was the major problem, followed by general questions dealing with suspension components, such as shock absorbers, springs, front-end alignment and wheel bearings.

### SHAKING THINGS UP

The terms shimmy, vibration and quiver are synonymous. None, however, is the same as wheel tramp (thump).

Shimmy is the continuous shaking sensation you feel in the steering wheel (most often), floor or seat while driving on a paved highway at a set speed usually between 50 and 70 mph. It continues as long as you maintain that speed, but disappears or diminishes when the speed is increased or decreased.

Front-wheel tramp is a cyclical thumping sensation that's transmitted through the steering wheel, floor or seat at a speed of about 25 mph.

Some malfunctions that cause vibration may also cause wheel tramp, but usually what creates one sensation will not produce the other.

The typical letters on the subject of shimmy read like this one from a reader in Orlando, Fla.:

**"The front end of my Ford vibrates at a speed of 55 mph. Below and above this speed, the car runs smooth as silk. Tires have been balanced, but that hasn't helped. What will?"**

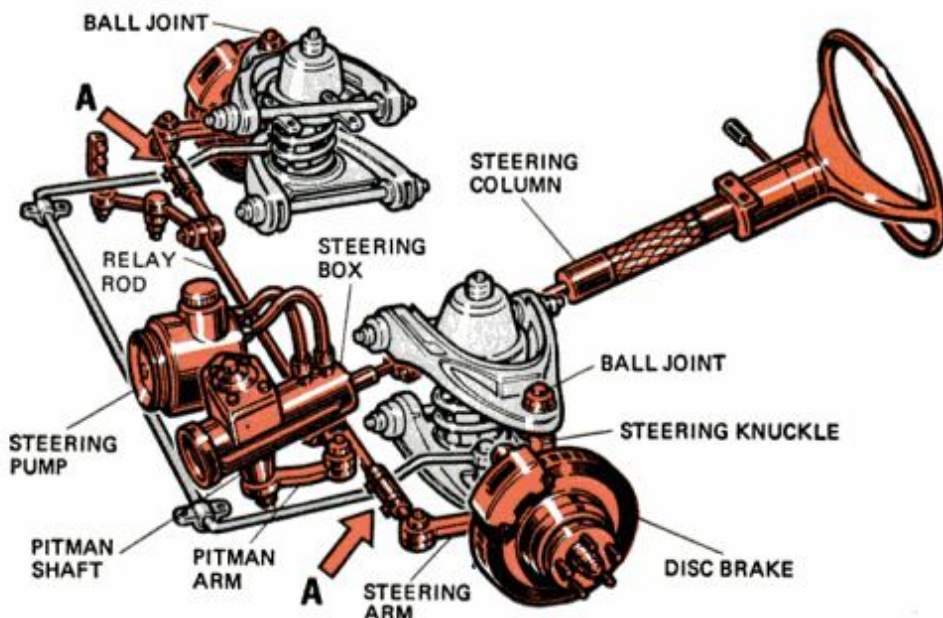
Wheel and tire unbalance is often blamed for vibration, and yet it's just one of 11 possible reasons—not even the most common. Here's a list of all usual causes of vibration. An asterisk means that the particular reason should be tackled before others since testing is easier and can be made without costing money.

- Improper tire pressure\*
- Tire bulge\*
- Loose wheel nuts\*
- Worn shock absorbers\*
- Loose steering linkage\*
- Worn or loose front wheel bearings\*
- Loose engine mount\*
- Incorrect driveshaft angularity\*
- Worn ball joints
- Unbalanced wheel and tire assemblies
- Improper front-end alignment

### ELIMINATING SHIMMY

Proceed as follows:

1. See that tire pressure is neither low nor uneven, and examine tire sidewalls for bulges that can cause shimmy. Discard a bulging tire—it's unsafe.



Steering linkage can be tested for looseness at tie-rod adjustment sleeves (A).

2. Tighten wheel nuts with a hand wrench, preferably a torque wrench, to manufacture specification. Tighten nuts in a crisscross manner to equalize pressure around the wheel. Tighten each nut, in turn, to half its torque value—then go back and tighten each to full value.

**Caution:** Avoid having wheel nuts tightened with pneumatic power wrenches, which can enlarge wheel-nut holes, preventing nuts from securing the wheel. This would cause the wheel to wobble. Pneumatic tools can also distort brake drums and discs.

3. Test shock absorbers by pushing up and down on the bumper or fender at each corner of the car in turn. Increase the length of the stroke with each push until the car is rocking really well. Then release your grasp on the bumper or fender at the bottom of a downstroke. If the car continues to rock up and down two or more times, the shock absorber in that corner is probably worn and should be removed from the car for further testing. Replace if necessary.

Other ways of discovering a bad shock include examining the shock's case for fluid. A leaking shock absorber should be replaced. You should also grasp each shock and try shaking it. If the shock is loose, tighten fasteners and retest. If still loose, the bushing is probably worn and should be replaced, if possible. If not, replace the shock.

**Important:** If one shock absorber has to be replaced, replace the other shock on the same axle. It is not necessary, however, to replace shocks at the other end of the car, assuming both are still in good condition.

4. Examine steering linkage, consisting

of tie rods, pitman arm, idler arm and relay rod. Look for bent components. Grasp each and try shaking. If any rod is bent and/or demonstrates looseness, replace that part. A damaged or worn steering linkage component results in vibration and also loose steering control, jerky steering and side-to-side wander of the car.

5. To determine if front wheel bearings are causing vibration, feel wheels or hubcaps after driving the car several miles. Friction could heat the wheels, signifying a worn or improperly adjusted wheel bearing. You should also jack up the front of the car and spin each wheel by hand. If you hear clicking, grinding or scraping, remove the wheel, inspect bearings for damage, and adjust bearings properly before replacing the wheel.

**Important:** With cars having front-wheel drive only, inspect rear wheel bearings as we described. If a vehicle is equipped with both front and rear-wheel drive (that is, four-wheel drive), the inspection is unnecessary. Wheel bearings on an axle with a drive system seldom fail because they are being treated constantly with lubricant from the differential or transfer case.

6. One of the most serious conditions that causes vibration is a loose engine mount. Reports have reached us of mounts loosening so badly that engines have actually rocked forward, smashing radiators. In more severe cases, loosened engine mounts have caused throttles to jam, leading to runaway cars.

At the first indication of shimmy, engine mounts should be tested. Vibration is the initial indication of looseness.

If a car has a manual transmission, let the engine idle. Set the hand brake tightly,

*(Please turn to page 168)*

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KEEPS CARS RUNNING YOUNG.**



# CAR CARE GUIDE

## SUSPENSION AND STEERING

(Continued from page 166)

place the transmission in gear and have someone watch the engine as you let the clutch out. If an engine mount is loose or defective, the engine will give a violent upward jerk as it stalls out.

If the car is equipped with automatic transmission, place a hydraulic jack under the oil pan or some other accessible section of the engine block. Put a 2x4 wood block between the jack and engine to prevent damage, and lift up carefully on the engine. If the engine mount is loose, the engine will lift far enough off the mount for you to see daylight between the two.

**Caution:** Don't put too much pressure on the oil pan. You may cause damage.

If an engine mount is loose, it should be tightened with a torque wrench to manufacturer specification. If damaged, or if it won't tighten up, it should be replaced.

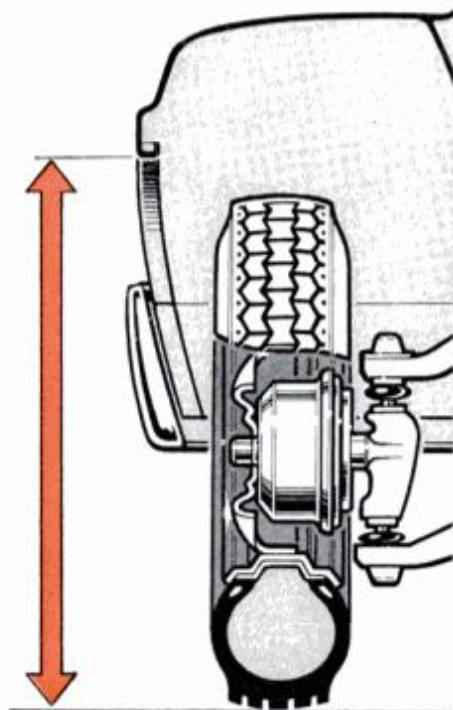
7. Check universal joints as discussed in the section on transmission and drive train. With the car on a two-post lift so wheels hang free and the driveshaft is not obstructed, have someone start the engine and place the transmission in gear as you watch the action of the driveshaft.

Driveshaft motion should be smooth. If the shaft is out of alignment, it will whip. Edges of the shaft will look blurry.

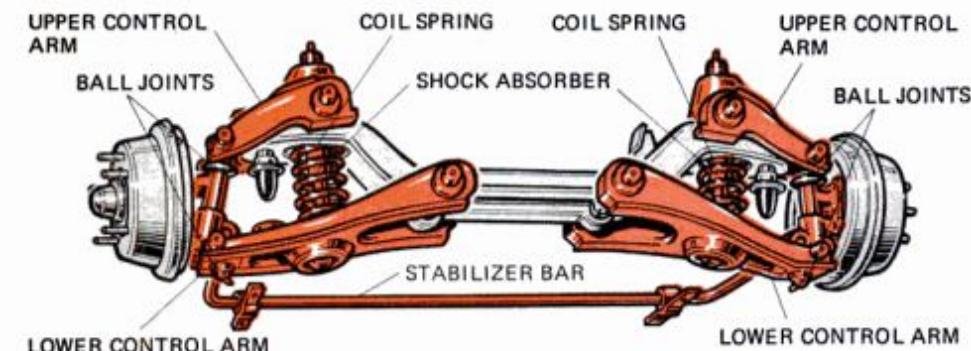
Wash the shaft with cleaning solvent on the chance that a cake of mud or some

alignment gauge against manufacturer specification.

8. Have ball joints tested for axial (up-and-down) movement. This is done by



Weak or broken springs can be detected by checking height of both sides of the car.



Front suspension components for typical rear-wheel drive car are shown here.

other foreign matter is throwing the shaft out of balance. Look for damage to the shaft. A shaft that's bent or dented should be replaced.

Now, bring the car down to the ground. See that it's resting on level pavement and measure the distance from the ground to the center of the fender well with a gauge. Do this at each corner of the car. You are looking for a weak or broken spring that can cause a driveshaft to whip during driving. If one corner measures lower than the opposing corner, the existence of a bad spring is verified.

This procedure, incidentally, can be used by you readers who wrote us asking how to check for weak springs.

If shimmy still exists after other possible causes have been investigated, have driveshaft angularity checked. Angularity has to be determined with a driveshaft

jacking up each front wheel, relieving pressure on the load-bearing joint, attaching a dial indicator to the wheel assembly and prying up on the wheel assembly. See if movement falls within manufacturer requirements. If it exceeds this specification, ball joints should be replaced.

Ball joints in some cars since 1974 (GM in particular) have indicators that allow you to make this check yourself. Just wipe off the base of the joint and scrape a screwdriver or your fingernail across it. If you can feel a nub, the ball joint is not worn beyond limits. If you can't, replace the joint.

9. If vibration started right after you put new tires on the car, replaced a brake drum or disc, rotated tires, or upset the original setting of wheel assemblies in some way, have wheel-assembly balance tested dynamically and statically—that is,

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### 1. Ask about gas saving.

The Firestone Steel Belted Radial 500™ is the proven Gas Saver. Run at steady highway speeds on American cars against our bias belted tires, they proved they can save up to a dollar a tankful.

### 2. Ask about a test period.

When you buy Firestone Steel Belted Radial 500's, you can drive on them for 7 days, and get every cent back if there's anything you don't like. It takes a great tire to make this promise.

### 3. Ask about a 40,000 mile limited warranty.

If the Steel Belted Radial 500 doesn't give you 40,000 miles of treadwear in normal passenger use on the same car, any Firestone Store or participating Dealer will give you a new one, charging you only for the mileage received plus Federal Excise Tax and a small service charge. Make sure you get a warranty this good!

### 4. Ask about a special rain tread.

Firestone's remarkable Water Squeezer Tread actually pushes water out the sides of the tread. Your tires need a big, wide footprint, too—to help hold tight to wet pavement.



# CAR CARE GUIDE

with wheel assemblies in motion and at rest, respectively. Correct an unbalanced condition with balancing weights.

10. Finally, a misaligned front end may be causing the vibration, and the car's camber, caster and toe should be checked against manufacturer specification and corrected. Besides vibration, front-end misalignment can cause pulling of the car

to one side on a level roadway when you remove your hands from the steering wheel, instability (wander and weaving), tire squeal on turns and uneven tire wear.

## TRAMP, TRAMP, TRAMP

Letters to *Car Clinic* show that this is a problem that many readers are finding dif-

ficult to track down. That's surprising, because there are only three reasons for wheel tramp—weak shock absorbers, unbalanced wheel assemblies and out-of-round tires. We've discussed how to check out the first two.

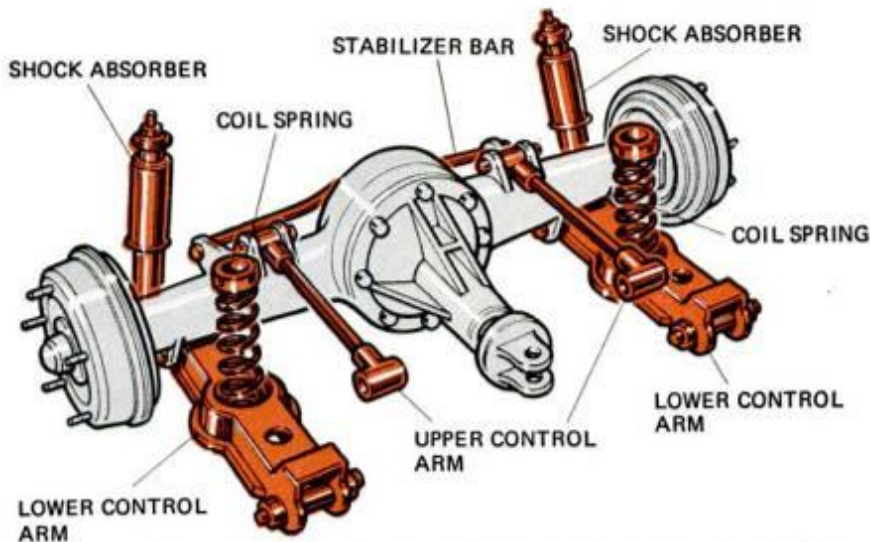
To verify the existence of an out-of-round tire, inflate all tires to 50 pounds and drive the car. If a tire is causing tramp, you will **not** feel the sensation. To uncover the offender, reduce inflation in one tire to normal pressure and drive the car. Follow the procedure for each of the tires until tramp reappears, revealing the eccentric tire.

## STEERING PROBLEMS

Other than vibration already discussed, the most common complaint relative to steering is noise when the steering wheel is turned sharply.

Start by seeing to it that the power-steering-pump drive belt is properly tightened. Loose drive belts cause more power steering difficulties, including noise, than anything else. Noise may also be caused by a glazed belt or pump pulley.

If noise continues, the job becomes one for a steering technician. The noise may not be coming from the booster, but from the steering itself. Maybe the cross shaft has to be adjusted or is damaged.



Rear suspension may be of the coil-spring type (shown here) or the leaf-spring type.

## 5. Ask about handling and steering.

We've engineered our radials to handle and steer a whole lot better than our conventional tires. Noticeably better on cornering, and less "squirm."

## 6. Ask about noise.

Compare radials. The Firestone Steel Belted Radial is the quiet radial running and cornering—with a computer-designed, logarithmic tread.

## 7. Ask about the number of dealers behind it.

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## 8. Ask a friend about

# Firestone

The New Steel Belted Radial 500—Guaranteed for 40,000 miles of treadwear.

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## 7. Oil problems

Of those who wrote *Car Clinic* in 1975, 5.2 percent had questions dealing with oil: oil burning, oil leaks, oil filters, selecting oil and the like. Problems were quite varied, and for this section we have selected the most prevalent, most interesting and most important.

### DOES YOUR CAR BURN OIL?

The following is a good example of the kind of perplexing problem engine oil loss can present:

**"My car has been driven only 25,000 miles and has suddenly started using oil. I can't see any leaks, sparkplugs aren't fouled, no smoke is being emitted from the tailpipe. Where is the oil going?"**

This reader has put his finger on the two greatest problems oil presents. Our *Car Clinic* letters indicate that 2.8 percent of those writing about oil thought their cars were burning oil, while 1.2 percent spotted oil leaks. The most difficult prob-

lem, obviously, is the one detailed above—when the car owner can't tell whether oil is being lost by burning or leakage.

Let's discuss leakage first, because it is usually easier to establish or dismiss. An engine that has an external oil leak will lose oil from around seven specific areas. They are the front oil seal, timing-gear cover, fuel-pump housing, oil filter, crankcase (oil pan), rear oil seal and valve covers.

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How can you determine if your engine oil loss is being caused by a leak through one of the seven critical areas mentioned above? Spread newspaper on your garage floor or driveway and drive the car over it.

Run the engine at fast idle for about five minutes. Back the car away and then examine the paper.

If you see oil, the engine is leaking from one of the areas we've noted. Your next task is to examine each of the areas closely with the engine turned off. Run your hand around the housing and see if you can find the spot.

### LEAK OR SEEP

Many people have difficulty distinguishing an oil leak from oil seepage. This leads them to believe that they have a problem when, in fact, they do not. The following excerpt from a reader's letter is indicative:

**"My car is still under warranty, so I need help. There's oil leaking from around the valve covers. The car requires a quart every 1500 miles. The manufacturer says the loss is normal."**

What this reader is experiencing is not, as he claims, an oil leak, but an oil seep.

A seep, which is a normal condition, is characterized by oil oozing through fine pores or small, natural openings. Many times even this small amount can be curtailed by tightening up on components, such as valve covers. A seep will not be a drip, nor will there be an appreciable loss of oil, as indicated on the dipstick.

On the other hand, a leak as we mentioned will show itself when the lubricating system is put under pressure, and many times even when it's not. Oil will drip to the ground, and there will be a sharp loss of oil as indicated on the dipstick.

### ARE YOU RUNNING AN OIL BURNER?

Too many car owners rush into a com-

plete overhaul when they think their engines are burning oil. Our advice is this:

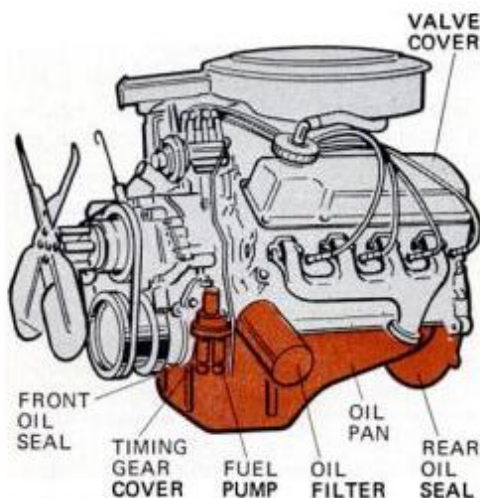
Go slow! You might not have as serious and as money-consuming a problem as you think.

**"My new car is using a quart of oil every 500 miles. The dealer says to drive it a few thousand miles more, and the problem will alleviate itself. Can I believe him?"**

The dealer is talking with a straight tongue. However, should oil consumption persist beyond, say, 5000 miles in total, the engine should be repaired under the terms of the new-car warranty.

Manufacturers generally stress in owners manuals that oil consumption in the beginning of a car's life is going to be higher than normal. Pontiac, for example, states, "Oil consumption will be slightly higher than normal until the piston rings are fully seated."

An engine should be given a reasonable



Oil leaks can be from one or more of the locations shown in this engine drawing.

amount of time to stop using oil, but car manufacturers don't expect you to live with an oil burner for long. Sometimes piston rings do not seat, and oil consumption not only remains "slightly higher" than normal, but gets worse. In this case, the dealer is authorized to disassemble the engine, remove glaze from cylinder walls and replace piston rings to bring consumption down to normal.

What constitutes "normal" oil consumption? This question, frequently asked us at *Car Clinic*, is very difficult to answer—almost as tough as the question: "What is good gas mileage?"

### WHEN'S A LEAK A LEAK?

Manufacturers generally do not define "normal" in public. Even service managers I ask tell me that normal oil consumption is a quart every 850 miles to 2000 miles. As you can see, this is vague. All we suggest is that you be reason-



Air filter should be checked if black exhaust smoke indicates too-rich mixture.

All we suggest is that you be reason-

All we suggest is that you be reason-

All we suggest is that you be reason-

All we suggest is that you be reason-

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## CAR CARE GUIDE

able. Having to add a quart of oil to a fairly new car every 850 miles, say, isn't outlandish. However, no auto manufacturer expects you to put up with a new car that burns oil. He will repair the car as long as it's still under warranty and the recommended services have been performed.

### WHEN OLDER CARS BURN OIL

Driven long enough, every car is going to start burning oil. Consumption may increase after 30,000, 50,000, 75,000 or 100,000 miles. There is no definite point, but eventually oil usage will increase.

A black oily film that comes off on your fingers when you run them around the inside of the tailpipe is a sign that too much oil is being burned. Blue or blue-gray smoke emitted from the tailpipe is another indication. However, black smoke



New seals installed over valve stems may be necessary if you're burning oil.

or white has nothing at all to do with oil consumption. This is mentioned especially for the benefit of the man from Oregon who wrote:

**"I'm really concerned because my new car gushes a plume of white smoke every cool morning. Will it start consuming oil soon?"**

White smoke coming from the tailpipe during engine warm-up periods, especially on cool, humid days, is the engine's way of throwing off condensation.

Black smoke, however, does signify a malfunction. It tells you that the fuel mixture being burned is too rich. You are wasting gas, so refer back to the section on carburetor tune-up and apply procedures.

You can get a pretty positive indication of oil consumption by road-testing a car. Drive at a steady speed of 40 mph. Then coast with the throttle closed, while someone following you checks for blue or blue-gray smoke during deceleration.

There are two ways in which oil can pass from the crankcase into combustion chambers where it's burned:

1. Through bad valve seals or worn valve guides.

2. Past piston rings.

You should determine which condition exists, since the first is less expensive to correct than the second. You can perform certain tests.

One is to remove valve covers and shut off the oil supply to the rocker-arm assembly. Warm up the engine and drive the car at least five miles. If exhaust no longer looks blue or blue-gray, or the amount of smoke decreases, oil has been getting past valves, probably because of bad valve seals or worn valve guides.

Another test—a "wet" compression test—is easier to do, but it's a process-of-elimination test. It will tell you whether oil is being lost past worn rings. But if not, it won't tell you if oil is being lost because of worn valve seals or guides. However, if there are no leaks, it's a safe bet that seals or guides are to blame.

To do the test, remove all sparkplugs and test compression in each cylinder, recording readings. Now, in one cylinder after another, inject a substantial quantity of engine oil and perform the compression test again.

If there's a notable increase in compression, brought about by oil having sealed off "gaps" around rings, the blame for oil loss can be pinned on rings. The engine is a candidate for overhaul.

### ADVICE ABOUT OIL FILTERS

We received this informative letter from a reader during 1975 that should be interesting to others:

**"Car suddenly started using oil. At next oil change I found a loose oil filter. Problem solved."**

Right—but an overly tightened oil filter can cause a leak as fast as a filter that's too loose. The important fact to keep in mind when replacing an oil filter is that an oil filter wrench is used to **remove** an oil filter **only**.

An oil filter wrench should never, never be used to tighten a filter, because if the filter is overtightened its seat could be deformed, presenting a perfect avenue of escape for oil.

The right way to replace an oil filter is to loosen the old filter with your wrench and spin it off its seat by hand. Wipe off the engine surface.

Now, with clean hands, spread a thin layer of fresh engine oil around the gasket of the new filter. A dry gasket can be damaged.

Using care, screw the new filter on to the engine by hand. See that you don't get the threads crossed. When the filter's base makes full contact with the seat, turn the filter one-half turn additional—no more.

Start the engine, run it at a fast idle, and inspect around the filter for an oil leak. If oil is leaking, shut off the engine and give the filter one-quarter more

(Please turn to page 174)



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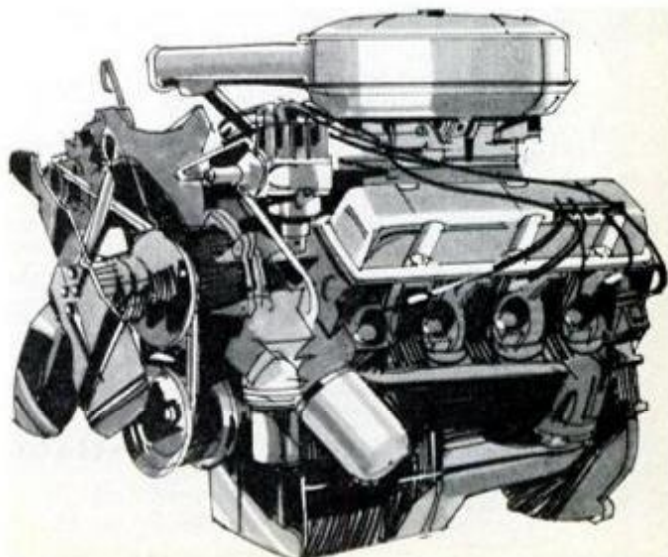
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## OIL PROBLEMS

(Continued from page 172)

by hand. Now, if there's a leak, something is wrong with the filter.

**"Should I replace the oil filter every time I change oil or do as the manufacturer suggests—replace the filter every other oil change?"**

There are two points of view:

1. Replace an oil filter when changing oil since leaving one quart of dirty oil in the system to mix with clean oil is ridiculous.

2. Present-day oil filters are excellent products that will do a very effective job filtering out foreign matter for a period equaling the length of time between two oil change intervals. But, when you're not changing the filter make sure you remove it and empty it of its dirty oil.

Take your choice.

What do I do? I replace an oil filter every time I change oil. To me, the extra few bucks I have to spend is worthwhile for the insurance it buys.

## TWO OTHER OIL PROBLEMS

**"Can you explain why the dipstick in my car reads one-half quart over the full mark when I install the quantity of oil recommended by the manufacturer?"**

Sure. The dipstick is probably marked wrong, which happens more frequently than you'd suspect, or the dipstick tube isn't correctly installed. We received a number of letters last year complaining about this.

If you don't want to bother getting another dipstick, you can re-mark the old one by scribing a line at that "one-half quart over" level. Or you can simply note where the level falls and leave it alone.

If the dipstick tube is off kilter, maybe just bending it slightly one way or the other will settle the problem.

**"I'm really worried, because that oil-pressure indicator light of mine started flashing on and off intermittently some time ago, and now glows red almost always. What can the trouble be?"**

From the sound of it, this man has been operating his car's engine with the oil-pressure warning light showing "red" for quite some time. If there was a serious condition, such as a bad oil pump, he would have burned out his engine by now. So obviously, the problem isn't serious. Quite likely there is a breakdown in the oil-pressure indicator setup. Perhaps the lead terminal at the oil indicator (where it screws into the engine) is loose, or has become coated with oil-soaked dirt. Pull off the lead, wipe it and the indicator clean, and reinstall the lead tightly.



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## 8. Engines

Engine noise seems to be the biggest single problem in this category, which represents 4.8 percent of all letters received at *Car Clinic* in 1975. Noise complaints were voiced by 2.1 percent.

Some noises indicate major problems, while other noises are easily eliminated. Our problem at *Car Clinic* in trying to help a person with a noise problem is to make sure that we're both speaking about the same noise.

### THERE'S NOISE—AND THERE'S NOISE

This man wrote:

*"My car's engine has developed noise similar to a piston slap or sticking valve, particularly when I start it up in the morning. I'm wondering what I should do about it."*

There's a big difference between the noise of a piston slap and the noise from a sticking valve. The problem is recognizing the difference, and understanding the noise from hundreds of other parts both inside and attached to the engine.

The illustration on this page shows a cut-away of an engine, pinpointing some of the major problems that produce internal noise. The noises that these malfunctions and others make are described by mechanics as slap, rap, rattle, click, whine, thump and thud.

Keep in mind that we are now discussing sounds symptomatic of **major** engine problems. We will cover "minor" problem sounds later. The word **minor** is encased in quotes, because one of these noises—ping—may, in fact, be caused by a major problem, but we'll discuss that further on in this section.

In determining which one of the noises applies to your engine, it's also important to ascertain under what conditions the sound occurs and, if possible, at what pitch.

For example, is the noise loud, faint, sharp or dull? Does it occur regularly or intermittently? Does it happen when the engine's hot, cold, or all the time—during acceleration, deceleration, idling or at high speed?

### SOUNDS DEFINED

Let's run down each of the various noises that are created by major engine problems and define them:

■ **Slap**—This is described as a sound resembling a hammer striking a metal surface, but not sharply. It's a dull noise. The one part inside an engine that's most notorious for slapping is the piston. It happens when a piston loosens up.

■ **Rap**—A rap is similar to a slap—like a hammer hitting a metal surface—but it's much sharper in intensity. A primary cause of engine rap is putting a load on an engine or running it at high speed when

it's low on oil. The noise is actually being made by connecting rods.

■ **Rattle**—This term is quite descriptive. It sounds like a baby's rattle that's being furiously shaken. A loose piston may cause a rattle rather than a slap. So can ignition timing which is too advanced.

■ **Click**—Run a stick along a picket fence, and you have some idea of what is meant by engine click. Clicking has become one of the most prevalent sounds...

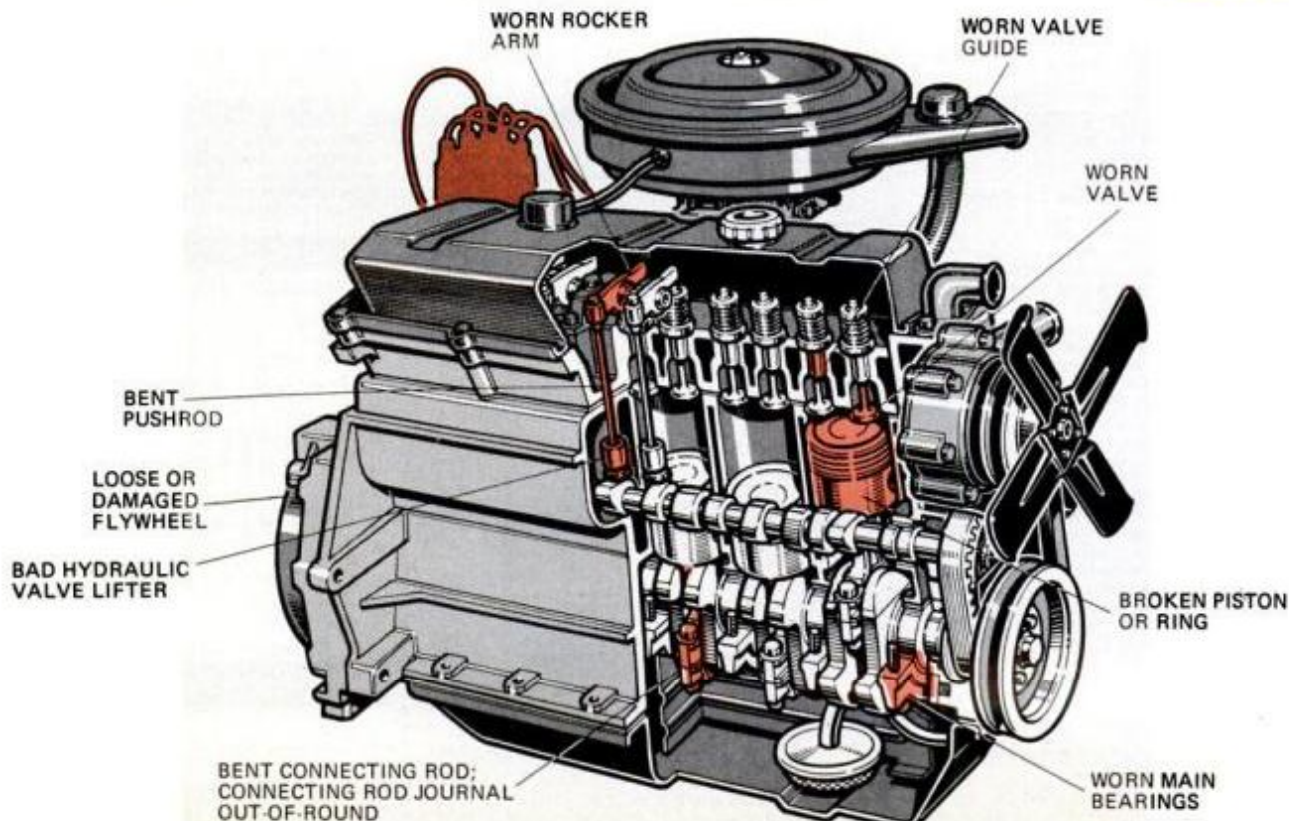
*"My engine makes a clicking noise for about 20 seconds when I start it first thing in the day. Otherwise, there is no noise. My mechanic has told me not to worry—it's nothing. Is it?"*

A clicking sound such as this is frequently caused by a dry hydraulic valve lifter. As soon as the lifter gets pumped up with oil, the noise ceases.

As this person's mechanic says, a 20-second click (or less) produced by a dry lifter is no reason for ripping the engine apart. However, the longer the noise duration, the more serious the problem. In time, the engine may have to be disassembled to reach and replace the bad lifter(s).

Clicking can also be caused by excessive valve lash (usually in engines with

[Please turn to page 178](#))



Engine noises can originate in a number of areas some of which are shown here.



# Newspapers for Car Care Month

Check for fact-filled "Car Care Month" sections in the hundreds of newspapers listed below. These sections—brought to you in cooperation with Popular Mechanics and the APAA—will be loaded with automotive know-how and special offers from your local retail "Car Care Month" Headquarters.

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# CAR CARE GUIDE

## ENGINES

(Continued from page 176)

mechanical lifters—a valve adjustment may help); a piston that's lightly touching the head gasket or cylinder ridge; or a nick on a timing gear.

■ **Whine**—This one is in the gray area. It might indicate a major problem, but then again it might not. A whine is described as a high-pitched, continuous sound. It may be more pronounced at some speeds than at others.

The noise may be caused by nothing more serious than a glazed fan belt. It might be the result of a malfunctioning rotor in the alternator, which again is not that serious. However, whine can also be caused by a loose or worn timing gear, and this means a major repair.

■ **Thump**—A thumping sound is a deep-throated noise that you seem to feel as well as hear. It indicates a serious condition, such as loose main bearings. A thump occurs intermittently—not on a regular rotational basis.

■ **Thud**—A thud is similar in pitch to thump, but it occurs regularly—that is, every revolution. Loose flywheel and excessive crankshaft end play are two possible causes.

## ZEROING IN ON NOISE

Trying to analyze the cause of engine noise from sound alone is tough. However, there is an "old-timer's" test that we'll outline.

Internal engine noise usually falls into one of these classifications:

1. Noise that occurs once every revolution.
2. Noise that occurs once every cycle (two revolutions).
3. Noise that occurs intermittently, having no rhyme or reason.

Do the test as follows:

■ Check engine oil; replenish if necessary.

■ Warm up the engine to normal operating temperature.

■ Set the engine to idle at about 600 rpm, and place a neon-type sparkplug tester on one of the sparkplugs (pull the boot off the plug, of course).

■ Note when engine noise occurs in respect to the flashes of light.

If noise occurs twice for each flash (once every revolution), the cause of the sound is a part driven by or driving the crankshaft. Pistons, rings, pins and main journals are in this category.

If the sound occurs once for each flash (once every cycle), anything driven by or with the camshaft could be causing the noise since the camshaft makes a single revolution per cycle. Falling into this area are valves, oil pump, distributor, fuel pump and the camshaft itself.

If the noise occurs intermittently—neither once nor twice for every flash of light—the cause of the problem is some component that isn't tied directly into the camshaft or crankshaft. Consider excessive end play of one of the shafts or noise being made by some engine-driven com-

ponents, such as the alternator, starter or distributor.

Noise can often be isolated by shorting out the sparkplug of each cylinder in turn. If the noise stops when a cylinder is shorted, you have isolated the noise to that cylinder.

## NOISE INDICATING "MINOR" PROBLEMS

As in previous years, we received several letters in '75 that asked us this:

**"My engine pings. Switching from regular gasoline to premium stops the ping, but my owner's manual tells me to use regular. What now?"**

The subject of selecting gasoline is discussed in Section 13 on Fuel. However, the subject of engine ping deserves our attention here. Pinging usually indicates a minor condition, but it may also tell you that your engine is in big trouble. It depends on whether ping is being produced by detonation of a mild sort, detonation of a serious nature or preignition.

Detonation and preignition are very different and should not be confused.

Ping is a rapid, rattling knock coming from an engine. Ping caused by detonation occurs primarily when the engine is placed under load, such as when the car is climbing a hill. It happens when gasoline isn't able to withstand the heat and pressure inside a cylinder.

Instead of burning evenly and smoothly, as gasoline should, the unburned portion of the mixture ignites violently **after the mixture has been ignited by the sparkplug**. This sudden premature bursting into flame of the unburned gasoline causes the engine's cylinder head to rattle. It is this noise that you hear as "ping."

Detonation can usually be eliminated or at least relieved greatly by seeing to it that ignition timing is set to manufacturer's specification, that the engine isn't overheating, and that gasoline of the needed octane rating is being used. In checking timing, you should also check the condition of those parts affecting engine timing—the distributor and spark advance.

Ping caused by preignition occurs when there is combustion of gasoline in a cylinder **before the sparkplug ignites the fuel**. Combustion is caused by a "hot spot" (red-hot carbon usually) in the cylinder.

Preignition places moving parts under extraordinary stress and can cause the most serious damage. There is no such thing as harmless preignition, and at the first sign of the condition the engine should not be operated—but should be disassembled for a carbon cleaning.

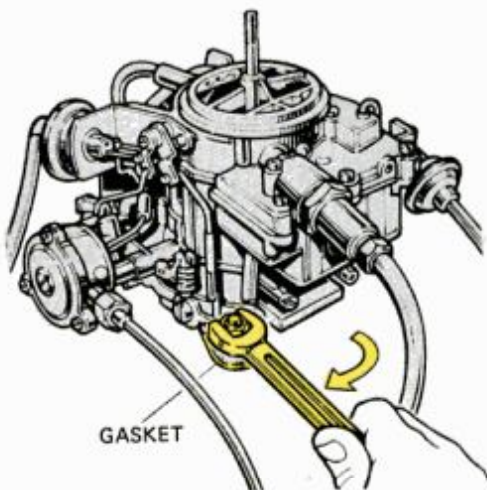
But how do you tell the difference between ping caused by detonation and that caused by preignition? It's very difficult to listen to the noise and distinguish between the two.

So, if engine ping doesn't clear up at once by setting timing, assuring proper

engine operating temperature and changing to high-octane gasoline, watch out. You have a preignition problem.

### UNWANTED WHISTLE

*"A whistle is coming from the engine compartment. Why?"*



Tighten carburetor mounting bolts to prevent air leaks and loss of power.

His dilemma, shared by others last year, could be a drive belt that's too tight or glazed. But many times a whistle coming from under the hood is produced by a vacuum leak because of loose intake manifold attaching screws, loose carburetor mounting bolts or a leaking gasket.

To determine if this is causing the noise, spread a mixture of oil and kerosene around the manifold and carburetor with the engine running. If the whistle ceases or changes pitch, you have found the reason.

Tighten up on all bolts. If this doesn't help, the gasket should be replaced.

Loose carburetor and manifold mounting bolts can also lead to another problem, the solution to which was sought by .5 percent of the readers who wrote us about engine problems: lack of power on acceleration. If there is no vacuum leak to blame for the engine's unresponsiveness, then the following should be checked out (consult the respective section in this Car Care Guide):

#### In the fuel system:

- Improper carburetor float level.
- Damaged needle valve-seat assembly.
- Restricted gas line or fuel filter.
- Weak fuel pump.
- Malfunctioning carburetor accelerator pump.
- Dirty carburetor.

#### In the ignition system:

- Weak coil.
- Incorrect ignition timing.
- Insufficient point dwell.
- Fouled or improperly gapped spark-plugs.
- Damaged spark advance unit.
- Worn distributor cam.

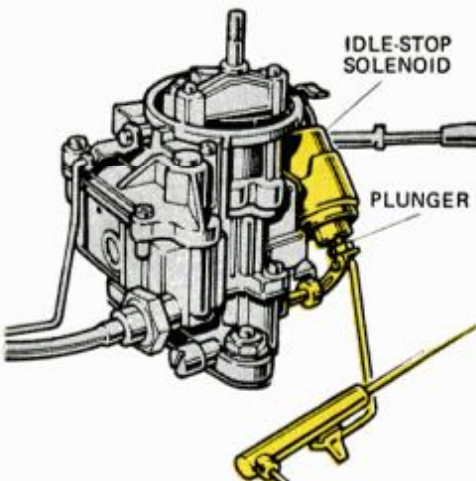
- Excessive play in the distributor shaft.

### ENGINES THAT RUN ON

A total of 1.1 percent of the readers sending letters that fall into the engine-problem category wrote as follows:

*"My engine continues running after I turn off the ignition. What's happening?"*

"What's happening" is a condition known as dieseling, which is ignition in the absence of spark. It occurs when fuel in the combustion chambers is ignited by heat. The problem has prevailed particularly since 1968 because of the higher temperatures at which engines have been operating to combat pollution.



Dieseling can be caused by an idle-stop solenoid that's not working properly.

To help prevent dieseling, manufacturers have added a device called an idle-stop solenoid to the carburetors of most engines coupled to automatic transmissions. The solenoid's job is to shut the throttle at once when the ignition is turned off, keeping excess fuel from entering the combustion chambers where it can be ignited by high temperature.

If your car has an idle-stop solenoid, dieseling will occur if the solenoid isn't working.

With the ignition on, the plunger in the base of the solenoid should be pressed against the throttle lever. As soon as the ignition is turned off, the plunger should retract at once, allowing the throttle valve to close.

Other causes of dieseling include the following:

1. Improperly adjusted slow idling speed.
2. An ignition malfunction, such as the wrong breaker-point dwell or misadjusted ignition timing.
3. A carburetor linkage that is hanging up because of dirt or damage.
4. A stuck manifold heat-control valve.
5. An engine temperature that is exceeding the "normal" range.

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**CAR CARE GUIDE**

**9. Brakes**

**A** breakdown of letters dealing with brakes (4.0 percent of the total) reveals 2.3 percent asking general questions, 1.3 percent complaining about noisy braking, and the remaining .4 percent wanting information about master and wheel-cylinder repair.

**GENERAL INFORMATION**

As the following excerpt shows, sudden brake failure is the most dangerous situation you can face:

*"My brakes failed coming down a hill. I swerved to avoid an accident, running the car into a ditch . . . Could the failure have been detected before it happened?"*

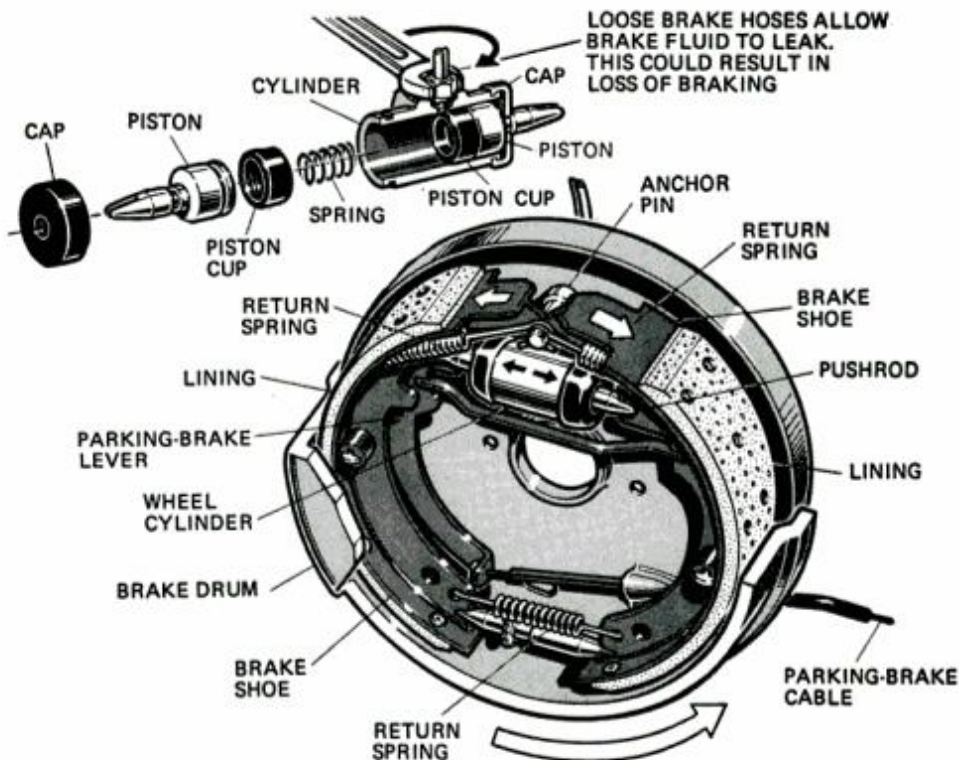
Failure can usually be prevented by inspecting the brake system every 10,000 miles. With the car at a standstill, press heavily on the brake pedal. If the car is

quality of brake fluid specified by the manufacturer in your owner's and service manuals. If the car has power brakes, pump the brake pedal a few times with the engine off.

Attach an 18-inch hose to the bleed screw at one of the wheels, put the other end of the hose in a plastic or glass container half-filled with clean brake fluid, and have someone inside the car apply steady pressure on the brake pedal as you open the bleed screw 3/4-turn. When fluid in the container stops bubbling, tighten the bleed screw and go on to each of the other wheels.

**Important:** When you've finished, discard the brake fluid in the container.

Another cause of a spongy pedal is a loosely connected or soft brake line and hose. Tighten lines at each wheel and at the master cylinder, and see that hoses are firm. Replace a soft hose. Remember to bleed the system if a connection is



Wheel cylinder of hydraulic drum brake is shown in wheel and in exploded view above.

equipped with power brakes, start the engine and allow it to idle.

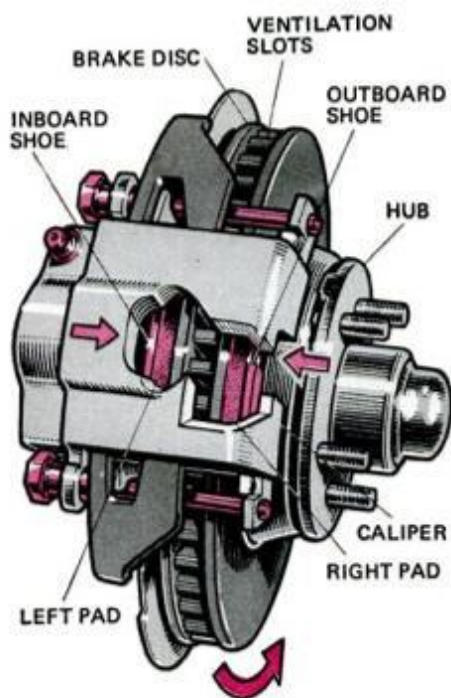
Does the pedal feel firm or spongy underfoot? A spongy brake pedal (one giving a springy sensation) is usually produced when air is trapped in the hydraulic fluid system. The condition could occur if the system was not properly bled after repairs required draining and refilling with brake fluid.

Bleeding brakes is done by filling the master cylinder, if necessary, to within 1/2 inch of the top with the type and

loose or if a hose should be replaced.

Less common causes for a spongy pedal are a damaged or out-of-round brake drum or disc, and a leaky master cylinder.

During the pedal test, observe if the pedal falls too close to the floor, indicating little reserve. You have adequate reserve level when the pedal is parallel to or above the height of the accelerator pedal. If insufficient pedal reserve is indicated, drive the car forward about 200 feet, stop, shift into reverse, back up 200



Disc brakes may have a single, solid disc or a ventilated disc as shown here.

feet, stop, and repeat the process three or four times.

Brake pedal height should increase, but if it doesn't, look for frozen self-adjusting mechanisms, damaged or out-of-round brake drums or discs, and a leaky master cylinder.

Still with the car at standstill, place your foot lightly and then heavily on the pedal for 15 seconds at a time. A pedal that falls away under pressure pinpoints a leak in the hydraulic system. Look for fluid leaks at the master cylinder, each brake line and wheel cylinders.

To inspect wheel cylinders of drum brakes, remove each wheel and pull back the rubber boot on each side of the cylinder. If fluid drips out, the cylinder is leaking and should be replaced or rebuilt.

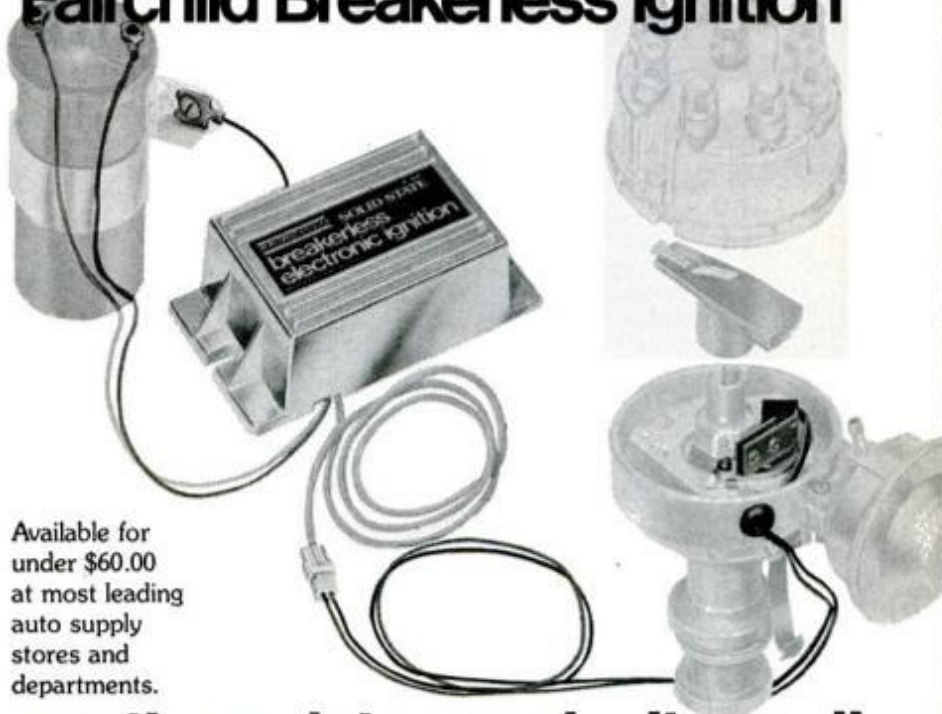
The cylinder of a disc brake can be checked by removing pads from the caliper and seeing if fluid is leaking from around the rubber boot. A leaking cylinder means that the caliper has to be overhauled.

To complete a brake inspection, remove one front wheel of a car equipped with drum brakes, or one rear wheel of a car having disc brakes up front and drum brakes in the rear. Measure brake-lining thickness along the entire edge. If thickness at any point is 1/32 inch or less, replace linings of all wheels. To inspect disc brake pads, remove the pads of one wheel and measure. Again, the minimum thickness at any point is 1/32 inch.

#### A ROAD TEST COMES NEXT

Inflate tires to manufacturer specification. Drive at 10 to 15 mph on a dry, smooth road devoid of traffic. Make several stops, alternating between light and medium pedal pressure. Do brakes grab? Is too much pressure needed to stop the

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## CAR CARE GUIDE

car? Inspect linings or pads, master cylinder, wheel cylinders, and drums or discs. The need for brake system overhaul is indicated.

Does the car pull? Before delving into the brake system, see if tire tread is worn unevenly. Pulling to the left or right may also be caused by loose or damaged front wheel bearings, loose steering, or front-end misalignment.

Accelerate to about 55 mph and make one or two hard pedal stops without skidding. Brake chatter or shudder indicates the probable need for brake overhaul, but inspect wheel bearings first.

It's during a road test that you should be aware of noise coming from the brake system, such as the kind indicated by this reader from Maine:

**"I get a loud squealing noise in the front wheels when applying the brakes. My mechanic can't explain why, but he thinks there's nothing to worry about."**

Brake squeal is the most common noise *Car Clinic* correspondents complain about, but a driver may also experience clicking or scraping when applying the brake pedal. The most common reason for squealing is the composition of the material used for making linings and pads. It's a "hard" composition to extend the life of linings and pads, but it produces an annoying squeal. If linings or pads in your car are new and the brake system has been inspected for damage outlined in the next paragraph, the squeal is not serious.

Noise from brakes upon pedal application, with the exception noted above, is usually caused by one of the five following reasons:

- Worn or contaminated brake linings or pads.
- Uneven adjustment, which indicates that self-adjusting mechanisms may be frozen.
- Damaged, out-of-round or dirty brake drum or disc.
- Weak or broken shoe return spring (drum brakes only).
- Rusted or loose brake backing plate (drum brakes only).

### CYLINDER OVERHAUL

**"My problem is finding a master cylinder for my 1957 Plymouth. Is there a way of overhauling my old one or should I keep up the search for the part?"**

This question from a reader in California is typical of letters *Car Clinic* receives regarding master and wheel cylinders. Wheel-cylinder inquiries for the most part are confined to those about drum brakes.

### MASTER CYLINDER

A master or wheel cylinder may be overhauled if a master cylinder or wheel cylinder kit for the respective unit is avail-

able from your auto parts and accessories dealer. Instructions accompanying the kit should be carefully observed. When you're doing your own brake work, you want to do a safe job.

The general procedure for rebuilding a master cylinder is as follows:

1. After removing the part and dumping brake fluid, unscrew the cap at the outlet end of the cylinder housing. Pry off the valve seat washer and replace it with the washer in the overhaul kit.

**Note:** If the master cylinder has two chambers (one serving the front brakes and one for the rear brakes), the procedure is the same except that parts are duplicated.

2. Remove the main spring and check-valve assembly, then remove the primary cup.

3. Slide the piston and secondary cup from the cylinder. This entire part and all other parts you've removed are normally replaced.

4. The bore of the master cylinder should now be honed with a honing stone of a size equal to the bore of the cylinder. Lubricate the bore with alcohol or fresh brake fluid before honing. Honing is done until the bore is smooth and clean.

5. Inside the bore you will see small holes. These are compensating and breather ports. Clear each with a piece of wire equal to or less than the size of the holes. Be careful not to enlarge the holes.

6. Slide the new piston and secondary cup assembly into place and measure piston-to-bore clearance with a feeler gauge. A clearance of .005 inch or less is required. If clearance is more than this, replace the master cylinder.

7. Reassemble the unit.

### WHEEL CYLINDER

The general procedure for overhauling wheel cylinders of drum brakes is as follows:

1. After removing the part from the brake backing plate, take off one of the end caps.

2. In order, remove the piston, piston cup and spring from the cylinder.

3. Disassemble the other end of the cylinder in the same manner. Parts are duplicated on each end.

4. Hone the bore of the cylinder as outlined above for the master cylinder.

5. Reassemble the unit and check piston-to-bore clearance for excessiveness (.005 inch or more), in which case the cylinder should not be used.

Wheel cylinders should be overhauled whenever drum brakes are overhauled. It is not necessary to overhaul a master cylinder unless it's leaking.

### TIPS ON OVERHAULING DRUM BRAKES

As long as we've brought up the subject of overhaul, there are several very important points to keep in mind whenever you have a brake job done to the drum brakes on your car. Make sure the

one doing the job observes the following precautions:

- A high-quality brake job involves a light cutting of brake drums to remove high spots, dirt and roughness. Don't scrimp on safety.

- Brake drums should be checked with a micrometer after cutting to make certain the minimum standard for thickness stamped on the drum is not exceeded. Driving with thin brake drums is an invitation to disaster.

- Spring anchor pins should be checked for looseness. Tight pins are necessary to securely anchor brake shoe return springs.

- Discard sprung, chewed up or bent brake shoe return springs.

- Only new brake linings of the highest quality should be used. Your auto parts and accessories dealer can help you to select the linings that are right for your car.

- Brake linings should be matched to drum diameter to avert brake chatter and shudder brought about by uneven lining-to-drum application. This involves grinding linings until they mate evenly with the drum diameter and then adjusting lining-to-drum clearance to manufacturer specification.

- Be sure to install new grease seals in the wheels.

- See that backing plates are clean and free of damage.

- Make sure self-adjusting mechanisms are not damaged and that they are working freely.

- Use only brake fluid of the type and quality recommended by the manufacturer of your car.

#### TIPS ON DISC BRAKES

Usually, there should not be a reason for complete overhaul of disc brakes if you replace pads (linings) before they wear down to metal. If metal shoes come in contact with the metal disc (rotor), the abrasive action will ruin the disc. That's when disc brake overhaul becomes involved and costly.

There are two pads to each wheel. Brake-pad replacement kits are available for your car at auto parts and accessory dealers. We don't have sufficient space here to go into detail about replacing pads of individual models, but we suggest you consult the January 1976 issue of PM. An entire article on the subject is presented.

For the most part, the task is as easy as removing retaining pins, which leaves old pads free to be taken from the caliper. At this point, the area around the cylinder should be closely inspected for brake fluid leakage. If fluid is leaking, the caliper should be overhauled.

Then you're ready to install the new pads.

**Important:** Whether replacing linings of drum brakes or pads of disc brakes, be sure you replace **all** on the same axle—not just one or two—to assure equal braking.

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## CAR CARE GUIDE

# 10. Heaters and airconditioners

The position of this category in our lineup provided a surprise. More of our *Car Clinic* correspondents—3.6 percent—are having problems with airconditioning and heating systems than with such things as the cooling system and tires.

Most questions, 1.7 percent, concern airconditioning. Closely behind, at 1.5 percent, are letters asking about auto heaters. The scattered remainder dealt with defrosters and full-time ventilation.

### TIPS AND HINTS ABOUT AIR

By far the most common complaint from readers regarding auto airconditioning, as you might suspect, concerns system ineffectiveness. Following is an excerpt from one letter which pretty well sums up most:

*"Could you tell me what's wrong with my car's air conditioner? It worked fine for the past few years. Now it won't cool."*

Several important points should be emphasized about operating an auto air conditioner. Proper operation is essential to a unit's well-being. This emphasis is placed on correct operation because from a repair standpoint there is a limited amount the average car owner can do himself. For one thing, special test equipment is necessary. To avoid an expensive

repair, the following should be considered:

1. An air conditioner should be operated at its maximum setting for at least five minutes once every week **all year long**. This allows the compressor to pump oil, which lubricates the compressor seal. A major problem is thus avoided—specifically, having the seal dry out, which causes refrigerant to be lost around the seal.

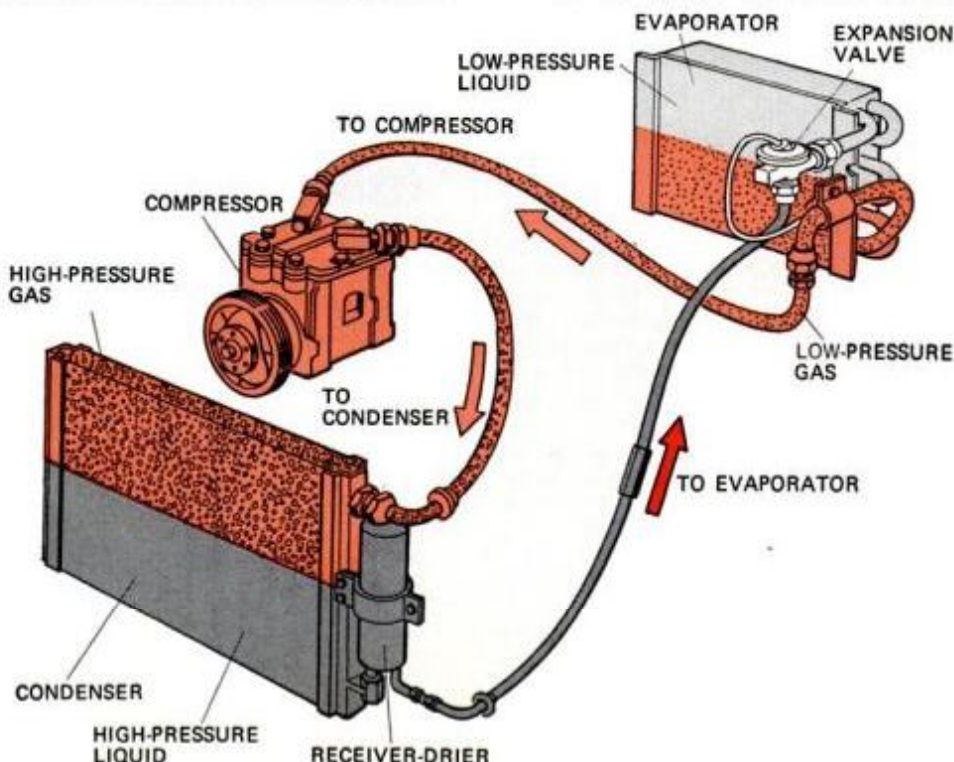
To keep from freezing during the five-minute operational period in winter, set the temperature control lever to the "warm" setting.

2. The cooling system of a car equipped with airconditioning should be provided with ethylene glycol antifreeze all year long. Protection to at least -15° F. will keep the heater core from freezing in summer and provide sufficient inhibitors to protect the cooling system itself against corrosion.

Manufacturers generally agree that if a car has an air conditioner, antifreeze should be changed once a year.

3. If your car's been parked in the hot sun and you want to cool it down quickly, here's the best way to do it:

- Open all windows and drive the car.
- At the same time, set the temperature control lever to the coolest setting or "off" and set the air conditioner control at maximum cooling.
- Set the blower fan switch on the



Automobile air conditioner care should include once-a-week operation all year.



highest setting that you have available.

After a few minutes, when the car has cooled, close the windows and reset air conditioner controls for individual comfort.

4. There's a way to solve the following problem sent to *Car Clinic* by several readers if you have an air conditioner in your car:

**"The windshield and windows in my car occasionally fog so badly that it's impossible to see out of them. The defroster isn't much help."**

Excessive fogging frequently occurs in rainy or muggy weather when the outside air temperature is between 50° and 70° F. Keep in mind that your air conditioner is one of the best dehumidifiers you can have, and can be used effectively, even in cool weather, without making you and the occupants in your car uncomfortable.

All you have to do is operate the air conditioner as you normally would do in warm weather. This will clear the windows. To maintain comfort, set the temperature control lever accordingly. Even though the air conditioner is on, if the temperature control lever is set to a "warm" position, you will get a flow of warm air.

5. Operation in slow, stop-and-go traffic, negotiating very steep hills, and pulling a trailer at other than cruising speed places a heavy load on a car's cooling system when the air conditioner is on. The load may be reduced by shifting the transmission to a lower gear as long as you're rolling. At stop lights and when halted for relatively long periods, shift the transmission to neutral and depress the accelerator pedal slightly to increase engine speed. The fast engine speed provides more cooling for the engine.

6. Since air conditioners place more load on a car's cooling system, it is important that this system be maintained in top notch shape (see Section 12). One of the most important and frequently overlooked components is the radiator pressure cap. Those in cars equipped with air conditioners are generally rated for a holding pressure that's higher than those in cars without air conditioning.

You should test this cap frequently with a radiator-pressure tester to make sure it's maintaining the rated cooling-system pressure. This specification is normally stamped on the cap. If the cap does not hold the pressure, get a new one.

7. An important maintenance task you should do often is inspecting and cleaning the air conditioner condenser. Obstructions impede the free flow of air across the condenser, which decreases the efficiency of the unit, resulting in reduced cooling.

Look for bent fins which you might be able to straighten, but do it gently. Look also for dead bugs and other foreign matter wedged into the fins, which can usually be dislodged with a soft-bristle

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# CAR CARE GUIDE

brush or short bursts of compressed air.

8. Never install a bug screen on your car if it has an air conditioner. A bug screen installed in front of the condenser reduces air flow and restricts air conditioner performance. If the outside temperature is high, a bug screen could cause engine overheating.

You're better off stopping every 100 miles or so at a service station to get bugs cleaned off the front grille work and the condenser with compressed air.

## GETTING UNITS TO COOL AGAIN

The most common questions concerning air conditioners are:

**"My car's air conditioner doesn't cool enough. Why?"**

**"My car's air conditioner has just stopped working. Why?"**

When either one of these malfunctions occurs, don't hightail it to an air conditioner shop—not yet anyway. There are a few troubleshooting procedures you can do yourself. They are:

■ Check the fuse or fuses protecting the unit. Normally, there is a fuse located in your car's main fuse panel, which is generally beneath the dashboard on the bulkhead or, in some foreign cars, under the hood in the engine compartment. Replace this fuse and see what happens.

If performance doesn't perk up, look for another fuse. If the car has one, it is often located in a fuse holder in the engine compartment, somewhere near the compressor. The best way to find this fuse, though, if there is one, is to consult a wiring schematic which outlines the air conditioner circuit.

When you locate the fuse, replace it.

■ If your air conditioner isn't cooling enough for you, read operating instructions outlined in the owner's manual. Often, the reason for insufficient cooling lies with an improper control setting.

■ Inspect the drive belt which operates the compressor. If the belt is loose, glazed or damaged, it will affect compressor action which will reduce the flow of refrigerant. The result is insufficient cooling.

You can get a good idea of the way the drive belt is working by starting the car's engine with the air conditioner turned on. Watch the belt. If it's slipping, the pulley won't rotate or will hesitate. Tighten the belt if it's loose, or get a new one if it's damaged. Also check the pulley to make sure it's in good shape.

■ While you're checking the belt, inspect the compressor's magnetic clutch to see that it's working. The magnetic clutch couples the pulley to the parts of the compressor which pump refrigerant through the system. The clutch is the inner section of the compressor pulley.

With the car's engine running and the air conditioner control set for maximum cooling, look at the magnetic clutch. If it's not rotating, you've located the cause of your problem. The compressor will have

to come off the car and be disassembled so repairs to the clutch can be made.

■ As we mentioned above, check the condenser. If it's plugged, cooling will be restricted.

■ Find out if the receiver-dryer is clogged up. Run the air conditioner at maximum cooling for about five minutes, then feel the receiver-dryer with your hand. If the outlet side feels cool, the receiver-dryer is clogged, restricting the flow of refrigerant. Have the receiver-dryer replaced.

■ Look for air leaks into the passenger compartment which are reducing the effectiveness of the air conditioner. Look for openings in the engine compartment and beneath the car, such as around wires, hoses, cables and bolts. Seal openings with automotive caulking compound.

## TAKE IT TO A SERVICEMAN

Once you've done all of the above without success, you are left with no choice but to take your car to an auto air conditioner specialist. He has the special



Professional air conditioner service will include check for leaks, discharge, moisture removal and recharging. Pressure is checked with a manifold gauge set (shown).

equipment needed to give the unit a complete going over, and he also has the technical knowledge and tools.

## WHEN A HEATER WON'T HEAT

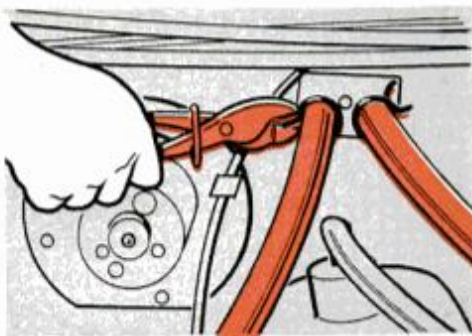
Of the 1.5 percent of the letters *Car Clinic* got last year complaining about auto heaters, almost all voiced this cry:

**"Help! I'm freezing. My car's heater isn't putting out, and it's cold here."**

Keep in mind that a car's heating system resembles the car's cooling system. Forgetting the ductwork, the essential parts of a heating system are the heater core, which is nothing more than a miniature radiator, and two hoses.

One hose brings hot coolant to the heater core in the passenger compartment, while the other hose returns coolant to the engine.

When the problem of insufficient heat crops up, there are some pretty definite



Check clamps of inlet and outlet hoses which go through firewall to heater core.

things to do. Let's run them down by the numbers:

1. Look under the dash at the various heat outlets to make sure nothing is obstructing the flow of warm air—carpeting that's bunched up, for example.

2. Under the hood, check each heater hose for leaks. To establish definitely whether a leak exists (inspect especially around clamps), you may have to place the cooling system under pressure using a cooling-system pressure tester (see Section 12). If there's a leak, replace the hose and, if necessary, the clamp.

3. Squeeze heater hoses, as you would a radiator hose (Section 12 again), to see if hoses are failing. If they feel mushy or cracks appear under hand pressure, replace. You should also squeeze hoses to determine if there's an obstruction.

4. See to it that neither of the radiator hoses is kinked, which would restrict the flow of coolant.

5. If insufficient heating problems began right after you did some work that necessitated removing heater hoses, there's a chance that you connected the hoses back up improperly. Switch them around and see. There's also the possibility that air trapped in the system is restricting coolant, and the system should be bled.

6. Check the cooling-system radiator to see that coolant is up to the level it should be. Low coolant could affect heat output.

7. Is the blower motor working? If not, look for a blown fuse, bad blower-motor switch, faulty blower resistor, loose connection or a burned-out motor.

8. The thermostat in the cooling system, if stuck in the open position, won't allow coolant to heat up properly. If coolant is too cold, heat output would naturally be insufficient. Remove and test the thermostat, replacing it if necessary (see Section 12).

9. Check to make sure that the various doors of the heater assembly, especially those controlled by cable, such as the temperature door (and also the defroster door, if defroster action is found wanting), are working and aren't stuck.

10. If all the procedures just described fail to get you enough heat, the cause of the problem is undoubtedly a clogged heater core, which should be removed from the car and cleaned out, if possible, or—failing that—replaced.

## II. Exhaust systems

Of the 3.3 percent of the people who sent letters to *Car Clinic* about exhaust systems, .9 percent asked a question similar to this one:

**"Because of the gasoline crunch, I want to disconnect my car's pollution system. Can you tell me how?"**

The answer to each letter was: "No, we can't tell you how. It's against the law."

With this out of the way, let's get to other problems concerning exhaust systems that are bothering readers. They include questions about general exhaust system repair and maintenance, exhaust manifold, catalytic converters, and other components that comprise a car's exhaust-emissions control system.

### WHEN THERE'S ODOR

Although *Car Clinic* received only a few letters last year similar to the one below, we feel the problem is of such a serious nature, which can happen to anyone, that it deserves discussion. One of these letters read as follows:

**"I have had to lay my car up because no one—not the dealer or a factory serviceman—has been able to determine why my wife and I get deathly sick when driving. I'm sure there is a carbon monoxide leak, but these so-called experts simply throw up their hands. Please help."**

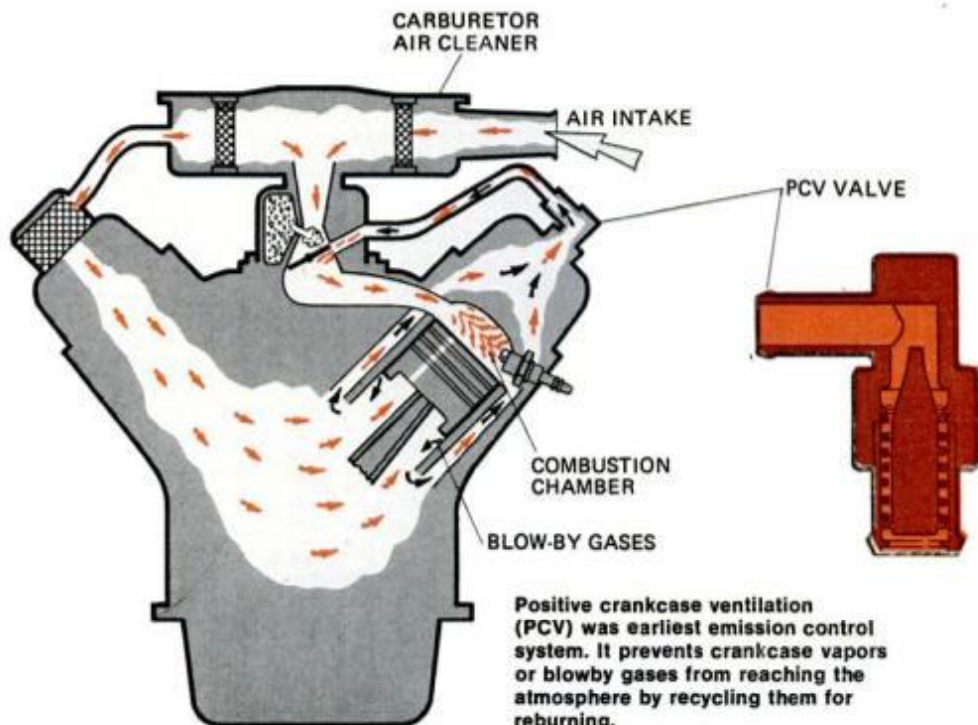
Letters such as this put us in a spot because our sympathies certainly lie with the reader. But trying to find an exhaust leak from miles away based on information in a letter is just impossible.

So all we can do is outline the way in which the car owner or mechanic should attack the problem. In this way, we hope that we will touch on something that hadn't been previously thought of.

Exhaust gas, as any school kid knows, contains carbon monoxide (CO), which is a toxic gas. In sufficient quantity over a long enough period of time, it will kill you.

Investigations by automobile manufacturers and safety experts show without question that in cases where exhaust gas problems have existed, they were caused by some combination of the following conditions:

1. Collision damage. In those cases where collision was a factor, it was found that the exhaust system had been damaged or displaced in some way to change the location and/or direction of the tailpipe: Or that rear-end body damage had been done, such as sheet-metal tears, opening of seams between panels, distortion of the deck lid or tailgate causing



Positive crankcase ventilation (PCV) was earliest emission control system. It prevents crankcase vapors or blowby gases from reaching the atmosphere by recycling them for reburning.

gaps around sealing pieces of weatherstrip: Or that there was bumper distortion and dislocation causing loss of sealing around rear lamps and body plugs. Any of these can create an opening for exhaust gas to enter the passenger area.

The damage has to be found and repaired, which sometimes takes a real sharp technician. But it's the only way.

2. Operating the car in such a way as to allow a high concentration of CO inside the vehicle. This includes running at idle for a long period of time, especially in closed, restricted areas with the windows closed and **without** the blower system operating. The blower system forces outside air into the car.

3. A rich adjustment of the carburetor idle-mixture setting, which results in excessive CO concentration in the exhaust gas. Correct adjustment is spelled out on the car's Vehicle Emission Control Information label, which provides tune-up specifications. The label is glued in a prominent position in the engine compartment.

### SAFEGUARDS AGAINST CO POISONING

To protect your passengers and yourself against the danger of breathing toxic exhaust, you should investigate the above conditions and also follow these precautions:

- Never run the engine in a closed garage or a confined area any longer than necessary to move your car in or out.

- If you have to sit in a parked car with

the engine running for more than a short period, adjust your heating or airconditioning system to force outside air into the car. Set the blower fan on high speed and the heater or airconditioner controls in any position except "off" and "maximum cool."

- Never drive with the trunk lid open if you can avoid it as this draws exhaust fumes into the car. If you can't avoid it, set the heater or airconditioner in a position described above.

- Station wagons deserve additional attention. That tailgate window should be **closed** when the car is in motion or when it's run at engine idle for an extended period. However, if it becomes necessary to operate the wagon with the window open—say, in order to carry a long object that protrudes out the window—close all other windows and adjust the heater or airconditioner controls as described above.

### INSPECTING THE EXHAUST SYSTEM

We all know that exhaust systems deteriorate over a period of time. The precautions outlined above are valid and will prove valuable, but when you come right down to it the best protection you have against CO entering your car through holes and seams in the underbody, or elsewhere, is a sound exhaust system.

You can assure soundness of that system by performing a periodic inspection, which should also be done if you notice a change in sound from the system, if

(Please turn to page 190)

# "May is Car Care Month" Enters Its 4th Great Year

By Michael N. Orren, President  
Automotive Parts and Accessories  
Association

For the fourth year, the Automotive Parts and Accessories Association, representing over 50,000 retail outlets, and Popular Mechanics, with its 6,000,000 readers, are working together to make driving safer, more economical, and more fun.

This year's "Car Care Month" program is better than ever. There are more manufacturers with many more products. There are more retail outlets, too. And this year, hundreds of local newspapers—they're listed on page 177—will be bringing you information-packed "May Is Car Care Month" sections produced in cooperation with the Automotive Parts and Accessories Association and Popular Mechanics. Check the listing below for the quality manufacturers who are participating and be sure to look for your local retail "Car Care Month" Headquarters in the retailers' listing.

**ACCEL**  
Performance Products

Accel Eliminator Ignition System



"Super Ramp" Car Ramps  
"Adjust-A-Stand" Jack Stands

**Airguide**

INSTRUMENT COMPANY

Deluxe Auto Compass

**ALEMITE CD-2**

CD-2 Oil Detergent  
CD-2 Oil Treatment  
CD-2 Gas Treatment

**ALONDRA, INC.**

Fit-O-Reg Fuel Pressure Regulators  
View-All Inline Gas Filters



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Amasco Tiger Rag Synthetic  
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Armor All Protectant  
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B-12 Chemtool Round Cone Top Pints  
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Seal-R 8 oz. Tire Sealer



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Dowgard Coolant Antifreeze  
Dow XHD 450 Brake Fluid

**DUPLI-COLOR**

Auto-Panel Paint



Rain Dance Wax  
"Rally" Cream Wax



Bondo Auto Body Repair Kits  
Bondo Fiberglass Repair Kits



Electronic Ignition System

**GENERAL ELECTRIC**

4-Hook Blister Pack Display/Lamps  
Sealed Beam Headlamp System



GE Silicone Auto Seal-Clear  
GE Silicone Auto Seal-Black  
GE Silicone Windshield & Glass Seal  
GE Silicone Hi-Temp Instant Gasket  
GE Silicone Battery Care  
GE Silicone Penetrant



Giant Steel Belted Radial



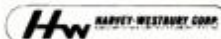
Go-Jo Hand Cleaner  
Go-Jo Mint Dispenser



Gumout Carburetor & Fuel System Cleaner  
Jet-Spray Gumout Carburetor Cleaner



Gunk Engine Brite  
Gunk GTX XTRA Engine Enamel



Auto Air-Conditioner Recharge Kit  
Crankcase Drainplug  
Battery Tester  
Muffler & Tailpipe Repair Kit



Auto Ramp  
Service Floor Jack



Superb Multi-Vis Motor Oil



Car Ramp  
Corduroy Seat Cover



Highway Flares (3 pack & 2 pack)



PK/EW Rust Not  
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PK/EW Competition Colors

**PYLON Wiper Blades and Refills.**

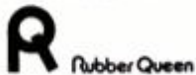
Pylon Wiper Blades



Ceram-Cast Muffler Bandage Kit



Volt/Ohm/Amp Ignition Tester  
Cycle Analyzer  
Maxi-Tune  
Dwell-Tach Tester  
Supertronic Timing Light  
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The Mark Carpeted Rubber Car Mat



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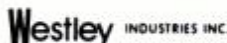
Motor Oil



WD-40

**WALLFRIN LA-CAL INDUSTRIES, INC.**

Quartz Power Hand Spotlight



Bleche-Wite  
Concentrate Auto Polish  
Liquid Rubbing Compound  
Chrome Brite



Super Glue-3  
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Make these excellent retailers from across the nation your "Car Care Month" Headquarters. They'll be bringing you top-quality products to give your car the very best in maintenance. Many of them will be offering money-saving specials on some of the excellent products appearing in

this Guide to help you care for your pocket as well as your car. Watch for the newspaper announcements and advertisements from your nearest "Car Care Month" Headquarters and see the exciting "Car Care" sections in your local newspapers.



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Pennsylvania



Connecticut, New York



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Pennsylvania

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New Mexico



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Illinois



Michigan



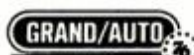
Pennsylvania



Alaska, Washington



Louisiana, Texas



California



Indiana



Ohio



Minnesota



Texas



Ohio



AL, AR, FL, GA, IN, KY, LA, MI, MS, NM, NY, NC, OH, SC, TN, TX, VA, WV



Texas

**LEVIN'S HOUSE OF AUTOMOTIVE**

California



Illinois



Massachusetts

**MARINO'S HOME & AUTO SUPPLY**

Pennsylvania



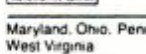
New York, Ohio



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Maryland, Ohio, Pennsylvania, Virginia, West Virginia



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**Pan American Tire Co.**

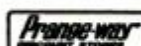
Florida, Virginia



California



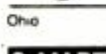
Delaware, Maryland, New Jersey, Pennsylvania, Virginia



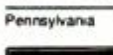
Wisconsin



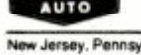
Ohio



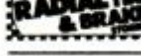
Pennsylvania



New Jersey, Pennsylvania



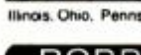
California



Illinois, Ohio, Pennsylvania, Virginia



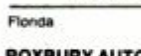
California



Florida



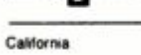
Washington



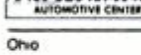
California



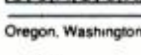
Ohio



Oregon, Washington



Texas



Nebraska

**STATEWIDE AUTO SUPPLY**

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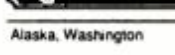
California

**THRIFTY AUTO PARTS**

California



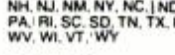
Alaska, Washington



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New York



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New Jersey



California



Illinois, Kansas, Missouri



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California

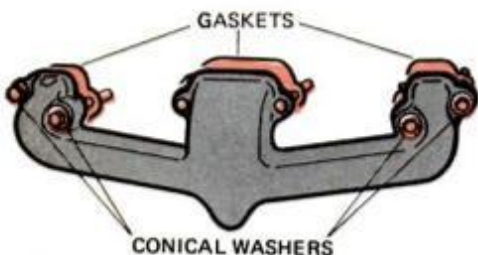
# CAR CARE GUIDE

## EXHAUST SYSTEMS

(Continued from page 187)

there's a definite exhaust odor inside the car, or if possible damage has been done to the underside or rear of the car. The way to do this inspection is as follows:

Start at the exhaust pipe, which is the pipe that's connected to the exhaust man-



Exhaust manifold should be inspected for cracks and torqued to specification.

ifold and extends to the muffler or resonator. The exhaust system of every car consists of three essential parts: exhaust pipe, muffler and tailpipe. Some exhaust systems may also have a resonator, which is nothing more than a miniature muffler that helps reduce exhaust noise.

**Important:** Beginning with the 1975 models, most cars have had a catalytic

converter incorporated into their exhaust systems. You can examine this part and even run your hand over it (make absolutely certain when doing exhaust system and converter inspection that the car is cold). However, do not do anything that can damage the converter, such as tapping it. Any damage to the converter reduces its effectiveness—and a new converter costs in the neighborhood of \$200.

Okay, at the exhaust pipe-exhaust manifold joint, look for a white corrosive-appearing powdery substance. This indicates that exhaust gas is leaking. The cause is either loose bolts or a bad gasket.

Speaking about the exhaust manifold, here's an excerpt from a letter sent *Car Clinic* by a reader with a question that's been asked us time and again.

**"My car's exhaust manifold is cracked. Can it be repaired?"**

Maybe—maybe not. I wouldn't try a repair if the crack is at some stress point, such as near a bolt where the forces of expansion and contraction are greatest. Repairs won't hold.

If the crack is on the manifold body somewhere, having it welded is up to you. Just judge the cost of welding against the cost of a new exhaust manifold or

against the cost of one you can pick up in an auto salvage yard.

Continue exhaust system inspection by running your hand over each exhaust system component. Keep your eyes open.

If rust flakes off in your hand, that exhaust part is in sad shape. If you spot any damage—holes in the muffler or a bent or crushed pipe, for example—replace the part.

Now test the internal integrity of each exhaust system component by tapping it with a wrench. The part should emit a ringing noise. If it gives forth with a dull thud, it means that the part is being or has been eaten away from the inside out. If the part hasn't failed yet, it's about to.

If the exhaust system looks sound, tighten bracket and hanger bolts. Once these loosen, exhaust parts are left insecure. They are then able to vibrate and bang against adjacent underbody components, which will damage them.

Finally, start the engine and scan the entire system for puffing. As long as parts are cold, hold your hand over pipe-to-muffler, pipe-to-resonator and other joints. Determine if you can feel any exhaust gas leak. If you can, loosen the clamp and slide it off the joint. Coat the joint with a layer of exhaust system sealer, slide the clamp back over the joint and tighten securely.

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BOBBY UNSER AND WAYNE LEARY SAY:**

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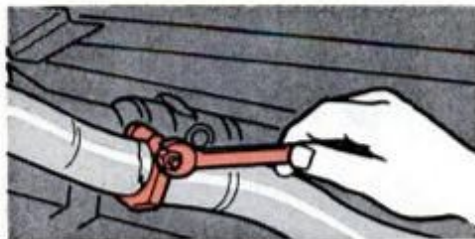


Knurled handle provides positive grip. With the S-K quality ratchet, you save time on jobs—especially in cramped quarters.

Forged from superior alloy steel. Carefully machined. Chrome-plated. Polished to high luster finish.

Close-acting, triple-tooth contact. Operates in arc as little as 5.1°. Relatively little back movement. Ordinary ratchets with wide-acting coarse drive gears operate in arc of 10° to 20°; have 5° to 10° back movement.

Did you know that 7 out of 10 professional mechanics own an S-K quality ratchet?



Exhaust system joints must be tightened securely to prevent dangerous leaks.

**Caution:** Don't bear down too hard on clamp bolts. You may crush the pipe.

Treatment of joints with exhaust system sealer is a "must" to prevent exhaust leaks whenever exhaust system components are replaced. Sealer, as well as all exhaust system replacement parts you need, are available from an auto parts and accessories dealer.

### RUNDOWN ON CATALYTIC CONVERTER

More than a few readers wrote *Car Clinic* last year to ask:

**"What can I do to keep my new car's catalytic converter in good shape? What kind of maintenance is required?"**

There is only one thing you have to do for a catalytic converter. You have to make sure your engine burns no other kind of fuel but unleaded gasoline. Leaded gasoline will destroy the catalyst in no time flat.

**"Let's say I'm driving somewhere in the boondocks and I can't get unleaded gas to use in my new car with catalytic converter. What then?"**

Then you have no choice. You have to use whatever you can find, but I wouldn't fill the fuel tank with leaded gas. Judge how much you'll need to get back to "civilization" where you can find a service station selling unleaded and put in just that much. The less leaded fuel you burn, the better off you'll be.

### UNDERSTANDING POLLUTION CONTROLS

Not all pollution controls limit the amount of exhaust gas expelled from an engine. There are, in fact, several kinds of emissions-control systems. Your car may have one, two, three or more. Here are servicing tips for three:

1. First to come along was the positive crankcase ventilation (PCV) system, which prevents crankcase vapors from escap-

ing into the atmosphere. All cars from 1963 on have a PCV system. Since 1968, the so-called closed PCV system has been in use, which draws in fresh air through the carburetor air cleaner to mix with and dilute blowby gases and permit them to be burned.

■ Test the functioning of the PCV valve by starting the engine and pulling the PCV valve from the rocker arm or valve cover. Cover the end of the valve tightly with your finger. If you don't feel a strong pull, replace the valve.

■ Make sure the hose from the PCV valve to the manifold is in good shape—also the hose from the carburetor air cleaner to the cap.

■ Remove the carburetor air cleaner cover and on the other side of the PCV hose you will probably find a filter. Examine it. If it's dirty, replace it.

2. Check the fuel evaporation control system (on cars since 1971). The charcoal canister uses a filter that must be replaced periodically.

3. Clean the exhaust gas-recirculation valve used in many cars from 1972 onward by taking the valve off the engine and cleaning deposits from the valve seat, mounting surfaces and all other areas where they've accumulated. Install the valve back on the intake manifold, using a new gasket.

# tools!"

**'75 Indy 500 champion driver and his chief mechanic demand the best so they can do their best in the garage, in the pits, and on the track!**

"Bobby's a winner because he always does his best," says Great One, Wayne Leary. "To help him, I do my best so the car gives all it can under toughest conditions. That's why I use S-K tools. Take the S-K ratchet wrench. Can't beat it for quality. It's perfectly balanced. Acts like an extension of my hands

and brain. Helps me do tough jobs in hard-to-reach places. And it's made in America. That means quality." Little wonder champion mechanics prefer S-K quality tools. 3 top quality S-K sets on sale now at auto parts and hardware stores.



**SAVE No. 4116-76.** 16 pc. 1/2" drive Socket Set with S-K ratchet. Quality designed for professionals. Includes 13 standard sockets; 7/16" thru 1-1/4"; 5" extension; 1/2" drive flex handle; reversible ratchet; steel case. Adds up to a \$17.71 value.\*\*  
Suggested user price **\$39.98.**



**SAVE No. 4224-76.** 24 pc. 1/4" and 3/8" drive Socket Set with S-K ratchet. For auto maintenance. 15 standard sockets; 3 deep sockets; spark plug socket; spinner handle; 1-1/2" & 6" extensions; 3/8" F x 1/4" M adapter; reversible ratchet; steel case. Adds up to a \$61.83 value.\*\*  
Suggested user price **\$29.98.**



**SAVE No. 1709-76.** 10 pc. set including 9 piece S-K quality alloy Combination Wrench Set plus Tongue and Groove Plier in Vinyl Pouch. Combination wrenches are 1/4" thru 3/4". heat treated and chrome plated. Plier has cushion handle. Adds up to a \$43.57 value.\*\*  
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## CAR CARE GUIDE

# 12. Cooling systems

What do you tell a person who asks a question like this?:

**"My car overheats. I've tried everything I know. Why does it happen to me?"**

More than half the 3.3 percent of radiator letters received by *Car Clinic* referred to overheating and leaks. General questions about radiators accounted for .8 percent; thermostat problems, .6 percent; and water pump, only .1 percent.

### HOW IT SHOULD WORK

When it comes to preventing overheated engines, there are no shortcuts. You have to give your car's cooling system everything it requires when it requires it. Given minimum care, a cooling system proves to be one of the more reliable areas in a car. At least the insignificant amount of our *Car Clinic* mail involving cooling-system problems would indicate that's so.

The place to start is to remind people that there doesn't necessarily have to be anything wrong with a cooling system for overheating to occur. There are four common "nonmechanical" causes of overheating:

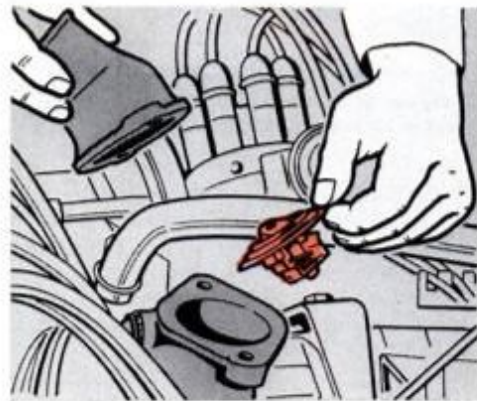
1. Prolonged engine idle in hot weather.
2. Prolonged engine idle with the air conditioner operating.
3. Pulling a trailer if your car is not equipped to handle the load.
4. Incorrect installation of an aftermarket air conditioning system.

If you find yourself in categories 1 or 2, and you see the temperature gauge needle rising, shift the transmission into Neutral and depress the gas pedal a bit to increase engine rpm, which causes a greater amount of coolant and airflow to cool the engine. Naturally, if you've got your air conditioner operating and the problem is reaching a critical point, turn it off.

If your car is equipped to handle a medium or heavy trailer, you should have no overheating problems unless you find yourself in categories 1 or 2. However, a car equipped with an ordinary, standard cooling system could present big trouble if you hitch a trailer to it.

If you think you are going to haul a trailer, even if you aren't sure, order a heavy-duty cooling system package next time you order a new car. This package is generally a necessity if a car is to pull a trailer weighing 2000 or more pounds.

If your engine started overheating soon after you had an aftermarket air conditioner installed, take it back to the installer. An aftermarket air conditioner is one that hasn't been installed by the car's manufacturer. If your air conditioner was put into the car without benefit of a heavy-duty radiator and thermostatically



Thermostat should be checked if your engine is running too hot or too cold.

controlled fan, cooling system overheating is a probability. You should see that this equipment is installed.

### MECHANICAL LETDOWNS

The following mechanical failures cause an engine to overheat:

- Coolant loss
- Loose drive belt
- Collapsing lower radiator hose
- Bad radiator pressure cap
- Defective thermostat
- Clogged radiator
- Faulty fan

Let's run down each to see what happens and what you can do about it.

**Loss of coolant** results most often from a leak in the cooling system, but not always from a leak because of damage, as was proved by the following letter received at *Car Clinic* last year (one of several) and the way it was answered.

**"What can I do about a radiator that insists on throwing off coolant through the overflow tube? I've checked everything the 'book' says to check."**

The answer to this person's problem hinged on the installation of a coolant-recovery system. We know this for a fact, because he wrote us back after installing one at our suggestion and told us that his problem was no more.

A coolant-recovery system prevents coolant loss, because coolant overflow is diverted to a closed plastic reservoir for reuse instead of being lost through spilling to the ground. Coolant overflow can occur when an engine is run hard and excessive pressure builds up internally.

Coolant-recovery systems are sold by auto parts and accessories dealers. They are nominally priced and easily installed.

Most times, though, coolant loss can be attributed to a leak through a damaged area. The following should be inspected:

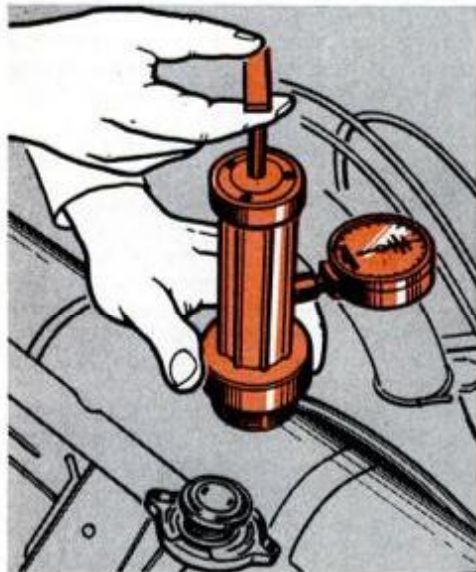
1. Radiator hoses. Look for damage by



squeezing both top and bottom radiator hoses. Replace a hose that feels mushy or shows cracks under pressure.

If you can't tell whether a hose is weak or not, loosen the clamp and pull the hose from its connection. Run your fingers around the inside. If rubber flakes off, get rid of the hose.

To install a new hose, clean the connections with a wire brush and coat them with a water-resistant sealing compound. Push the new hose tightly into place and position clamps about 1/8 inch from the end of the hose. (By the way, it's a good idea to use new clamps.) Tighten clamps securely.



Cooling system pressure tester is the best tool for checking system for leaks.

2. Radiator. You may be able to spot a leaky radiator by the presence of corrosive deposits or rust along top and bottom tanks, especially around seams, or on fins. A leak (unless it's a gusher) should at first be treated with a chemical leak sealer. You may be able to avoid a big expense this way. If the leak sealer doesn't work (be sure to follow directions for its use), the radiator will have to be removed for repair or replacement.

3. Water pump. With the engine off, run your hand around the water pump. If your palm comes away wet, you've got yourself a leak. The best thing to do is replace the water pump before it fails completely and causes serious problems.

4. Thermostat housing. Give the joint between the thermostat housing and engine a careful inspection. Corrosive deposits or rust denote a leak. The gasket has probably gone bad, so replace it. Unbolt the housing, wire-brush all old gasket material from surfaces, apply the new gasket and waterproof-sealing compound and reattach the housing tightly. Check for leaks.

5. Heater hoses and heater. Don't forget that these components are part of the cooling system. They should be checked, too (see Section 10).

(Please turn to page 194)



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SHUR-START will by-pass faulty ignition systems. It will work with or without ignition key. It will work with either 6V or 12V systems. It will also work with transistorized ignition systems. It will work when you need it most.

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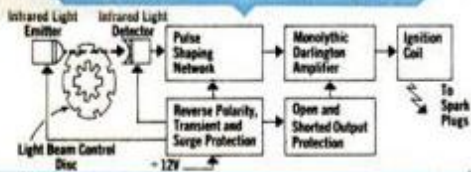
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## CAR CARE GUIDE



Hose clamps should be positioned at least 1/4-inch from end of hose and tightened.

**"I know I have a leak somewhere in my cooling system—I'm losing coolant, but I can't seem to find where. Is there some method to use?"**

A cooling-system pressure tester, which you can purchase from a dealer of auto parts and supplies, facilitates the location of a cooling-system leak, which is frequently tough to spot because most don't appear until the cooling system is pressurized.

To use the pressure tester, remove the radiator pressure cap and screw the tester to the radiator filler neck. Look at the radiator pressure cap to determine from stampings at what pressure the cooling system is rated.

Pump up the pressure tester until the gauge on the tester records the system's rated pressure. Let things set for about 10 minutes. Then check the reading. If pressure has dropped off, there's a leak somewhere, so pump up the tester again and examine all the spots we've mentioned above. Also look around the petcock, which is the drain at the bottom of the radiator, and at the drain and freeze plugs in the engine.

### WHEN A LEAK IS INTERNAL

The most serious coolant loss results in an engine which is cracked internally, permitting coolant to leak into oil galleries. When all else has failed to reveal an external leak, suspect that it's internal. A simple test may verify the condition.

Warm up the engine and draw the oil dipstick from its place. If oil looks white, you've got an internal leak. Let some oil drop on the hot exhaust manifold. If it sizzles, that's also an indication of the presence of coolant.

One final area of leakage may be out the overflow tube because of an air or combustion gas leak into the cooling system that's increasing pressure. You can find out if this is happening by filling the radiator to the correct level and placing

a nonpressurized radiator cap on the radiator filler neck. Disconnect the overflow tube from where it clips to the side of the radiator and put its end in a jar of water.

Start the car and let the engine run at fast idle for a while. If during this period water starts bubbling, you've got a leak into the system. The problem may be caused by a bad water-pump seal or a leaking cylinder-head gasket.

### MORE CAUSES OF OVERHEATING

**Loose drive belts**, as we mentioned before (Section 10), can cause overheating. Make sure the belt is tight, but also see that it isn't glazed. A glazed belt (or pulley) causes the belt to slip, which can prevent it from adequately driving the fan and water pump. Replace a glazed belt.

**"I got an odd problem. My engine overheats only when I drive it at high speed. Why?"**

It's not so odd, and the reason for it lies with the lower radiator hose. The hose possesses a coiled spring that's supposed to keep the hose from collapsing when pressure occurring at high speeds produces a vacuum.

**Collapsed lower radiator hoses** result if springs lose tension, and many readers like the one above have experienced overheated engines. The solution is to replace the hose.

**A bad radiator pressure cap** can't do its job of permitting pressure to build up in the cooling system, which serves to increase the boiling point of coolant. Instead of boiling at 225° F., for example, ethylene glycol coolant under pressure won't boil until the temperature reaches about 260° F. This gives you quite a safety margin.

However, when the cap starts "leaking" pressure, the boiling point of coolant falls. To find out, attach the cap to the radiator-pressure tester (testers come with adapters that permit this) and pump up the tester until the dial reads the specification stamped on the cap. If the dial starts falling off, it means the cap is damaged. Get a new one.

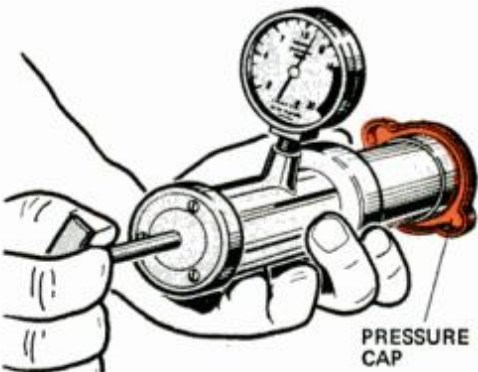
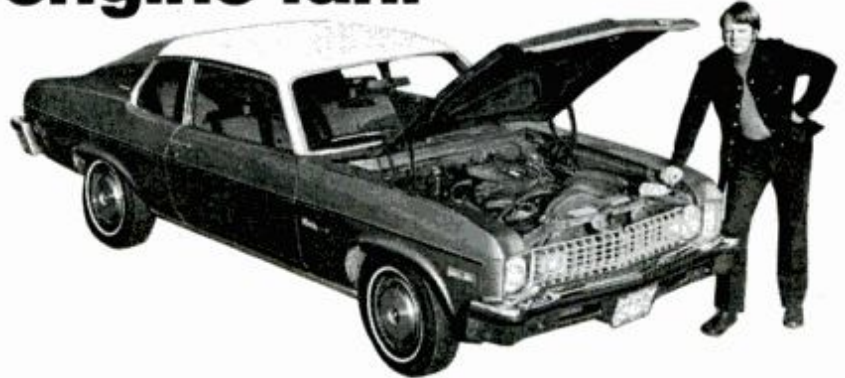
Make sure, too, that the radiator filler neck isn't damaged, which will prevent the cap from seating firmly although the cap may be in great shape. Rid the neck of nicks and raised spots with some emery cloth or a wire brush. If the neck is really in bad shape, have it taken off the radiator and replaced with a new one.

**A defective thermostat**, as we pointed out in Section 10 in discussing heaters, can prevent an engine from heating up properly if the thermostat valve sticks in the open position. If the valve sticks in the closed position, the engine will overheat.

You can test a thermostat without taking it from the engine by starting the engine when it's cold and inserting a cooling-system thermometer into the coolant.

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# Give me 1 good reason why I should replace a perfectly good engine fan.



PRESSURE CAP

Pressure tester is also used to test the condition of radiator pressure caps.

Squeeze the upper radiator hose. You should feel no surge. If you do, it means the thermostat is stuck open, verifying an engine overheating condition.

Now, when the thermometer records the temperature at which the thermostat is rated (consult your owner's manual for this specification), squeeze the upper radiator hose again. You should now feel coolant surging through. If not, you have verified why your engine is overheating. Replace the thermostat. Make sure that when you remove the thermostat housing, you always replace the gasket.

A clogged radiator, obviously, will cause an engine to overheat. There are two types of "clogs." One is easily taken care of—bugs and other foreign matter embed themselves in radiator fins, blocking the flow of air. A radiator should be cleaned periodically with a soft-bristle brush or brief bursts of compressed air.

The other type of clogged radiator is caused by owner neglect—because it's not drained and flushed as often as it should be. If you've let your radiator go too long, the radiator will probably have to come off the car and be boiled out in acid or replaced.

Finally, a defective fan can cause engine overheating, especially the kind of fan that uses a clutch. Cars with air conditioning or those equipped for trailering (heavy-duty cooling system) usually have this kind of fan. The fan is thermostatically controlled, so it delivers more air for cooling when needed and less air when less cooling is required.

Check the fan with the engine turned off and cold. Turn the fan by hand. It should revolve freely. If it doesn't, the clutch has probably failed and repairs are needed.

Fluid leaking from the fan housing is another indication of failure. Clutch bearings may have gone bad.

## MAINTENANCE: THE SMART WAY TO GO

Check your cooling system at least twice a year. Then every two years—some manufacturers say every year: drain; flush; check water pump, drive belt, radiator, hoses, thermostat. Refill system with ethylene glycol.

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## CAR CARE GUIDE

# 13. Fuel systems and gasoline

Questions about gasoline represented only 2.1 percent of all letters *Car Clinic* received in 1975. Most of them concerned unleaded gasoline, and gas as it relates to engine ping.

Here is an example of the confusion which the advent of unleaded gasoline has caused in some people's minds:

*"I have been warned not to use unleaded gasoline in my 1972 car. No one can explain whether this advice is indeed valid or why."*

Some carmakers, such as Chrysler, warn against using unleaded gasoline in pre-1975 models because of possible damage that may be done to valves. The lead in leaded gasoline acts as a lubricant for valves.

In cars equipped especially for unleaded gasoline, improvements have been made to valves that compensate for lack of lead.

If you want to use unleaded gasoline in your engine, first check the owner's manual for the manufacturer's suggestions or requirements. If your car was produced before unleaded gasoline was marketed, then write the manufacturer (see Section 15) to see if there is any reason why you shouldn't use unleaded fuel.

**Important:** As we've mentioned several times before in this *Car Care Guide*, any car equipped with a catalytic converter must use unleaded gasoline.

### REGULAR VS. HIGH-OCTANE

As we discussed in Section 8, engine ping caused by insufficient gasoline octane is a common problem. Some people who wrote *Car Clinic* stated that to stop ping they have switched from regular gasoline to premium although regular is recommended for use by the carmaker. Something as expensive as this can be avoided by simply remembering an important fact:

Different brands of gasoline of the same grade (regular, for instance) may vary in octane rating by as much as two points. Trying one brand after another to determine if pinging dissipates is a wise course of action. Why pay for premium when you shouldn't have to?

### GAS PRICES BRING QUESTIONS

Probably because of the price of gasoline, we received several letters at *Car Clinic* in 1975 wanting to know if it was possible to modify a high-compression engine designed to burn premium gasoline so it would use regular without

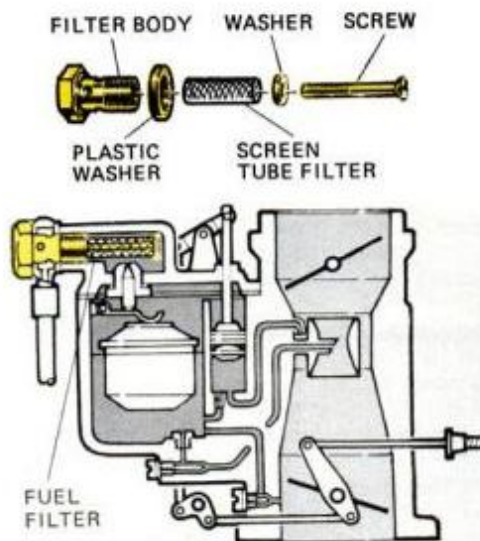
knocking. These readers, I'm sure, were trying to find a way of saving themselves the 5 to 9-cent per gallon additional that premium was costing them.

More than one letter presented another reason for wanting to do this:

*"I've been hearing recently that premium gasoline will become a thing of the past in years to come. I intend driving my Lincoln for as long as possible. It is, of course, designed to use premium fuel. What do I do if this scuttlebutt turns out to be true?"*

We presented a thorough study of the subject in the December, 1975, issue of PM. Here are some of the modifications and procedures which were discussed at that time.

- Retard the timing. This is the easiest

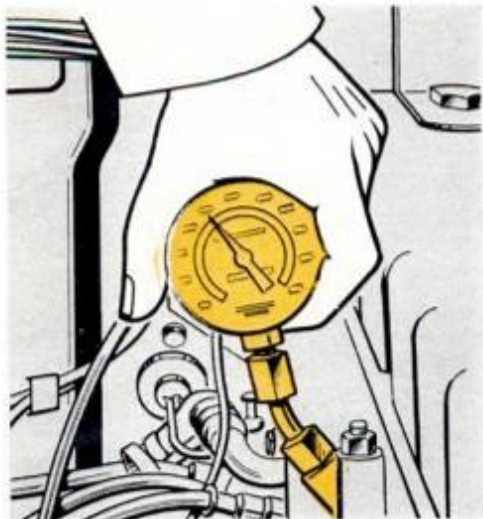


Fuel-filter cleaning, when done regularly, can prevent fuel starvation.

and least expensive method to try. The method should permit you to switch from premium to regular if you have a car that is borderline—in other words, one that will stop pinging heavily by simply moving the timing a few degrees.

Keep in mind, though, that there is a limit to retarding beyond which you should not go since power loss will become unacceptable. This is anywhere from 6° to 10° from the recommended specification. In realigning the timing, move the setting about 2° at a time between tests.

Remember, too, that you should install centrifugal advance mechanism retard springs, which you can buy from an auto parts and accessories dealer or your new



Compression ratio can actually increase as carbon builds up in the engine.

car dealer. These springs limit the distributor from advancing normally under load.

■ Purge carbon. A coat of carbon on the cylinder head and/or pistons increases the engine's compression ratio and helps the engine retain heat—conditions that cause pinging which might be overcome only by the use of premium gasoline.

Try to purge carbon from the engine by using a good-quality chemical cleaner, such as GM's Top Engine Cleaner. Pour it into the engine as directed and repeat the treatment a couple of times to increase chances of its working.

If the engine is really loaded up with carbon and you are willing to incur the expense, then the cylinder head (two heads in a V8) can be removed to do the job by hand.

■ Use a thicker head gasket. As long as the head(s) is off, you might just as well install a thicker head gasket(s) if the manufacturer of your engine makes this part to fit your engine. A thicker head gasket tends to decrease an engine's compression ratio, reducing the tendency of gasoline to detonate and pinging to occur.

#### EXPERIMENTATION IS BEST

If you're really bent on using regular fuel in an engine calling for premium, probably the first course of action you should take is to compromise. This may be possible through experimentation.

First of all, retard the timing a bit. That will cost you nothing if you have your own timing light.

Now, fill up the tank with a premium grade of fuel and run the car until the fuel gauge shows that half a tank has been consumed.

Pull into a gas station and fill the tank, but this time with a regular grade. See how the car responds, especially when climbing a hill. If you get no ping or a mild ping (a mild ping is acceptable), you might try one quarter tank of premium to three-quarters of a tank of regular.

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## 14. Tires

The most surprising result of the computer study was that only .7 percent of our readers asked questions about tires. The questions were divided into two categories.

The first concerned tire balancing. A total of .6 percent of the letters were related to this topic. The second category was tire size.

### WHAT ABOUT TIRE SIZE?

Some readers have written in to ask if they can use a tire size other than the one originally specified, usually wanting to go larger.

The answer to this is to look in your owner's manual under the section entitled "Tires." If the tire size you want to use is not among those recommended by the manufacturer, then you shouldn't use it.

If you need further advice, consult with your favorite tire dealer. He's got all the data he needs to recommend to you exactly how big you can go.

### THE WHEEL BALANCE STORY

Of greater importance to the majority of car owners is the subject of wheel balancing. What is it? Why does it have to be done? When should it be done? How should it be done?

We use the term wheel balance rather than tire balance. Actually, neither is truly descriptive: A tire may be perfectly balanced. However, if it is placed on a wheel that is not balanced, the assembly is going to be thrown off kilter.

Similarly, both the wheel and tire may be in perfect balance. Now, let's say, you have to have the brake drum replaced, and for some reason it isn't in true balance. Bingo—out of whack goes the whole thing.

So, the term balance refers to the whole ball of wax: tire and wheel and brake drum or brake disc. If one is out of balance, all will be out of balance. Keep this in mind.

However, we'll use the term wheel balance in our description here. It is the most common, and it's briefer than saying tire and wheel and brake drum or disc balance.

Why should balancing be done? Because if there is an unbalanced condition, wheel tramp could result and tires would wear unevenly.

**"I bought a brand new set of tires, which were expensive enough, and then the tire dealer said I must have them balanced. I told him to forget it. But now I'm wondering—should I go back and have it done?"**

Wheels and tires should be balanced when a tire is newly mounted on a wheel,

and when a wheel or tire is replaced. Wheel balancing should also be done when a brake drum or disc has to be replaced.

There are two ways in which wheel assemblies become unbalanced. These are described by the terms **static** and **dynamic**.

When a wheel is out of balance statically, there is a heavy spot at a single point on the assembly. As the wheel, tire and brake component rotate, the heavy spot is forced against the pavement with each revolution of the wheel. This creates a pronounced vertical vibration.

When a wheel is out of balance dynamically, there is a heavy spot which is causing the assembly to waddle from side-to-side. This causes horizontal vibration. The wheel oscillates, which causes the tire to scuff against the pavement, and dynamic unbalance shows up as the appearance of flat spots over a tire.

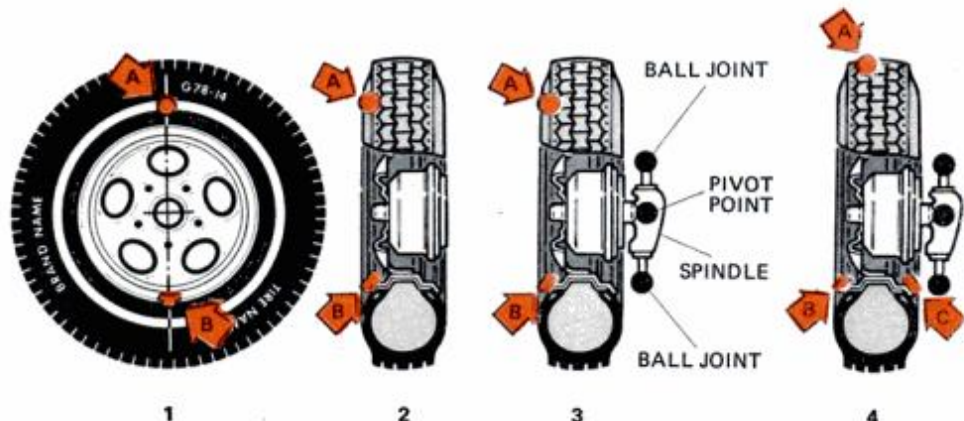
To balance a wheel assembly, weights are placed at locations on the assembly which counter the effect of the heavy

whether the weight is of sufficient size and whether it's positioned properly.

In the case of dynamic balancing, this must be done with the assembly in motion. To offset the effect of the heavy mass, which causes the assembly to oscillate from side-to-side, a weight equal in mass to this heavy spot has to be placed diagonally opposite. Sometimes, if the heavy spot falls inward, away from the rim, two weights have to be placed to offset its effect—one on the inside of the wheel and one on the outside.

Should you have your wheel assemblies balanced statically or dynamically? Some contend that to be 100 percent certain, you should have them balanced both ways. Static unbalance, you see, creates road tramp primarily at slow speeds, while a dynamic unbalanced condition creates a problem mainly at higher speeds.

There is a bit of confusion regarding dynamic balancing machines which should be cleared up. Dynamic balancing machines are of two kinds. With one



Wheel balancing procedure is shown in these drawings. (A is heavy spot, B and C are rim weights). Fig. 1 shows simple static balancing: Heavy spot at A is balanced by rim weight at B. In 2, a different view: Rim weight at B should be opposite heavy spot A and also be in the same plane. In 3, the wheel and tire

mass causing the unbalance. In the case of static balancing, the weight is placed on the wheel's rim just opposite the heavy spot that's disrupting balance.

**"Down at the tire center I heard the mechanics joking about the 'bubble machine.' What were they talking about?"**

Determining where this weight should be positioned is usually done with a static (bubble) balancer. The wheel and tire are placed on the machine, which shows the degree of unbalance. Then a weight is placed at the spot to offset the heavy mass. The machine's bubble shows

are shown with the wheel spindle. Dynamic balancing attempts to cancel out the centrifugal forces on the spindle when the wheel is spinning. In 4, weights are used inside and outside of the wheel rim to cancel out heavy spot at A. When perfect dynamic balance is achieved in this way, side-to-side waddle is eliminated.

type, the wheel and tire assembly—but not the brake drum—is taken off the car and mounted on the machine, which spins the assembly at high speed. With the other kind, the machine tests balance by spinning the entire assembly—tire, wheel and brake drum or disc—right on the car.

The former machine is okay to use as long as the brake drum or disc is known to be balanced. Original factory brake drums and discs are balanced.

However, replacement drums and discs may not be balanced, so if you get a new drum or disc, dynamic balancing should be done by one of those machines which permit spinning of the assembly when it's mounted right on the car.



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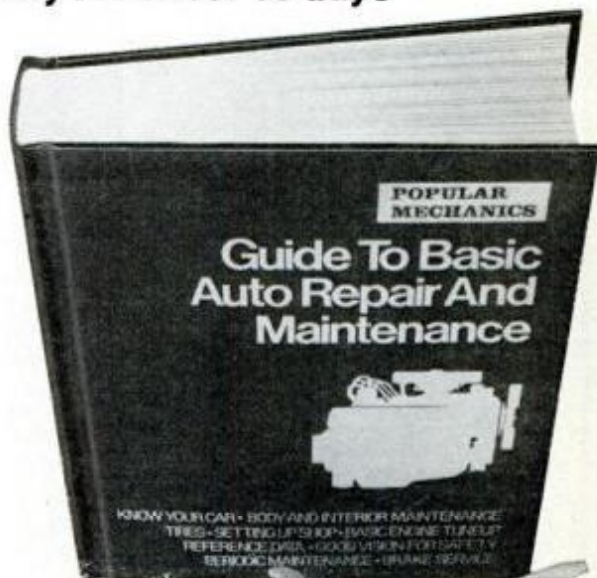
Called the *Popular Mechanics Guide to Basic Auto Repair and Maintenance*, this valuable volume takes nothing for granted. It starts from scratch and explains—with clear instructions and 594 pictures—exactly how to do routine repair and maintenance jobs like engine tuneups, brake adjustments, hose and belt replacements, oil and filter changes, and many other day-in, day-out jobs that chip away at your wallet with maddening regularity.

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- Replacing disc brake pads
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- Adjusting parking brakes
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Rebel	Biscayne	Dart	Torino	Cutlass	Roadrunner	Le Mans
Rogue	Camaro	Demon	LINCOLN	Delta 88	Satellite	Sprint
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## CAR CARE GUIDE

# 15. Information wanted

The largest number of letters, 20.4 percent, asked for sources of information.

There are many places to get automotive data. The list that follows is a basic one. First there's a group of reference books. Next are the names and addresses of domestic and foreign car manufacturers. And finally there are names and addresses of government and private agencies that are concerned with motor vehicles.

### GENERAL REFERENCE BOOKS

The following books may be ordered from Popular Mechanics Books, Box 1575, Radio City Station, New York, N.Y. 10019.

*Popular Mechanics Complete Car Repair Manual.* \$9.95.

*PM's Guide to Basic Auto Repair and Maintenance.* \$16.95

The books listed below may be ordered from Motor Books, Box 2316, New York, N.Y. 10022.

*Motor's 1976 Auto Repair Manual.* \$13.95  
*Motor's Auto Repair Manual—Early Model Edition.* \$13.95

*Motor's 1976 Truck Repair Manual.* \$21.95  
*Foreign Car Repair Manual.* \$18.95

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### DOMESTIC CAR MANUFACTURERS

**American Motors Corp.**

14250 Plymouth Rd.

Detroit, Mich. 48232

**Buick Motor Division**

General Motors Corp.

902 East H. Milton Ave.

Flint, Mich. 48550

**Cadillac Motor Car Division**

General Motors Corp.

2860 Clark Ave.

Detroit, Mich. 48232

**Checker Motors Corp.**

2016 North Pitcher St.

Kalamazoc, Mich. 49007

**Chevrolet Motor Division**

General Motors Corp.

General Motors Building

Detroit, Mich. 48202

**Chrysler-Plymouth Division**

Chrysler Motors Corp.

1200 Oakland Ave.

Highland Park, Mich. 48203

**Dodge Division**

Chrysler Motors Corp.

Walter P. Chrysler Center

Detroit, Mich. 48231

**Ford Division**

Ford Motor Co.

Ford Marketing Corp.

Rotunda Drive at Southfield Rd.

Dearborn, Mich. 48121

**GMC Truck and Coach Division**

General Motors Corp.

660 South Boulevard West

Pontiac, Mich. 48053

**International Harvester Co.**

401 North Michigan Ave.

Chicago, Ill. 60611

**Jeep Corp.**

(See American Motors Corp.)

**Lincoln-Mercury Division**

Ford Motor Co.

3000 Schaefer Rd.

Dearborn, Mich. 78126

**Oldsmobile Division**

General Motors Corp.

920 Townsend St.

Lansing, Mich. 48921

**Pontiac Motor Division**

General Motors Corp.

1 Pontiac Plaza

Pontiac, Mich. 48053

### IMPORTED CAR MANUFACTURERS

**Alfa-Romeo, Inc.**

200 Sylvan Ave.

Englewood Cliffs, N. J. 07632

**American Honda Motor Co., Inc.**

100 West Alondra Blvd.

Gardena, Calif. 90246

**Arrow**

(See Plymouth)

**Aston Martin Lagonda, Inc.**

650 Clark Ave.

King of Prussia, Pa. 19406

**Audi**

(See Volkswagen of America, Inc.)

**Avanti Motor Corp.**

765 South Lafayette

South Bend, Ind.

**BMW of North America, Inc.**

Montvale, N. J. 07645

**British Leyland Motors, Inc.**

(Austin, MG, Jaguar, Triumph)

600 Willow Tree Rd.

Leonia, N. J. 07605

**Capri**

(See Lincoln-Mercury)

**Citroen Cars Corp.**

40 Van Nostrand Ave.

Englewood, N.J. 07631

**Colt**

(See Dodge)

**Datsun**

Nissan Motor Corp. in U.S.A.

Box 191

Gardena, Calif. 90247

(Please turn to page 202B)

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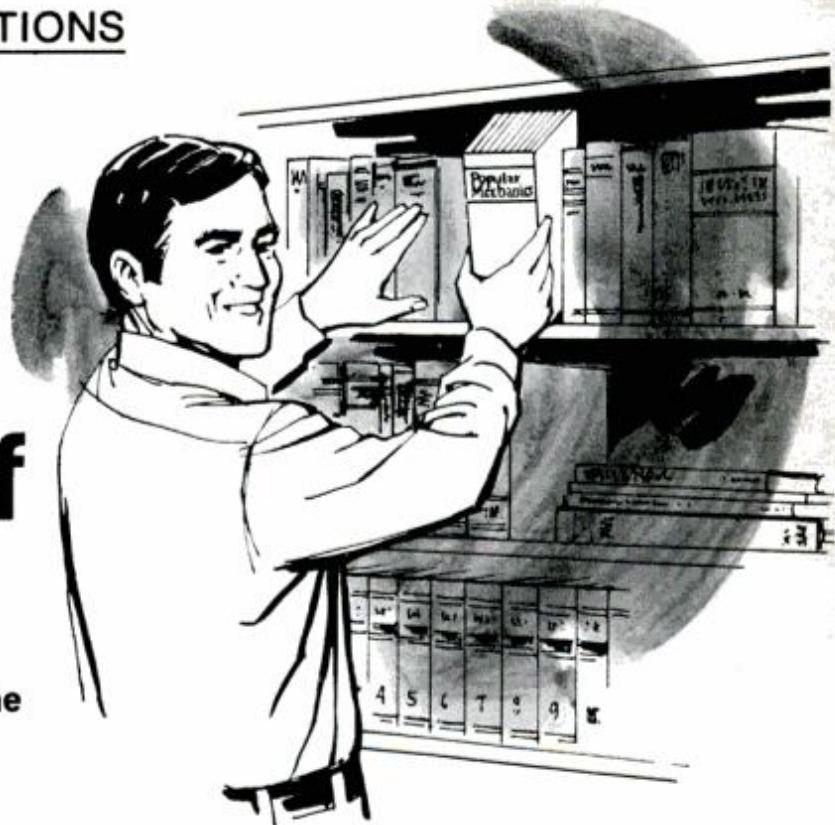
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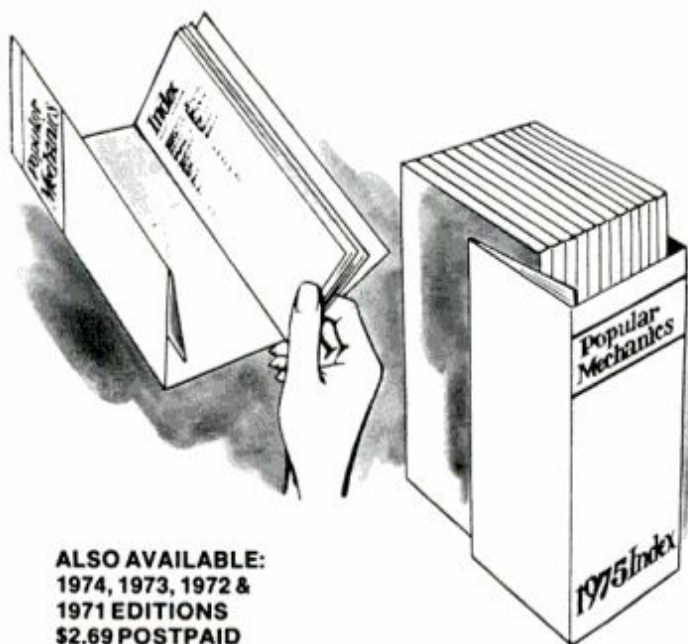
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# CAR CARE GUIDE

(Continued from page 201)

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1100 West Swedesford Rd.  
Paoli, Pa. 19301

**Fiat-Roosevelt Motors, Inc.**  
Montvale, N. J. 07645

**Maserati Distributors, Inc.**  
Grossman Motor Car Corp.  
336 Rte. 59

West Nyack, N. Y. 10994

**Mazda Motors of America, Inc.**  
3040 East Ana St.  
Compton, Calif. 90221

**Mercedes-Benz of North America, Inc.**

One Mercedes Drive  
Montvale, N. J. 07645

## NSU

Overseas Motors, Inc.  
32400 Plymouth Rd.  
Livonia, Mich. 48150

## Opel

(See Buick)

## Peugeot, Inc.

300 Kuller Rd.  
Clifton, N. J. 07105

## Porsche

(See Volkswagen of America, Inc.)

## Renault, Inc.

100 Sylvan Ave.  
Englewood Cliffs, N. J. 07632

## Rolls-Royce, Inc.

West 75 Century Rd.  
Paramus, N. J. 07652

**Saab-Scandia of America, Inc.**  
Saab Drive

Orange, Conn. 06477

## Subaru of America, Inc.

7040 Central Highway  
Pennsauken, N. J. 08109

**Toyota Motors Sales U.S.A., Inc.**  
2055 West 190th St.

Torrance, Calif. 90509

## Volkswagen of America, Inc.

818 Sylvan Ave.  
Englewood Cliffs, N. J. 07632

## Volvo of America Corp.

Volvo Drive  
Rockleigh, N. J. 07647

## GOVERNMENT GROUPS, AUTO-RELATED

**Bureau of Motor Carrier Safety**  
Federal Highway Administration  
Department of Transportation  
400 Seventh St., N.W.

Washington, D. C. 20590

**Office of Consumer Affairs, HEW**  
Fourth and Independence S.W.

Washington, D. C. 20201

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1750 K St. N.W.

Washington, D. C. 20207

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New Post Office Building  
Washington, D. C. 20641  
**National Highway Traffic Safety Administration**  
Department of Transportation  
400 Seventh St. S.W.  
Washington, D. C. 20590  
**National Transportation Safety Board**  
800 Independence Ave. S.W.  
Washington, D. C. 20591

#### ASSOCIATIONS AND PRIVATE GROUPS

**American Assn. of Motor Vehicle Administrators**  
1828 L St. N.W.  
Washington, D. C. 20036  
**American Petroleum Institute**  
1801 K St. N.W.  
Washington, D. C. 20006  
**Automobile Association of America**  
8111 Gatehouse Rd.  
Falls Church, Va. 22042  
**Auto Dealers Traffic Safety Council**  
(Highway Users Foundation)  
1776 Massachusetts Ave. N.W.  
Washington, D. C. 20036  
**Automobile Owners Action Council**  
733 15th St. N.W.  
Washington, D. C. 20005  
**Automotive Parts & Accessories Assn.**  
1730 K St. N.W.  
Washington, D. C. 20006  
**Auto Improvement Development Foundation**  
5055 Nicholson Lane  
Rockville, Md. 20852  
**Center for Automotive Safety**  
1223 DuPont Circle Building  
Washington, D. C. 20036  
**Car Care Council**  
2130 Buhl Building  
Detroit, Mich. 48226  
**Motor Vehicle Manufacturers Assn.**  
1909 K St. N.W.  
Washington, D. C. 20006  
**National Congress of Petroleum Retailers**  
2021 K St. N.W.  
Washington, D. C. 20006  
**National Petroleum Council**  
1625 K St. N.W.  
Washington, D. C. 20006  
**Rubber Manufacturers Assn.**  
1901 Pennsylvania Ave. N.W.  
Washington, D. C. 20006  
**Tire Industry Safety Council**  
766 National Press Building  
Washington, D. C. 20024  
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For putting the black back, there's Black Top Wax. For brightening white and colored tops, there's Neutral Vinyl Top Wax. And both include a no-mess sponge applicator.

And if you're not a buffing buff, there's Self-polishing Vinyl Top clear liquid wax.

Whichever you choose, you'll see that faded top looking new and bright again . . . and protected against the onslaughts of the elements for months and months.

So stop blowing your top. Get the Turtle today. And your faded vinyl top will snap back pretty as a picture.



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**Vinyl Top Products by Turtle Wax®**



## Road-testing STP

Just about everyone has heard of it and 18 million people use it. But not many people can tell you what STP Oil Treatment is and what it can do to help reduce engine wear and oil consumption. That's one reason why the STP Corporation hired Automotive Research Associates (ARA) to test STP Oil Treatment under typical pleasure car driving conditions.

### 27 cars road-tested 600,000 miles

ARA tested 27 cars ranging from one with only 1,867 miles on it to one with 266,900 miles on it. A single and a multi-grade premium motor oil were used. Each was tested for two 6,000-mile oil change intervals. Then the test was repeated with STP added to each oil. Professional drivers ran the cars through a range of speeds from stop-and-go driving to long stretches at 55 mph.

### Lubrication experts analyze the results

After completion of the tests two of the country's prominent lubrication authorities (Ward O. Winer, PhD and author of over 50 publications on lubrication and related subjects, and Charles F. Schwarz, former Chairman of the U.S. Army Engine Oil Reviewing Committee), reviewed the data and concluded:

"The analysis of the fleet test data from Automotive Research Associates, Inc. (ARA) on STP Oil Treatment, conducted during 1974, clearly shows that use of STP Oil Treatment results in a reduction of oil consumption and wear rate."

### Taking care of your engine

These scientific tests run a total of more than 600,000 miles show that adding STP Oil Treatment, even to a premium grade 10W-40 oil, reduced wear of cylinders and sliding iron and steel parts; reduced wear of bearings and other parts contain-

ing copper and aluminum; and reduced oil consumption, too. All of which means that anyone who wants to be sure they are doing everything they can to take care of an engine should probably consider using STP Oil Treatment.

### What's in a can of STP Oil Treatment?

STP Oil Treatment is a concentrate of important ingredients for reducing wear in your car's engine. One ingredient is a long chain polymer which reduces the rate at which oil thins out as temperature rises. Another ingredient is ZDDP which reduces metal-to-metal wear, metal corrosion, and oil oxidation. That's why STP Oil Treatment can improve the ability of virtually any motor oil to reduce wear.

### The real value of STP is added protection

Lubrication experts hasten to point out that STP Oil Treatment is not a fixer, or a mechanic in a can. It can't repair worn or damaged engines. But STP can help your oil do a better job even under tough operating conditions . . . high speeds and stop-and-go driving. Beyond that, it also helps reduce metal-to-metal wear, corrosion and oil oxidation.

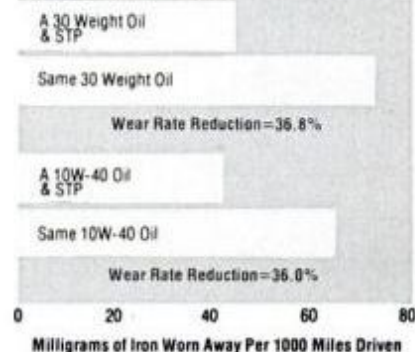
### Smart money

If you consider the fact that a car wash can cost more than a can of STP Oil Treatment, it's a matter of simple arithmetic that you can give your engine the added protection of STP Oil Treatment for a full year for less than the price of a couple of car washes.

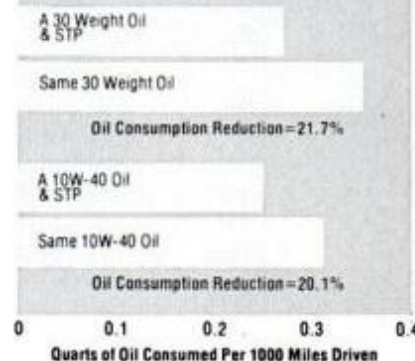
**Helps reduce engine wear and oil consumption.**



### Scientific Tests on Cylinder and Sliding Iron and Steel Part Wear Rate for Oils With and Without STP\*



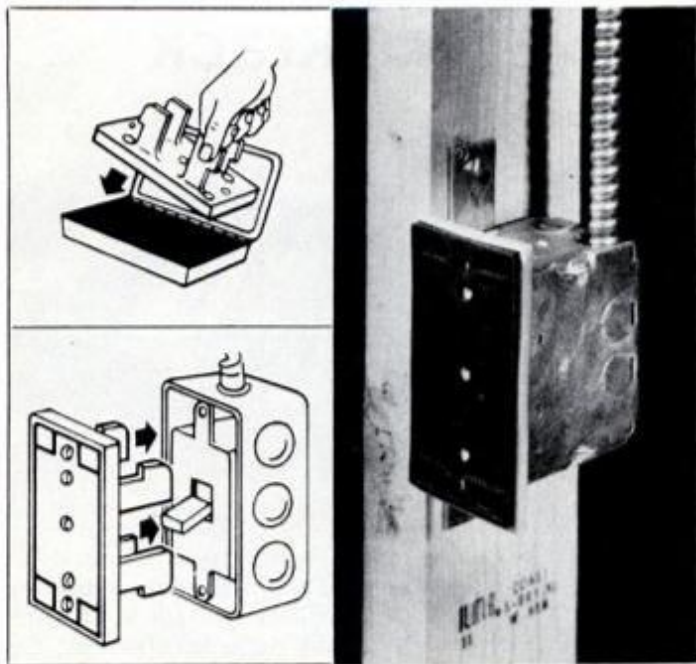
### Scientific Tests on Oil Consumption for Oils With and Without STP\*



\*Here's what the graphs mean: On the wear graph, for example, for every 1,000 miles driven, 64.8 milligrams of iron were worn away without STP in a 10W-40 oil, and 41.5 milligrams of iron were worn away with STP in the same 10W-40 oil. This is an average reduction in wear rate (calculated from parts per million of iron measured in the crankcase oil) of 36%. Of course, use of STP will not always result in a 36% reduction in wear rate. The results shown are averages for the test cars. Results for individual test cars varied. The actual wear and oil consumption results that you obtain may also vary depending upon the way you drive, driving conditions, the motor oil you use, your car's condition, model year and optional equipment. What these scientific tests show is that the use of STP Oil Treatment will help reduce wear and oil consumption.



# IT'S NEW NOW



## Putting the hole where the outlet is

Cutting an outlet hole in a 4x8 wall panel is tricky enough so most amateurs feel lucky if they just come close the first time around. Now the problem has been solved with a template you ink on a stamp pad and plug into the open box. Then you lift the panel into place, press it against the inked template and go to work on the stamped outline with your saber saw. The unit costs \$1.95 and is available from Panel Marker, 24 Hunt Ave., Trenton, N.J. 08610.

## One-man winch for the main

In heavy weather on tall-masted sloops it often takes two men to haul the sheets for the mainsail: one to hold tension on the tail of the rope; the other to crank the winch. No more. A new inexpensive self-tailing winch, with a revolving groove on the top of the drum, grips the sheet tail, takes it a complete turn and then spills it. Price of the winch in this country is not yet known. The low-cost self-tailer will hit a production of 60,000 this year by the Barlow Winch Co. in Sydney, Australia.

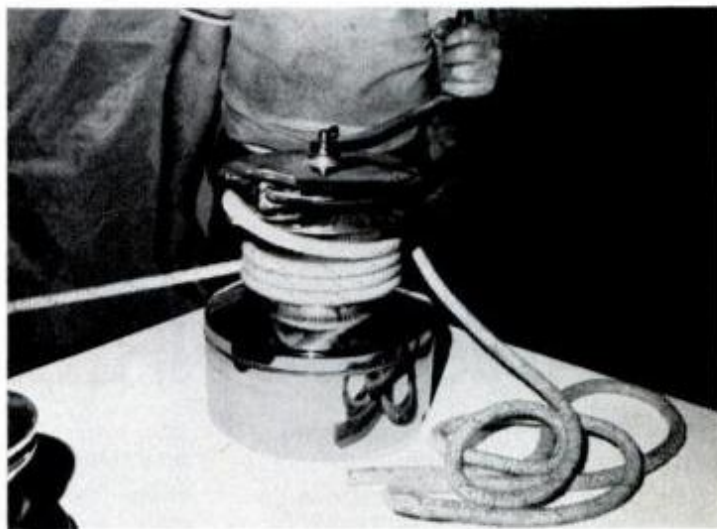
## Dolly with a lift lever

It's easy to move freight on a dolly, but getting it onto a truck is something else. A new dolly does the job easily. At the truck, the dolly's handle is swung up onto the bed. A slide-away handle at the other end slips out and is lifted to raise the load. Price f.o.b. France is \$90. Manufacture d'Armes et Cycles, 48 Ave. du Pres. Wilson, 86101 Chatellerault, France.



## Look, Dad—no hands

Hand-washing dishes usually means the water runs continuously. A new foot-pedal valve control not only saves all that runaway water, but leaves the washer with hands free for the work. The attachment, called Rainbow, consists of a swivel spray head that fits on the kitchen faucet, plus the foot-pedal control. Water temperature is preselected on the mixer, and from there on you use the proper temperature water as needed by tapping the foot pedal. The price is under \$9. Conservocon, Inc., 191 Edgewater St., Staten Island, N.Y. 10305.



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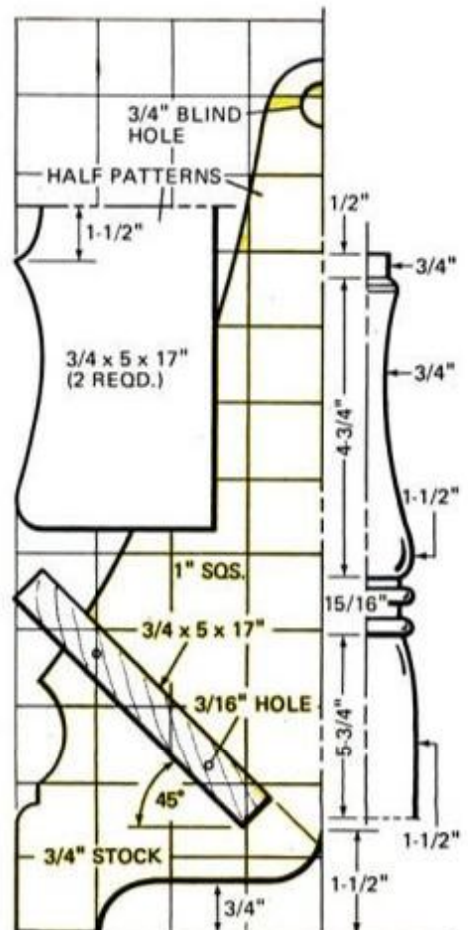
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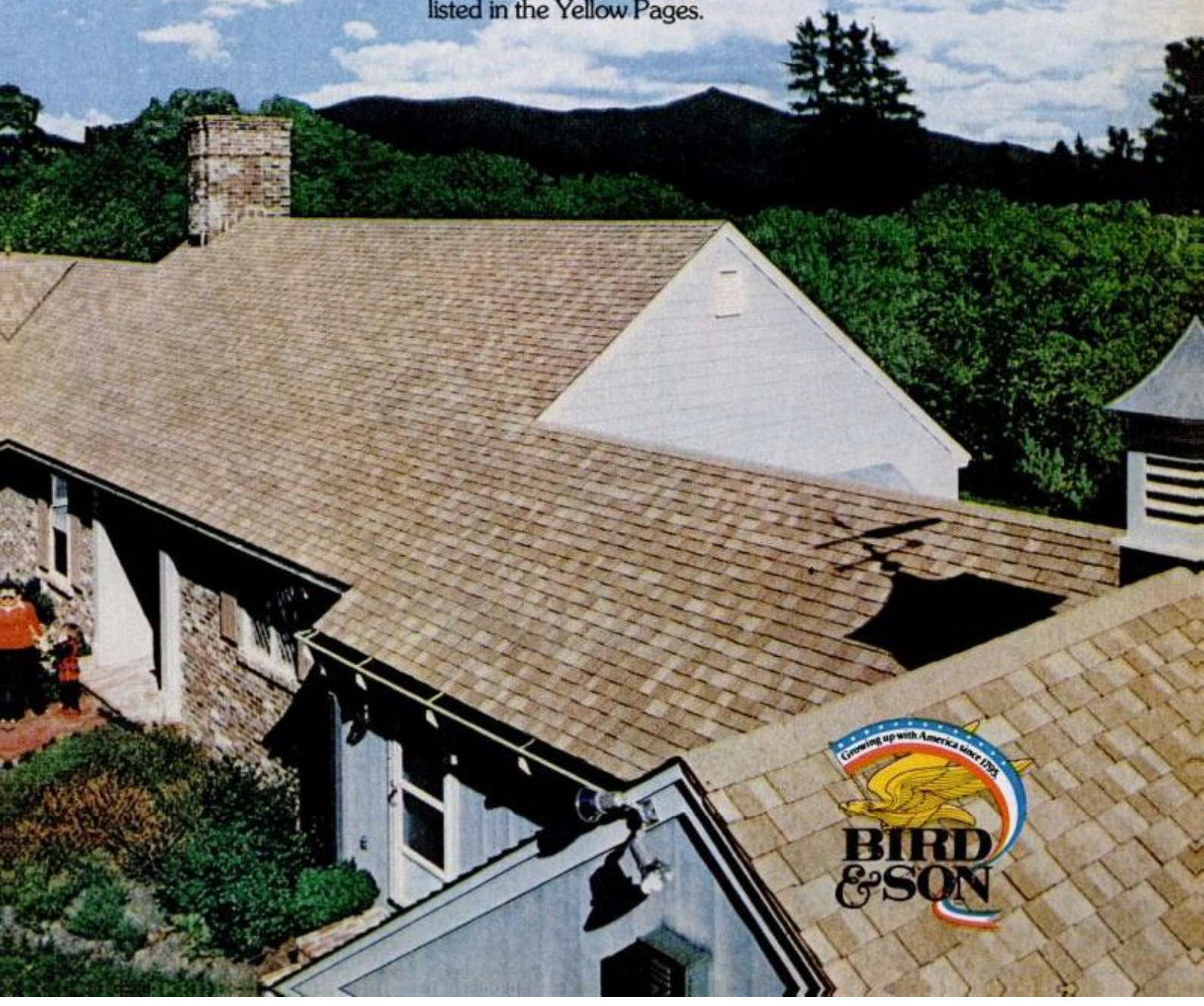
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Popular Mechanics May 1976



## CAMP AWAY FROM CAMPERS

(Continued from page 100)

Information about California areas is available from:

**California Regional Headquarters  
USDA Forest Service  
630 Sansome St.,  
San Francisco, Calif. 94111**

Among the 21 areas in the state, there are:

**Agua Tibia.** For the camper interested in flora and fauna, there is variety that ranges from desert plants at 1500 feet, a chaparral belt, and firs, cedars and pine up to 5000-foot level. Mountain lions, bobcats, deer, coyotes and many types of birds may be seen. Since much of the area has not had forest fires in over 100 years, many kinds of plants flourish. Because of fire hazard, use is limited to winter and spring; the area is closed from July to October.

**Desolation.** Located in the Eldorado National Forest, this area has small streams and 130 lakes that hold great appeal for fishermen. Elevations range from 6500 up to 10,000 feet with alpine timber and flora. In the scenic northern High Sierras, it has a 20-mile foot and horse trail that runs the length of the area.

**Hoover.** For the hardy backpack-

er, this wilderness has elevations of 8000 to 13,000 feet and trails too rugged for easy horse travel. Even during its two-month season of July and August, there may be rains, summer blizzards and high winds. Small stands of lodgepole pine and aspen near lakes and streams stocked with rainbow, brook and golden trout offer protected camping spots. The west boundary edges Yosemite National Park.

**Marble Mountain.** Named for a mountain of white marble that gives the impression of perpetual snow, the area is forested and easy to hike over gently rising trails. Lakes are stocked with trout and the lower streams support ocean runs of steelhead and salmon. Wildlife is plentiful and deer and bear are hunted. Some rare alpine flowers are found only in this area.

**John Muir.** This 503,478-acre wilderness, largest in California, carries the name of the famed naturalist and extends along the crest of the Sierra Nevadas from Mammoth Lakes down to the Mount Whitney region. With thousands of well-stocked lakes and streams, this summer range for 50,000 mule deer is considered one of the most inviting wilderness areas in America.

For 15 areas in Washington and Oregon, address requests for information to:

**Pacific Northwest Regional HQ  
Box 623, USDA Forest Service  
319 S.W. Pine St.  
Portland, Ore. 97208**

**Mount Hood.** Among snow-capped mountains, Mount Hood may rank next to Fujiyama for the greatest number of climbers. Novices with guides and rented equipment can reach the summit in the summer, but the weather is unpredictable and climbers should sign in and out at registers at three ranger stations. Trails are usually opened for foot travel around July 15, although they may not be free from snow until mid-August. Wildlife is not plentiful here, but deer, bear, bobcat, squirrels, grouse and cougar may be seen.

**Paysayten.** Almost every wilderness experience can be found in this 20 by 40-mile region of the Mount Baker and Okanogan National Forest. The wide range of topography, plant cover and elevations offers a guided horseback tour for a senior citizen or a challenging climb for a mountaineer. Most of the 94 mountain lakes are stocked with cutthroat, eastern brook, Montana blackspot, rainbow, German brown or Dolly

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Inquiries about the Colorado, Idaho, Montana, Nevada, Utah and Wyoming areas can go to:

**Rocky Mountain Regional HQ  
USDA Forest Service  
Federal Center Building 85  
Denver, Colo. 80225**

**Maroon Bells-Snowmass.** Picture postcard peaks fill the skies of this popular region that is easy to reach from boundary-line campgrounds in the White River National Forest. Mountains and high ridges range from 12,000 to 14,259 feet. Even hot springs gush out near timberline where mountain sheep summer and winter.

**Selway-Bitterroot.** Stretching over nearly a million acres of Idaho and Montana, this largest of all wilderness areas rises from 1600 feet on the Selway River up to 10,000 in the Bitterroot Mountains, and is home for one of the world's largest elk herds. Trails radiate into the area from access roads on all sides.

Information about Montana and Idaho areas is available from:

**Northern Regional HQ  
USDA Forest Service  
Federal Building  
Missoula, Mont. 59801**

**Bob Marshall.** Extending 60 miles along the Continental Divide, this rugged back country has game that include wolverine, grizzlies, deer, elk, moose, black bear, mountain goat, mountain sheep and mountain lion. Fossils from animals of a billion years ago are also found here.

Arizona and New Mexico, with 17 areas, offer camping wilderness managed by:

**Southwestern Regional HQ  
USDA Forest Service  
517 Gold Ave. S.W.  
Albuquerque, N. M. 87101**

**Gila.** This area contains the first public lands ever set aside because of their wild unspoiled quality. The desert canyons here were once the hide-out of an earlier camper, Chief Geronimo.

Most wilderness and primitive areas are in the west, but within the last couple years a number of additions have been made in the north and southeast. Information is available from:

**Eastern Regional HQ  
USDA Forest Service  
633 West Wisconsin Ave.  
Milwaukee, Wis. 53203**

**Boundary Water Canoe Area.** This famous region is very different from any other in the National Forest Wil-



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derness System. Its 747,840 acres along the Minnesota-Canada border are one-fifth water. Over 1000 lakes of 10 acres or more in size are waiting here, plus a lacework of rivers and streams. Here jagged rocks and lush undergrowth cover islands edging waterways once paddled by the Chippewa and Sioux, early voyagers who trapped and traded furs. Today's camper can fit out with canoe and gear at a town like Ely and then paddle in away from it all. Unlike other wilderness areas, limited timbering also goes on in portions of the region. The 1950s and '60s saw land set

aside to be forever wild in North Carolina and New Hampshire.

**Linville Gorge.** Steep slopes and overhanging cliffs enclose 12 miles of the Linville River as it drops 2000 feet into valleys below. Word should be left with a district ranger before you enter to camp this rugged territory. Shining Rock, with elevations from 3500 to 6033 feet, and outcroppings of white quartz, forms another wilderness of 13,350 acres within the Pisgah National Forest in western North Carolina.

**Great Gulf.** In New Hampshire's

(Please turn to page 210)

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### CAMP AWAY FROM CAMPERS

(Continued from page 209)

White Mountain National Forest, on the eastern slopes of the Presidential Mountain Range between Mount Washington and the Northern Peaks, a 1600-foot-deep valley extends east for 3 1/2 miles. Gouged out by ancient glaciers and ravaged by hurricanes that have torn the timber of the upper slopes, this 5552-acre area offers the hiking camper a rugged climb through growth that ranges from lush up to barren. Two lakes are in the upper reaches of the area. The region seems like a small oasis in the heavily populated East.

For 10 years there was little activity in establishing new wilderness areas. Then, early last year, Congress changed the designation of five "primitive" areas to "wilderness," and added 17 new areas with most of them in the eastern United States. Agua Tibia and Emigrant Basin Primitive Areas in California were changed to wilderness status. The Upper Rio Grande and San Juan Primitive Areas of Colorado become the Weiminuche Wilderness. Flat Tops in Colorado and Mission Mountains, Mont., also joined the system.

Pure bonus, however, were regions newly designated as set aside for the wilderness experience. Though not yet shown on most maps of National Forest Wilderness Areas, these include Hells Canyon on the Oregon-Idaho border; Bristol Cliffs and Lye Brook, Vt.; Dry River-Presidential Range, N.H.; and Rainbow Lake, Wis.

Added to the two previous areas in North Carolina are a dozen new regions for which camping and hiking data can be obtained from:

**Southern Regional HQ**  
**USDA Forest Service**  
**1720 Peachtree Rd.**  
**Atlanta, Ga. 30309**

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## The Marines





## OUR NEWEST DESTROYER

(Continued from page 83)

the subhunter as it is to the successful burglar. Noise tips off the enemy and interferes with the ship's own listening devices. A gas-turbine powerplant—first to be used in a major Navy combat vessel—accounts primarily for the low noise levels.

The turbine is the General Electric LM 2500, a marine version of the jet engine that powers the giant Lockheed C-5 transport. Together, the ship's four engines produce 80,000 shaft horsepower. The engines can be operated independently, if need be. Wide open, the four turbines can push the destroyer at better than 30 knots (top speed is still a secret). The ship's reversible-pitch twin propellers increase maneuverability.

The *Spruance* is not only quiet in operation but also remarkably vibration-free. On my trip I never became aware of so much as an engine throb. In fact, the forward engine room, in which I spent some time, was not the pounding, clanking sweatbox typical of many older ships. My ears weren't assaulted even when I stood right next to one of the gas turbines.

There was only one man on duty in this (one of two) engine room, which says a lot about the ship's level of automation. There's no need for an engine-room crew to open and close valves, lubricate bearings and read gauges—automated systems take care of these tasks. Information on the ship's various energy systems flows continuously into the Central Control Station, a large room above the forward engine room.

### Checking the ship's health

Electronic consoles take up most of the wall space. Crewmen sit in big chairs that ride on tracks as they keep a close eye on panels flickering with lighted pushbuttons, digital displays and warning lights. Like the nursing station in an intensive care ward, the displays report continuously on the state of the ship's "health"—on the functioning of the propulsion and electrical systems, fuel consumption and reserves, freshwater levels, and many other factors. A significant drop in an oil-pressure reading or rise in an operating temperature—and warning lights flash.

All this high-powered technology would surely have floored the average sailor of a decade ago, but today's bluejacket takes it in stride. Not only does he have the technical training, but he has grown up in an electronic, computerized world. This easy assurance, I decided, helped to account for the relaxed atmosphere

in Central Control. There was a ready give-and-take among all hands—enlisted men and officers—that made this civilian feel right at home.

The bridge was run with more formality, which is traditional. Here, sailors never failed to repeat and acknowledge commands or respond with an "aye aye, sir."

### Bridge visit

My first visit to the bridge was at night. When I opened the door the light went out in the companionway behind me. The bridge was dark, bathed in a greenish glow from what appeared to be a radar screen and two display consoles. Until my eyes became adjusted, I had the sensation of being underwater.

An officer told me that they were operating under "darkened" conditions, as they would in hostile waters. The companionway light turned off automatically when the door was opened to prevent a sudden flash of bright light on the bridge.

As I gingerly moved about to get a better look at some of the hardware, I almost tripped over an object on the floor next to the wall. The glow of a small red light saved me from catastrophe. Closer inspection revealed not some mysterious piece of navigational gear—but a large coffemaker. One aspect of Navy life that hasn't changed is the ever-present mug of coffee.

It was over coffee, in fact, that an officer explained to me the main purpose of the intensive "proving" program the ship was being put through. "It's similar to the warranty period of a new car," he said. "Right now the Navy is pinpointing all the things that have to be fixed by the builder. Since this is the first ship in its class, there are bound to be problems. But believe me—this is a darned good ship."

### Result of weapons test

One of the problems—a minor one, I'd judge—was pointed out to me by a young sailor. He showed me a door leading to the open deck where the aft five-inch gun was located. The heavy steel door could not be closed.

"It got banged out of shape," he said, "just like a wooden door might warp. That happened when we first fired the aft gun. We'll have to get a new door."

The ship's two guns—the aft gun is now slated to be replaced with a more powerful eight-incher—work automatically and are fired by remote control. On our second afternoon out, on a rainy overcast day, I watched while both guns were fired during a

(Please turn to page 233)

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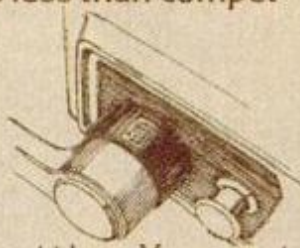
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Boats shown above: left, 17' Conqueror 135; right, 20' Commando 300.

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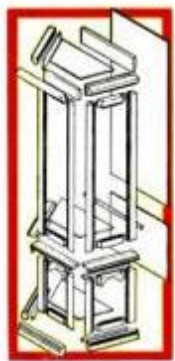
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**A ROUGHNECK'S BEST FRIEND**

(Continued from page 81)

maintenance center is in Lafayette, La., where, in addition to an engine overhaul facility, machine shops, paint shops and the like, some \$3 million in spare parts are kept on hand. It's a PHI boast that its mechanics can build a copter from the skids up, if need be.

**Heliport with 46 pads**

But the main heliport is at Morgan City, La., the home of many companies—from diving to heavy construction—offering services vital to the offshore-oil industry. The PHI base covers 50 acres, has 46 landing pads and a large main building for operations and maintenance activities, a modern passenger lounge and pilots' ready room.

Three roving helicopters are used only for offshore maintenance, carrying mechanics out to big platforms where PHI choppers are based. Up to 46 aircraft are kept out in the Gulf at all times.

Though PHI hires only experienced pilots (many of its present staff flew in Vietnam), the company puts them through its own ground and flight schools. At least once a year, a pilot has to take a refresher course.

A driving force behind the company's success is Robert L. Suggs, a husky, white-haired dynamo, PHI president and one of its founders.

**All-weather capability**

About a year ago, Suggs announced that PHI had become the first air-taxi operator authorized to fly helicopters under IFR (Instrument Flight Rules). The FAA authorization, according to Bob Suggs, paved the way for PHI to provide flight services at times when weather conditions might otherwise halt operations. To prepare for the new capability, in 1973 PHI began training special crews and weather observers, selecting flight routes, developing operational procedures and installing special avionics in its Bell 212s. Because the standard airway "structure" does not extend offshore, it was necessary for PHI to provide its own routes, communications and weather service.

PHI reached a milestone last fall when one of its helicopters logged the company's 2-millionth flight hour. In making the announcement, Bob Suggs added: "Perhaps just as significant is the fact that PHI's helicopters have now flown 173 million miles, a distance roughly equal to 362 round trips to the moon."

In short, the yellow birds have come a long way since '49. ★★★

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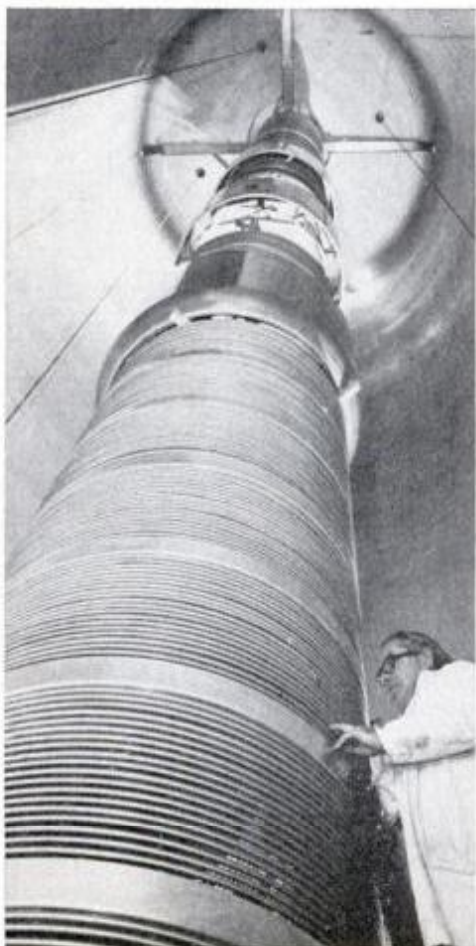
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With a giant tandem accelerator "gun" that juts vertically through several floors of the physics building at Australia's National University in Canberra, Professor John Newton and a crew of physicists are firing ion bullets at 1/10th the speed of light into the atoms of crystals. Object: to see what happens to them in the process. What will come of it all? No one knows—including the professor. "We can only say that the research gives us fascinating insights into nature," he says.

The high-velocity accelerator generates a positive charge of 14 million volts inside the towering pressure vessel that's insulated with 30 tons of sulfur hexachloride gas. The elaborate machine is necessary in order to work with minute particles of matter. If 100,000,000 atoms were lined up they'd span less than an inch; nuclei are even 10 to 1000 times smaller. How do you examine such stuff? It's not easy. "To find out how a car engine works, you take it apart," says Dr. Newton. "But if you can't do that, you might put identical engines on a conveyor and, as they pass a point, fire cannonballs at them. As the engines fly apart, you'd measure the directions, velocities and masses of the bits. By studying such data, you might come up with the main features of an engine's structure. This is what we do in nuclear physics." And, in effect, that's just what the tandem accelerator does with atoms.



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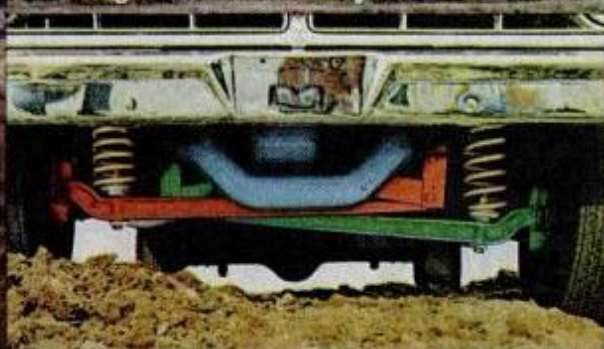
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## PROTECTING YOUR GARDEN

(Continued from page 86)

known to nibble at garden vegetables, too. Try tying aluminum pie tins to stakes so they flash and clatter in the wind. Only the most persistent, most hungry squirrel will risk his bushy tail amid such a clanking commotion.

### 9. Dealing with deer

If deer in your area are proving themselves to be garden pests, you'll find an effective control (probably in conjunction with a tall fence) to be bone tar oil, an odor-producing chemical. It is sold under various trade names. Follow the manufacturer's directions carefully for mixing and application.

It is best to make your first application before deer develop a habit of tasting your garden's offerings. Subsequent applications should be made monthly. If deer are already helping themselves at your smorgasbord, you may have to mix a solution stronger than normal.

### 10. Airborne attackers

Not all attacks on your garden will come from enemy forces moving over the ground. You may find your tomatoes the target for airborne action from birds. Scare-type devices will work to keep birds away sometimes, but not always. Sticky repellents have been used along with plastic twirlers, cloth strips and other moving objects and are fairly effective for small areas. The best, most positive protection comes from netting that will completely enclose your crop.

Authorities say, however, that effective bird control depends on three prime factors:

1. Timing: Control measures should be started at the first indication of damage.

2. Persistence: As long as nature's air force attacks (grackles, starlings, blackbirds, cowbirds and sometimes even woodpeckers), your garden is vulnerable, so control measures should be used.

3. Diversification: No single method is always satisfactory. Various devices must be used in combination and their placement frequently shifted.

Remember, when it comes to applying controls on any form of wildlife, you'll be wise to consult your state and local game law enforcement personnel to see that you're not violating any of the wildlife codes currently in effect. Most game and wildlife agencies will be glad to help in offering advice and assistance. ★★★

## HOW TO KEEP BUGS AT BAY

(Continued from page 86)

with an eye dropper will eliminate corn earworms (wait until silk has turned brown before doing this).

■ Table salt sprinkled on slugs and snails is lethal.

■ A spray made up of hot pepper, salt and sour milk is effective against cabbage maggots. A spray of hot pepper alone works well on ants, spiders, tomato worms and caterpillars.

■ Shallow saucers of beer sunk to soil level will lure slugs to their death.

■ Coriander and anise oil, mixed to form an emulsion, will kill aphids and mites.

■ Wood ashes strewn around the base of plants or around the borders of your garden will ward off slugs and root maggots.

**Good bugs against bad:** Several creatures are a gardener's best friend because they feed off of harmful insects without themselves causing damage. If you see any of the following in your vegetable patch, don't try to kill or get rid of them.

■ Ladybugs consume many undesirable insects, eating several times their own weight in aphids, whiteflies and scale mites.

■ The praying mantis eats scores of insects, especially aphids, beetles and caterpillars—even wasps.

■ Frogs and toads are also welcome in a garden. Frogs feast on sow bugs. Toads go after slugs, aphids, cutworms, spiders, ants, caterpillars and squash bugs.

**Mechanical aids:** Here are a few more things you can try that involve simple household materials or procedures:

■ Encasing your most favored plants in cheesecloth or muslin frames will discourage leafhoppers.

■ Aluminum foil strips laid between rows will keep many insects out of your garden.

■ Paper or tin-can collars placed around plant stems and forced down into the soil will prevent cutworm damage.

■ Cutting off and burning damaged plant parts will often keep insect infestations from spreading.

■ Frequent hosing of foliage with plain water will help prevent red spider mites and mealybugs from taking hold.

■ As a last resort, slugs and snails can be hunted down at night with a flashlight and removed by hand—if you're not too squeamish. Look under rocks and in thick foliage. (Caution: Be careful in regions where poisonous snakes, spiders or scorpions may be present.) ★★★

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steering wheel to your height and build. To a more comfortable driving posture. See your Chevrolet or GMC Truck dealer for a demonstration. **Saginaw Steering Gear Division**  
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# PHOTO HINTS

## FROM READERS

### Storing developer data sheets



An envelope taped to a chemical bottle keeps instruction sheets, records of your experiments and other data handy. Pour from the side of the bottle opposite the envelope to prevent staining the sheets.—*Guillermo Marmol, Chicago*

### Short light stand



A clamp socket and an old reflector can make an efficient, short background or tabletop light stand. I used a 1-inch inner-diameter furniture-leg tip inserted in the hole of the reflector, then cut off to form a well about  $\frac{1}{2}$  inch deep. The well was then filled with epoxy to hold a  $\frac{3}{8}$  x 1-inch bolt, head down in well. Standard  $\frac{3}{8}$ -inch light-stand adapters slip over the bolt to hold your lights.—*Ed Johnsey, Dayton, Ohio*

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The spring-loaded negative carrier opens wide when you lift the lamphouse, letting you advance negatives without disturbing their alignment. The lamphouse assembly is counterbalanced for smooth, easy movement. And a sliding panel allows instant access to the lamp, condensers and filter drawer. The rigid, inclined girder keeps negative and baseboard perfectly aligned, and leaves maximum room to center your easel.



Yet the whole unit will come apart quickly and easily for storage.

The B66 comes with three condensers, for optimum light distribution with negs to 35mm; or switch to two condensers to match the 2 $\frac{1}{4}$ " format optical requirement. Or get the optional dichroic color head and dial in the exact filtration needed for color or variable-contrast printing.

Priced as sensibly as it's designed, and for even greater savings, there's our "Two-Lens Outfit" for 2 $\frac{1}{4}$ "-square and 35mm formats.

Write for literature to Omega Division, Berkey Marketing Co., Inc., Woodside, N. Y. 11377. In Canada, Berkey Photo (Canada) Ltd., Ontario.



Ω OMEGA

The Greatest Name in Your Darkroom.

# THE GRAB SHOT CAMERA.



Whether you're trying to photograph a Stone rolling across the stage at a concert, or a favorite plant blowing in the breeze, you can be sure of a good shot with the new Konica C35-EF compact camera.

Because it's the only 35mm camera with a built-in electronic flash.

Just press a button and the flash pops up, ready for instant use. No matter where you are; how dark it is; how fast the action.

Just focus and shoot. You get perfect available-light pictures each time because your Konica C35-EF automatically sets the correct exposure for you.

Or perfect flash pictures because your Konica C35-EF automatically sets correct exposure as you focus. With this camera you always have a flash, in a flash. That's why we call it the Grab Shot Camera.

See your Konica dealer for a startling demonstration, or write for "grab-shot camera brochure", to Konica Camera, Woodside, New York 11377.



**THE SUN NEVER SETS WITH A KONICA C35-EF**  
**THE CAMERA WITH THE BUILT-IN ELECTRONIC FLASH.**

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## BEAT THE DICE TABLES

Make Dough . . . Like a "PRO" in all Legalized Casinos . . . Double-Your-Money-Back-Guarantee! Place only 5 bets. All numbers are in your favor. including 7 . . . 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

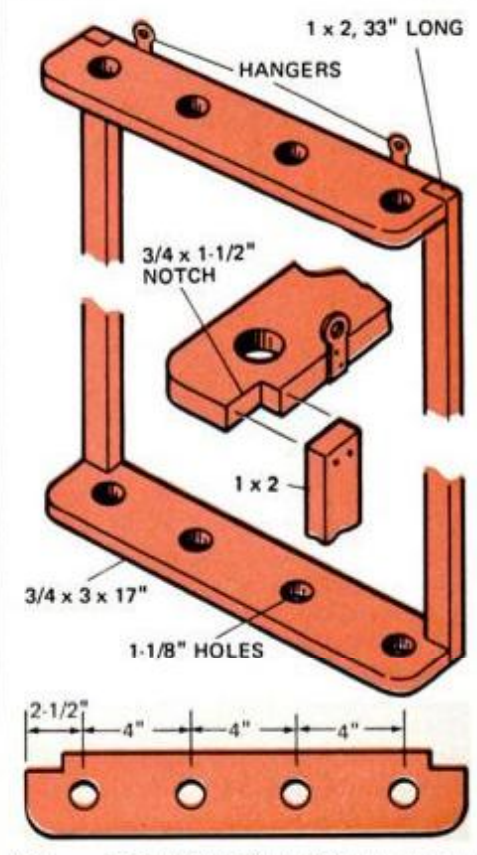
You win every roll!—Free details  
**M. C. CORBIN**, Dept. PM-5  
P.O. Box 869, Radio City Station, N.Y. 10019

## WORKSHOP PROJECT

# Bumper-pool cue rack



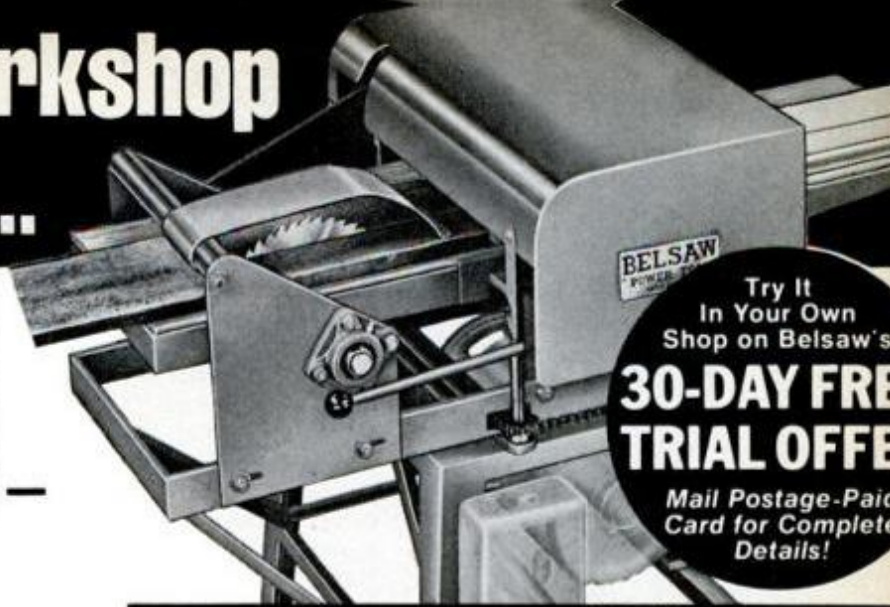
If you have a bumper-pool table but no rack to store your cue sticks, here's a project you'll be eager to make and hang in your game room. You have a choice of making it from hardwood and staining or softwood and painting. It will take a spade-type bit to bore the 1 1/8-in. holes, and they'll turn out clean as a whistle if you not only bore both pieces at one time but back them up with scrap. The cue sticks rest in the bottom holes (you may find the holes will need to be a bit smaller for your sticks). ★★★



# Your home workshop can PAY-OFF....

# ...BIG!

This one power-fed tool—  
**SAWS** to desired Width...  
**PLANES** to desired Thickness...  
**MOLDS** all popular Patterns...  
— all in one fast operation!



Try It  
In Your Own  
Shop on Belsaw's  
**30-DAY FREE  
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Here's a versatile power tool that literally pays for itself. In just one pass, you can quickly turn low cost rough lumber into high value finished stock. From the day it arrives your Belsaw will make and save you money. Low cost cutter bits let you make quarter round, base mold, door and window stop, casing, tongue and groove...all popular patterns. Other Belsaw operators are making and selling picture frame molding, fencing, clock cases, furniture, bee hives, bed slats, surveyor's stakes...all kinds of millwork. *These men report profits up to \$100 a day.*

**Your  
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Part Time  
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Men and women everywhere are using this one low-cost power-feed machine to start and build their own new businesses...and *YOU can do the same.* Supply lumberyards, carpenters and contractors in your area with door and window trim...base shoe...bed mold...cove and quarter round...ALL of their trim. You can sell picture frame to custom framing shops, paint stores, department stores and direct to users. All patterns available or design your own.

**Does The Belsaw Pay? YOU BET!**

**READ WHAT OTHER BELSAW OWNERS SAY:**

"I've been a planer man for years and am now retired. The Belsaw has earned me \$60,000 in eleven years...it's the best investment I ever made."  
**Robert Sawyer—Roseburg, Oregon**

"I bought a batch of walnut in the rough, and after planing it on the Belsaw I figured I saved enough money to pay for two-thirds the cost of the Planer. It really does a good job."  
**R. S. Clark—Springfield, Ohio**

"I recommend the Belsaw as the most useful shop tool any craftsman could own. We use one every day in the Workbench model shop... couldn't get along without it."  
**Jay Hedden, Editor  
Workbench Magazine**

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

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

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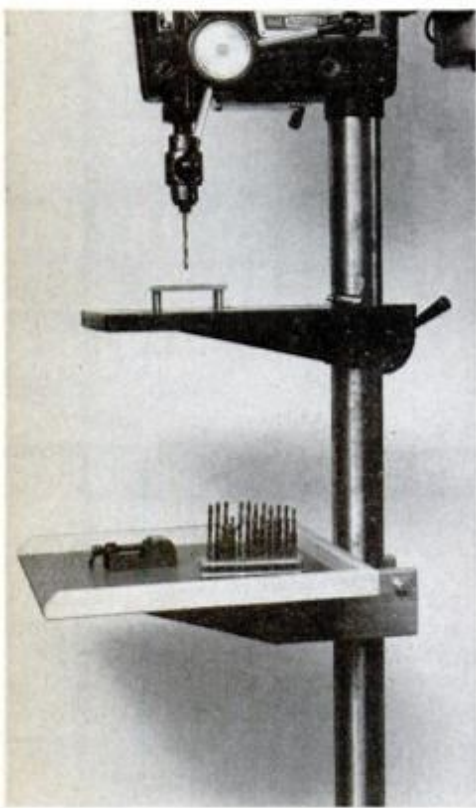
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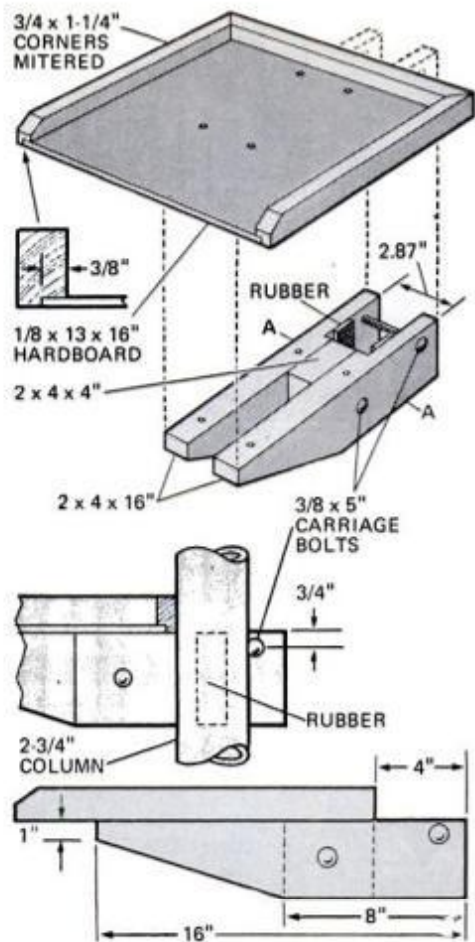
# Handy drill-press tray



Worktable tray makes good use of the idle portion of the drill-press column.

Those who have a floor-model drill press will find this below-the-table tray useful for holding drill bits, chuck key, work in progress and the like. Made of wood and hardboard, it clamps to the column a foot or so below the normal position of the table. Rubber strips are cemented to the rabbeted faces of the 2x4 brackets to keep them from slipping down the column. The rubber strips should fit snugly against the column to reduce the clamping force needed to hold the tray in place. Also, the clamping bolt should just skim the column to hold the tray level.

Fasten the hardboard tray bottom in its rabbets and the tray to its brackets with flathead wood screws in countersunk holes. Paint or varnish the completed tray to keep oil from soaking into the wood. When an occasional drilling job requires the full use of the lower half of the column, it's simple enough to remove the tray from the column and later replace it. The tray can be of any size you wish—just don't make it so deep it interferes with standing in front of the machine.—R. S. Hedin



# BELL & HOWELL

## Money-Back Movie Buy!

Get \$25  
Rebate on  
Sound  
Movies!

Sound adds a whole new dimension to 8mm movies. Now Bell & Howell wants to introduce you to the excitement of sound movies.

That's why we're offering a \$25.00 cash rebate on any Bell & Howell Filmosonic™ Sound Movie Projector, when you buy, or already own, a Bell & Howell Filmosonic™ Sound Movie Camera.\*

The Filmosonic Cameras have all the practical advantages of other Bell & Howell low-light movie cameras, plus the exciting added dimension of sound movies. And the heavy-duty projectors feature solid, die-cast construction that takes the knocks of a lifetime.

Best of all, there's the Bell & Howell name. It's your assurance of lasting value. Stop in today and ask your Bell & Howell dealer about the Bell & Howell Filmosonic™ Sound Movie System and your \$25.00 rebate.

\*To be eligible for rebate, projector must be purchased not later than December 31, 1976.



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BHMC

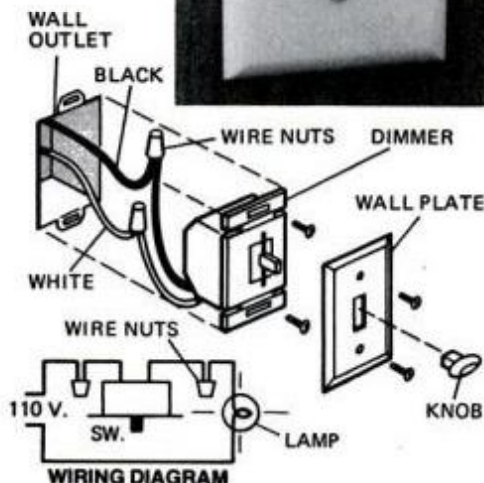
BELL & HOWELL/MAMIYA COMPANY

## HOME IMPROVEMENTS

(Continued from page 108)

the black cable wire to the black fixture wire, the white cable wire to the white fixture wire and the green cable wire to a ground connection on the fixture. If power is from a surface outlet on the house exterior, turn off the current and attach an L-shaped conduit to the outlet. Pull cable through the conduit and connect it to the corresponding color-coded wires in the outlet—white to white, black to black. If no outside outlet is available, run conduit through the basement wall as shown and connect it to the nearest junction box.

### Dimmer switch



If dining by soft, simulated candlelight is not reason enough to install a dimmer control in place of the conventional toggle switch, maybe a lower electric bill is. Keeping lights in the TV room, baby's room and halls at a low level will save energy and money, even extend bulb life.

Some dimmers control light intensity by a knob you turn, others like this solid-state Glyder by Lutron which has a knob you slide up and down. It's simple to install a dimmer switch. Turn off the electricity, then remove screws holding the wall plate, back out the screws that hold the old switch in the outlet box and disconnect wires. Then you reverse the steps to connect the new switch, press a fingertip control button in place over the end and turn the electricity back on. ★ ★ ★

# PART TIME or FULL TIME SHARPENING BUSINESS!

YOU Can Earn Up To **\$800** An Hour

In YOUR OWN

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

Yes, there's a lot of business waiting for the man who can sharpen saws, planer knives, jointer blades, wood chisels, scissors, axes and other garden, shop and home tools.

Belsaw SHARP-ALL does all these jobs quickly with precision and at a big profit for YOU. You can become Sharpening Headquarters for carpenters, builders, lumber yards, factories, home workshop hobbyists. And, you can start this Money-Making business for less than \$50.

FREE BOOK tells how to start your own sparetime business while you are still working at your regular job. People bring in their work and pay Cash—over 90c of every dollar you take in is cash profit.

*Does The Belsaw Pay?*  
**YOU BET!**

**JOIN THESE SUCCESSFUL SHARP-ALL OPERATORS—**

**\$4,000 a Year**

"Think the world of my SHARP-ALL. Am now grossing about \$4,000 a year part time, and hope to expand shortly. Now doing work for the State of New York, Carrier Corp., and General Motors."  
Lawrence Stevenson  
E. Syracuse, New York 13057

**Wanted to Retire**

"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 73085

**\$5-\$6 an hour**

"On Saturdays, my big day, I take in \$45 to \$55. Other days I average less, but I figure I make between \$5 to \$6 per hour... and sometimes more. I am presently enlarging my shop, and thank BELSAW and their fine equipment for making it possible."

V. O. Miller  
Hubert, North Carolina 28559

**Had to Quit His Job**

"Bought my SHARP-ALL four years ago, and it has done everything (and more) than you said it would. I never sharpened a saw in my life, but when I had to quit my regular job, I knew I had to have something to do. Now I have more work than I am able to do — I have as many as 100 saws ahead of me at a time."

Frank Sartin  
Grandview, Washington 98920

**100% Disabled**

"I was disabled by an accident while employed as an iron worker. They declared me 100% disabled and said I'd never work again. I don't think I could work for anyone else but I started my sharpening business part-time and now it's turned into a full-time job with more work than I can do."

Rez Stage  
Tampa, Florida 33614



Let Belsaw prove  
**YOU can do it — On our 30-DAY FREE TRIAL OFFER**

You risk nothing by accepting this offer to see how easily you can turn your spare time into Big CASH Profits with your own Complete Sharpening Shop. Send coupon or mail postcard for full details on our exclusive 30-Day Free Trial Offer!



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# ARIENS COMPACT TRACTORS:

**Lawn and Garden  
tractors with big  
equipment features**

Ariens Compact Lawn and Garden Tractors are available in 10 or 14 HP gear drive and 12, 14 and 16 hydrostatic models. A full range of Ariens attachments are available such as a rotary mower deck, snow blower, rotary tiller, and snow blade. Depending on model and horsepower, Ariens Tractors will also accept a variety of attachments from manufacturers of tractor accessories such as a tractor cab, rotary brush, front end loader, lawn vacuum, sickle-bar mower, to mention just a few.

In addition, Ariens has two Lawn Tractors — an 8 HP Gear Drive and an 8 HP Hydrostatic Drive model.

Your nearby Ariens dealer will be pleased to give you all the facts. Check the Yellow Pages or write the Ariens Company.



**Ariens Company**  
806 West Ryan Street  
Brillion, Wisconsin 54110

Please send your full-color Tractor Brochure.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_  
State \_\_\_\_\_ Zip \_\_\_\_\_

## LET 'EM KNOW WHO YOU ARE

**ENGRAVED  
IDENTIFICATION  
PLATE**

**YOUR NAME**  
**CITY, STATE**

Perfect for mailboxes, RV's, campers, trailers, boats, cabins, fish houses, offices, etc. Attractive, easy-to-read white block letters really stand out against black, scratch-proof plastic plate body. Convenient too . . . plate backed with pressure sensitive adhesive. Durable, strong . . . can be mounted with screws or bolts.

### ORDER FORM (Clip and Order Today)

**ORDER INFORMATION:** 20 characters per line max. Blank spaces count as one character

**PRICES:** Large Plate — (3" x 12") Two lines of print — \$6.95  
Each additional plate with same lettering — \$5.00  
Small Plate — (2" x 12") One line of print — \$5.00  
Each additional plate with same lettering — \$4.00

Minnesota residents add 4% sales tax.  
Check or money order must accompany order.  
Send to: **ABC SIGNS**  
P.O. BOX 29268  
MINNEAPOLIS, MN. 55429

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

PRINT ONLY Use these letters and numerals only: ABCDEFGHIJKLMNOPQRSTUVWXYZ/1234567890  
CAPITAL LETTERS (For ordering more than two different plates, letter on separate sheet)

PLATE 1 Use top line only for small plate																			
PLATE 2 Use top line only for small plate																			

I want to order \_\_\_\_\_ of PLATE 1. Here's my check for \$ \_\_\_\_\_  
(Qty.) (Total)

I want to order \_\_\_\_\_ of PLATE 2. Here's my check for \$ \_\_\_\_\_  
(Qty.) (Total)

Do Not Write In This Space

## LOW-COST POOL

(Continued from page 105)

into the bottom rim. It's like trying to hold five slippery eels by the tail—as you grab one, another slides away. Try a few 1x2 temporary stakes to brace one section while you're fitting the opposite side.

### Smooth as silk

Before you fit the liner, go over all of the ground with a fine-tooth rake. A small pebble or sharp twig can work its way through the liner and cause a leak. Any hard edge will be extremely uncomfortable underfoot. Fit the liner carefully and be sure to provide enough fill to create a soft corner where the liner meets the bottom edge of the pool wall. Bare feet are mandatory during this operation. Get the liner as wrinkle-free as possible and leave a healthy overlap on the rim. A 16-gauge material, standard on most pools, doesn't have much of a tolerance for stretching. Twenty-gauge liners are available and will adjust to a stress without ripping.

A new product worth noting is the solar pool cover panel, available through Wards (\$29.88 for a package of 4). The polyethylene bubble pads can raise the water temperature 10 to 15 degrees when floated on the surface and roll up for easy storage.

Choose the right pool and invest in quality equipment. It will pay off in years of summer fun for your family. ★★★

## Pool safety guidelines

### Structure:

- Check local codes for fence regulations.
- Eliminate any sharp metal edges.
- Stay away from overhead wires.

### Equipment:

- Use UL-approved filter and wire.
- Provide life-saving equipment.
- Maintain filter for clean water.

### Use:

- Permit absolutely no diving.
- Always supervise children.
- Install a fold-up safety ladder.

## Water treatment guidelines

### How to figure total gallons:

- Rounds = diameter × diameter × average depth × 5.9
- Ovals = length × width × average depth × 5.9.


### How to add chlorine:

- Weekly: 1 oz. per 1000 gal.
- Every other day: 1½ oz. per 5000 gal.
- Shock treatment: 10 oz. per 5000 gal.

Your dollars buy more at your independent hardware store!



## Shop at the store with the Sentry on the door

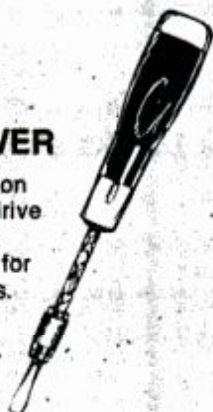
Your neighborhood Sentry Hardware dealer offers "something extra" . . . friendly, expert assistance in helping you select exactly the right tool or material to do every job better, easier, faster, more economically. Look under "Hardware" in your  classified phone directory.

**STANLEY**

### YANKEE SCREWDRIVER

Spiral ratchet action makes it easy to drive or remove screws. Can also be used for drilling small holes.

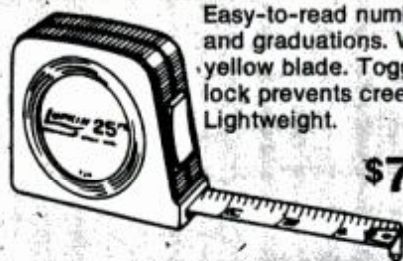
**\$4.99**



**Lufkin**

### 25-FOOT TWO WAY MEZURLOCK® TAPE

Easy-to-read numbers and graduations. Wide yellow blade. Toggle lock prevents creeping. Lightweight.



**\$7.19**

**FULLER**

### 3-PIECE CHISEL SET



½-¾ and 1-inch chisels come in handy on every woodworking job. Carbon steel blades. Unbreakable plastic handles.

**\$3.44**

**Crescent**

### 10-INCH MULTI-PLIERS

Strong jaws, aligned teeth and precision-milled ribs assure positive grip. Safety handles.

**\$4.88**



### Sentry 16 OZ. FIBERGLASS HAMMER

Perfectly balanced. Unbreakable "comfort" handle. Polished "mirror finish" head.



**\$5.88**

### Sentry HIP-ROOF TOOL BOX



19 x 6 x 7½ inches. Bright red. Nickel-plated handle and hardware. Handy tote tray. Padlock tabs.

**\$7.99**

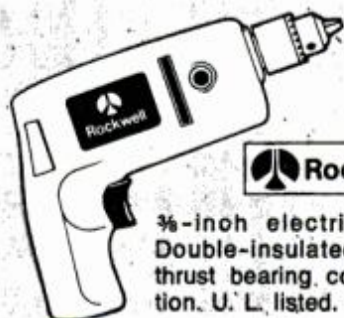
**EVEREADY**

### ALL-AMERICAN LANTERN



Dependable emergency light. Sturdy. Waterproof. 6 volt battery included.

**\$5.99**



**Rockwell**

¾-inch electric drill. Double-insulated. Ball thrust bearing construction. U. L. listed.

**\$12.99**

**EVEREADY**

**"D" BATTERIES**

Proven performance at a bargain price

**2 for 48¢** with coupon



**WD-40**

**\$1.11** with coupon

Lubricates. Stops rust. Penetrates. Stops squeaks. Loosens sticky mechanisms, locks, hinges, nuts, bolts. 11-oz. can.

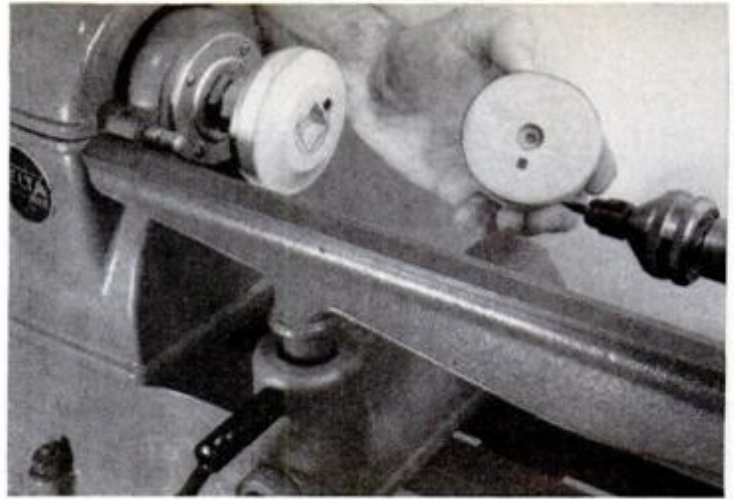


Merchandise, shown in this advertisement, is available from participating Sentry dealers only. Offer expires May 15, 1976. Sentry dealers own their stores. They select their merchandise and set their own prices. These are subject to change without notice. There may be variations in products, available quantities and prices in individual stores . . . Sentry Hardware Corporation, Cleveland, Ohio 44113.

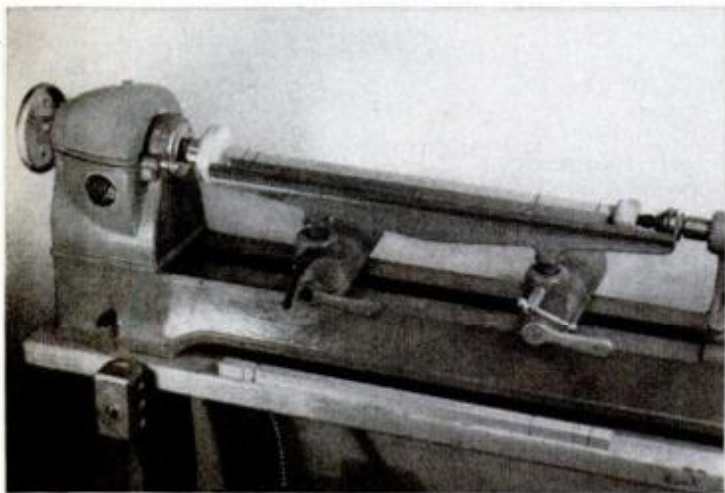
AA-4419



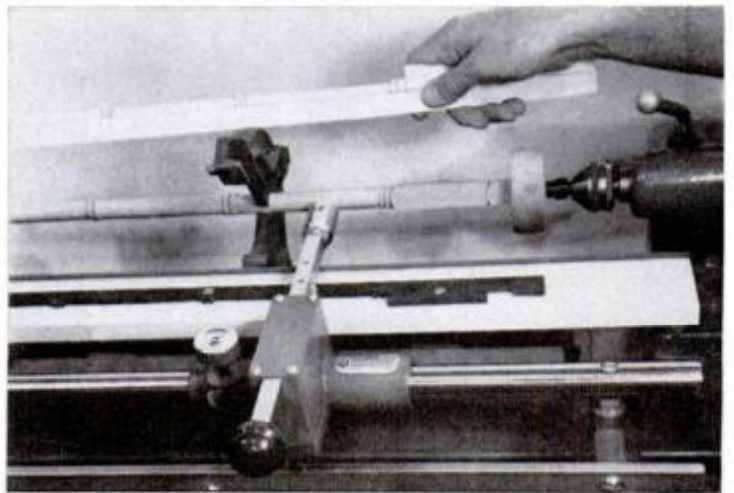
Clamp tabletop securely to workbench when routing groove for ebony cock beading. Square corners carefully with wood chisel.



Make wooden lathe chucks for head and tailstock to automatically center and hold leg blank. The chucks prevent splitting.



Mark location of shoulders on each leg blank with soft pencil. Mark will show when leg spins in lathe. Cut with heel of skew.



Lathe duplicator makes quick work of turning 16 identical legs, saves costly mistakes. Requires making template master of leg.

## QUARTET OF NESTING TABLES

(Continued from page 115)

length. Epoxy glue ebony into place.

Experts concede that a beautiful hand-rubbed oil finish is among the most durable and repairable. Its disadvantage is the length of time it takes to build up. After sanding and wiping the tops, I began scrubbing them with a pad dipped in boiled linseed oil thinned 10 percent with turpentine. As I proceeded to make the table trestles, I took a few minutes every few days to vigorously rub another coat of warm linseed oil into the tops. The last few coats took several days to dry. By the time the tables were assembled, the tops had acquired that beautiful sheen you get only from oil on satinwood.

Oily rags can cause fire. Dunk in water and dispose of them immediately.

### Dress leg blanks before turning

Rip the leg stock and cut the square blanks to 21-in. lengths. A few preliminaries simplify their turning. Dress the leg blanks so they are smooth and square. Clamp the 16 blanks together and simultaneously

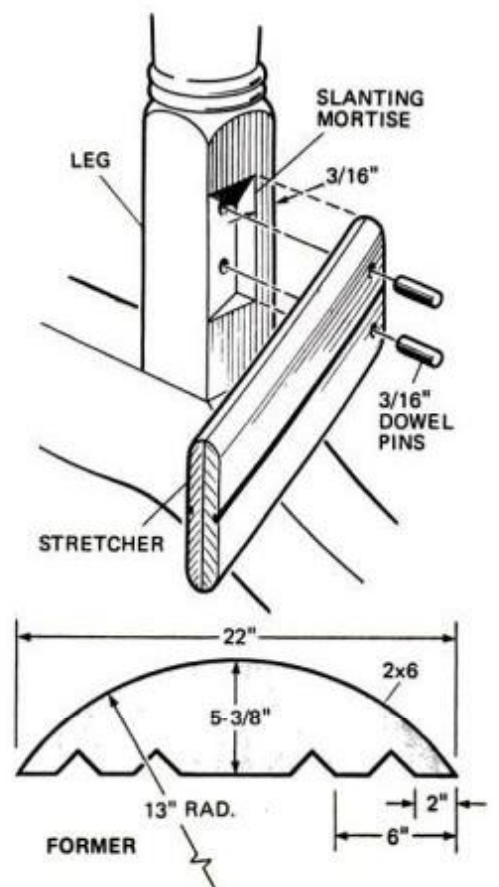
mark the limits of the square shoulders. Dark pencil lines on just one side of the blank will be visible when it is revolving.

I made the two 3-in.-diameter maple chucks to center the leg blanks automatically and keep the ends from splitting.

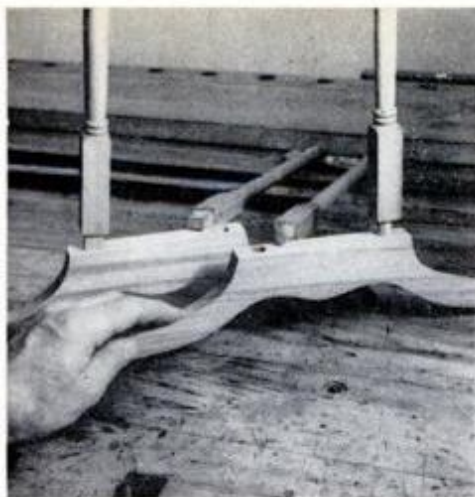
To make the chucks, screw a 1 1/8-in. piece of maple to a faceplate and turn it round. While it's on the lathe, bore a 3/4-in. hole 1/2 in. deep. Then remove the faceplate from the lathe (keeping the chuck attached) and square the hole with a chisel.

For the tailstock, lay out a 3-in. diameter circle on a second piece of 1 1/8-in. maple and saw it out. Bore a 1/8-in. lead hole through the center of the chuck. Then bore a hole big enough to accept the cup center and deep enough to get a good bite in it. On the reverse side form a 3/4-in.-square mortise 1/2 in. deep. Extend the point of the cup center about 1/2 in. so it fits deeply into the 1/8-in.-diameter lead hole. I completed this setup with a ball-bearing center.

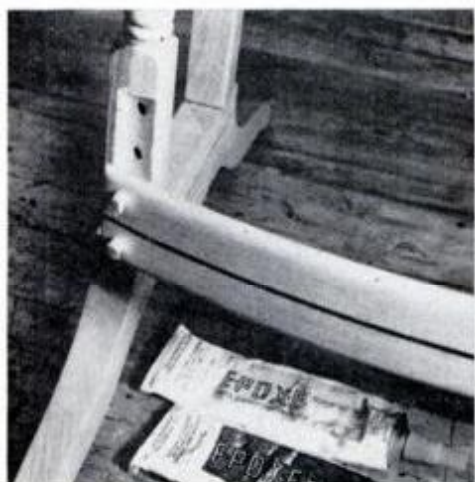
Put a black spot on one edge of the square mortises on both chucks and a spot on one side of each leg blank;







**Leg tenons** can be cut to fit square mortises or turned round to fit bored holes. You can cut the mortise by squaring up the hole with a wood chisel.



Use 3/16-in. dowels to pin the curved stretchers to the slanting leg mortises. Angle-cut the ends of the stretchers for an accurate fit and glue them with epoxy.

then, by inserting the leg so the spots on the leg and chucks are adjacent, you'll be able to remove and reinsert the legs in the same position in the chuck each time. After you go through all the steps on one leg, mass-produce each step on the remaining 15 blanks.

Begin turning a leg by nicking the shoulders. Point the heel of the skew away from the square shoulder. Turn the cylinder next. Mark off the location of the beads on the cylinder and cut them. Then turn gently convex shafts between the beads. Originals had square tenons, but modern glues now make round tenons practical. If you intend to use round leg tenons, cut them at this time, too. Sand the legs thoroughly.

I finished the legs by burnishing them with a 50/50 mixture of linseed oil and shellac as the leg spun in the lathe. When a leg would take no more polish, I removed it to dry. Later, I applied two additional coats with a

*(Please turn to page 232)*

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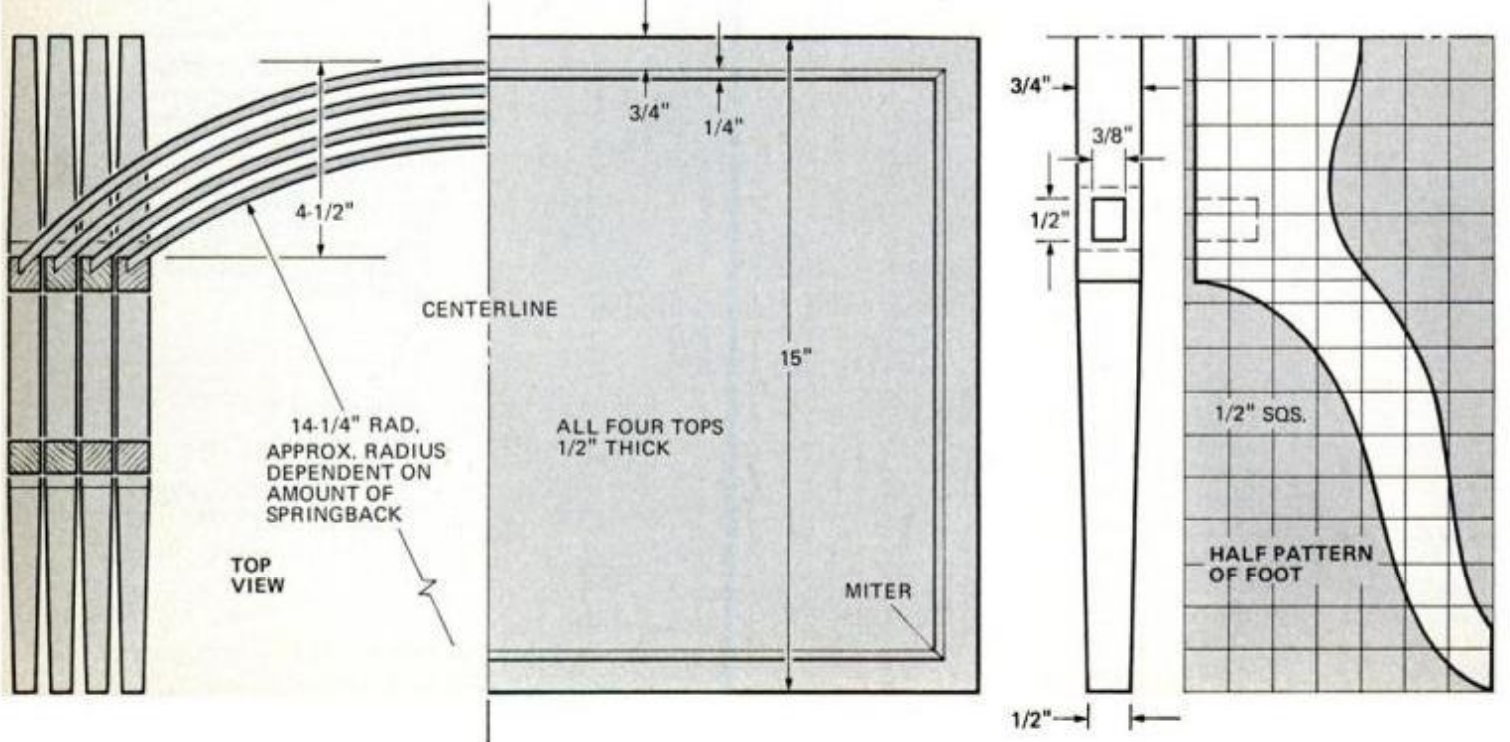
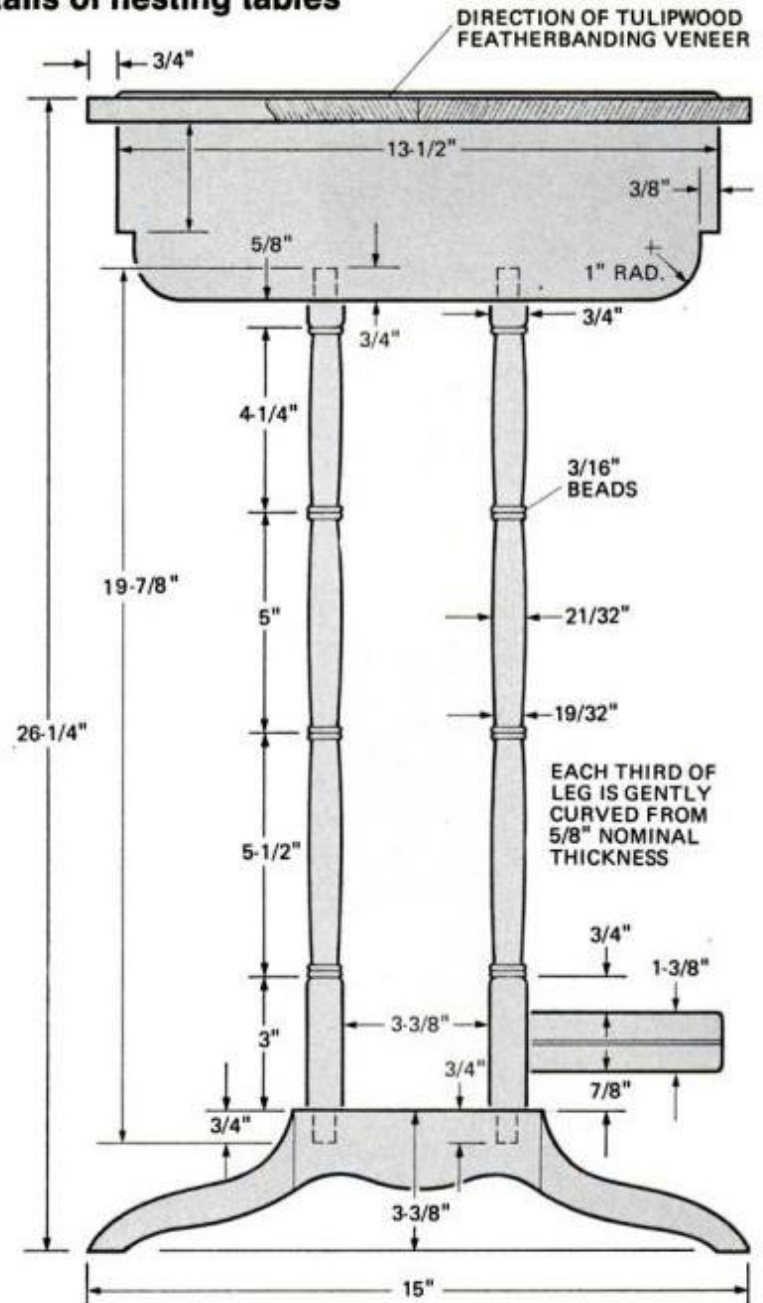
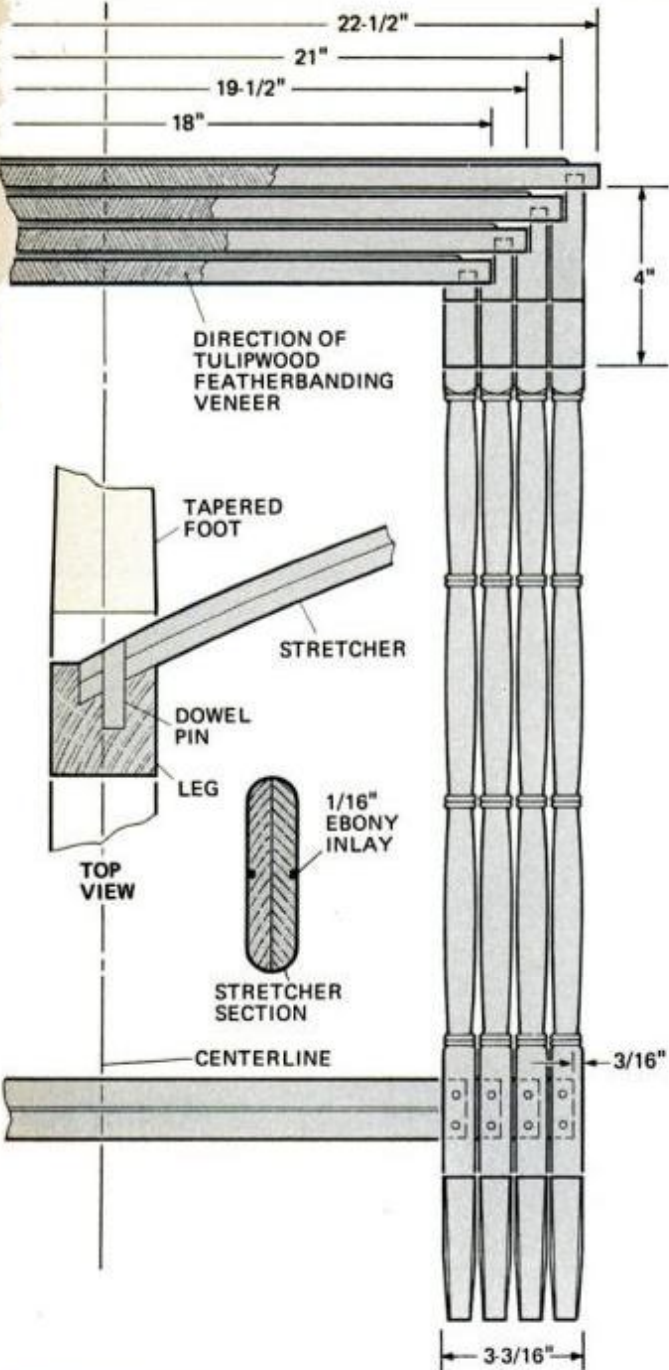
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# Details of nesting tables



## QUARTET OF NESTING TABLES

(Continued from page 231)

4/0 steel-wool pad. I let the legs dry thoroughly between coats and finally reinserted them in the chucks and applied carnuba paste wax with a soft cloth.

### Make cardboard pattern

Conserve wood by using a cardboard template to nest the outline of the feet on the board. Cut out the feet and sand the edges with a drum sander. Mark the taper on the feet, then cut the taper with a disc sander, spoke shave or block plane. Cut the leg mortises next.

Round the upper and lower edges of the stretchers, cut the inlay to length and glue it into place. Cut the sloping notches in the legs and fit the dowel-pinned stretchers into place.

Assemble the tables with epoxy glue. Finish the feet, rails and stretchers with the same polish you rubbed into the legs. Apply about three coats of polish until your tables reflect the same TLC (tender loving care) apparent in those \$1000 originals. ★★

## OUR NEWEST DESTROYER

(Continued from page 214)

drill. The first boom from the aft gun still hung in the air when I was surprised to see a sparrow sweep across the deck, head for open water, then fly parallel to the ship, his small wings moving so fast they were almost a blur. We were at least 100 miles off the southern coast. What was a sparrow doing out here!

A sailor standing nearby noted my surprise. "There's a couple of them on board," he said. "They built a nest when we were in port, but we haven't spotted it yet." He looked out at the bird, still flapping wildly to keep up with the ship. "He'll come aboard again as soon as we finish firing."

Like the smooth-running ship with all its sophisticated gear, this sailor also represented the "new" Navy to this landlubber, accustomed to the clean-shaven gobs of yesteryear. The sailor wore a full beard. I asked him about the regulations governing beards.

He stroked a whiskery cheek, smiled and said, "They must be kept neat."

His beard was neat enough, I decided, and a distinctive adornment for this member of the hand-picked crew assigned to putting the Navy's newest and most powerful destroyer through her first sea runs. ★★



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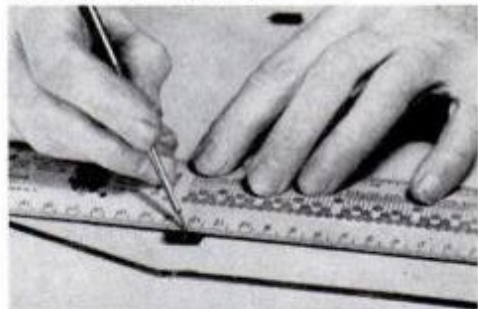
## FROM READERS

### Homemade handle



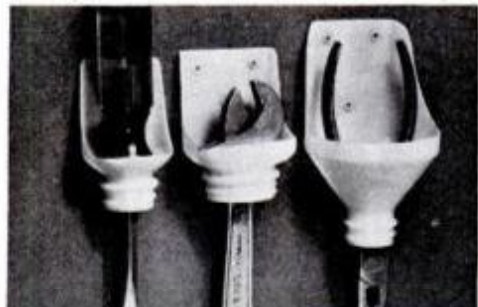
Faced with loosening a hard-to-reach, deep-seated nut, I made an L-shaped handle for my wrench sockets from a 5-in. pipe nipple, coupling, elbow and 2 3/4-in. piece of mild steel rod. I threaded the rod with a pipe die to fit the elbow, filed the other end square to fit the socket and cross-pinned the rod to the elbow. A spring-loaded steel ball holds the socket. It worked great. For a longer handle, screw another pipe into the coupling.—Walter E. Burton

### You're on the spot



To position a straightedge precisely when scoring glass, try this stunt: Coat the glass at opposite edges with a felt-tip pen, scratch a line through the dried ink and align the straightedge with the marks. You'll be right on the button with the glass cutter.

### Tool pouches from bottles



Flat-sided plastic bottles cut as shown and mounted upside down on your workshop wall make dandy tool holders. Cut off the bottom first, then trim away the front to suit the tool.

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Mr. Watkins is an engineer, consumer building consultant and author of such bestsellers as—*The Homeowner's Survival Kit*, and *The Complete Book of Home Remodeling, Improvement and Repair*.

And what Mr. Watkins has learned in his 25 years in the business he's capsulized in 26 pages of this booklet. Here are some of the categories covered:

1. Should you remodel or move?
2. How much do improvements increase the value of your home?
3. Eight fundamental tips for efficiency and economy.
4. What makes a good plan?
5. When should an architect be used?
6. How to conserve energy and cut future energy bills.
7. A new exterior for your home with prefinished wall siding.
8. How to buy a new roof.
9. Kitchen and bathroom remodeling.
10. Adding a new room.
11. Dealing with home improvement contractors.
12. How to finance home improvements.

Everything is covered in down-to-earth non-technical language with the essential goal being to improve your home.



### Should you be remodeling or moving?

This is the first question you should ask yourself before you start tearing down walls or ripping out ceilings. As Mr. Watkins explains it, your present home may have serious defects that make the kind of remodeling you're thinking of unfeasible. Yet in today's housing market, remodeling may be a more economically sound move than moving.

### Beware of overimproving your house.

One of the biggest mistakes you can make is putting more money into your house than you'll ever get out. For example, a \$15,000 kitchen is really inappropriate for a \$30,000 house. And here's something you might not know—a backyard swimming pool could be the chanciest investment of all. But if you're thinking of putting in air conditioning you're thinking right. Air conditioning almost always returns top-dollar value.

### What are the latest building materials?

If you're thinking about redoing the outside of your house in, say, quaint cedar shakes or Early American "clapboard", what's the best wood to buy? Well according to Mr. Watkins, wood shouldn't be used at all. There are vinyl sidings that not only look better than wood, but are better. Vinyl siding never needs painting. It won't show scratches. And termites hate it.

### Where's the best place to get the money for remodeling?

Maybe it's not the bank. Maybe you belong to a credit union that makes home improvement loans for its members. Or maybe you can get your loan financed against your passbook savings (this is the cheapest of all).

Or you might refinance your mortgage at the same interest rate as before and pay the higher current rate only on the remodeling money.

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## HOW TO FIND THE BEST SPOT FOR YOUR CAR'S CB

(Continued from page 90)

build your own roof-mounted console (as the owner of the van pictured on page 89 did), you can buy ready-made mounts. But be sure the mike cord doesn't dangle in the driver's line of sight or jiggle distractingly in the corner of his eye. And since a sharp-cornered radio can be a hazard in a crash, make sure it's above head level and that everyone's well belted in.

**Another roof-mount technique** is to hang the set from a van's roof right behind the front seats. This makes the controls more accessible to the driver than hanging it from the back of his seat, but still means that he'll have to tune by touch—or turn away from the road to find his channel. And with controls facing forward, the rear passengers have no access to them.

### Dashboard mounting best

The dashboard is the best and most common mounting point. Here, the radio can be visible and accessible to both driver and front-seat passenger, there is easy access to 12-volt power and the connections can be inconspicuous.

A few CB sets, mostly combinations that include commercial broadcast radio and/or tape, fit in the dash, like factory-installed car radios. The location is convenient, and an in-dash set is hard to steal; but it's hardest to install, too.

Atop the dash is where the tuning dial is easiest to read and the controls are often nearest at hand. But a radio here can also block the driver's view ahead, or cause head injuries in an accident. And holes that are cut into the top of its dashboard may reduce a car's resale value. Also, since the speakers are located at the bottom of most CB-set cabinets, an on-dash mounting may muffle the sound somewhat.

So most sets are slung beneath the dash, using the brackets that come with them. For increased rip-off protection, you can substitute a locking bracket (make sure the lock is hefty and the bracket's mountings strong and solid) or a slip-on bracket that lets you remove the set without having to undo all its connections individually.

### How to hang it

If, for some reason, there's no room beneath the dash, you can bolt your set to the top of the tunnel hump. Use a bracket that positions the set as high as possible for easier control access and to keep the carpeting from muffling the speaker.

Whatever bracket you use, and wherever you place it, it's a perfect template for locating and drilling your mounting holes. Hold it in its planned location and mark at least two holes for drilling. (You may find at least one existing hole that you can use.) Then use sheet-metal screws to fasten the bracket tightly to the bottom of the dash.

Connect your set's power line to a handy 12-volt source (see page 90 for tips) and snake the coaxial cable lead-in from the antenna to the radio or vice versa, depending on which end of the wire has the thinner plug (*How to add the right ears to your wheels*, page 86, March '76). If your antenna is trunk-mounted, or attached to your car's rear bumper, the cable can be fed through the trunk, beneath the rear seat, under carpeting, beneath the sill plate in the door opening, and back of a front kick panel to the area behind the dashboard near the radio (page 122, September '73).

Antennas mounted in the front cowl or fender have shorter cables that can be passed through the firewall directly into the dash area.

Make sure the plug at the radio end of the antenna cable matches the radio's antenna socket. If not, you can cut off the old plug (as close to the cable's end as possible) and mount a new one; but since coax connectors are no fun to install, you may prefer to buy a ready-made cable with connectors attached if your antenna's cable is removable.

When all connections have been made, and the bracket mounted, you're ready for the last two steps. Stick on your radio the FCC-required Transmitter Identification Card (FCC form 452-C, usually supplied with your radio) with your name, address and call sign.

You may also wish to engrave your driver's license number and state inside the cabinet, to help you recover your set should it be stolen. (Social Security numbers aren't as good, since federal privacy laws make them harder to trace.)

The other necessary step is to mount the microphone hanger. Most radios are supplied with hangers that are designed to be screwed to the dash or the radio's bracket (which may have pre-tapped holes to hold it in place).

Dealers also sell adhesive-mount and magnetic-mount hangers. Magnetic holders permit moving the microphone around for convenience, but may pop off if the car jerks or is bumped. ★★★

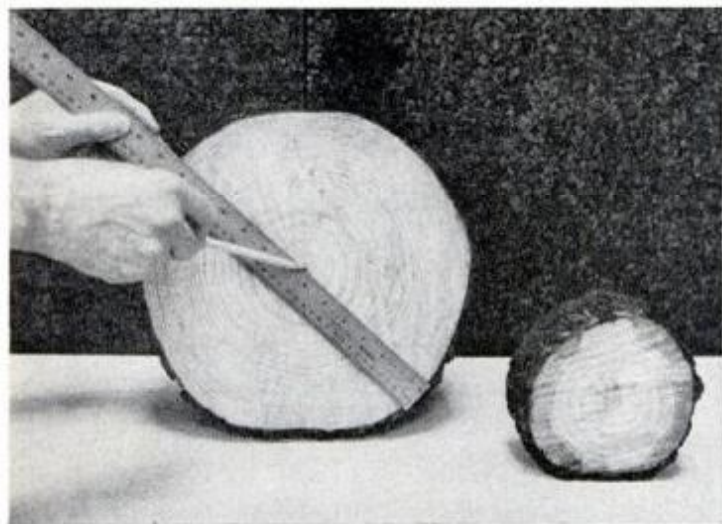
# Supertrees: More wood for an energy- hungry world

Forestry researchers are racing the clock to protect and increase our only renewable natural resource—and are coming up with some surprising discoveries about trees.

by Andrew H. Malcolm



**Meticulous care** is key to cultivation of supertrees. Here a Georgia-Pacific forester covers each individual blossom of a Southern pine with plastic bag to prevent fertilization by inferior pollen. Later, blossoms will be hand-fertilized with superior pollen using a hypodermic syringe to pierce the protective bags. Such elaborate techniques help to preserve purity of forest growth, resulting in bigger, better trees.



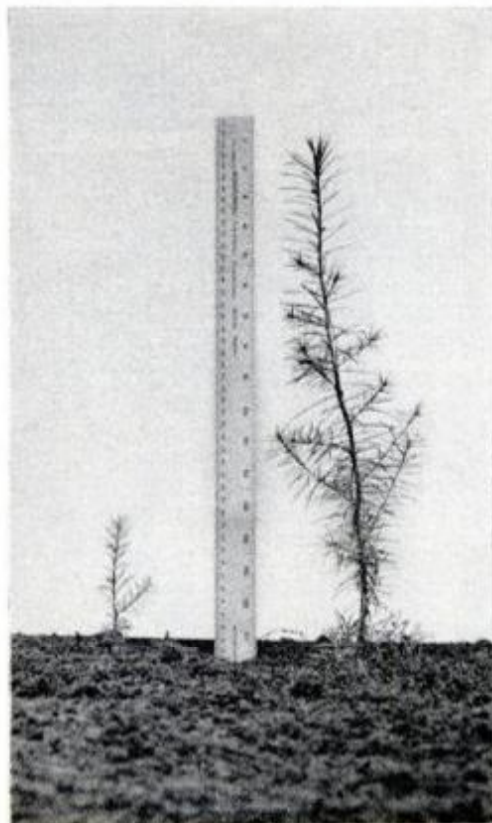
## Dramatic evidence

of what careful forest development can do: Above, two tree slices were taken from trees both 27 years old.

Slice at left, from tree grown under controlled conditions, is over 12 inches across.

Slice at right, from naturally grown tree, is only 5¾ inches across.

At right are two seedlings, both one year old. Natural one (left) is 4 inches tall; "pampered" one (right) is nearly 18 inches tall.



Photos:  
Georgia-Pacific

**S**cientists with computers, foresters in hard hats. Chemists in white coats and lumberjacks with giant machines are quietly bringing about a major scientific and technological revolution in our nation's woodlands, those vast, green areas that slowly produce man's only renewable natural resource—wood.

Most dramatically, these developments include chemical experiments leading to the growth of living trees in test tubes. These trees, produced without seeds, would carry the finest genetic characteristics of their single parents and would be ready for harvest decades sooner and inches larger than today's trees.

Other trees are being crossbred to produce hybrid strains of timber that mature faster, grow straighter and taller, reject harmful bugs, prune themselves over the years and make strong lumber for construction workers and do-it-yourselfers alike.

## 'Supertrees'—a new word

Already a new word has entered our language—"supertree"—a tree cultivated under controlled conditions so greatly superior to its naturally grown cousin that it can produce up to five times more timber in the same period. Using such techniques as artificial fertilization, grafting and periodic forest thinning, tree researchers can increase the yield from our woodlands to an extent never before dreamed possible. In these days of declining energy sources, this is of critical significance since the list of potential uses of wood products in new fuels and materials is almost limitless. The day may come when wood is as important as—or more important than—oil and gas.

To produce this revolution requires sweeping changes in forest technology. Giant Paul Bunyanesque machines

(Please turn to page 240)



**Fertilizing by air** speeds process of promoting good forest growth, is one of latest techniques in advanced tree culture. At top, a chopper leaves a swirling white trail as it spreads growth-giving nutrient over young forest at treetop level. Lower photo shows large spreader hopper slung below helicopter that holds and releases 3500 pounds of fertilizer per load.

**SUPERTREES** *(Continued from page 239)*

now roam the woods, snipping off 40-foot trees at ground level and passing them through portable pulpers in nine seconds. Now they are even studying the harvesting of roots, allowed to rot and go to waste in the past. Sawmill operators use computerized TV screens to diagram the most efficient cuts for radically thinner saw blades that save cutting waste. Helicopter pilots, some of them Vietnam veterans, fly a different kind of mission now, methodically spreading fertilized tree seeds from the air, artificially colored to fool hungry birds.

**The growing need for wood**

Vast forests, some of them larger than many entire states, are being systematically fertilized, thinned and cultivated as carefully as food farms. The results mean that wood and its products will play an increasingly vital—perhaps radically different—role in our lives, especially as the world's limited supply of other natural resources dwindles.

Already, we live inside wood—80 percent of America's homes are built with it. We breathe trees' major waste product, oxygen. We eat some wood products, including artificial vanilla. We wear wood products in rayon and facial makeup. We blast with wood products in dynamite.

We live on wood derivatives in blood plasma. We take pictures with wood products in film. We make electricity by burning leftover wood. And we transmit that power through cables made in part of wood products.

In France one inventor has built—and routinely drives—a car fueled by wood fibers in alcohol. Methanol, a synthetic fuel that helped power Nazi and Japanese fighting machines during the gasoline-short days toward the end of World War II, could be a vital answer to the coming petroleum crunch. More commonly known as wood alcohol, it can be produced from wood, wood waste products, even trash, and used as fuel in any of the three major energy-consumption areas of transportation, space heating and electrical power. With only minor carburetor adjustments, it can be burned in conventional car engines instead of gasoline. It can replace diesel fuel in electric generating plants. And for use in oil-fired home furnaces, all that's needed is to replace the burner nozzle.

**King of the wood world**

The giant plastics industry, now dependent on costly, dwindling petroleum, could also be revolutionized by wood. Since wood and petroleum products have similar chemical formulas, scientists say the potential exists for

*(Please turn to page 242)*



**Twin photos** taken from exactly the same point show how fast old timberlands can be reclaimed under modern rehabilitation programs. Upper view: A barren, burned-out section of Oregon forest area before Georgia-Pacific began replanting it with Douglas fir in 1958 to 1960. Lower view: Lush growth as it looks today with some trees ready for harvesting in 15 years.





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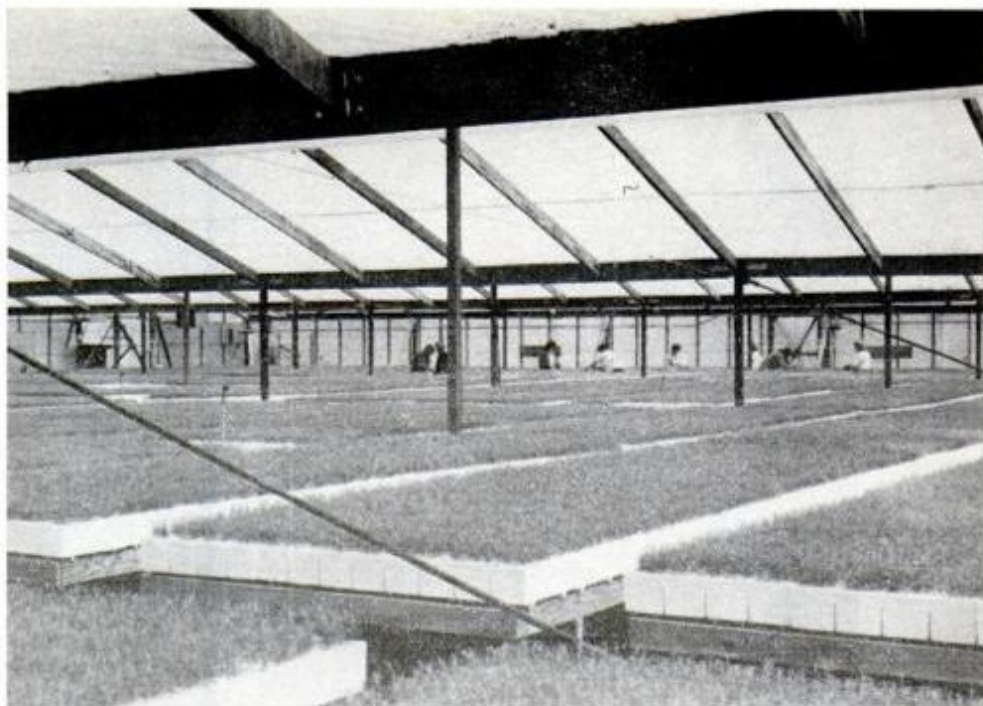
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A forest in the making, this is part of Georgia-Pacific's 4-million-seedling greenhouse in Oregon. The healthy, hardy "superseedlings" are grown in Styrofoam blocks to prevent soil contamination, will be ready for forest planting at the age of six months.

## SUPERTREES (Continued from page 240)

the mass production of plastics from wood, which could eliminate the need for oil.

With more than 753 million acres of forest lands, about a third of which are set aside as parks and wilderness areas, the United States is, in effect, the Saudi Arabia of the wood world. Its green riches are so abundant, in fact, that the United States has enough trees to cover every inch of Italy, France, Spain, Japan, Jordan, Portugal, Belgium, the Netherlands, Denmark, Great Britain, both Germanys, Austria, Israel and Algeria—with a considerable amount left over.

## Plundered in the past

In the past these woodlands were often thoughtlessly plundered by profit-minded wood companies and careless free-lance operators who gave our language such colorful expressions as "cut and run" and "skid road," later corrupted to "skid row." But now a number of factors, including rising land and lumber prices and longer-range planning, have combined to focus attention on improving and maximizing land and timber use. "Nature does a first-class job of growing trees," says W.D. Hagenstein of Portland, Oregon's Industrial Forestry Assn., "but she's awfully wasteful and time-consuming. And with an earthful of people we have to do better."

And so latter-day lumber pioneers like Hagenstein are creating large tree farms to promote replanting.

They are engaged in costly experiments to develop hybrid tree seeds. And, most recently, they have begun the delicate "genetic improvement" of trees. It is an intricate process already underway with other vegetation such as sugarcane, soybeans, barley, carrots, high-yield rice and other growths that mature in months. But trees take years.

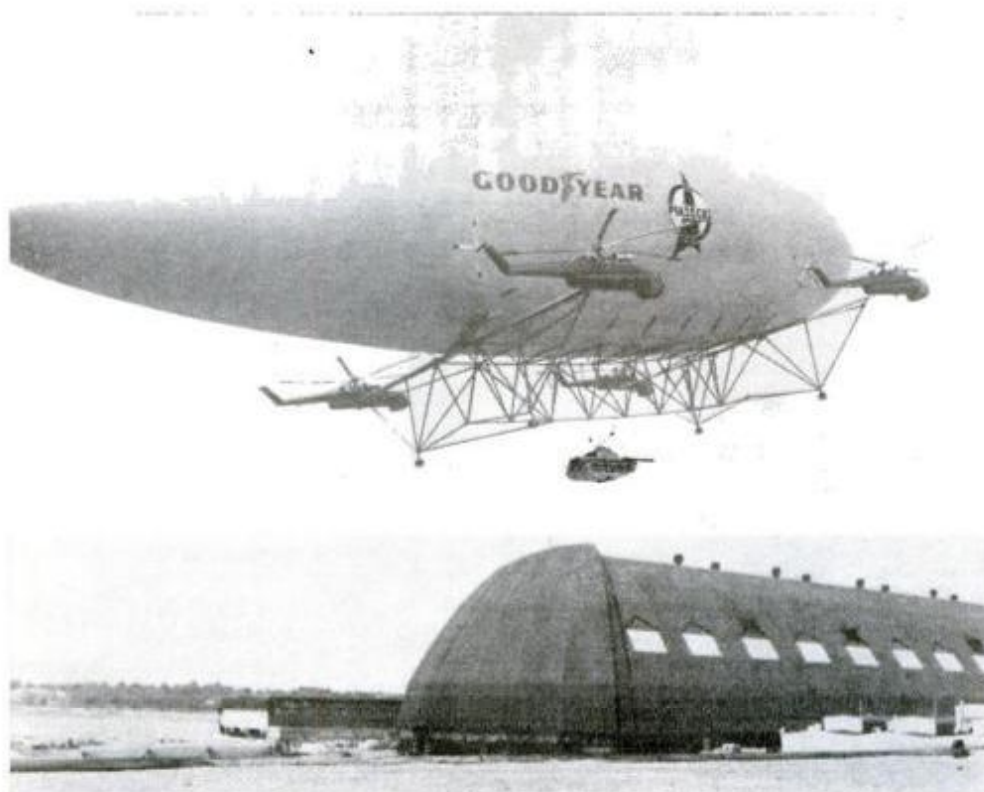
The goal is to develop the perfect commercial tree—tall, strong, fast-growing, insect and disease-resistant, free of many knotholes and able to live well over a wide area. To accomplish this, scientists are exploring "test tube trees." A number of research projects are underway across the country. But basically, laboratory technicians are trying to grow superior trees without the time-consuming and uncertain natural sequence involving seeds and pollination.

## Search for the perfect tree

The procedure is based on a biological theory that every living cell has locked within itself the genetic instructions and potential to regenerate the entire larger organism of which it is a part. The trick is to provide the right environment for the cell—a combination of heat, light, humidity, nourishment and other possibly as yet unknown factors. Once the right natural "key" has been found to unlock that cell, the organism's messenger molecules, such as hormones, will order the regeneration not only of similar cells but of

(Please turn to page 244)

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### Skyhook for heavyweights

Helicopters are great for sky-lifting transmission towers to inaccessible mountains, or elevating airconditioning units and TV antennas to the tops of skyscrapers. But when it comes to hoisting 62-ton tanks and similar heavy military or commercial equipment skyward, even the best of them lack power for the job. To solve this problem, a unique concept was proposed by Frank Piasecki of Piasecki Aircraft Corp. and the Goodyear Aerospace Corp. The companies have now joined forces to develop a rig they call a "Heli-Stat." It involves a blimp with an intricate undercarriage to which four helicopters are attached. The structural weight of the helicopters would be offset by the lighter-than-air blimp so that all of their thrust could be put to use lifting and moving payloads beyond the capacity of any present highway, rail or airborne equipment. The blimp, filled with 3 million cu. ft. of helium, would be hitched to four Sikorsky CH-54B military choppers, and would cost \$15 million without the helicopters. Oil companies, heavy-equipment manufacturers and construction firms also are interested in the gadget.

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## SUPERTREES

(Continued from page 242)

dissimilar cells to form wood, bark, leaves, roots and so forth.

Thus, once the techniques are fully mastered, scientists will be able to take cells from a fine tree specimen and produce under controlled conditions virtually any number of offspring genetically identical to the lone parent, all in a matter of days. The tiny trees, wired like hospital patients to measure their vital signs, grow in glass domes under special lights while scientists in smocks hover overhead like consulting physicians.



Grafting speeds tree growth by attaching mature, seed-producing tree tips to young, healthy tree bottoms. First step is to slit bottom stem to receive graft (above).

Presently, once a superior tree is found, foresters must wait years before the plant matures and produces enough seeds to get a sufficient number of offspring for planting. Even then, the seeds, formed by pollination from another possibly inferior tree, would not all contain the same desirable characteristics.

### The race to catch up

"It doesn't take much imagination to picture the dramatic changes in production and physical appearance of trees in the years to come," says Dr. Doyle Daves, chemistry department chairman at the Oregon Graduate Center. "In terms of domestication for timber, trees are at the stage that corn, wheat or rice were 10,000 years ago."

Such technology, well underway already, eventually will permit mass-production of superior trees, which



To complete graft, tree tip is inserted in split bottom stem and temporarily tied on until two grow together. Result: Baby tree becomes an almost instant grownup.

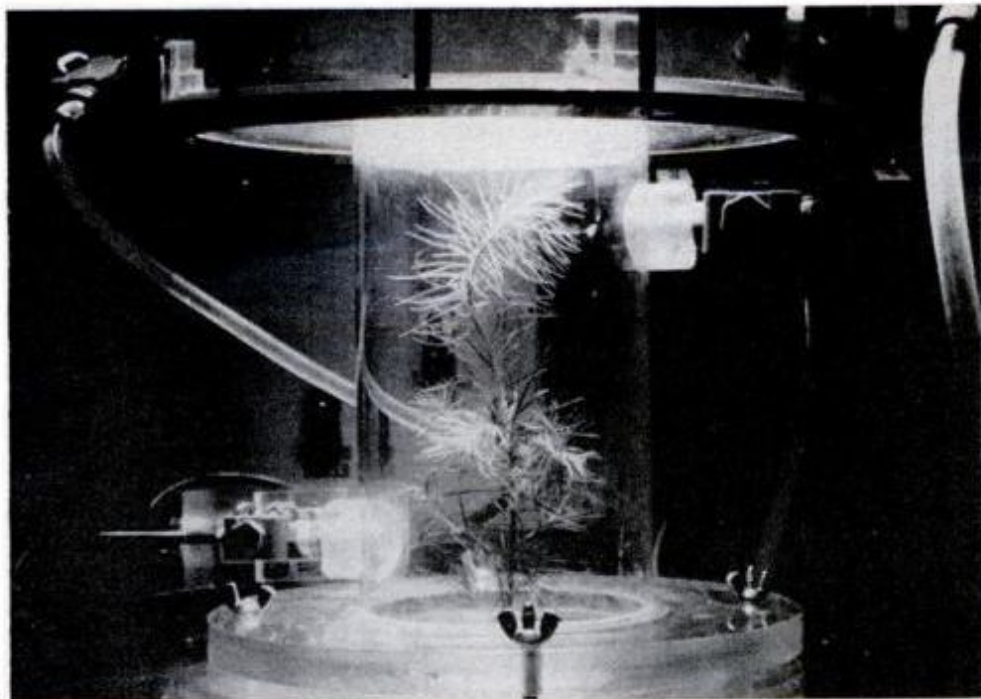
Photos: June Malcolm



Wired to a computer, this tree in a Weyerhaeuser test plot tells scientists how fast it grows. Bands around trunk detect tiniest amount of growth every half hour.

when grown under progressive forestry methods like thinning and fertilizing, will produce more and better wood in perhaps 20 percent less time. This means an extra tree harvest every five forest generations—a substantial saving in a nation increasingly sensing the pinch of limited space for development.

Foresters also seek the same goal through new tree-breeding programs. Here, the cone-producing tops of 50-



Housed in plastic cylinder, an infant Douglas fir seedling is tested for its photosynthetic efficiency at a Weyerhaeuser research lab. If it passes with high marks, seeds from its parents will be cultivated to genetically improve next generation of trees.

year-old, well-formed Douglas firs are grafted onto the vibrant bottoms of two-year-old trees. Using computers to monitor each growth's life history, researchers cover the cones of each tree with small plastic bags to permit controlled pollination. Hypodermic needles are stuck through the bags to fertilize the cones with the pollen from trees with other desirable qualities. Hopefully, the seeds will carry forth the best genetic traits of its parents, without contamination from undesirable pollination.

### Growing greenhouse trees

These fertilized seeds are meticulously planted by machines in sterile granite chips (to prevent fungi and rot) in holes drilled in white Styrofoam blocks. The blocks rest on tables in giant greenhouses where fans automatically draw in fresh air and thermometers monitor heat levels. Ceiling sprinklers douse the blocks regularly with fertilized water.

Within days, millions of tiny, green shoots spring from the holes. Such infants in four decades will each produce enough lumber to build half a house. However, most will first spend six months to several years in the greenhouse, gradually being toughened for their lives in the wild world where they will be planted by a new gun that digs a hole, deposits the treelet and tamps down the dirt.

But scientists seeking their "new improved brand" of tree have already got a good product in hand. For eons nature has developed some impressive methods of her own to improve and perpetuate her trees. For example,

the redwood, the dinosaur of the tree world, will live to become a picnic table or whatever, in part because its fibrous bark resists all but the most severe fires. When one redwood is cut down, its roots will sprout half a dozen new trees.

### Trees defend themselves

Somehow, healthy trees thinned out by forest fires are instructed to overproduce seeds temporarily until the bare areas are filled in. Some seeds, in fact, won't even sprout until exposed to intense heat such as that of a forest fire—to insure new growth.

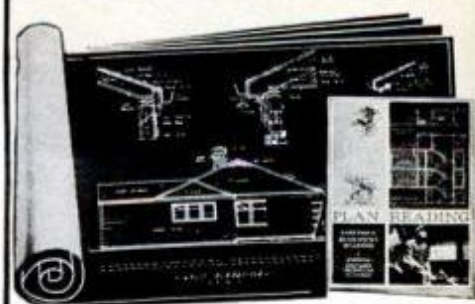
As a defense mechanism, when an insect penetrates the bark of some species, it touches off an alarm system that sends pitch rushing to the puncture. The pitch drowns the intruder and covers the wound like a natural bandage until it can heal.

One of the more interesting and aggressive tree species is the Douglas fir (named for David Douglas, a British botanist). If the top is blown off a healthy Douglas fir, the highest branches will turn upward and compete to become the new top until the strongest branch wins.

To refresh itself—and incidentally add to the forest floor's soil—every seven years the Douglas fir replaces half its needles, which have evolved to shed the heavy mountain snows that can snap other trees.

But nature's genius and man's genius (some would call it meddling) can clash at times. To prevent crossbreeding, some tree species make the receptivity of their female parts not

(Please turn to page 246)



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## SUPERTREES

(Continued from page 245)

they will not coincide with the male readiness of other species.

### Nature's traps

And nature has laid some potentially disastrous traps for human scientists seeking to manipulate the genetics of trees. For instance, what happens if the new hybrids carry within themselves some as yet unknown genetic weakness, a form of biological time bomb which in, say, two decades would see vast forests fall victim to disease or insects with potentially catastrophic economic repercussions?

When a similar problem struck hybrid corn crops in 1971, the exotic fungus cut harvests so drastically the bushel price jumped from \$1.05 to \$1.40. A blight-resistant strain of corn was developed months later. Such countermeasures for trees would take years.

But foresters and lumberjacks are not just creating a revolution for future woodlands. Even those trees harvested today are put to fuller use more efficiently than in the past. "We use everything from a tree except the wind in the boughs," said one foreman.

### Starting 'natural wars'

Researchers are investigating biological controls to determine which harmless insects and bacteria are the natural enemies of harmful insects and bacteria. Their hope is to set off "natural wars" to decimate the populations of insects that, according to some estimates, destroy much more timber than does fire.

Sawmills now can—and do—take a log four-fifths rotten and turn it into some usable lumber. New equipment enables plywood manufacturers to utilize smaller logs, previously discarded. This also conserves larger logs for other uses.

### Wasting nothing

Rotten wood, bark, sawdust and other natural refuse are then burned to provide the plant's heat and power (sometimes for neighboring communities as well), while some waste is pressed into fireplace logs. And at least one company is experimenting with a new device that digs up tree stumps, previously left to decay, and turns their fibers into usable wood pulp for paper.

As one forestry expert put it: "There are an incredible number of new things happening to a tree between the moment it is conceived and the moment somebody blows his nose on it." ★ ★ ★

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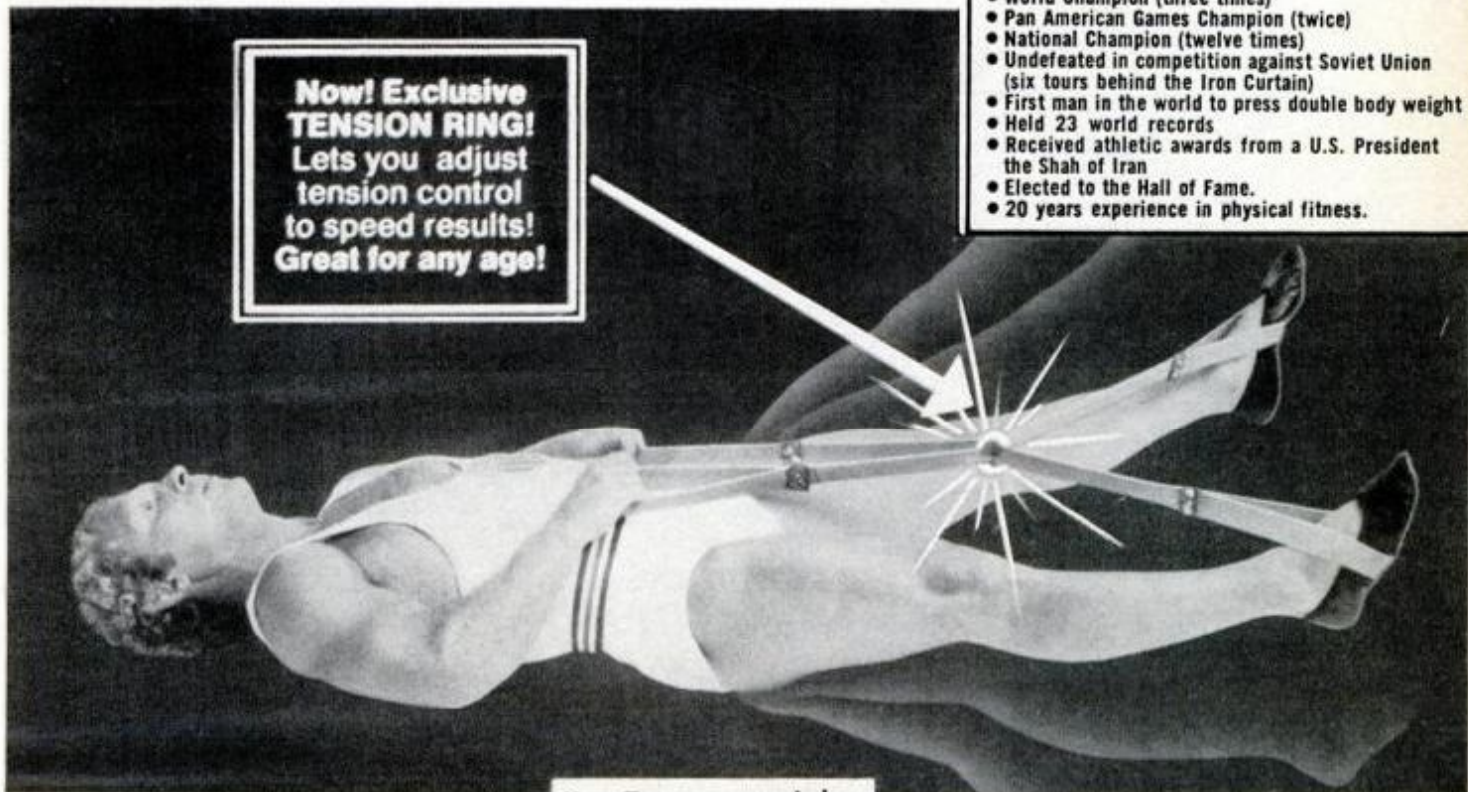
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## Ike Berger explains What is Synometrics?

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## The Science of SYNOMETRICS

I later learned the scientific reason for this amazing result. It's called **SYNERGISM**—meaning that when you combine two methods the result is greater than the both of them separately. I now called my new discovery **SYNOMETRICS** and developed a special exercise unit I call the **SPEED SHAPER**. And that's just what it is... a speed method to give you results in minutes, NOT hours! Now... build yourself a "fantastic looking body" with the incredible **SYNOMETRICS**—the invention that works on the exciting new scientific concept of **ISOTONIC + ISOMETRIC**.

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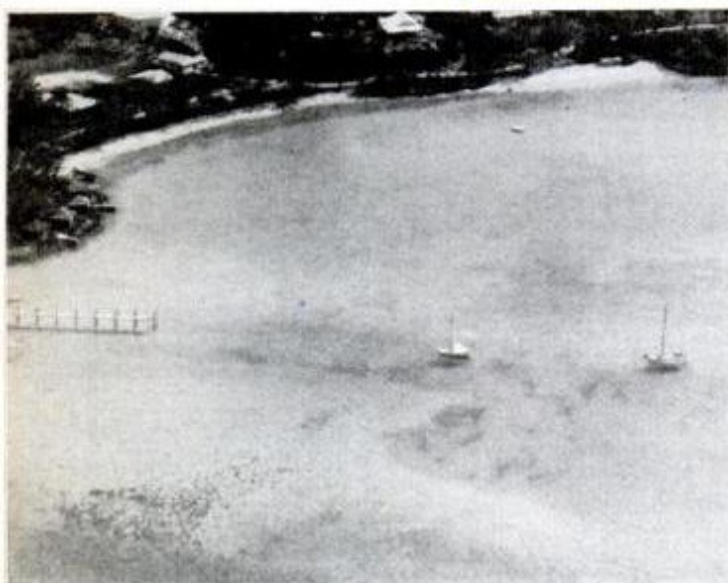
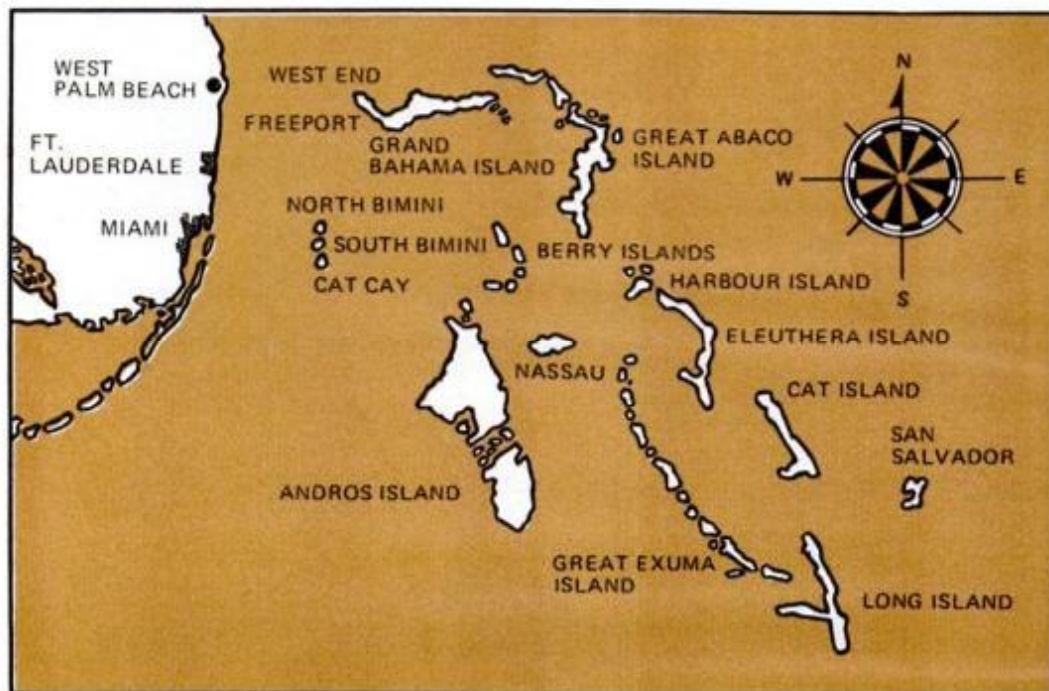


# The Bahamas: Beachcombing paradise for flying explorers

For unique thrills, take a plane over palm-studded cays and spot game-fish reefs, resorts, deep-sea denizens in their ocean habitat.

by Page Shamburger

**Tidy little plane** like the Piper Archer (above) used by the author, is just about the right size for exploring the 760-mile-long Bahama Banks. The chain comprises some 700 islands and more than 2000 cays (pronounced "keys") and rocks. Major islands, shown on the map (right) have airstrips to accommodate adventurous air explorers. Resorts on the palm-fringed isles cater to fishermen, snorkelers, scuba divers, treasure hunters and airborne travelers. Exploring the banks by air provides a rare opportunity to see sunken galleons, coral heads and schools of fish and marine life. The water is so clear that boats at anchor seem to float in mid-air (below) off a small Exuma cay.



**R**ecently a fellow told a group of yarn-spinners at a local party how he'd ridden the flight deck of a Pan American air freighter over the Caribbean on the way back from a South American run.

"Suddenly," he said, "the pilot dropped a wing and swung down a few thousand feet. 'Look at that manta,' he yelled. 'It has to run 25 to 30 feet wingtip to wingtip.' Sure enough, there was the monster dead ahead, flapping like some prehistoric thing along the sandy bottom in probably 20 fathoms. None of us had seen a ray that size, ever—but there it was. For a few minutes we got ourselves a good look through the incredible water. From the air, that sea is a vast, crystal-clear window on another world."

## Fabulous views from the air

I can't vouch for a 30-foot manta ray—that would be rare, indeed—but I can vouch for the gentleman's observations about the fascinating view from the air over the Caribbean and, especially, the territory that I like best to fly friends over: the Great Bahama Bank. If you've never taken a hop over that water—preferably in a low-flying small plane of your own or in one for hire with a pilot who knows the area—you've got a real adventure ahead of you.

Skirting those palm-fringed cays, their reefs and shoals bathed in iridescent light ranging from pale





**Rugged Exuma Cays**, least populated places in the Bahamas, have rocky eastern shores that toss spray high in Atlantic storms, and tranquil coves and beaches on west side.



**Polynesian cottages** and catamarans are for rent on larger cays, like Norman's (above) with long beaches of coral sand on its west shore. Norman's Cay also has an airstrip.

turquoise to royal blue—depending on depth—I can show you a sunken Civil War locomotive, Spanish galleons, sting rays and the whole "Jaws" family of sharks. All these things lie along the bottom on the Bahama Banks and are ideally viewed from the air.

Island-hopping through the 760-mile length of the Bahamas Archipelago, barely 50 miles off Florida's coast, is without question one of the most spectacular flying experiences available.

#### Requirements are simple

What's on the bottom, fathoms down in the crystal-clear water, is fascinating enough. But what's on top—the many faceted individual

islands and cays—is even more intriguing.

For anyone with his own plane, official requirements are painless. Canadians and Americans need no passports; a pilot's or driver's license is enough. Outbound, pilots must file flight plans with estimates of their penetration of ADIZ, a defense zone. The plane must have two-way radio and carry a minimum of survival equipment—a life vest for each person on board. Check your pilot on these items if you hire a plane. They're important. Liferrafts are comforting if there's space, but are not mandatory. Most pilots don't bother with them. If you're buying the ride, there are no other concerns

(Please turn to page 250)

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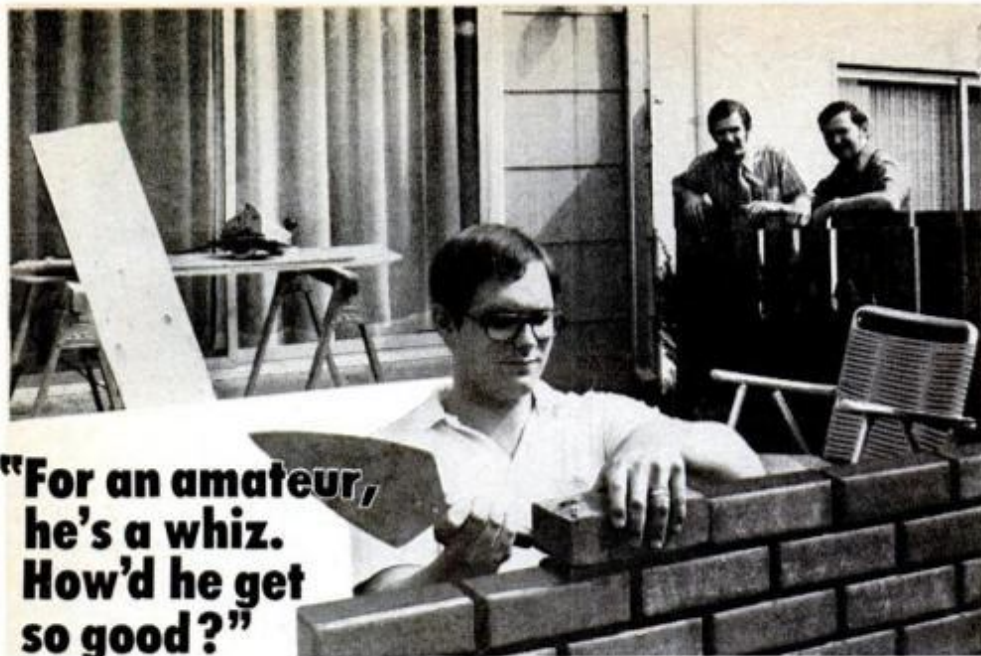
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**BAHAMAS**

(Continued from page 249)

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Paperwork for pilots is simple. Florida operators have general declaration forms and can help fill in the first three that must be turned in at the first port-of-entry airport in the Bahamas. The fourth is a manifest for flying between all the islands. It's really an interisland pass and is handed in at the last Bahamas port-of-entry airport on return.

**Choose your route**

That's it. From the northern gateway, Palm Beach, the nearest landfall is 60 miles away, Grand Bahama Island. If you prefer to head for the southern islands first, then leave from Miami or Fort Lauderdale and shoot for Bimini. Both islands have Omni stations and port-of-entry facilities. Grand Bahama's "West End" and Freeport airports have fuel; Bimini is questionable.

Make the trip in good weather. It's the only time to go—particularly if you're a first-time over-water pilot. Land, either in front or behind, is in sight the whole time except for about four minutes.

Maps are available: ONC-25, WACs and Jeppesen's Miami/Nassau Area are okay. Handout maps from the Bahamas Ministry of Tourism aren't to scale, but are more current on facilities.

**Good sights, lively action**

Some islands should be seen together. Bimini, Grand Bahama and New Providence (Nassau), for instance. "Foreign land" flavor of the islands is evident in other-side-of-the-road driving, bright-colored houses, tropical flowers and breathtaking skies. Bimini is a game-fishing center. Freeport has a casino with legal gambling. Nassau is filled with night-life action. If you go to the Bahamas to see Bahamians, be forewarned that these three spots offer more Americans than natives.

Other "Out Islands," however, are individual, largely uninhabited and stretch through the sea almost to Cuba. Andros is largest (1600 square miles) and heavily forested, it's famed for big-game fishing. Many records have been set in the "Tongue of the Ocean" east of Andros—a

famous deep haven for big marlin.

### A fishing paradise

Up in the bights, bonefishing and tarpon catches are unexcelled. Guides, boats and accommodations are available near all airports and on the eastern shore. Several port-of-entry airports are within range with no charge for "normal day" customs or landings.

Off the northeast tip of Andros are several small islands and cays called the Berry Islands. Two airports serve resorts, catering mostly to fishermen and water sports. Great Harbour Club (use Great Harbour Airport) has an excellent golf course.

Southeast of Andros are the Exumas, a chain of rugged cays 90 miles long. For best "flight-seeing," plan your Exumas trip after 11:00 a.m. when the sun will be at your back. Polaroid glasses help cut glare.

Weather is sunny most of the year in the Bahamas. Average temperature is 77° F. Tropical showers come up quickly, but go quickly and are easy to circumnavigate.

The Exumas have three public airports: Norman's Cay, serving the cay's own resort; Staniel Cay, midway down the chain; and George Town, largest, with dependable fuel supplies.

Exumas settlements are few. The crystal water ranges brilliantly from pale green to deep mauve. Most cays have a magnificent beach on the west side and caves eroded on the rocky eastern side. Some cays, only a few dozen feet wide, nearly vanish in the fury of Atlantic storms that toss spray high on the windward (east) side, while shallows and coves on the leeward are tranquil and calm.

### Colorful caves and coral

Since the Exumas are water-oriented they are the natural location for the Out Island Regatta. They also boast spectacular underwater caves with an astounding array of color in the coral formations and in tropical fish. Many cays are informal hosts to sportsmen for trolling, bottom fishing, spear fishing, scuba diving and snorkeling. George Town has the most beautiful harbor in the Bahamas—goats roaming loose and delightful places to stay. Prices aren't low. Everything comes in by air or water. Butter, for instance, is from Denmark.

Eastward lie Long, Cat and tiny San Salvador where Columbus first came ashore in the New World. All three islands are underdeveloped (so far) and have excellent resorts—rustic and charming with sufficient airstrips nearby. Most of the known sunken ships are in this area.

Treasure hunters abound. Hundreds of known galleons carrying gold bullion have yet to be found, and up the creeks and inlets pirates *did* bury loot.

North of Cat Island is Eleuthera, the most developed Out Island with the latest in luxury resorts, golf courses, tennis courts and other facilities. Airborne visitors are welcomed to Eleuthera's charms at three good airports: Cape Eleuthera, Rock Sound and—on North Eleuthera—an airport and STOL port. Off the northern tip, accessible by water taxi, are Harbour Island and Spanish Wells, locales of the true pink coral beaches.

### Locomotive that sank

That locomotive? When the sun's right, you can see it just off Spanish Wells. During the Civil War, a blockade runner was towing the engine to the South by barge when a big squall hit. Engine and barge both went down. It can't be recovered, according to Smithsonian experts, because salt accumulation is so dense that once it hit the air it would be destroyed. It's for fliers and divers.

North of Eleuthera is Abaco. Most of the populated area is in mid-island. It has two good airports, Marsh Harbour and Treasure Cay. Resorts are plentiful in the central area, with some dandies at Hope Town, an island reached by boat taxi or ferry.

From Abaco, you'll head west across Grand Bahama and back to Florida by way of Palm Beach. In all, the Bahamas have some 50 airports, though about 20 are military or private. Prior permission is needed to land at these. Practically every airport has a homing beacon. The magic VHF frequency is 124.2, Nassau. It is remoted all through the Out Islands and can be heard at 2000 feet almost everywhere. Fuel is expensive—about 90 cents a gallon. Wise pilots fill up when they can—and keep their tanks filled. Most light-plane accidents in this region have come from running out of gas.

Tie-down stakes don't hold in the loose rocky soil. Take chocks or use coral rocks as anchors. Some airstrips have potholes. You learn to dodge them on takeoff and landing. They're deep enough to flatten tires and nick props. The only maintenance facility is in Nassau.

### Island 'party line'

Unicom is the party line of the Bahamas. The ground set usually is in a clubhouse; airports are unattended. Unicom is used for everything from getting traffic alerts to reporting emergencies. ★ ★ ★

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## ADDING LIGHT AND SPACE WITH DORMERS (Continued from page 111)

rafters so they'll extend at least 3 or 4 feet beyond the top and bottom of the hole. Then saw the roof boards along the inside of the doubled rafters, and across the top and bottom of the marked opening. The trimmed boards above and below will support the cut rafters until you can spike double headers. Note that the opening should extend one roof-board width past the marked-out area at top and bottom.

The lower edge of the upper double header should be located at ceiling height. The bottom header members have their top edges set flush, at a height that will put the sill 28 to 30 in. above the floor.

Whenever possible, the side walls of the dormer should be erected over the doubled rafter—on sole plates nailed through the roof boards and into rafters below, using 20-penny (20d) nails. Build the front frame first and nail it in place, bracing it plumb until the rafter plates (cut by direct measurement back to the roof) are in position. Then add the side studs, spacing them 16 in. o.c., driving 16d nails down into them through the rafter plates, and toenailing their lower end to the sole plate with 10d nails.

Next, cut out one end of a 1x6 ridge board to match the roof slope, leaving it overlong; level it by tacking it to a temporary prop standing on the header above the sash opening. Now, lay out and cut a master rafter and use this as a cutting pattern for all dormer rafters except the valley jacks.

Since spans are short in dormer construction, light framing stock is often selected. It isn't unusual for dormers to be framed with 2x4s (or even 2x3s) in roofs with existing rafters of 2x8s or 2x10s.

Nail the rafters in place with 10d nails, starting from the outer end; then trim the ridge board flush with the outer rafters. A shed-type dormer, such as the gambrel shown, avoids all ridge-board fitting. It is used where headroom is the major concern.

The rough window opening is centered in the front frame and should be 4 1/4 in. wider than the sash unit you select. Whether the trimmer studs are single or double depends on their proximity to the corner posts. When they're close, as in three of the framing details on page 111, double trimmers aren't needed. The fourth detail shows a flush-with-wall dormer where the corner posts are merely nailed to existing studs to extend a section of the wall upward; in this case, the rough framing of

the window calls for double trimmers.

## How a cornice turns corners

The front cornice construction depends on which type of side cornice you choose. In any case, the roof boards run only to the inside face of the front rafter, where they are nailed to a 2x2 cleat fastened along the upper inside edge of the rafter itself, to create the front overhang. In plain cornice construction, this overhang is braced by trim, but for the box type you extend the plancier (or soffit board) its own width beyond the front rafter so you can "turn the corner" with it, nailing the front plancier to a second cleat fastened along the lower front edge of the rafter. Though the sketches show the roof boards beveled flush with the side fascia or sheathing, they may project an inch or so if you prefer an overhang effect.

Before shingling, lay a 14-in. sheet-metal valley where dormer and house roof meet, bending it until it lies flat against both roofs (see sketches, page 110.) Snap chalk lines up the valley to indicate where shingles must be trimmed. The top corners are also snipped off to shed water toward the valley. To avoid nailing through the valley, anchor the diagonally cut edges of the shingles with cement.

Where the dormer walls meet the roof, use step flashing, starting with a corner piece and working back each side, as shown in the bottom sketch, page 111. The side pieces should be 6 in. long, with the vertical flange extending at least 3 in. up under the siding and the other flange 4 in. out under the shingles. Don't nail the shingles through the flashing. The front strip rides on top of the shingles. ★★★

## Jugs say no to rust



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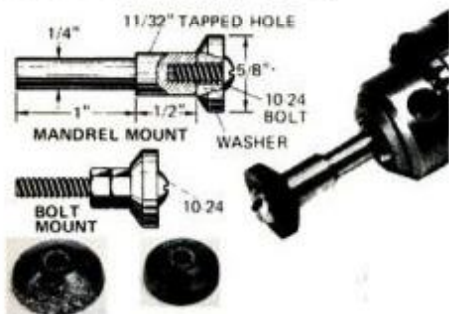
FROM READERS

## What goes where



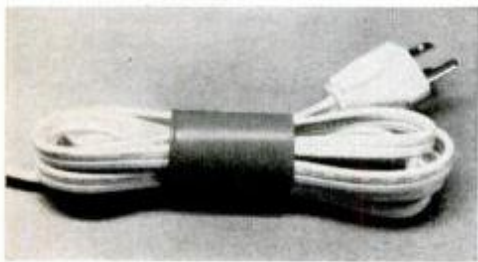
Stuck to mating parts and given a key number, small self-adhering labels can save time and errors when used to indicate the proper order of putting a project together. Labels are easily peeled off when done.

## Miniature polishing wheel



Mounted on a bolt or a turned mandrel (see detail) and chucked in your portable drill or drill press, a common rubber faucet washer makes a fine miniature polishing wheel for small work. In use, the polishing compound—in paste or soup form—is applied to the work and the rim of the rotating washer does the polishing.—Walter E. Burton

## Free cord caddy



The plastic sleeve from a 35-mm film container will keep an extension or appliance cord neatly folded when not in use. All it requires to make it a sleeve is to cut off the bottom with a utility knife.—Dan Googins

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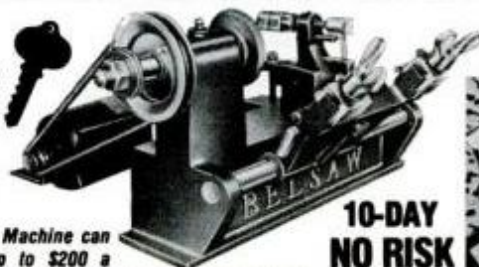
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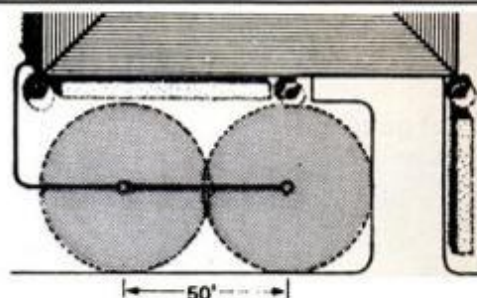
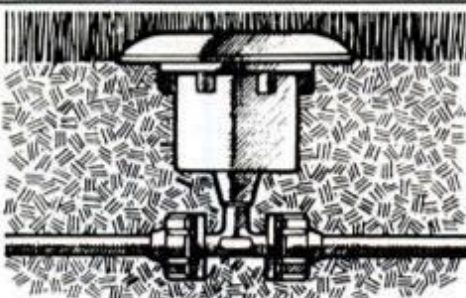
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**"HOW To Make \$5000.00 Per Month in your own Home Business."** Details Free. Harris, P.O. Box 106, Brooklyn, N.Y. 11207.

**AMAZINGLY INFORMATIVE NEWSLETTER REVEALS Best Business Situations, Home Opportunities, unusual Money Plans.** Details, stamped envelope, Jayem-BE, Box 485, Brooklyn, New York 11230.

**SELL Books By Mail.** Complete Drop-Ship Program, Everything Furnished. 70% Profit. Dealership-25¢. NORCO BOOKS, 5383A Carr, Dugway, Utah 84022.

**BOOKKEEPERS** Earn \$20.00 hour. Universal Bookkeeping, Box 664M, Springfield, Missouri 65801.

**STARTING MAILORDER?** Write me for free information first. Trosene, 5112 Curry Road, Pittsburgh, Pa. 15236.

**MAILORDER DEALERS Wanted!** Merchandise Dropshipped. Limited Offer. Free Details. Strategic, Box 3374AE, Evansville, IN 47732.

**EARN Extra Money in Your Spare Time Mailing Commission Circulars.** Rush Stamped Addressed Envelope For Free Details. Al, Box 224, Laval, Wis. 53941.

**EARN \$80.00 Daily Manufacturing Concrete Bricks-Tiles-Wooden Molds.** Send Stamp. Hilmar, Route One, Box 347-DH, Valrico, Florida 33594.

**MAILORDER Dealers Wanted.** Earn outstanding profits using tested promotions! Executive type business. Rutward—PG, Georgetown, CT 06829.

**UNIQUE Woodworking projects for spare time income.** Details \$1.00. Bradley House, Dept. P35, 157 Bradley Ave., Meriden, Connecticut 06450.

**\$250/THOUSAND STUFFING ENVELOPES. COMPLETE ASSISTANCE.** Rush Stamped Addressed Envelope. TZ Enterprises, Box 419, Youngstown, Ohio 44501.

**MONEY!** Very Little Effort. \$2.00 For Full Details, Refundable. Leu, 13531 Markdale, Norwalk, California 90650.

**\$50.00 \$1,000.00 Monthly possible.** Publisher needs Agents. Send Stamped Addressed envelope. C. D. Company, Box 1435, Slidell, Louisiana 70458.

**\$200.00 WEEKLY Possible mailing circulars.** PM2; 116 Fraternity, Lafayette, LA 70501.

**\$500 WEEKLY STUFFING ENVELOPES.** Rush 25¢ and Stamped Addressed Envelope. C. Brown, Box 51D, Tecumseh, MI. 49286.

**MAKE \$1,000 in the next 30 days. Guaranteed!!!** Rush 50¢ to: Prospectus, 3503A Kaliste Saloon, Lafayette, La. 70501.

**\$250-\$500. THOUSAND STUFFING ENVELOPES. COMPLETE ASSISTANCE.** Rush Stamped Envelope. Kemco, Box 73085-B5, Metairie, La. 70033.

(Continued on next page)

## BUSINESS OPPORTUNITIES

(Continued from preceding page)

**DEALERS** Wanted, sell plastic cutting boards. Replace old style wood. Send \$4.00 for sales sample and confidential dealer. Prices post paid. Electroware, 1455 Kings Highway East, Fairfield, Connecticut 06430.

**\$250-\$500/THOUSAND STUFFING ENVELOPES COMPLETE ASSISTANCE**, Send Stamped Addressed Envelope. Fortune, Box 7141-A5, Kansas City, Missouri 64113.

**SPARE** Time Security—details; Rush 25¢ and self-addressed stamped envelope. Somerset House, 433 Roquette, South Floral Park, New York 11001.

**CALIFORNIA MANUFACTURER NEEDS MAN** To assemble our product and be local agent, experience unnecessary. May start while presently employed. Five-Figure income for responsible applicant. S.K.R.M. Manufacturers, 1419 West Dolores Street, Wilmington, California 90744.

**\$500+/WEEK POSSIBLE, STUFFING ENVELOPES, COMPLETE ASSISTANCE. RUSH STAMPED, ADDRESSED ENVELOPE.** No-by, Box 692A5A, Dover, Delaware 19901.

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**\$50.00-\$1000.00 Monthly Possible, Publisher Needs Agents, Send Stamped Addressed Envelope.** Jadine, 88 South Street, Hingham, Mass. 02043.

**MAIL ORDER DEALERS WANTED.** Earn outstanding Profits. Free Information. Star Enterprise, RR #4, Van Wert, Ohio 45891.

**WOODWORKERS—\$4.00** Material brings \$34.95! Pine Shop, 336H, Sharon, NH 03458.

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**35 FIRMS** Start you in a Moneymaking Business FREE! Absolutely no investment! Guaranteed! More Details free. Genovese, Box 311-P56, Cairo, N.Y. 12413.

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**\$50.00-\$1000.00 Monthly Possible, Publisher Needs Agents, Send Stamped Addressed Envelope, WAT-CO Enterprises, Box 942, La Mesa, California 92041.**

**HOME, Spare time** bookkeeping. Worldwide Reports, Box 1242D, Greer, S.C. 29651.

**\$50-\$1000.00 Monthly Possible, Publisher Needs Agents, Send Stamped Addressed Envelope, My Enterprise, Box 5304P5, Long Island City, New York 11105.**

**WORLD'S** Easiest Mail Order Business—Stamped, Addressed Envelope—Moore Enterprises, Box 5059, New York, NY 10022.

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**SAVE! \$1.00** Sends Your Name to Every Business Opportunities Ad This Issue. Krause, 2208 Covert, Burton, Michigan 48509.

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## MONEYMAKING OPPORTUNITIES

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**HOW TO START MAKING MONEY** with Alfred Stern's NEW book, "500 MONEYMAKING MAIL ORDER IDEAS," ONLY \$10.00 ppd. CHARM HOUSE, P.O. BOX 425, Dept. PM5, Fairburn, Ga. 30213.

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**\$250-\$750/THOUSAND, STUFFING ENVELOPES, COMPLETE ASSISTANCE.** Send Stamped Addressed Envelope, CFM Enterprises, Box 418, Angwin, California 94508.

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**HOW TO BUY, SELL & INVEST IN REAL ESTATE—** Secrets of the pros published for the first time. You can do it too—retire in wealth—for free details. REIS, 6841-A Dublin Blvd., Dublin, Ca. 94566.

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(Continued on next page)

## MONEYMAKING OPPORTUNITIES

(Continued from preceding page)

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**BEST!** Money-making Opportunity Booklets—Full Details. Reliable, Box 177-E, Oak Lawn, Ill. 60455.

**MAILORDER Beginners**—Double or Triple your money in 30 days. Guaranteed! Free report reveals amazing system! Amex, 216 Jackson 612P5, Chicago 60606.

**DUCK HUNTING DECOYS**—Manufacture and sell quality plastic decoys at home. Simple, inexpensive process. Details, \$1.00 refundable. Decoys Unlimited, Box 69, Clinton, Iowa 52732.

**\$250/1000** Stuffing Envelopes. Free supplies. Send stamped addressed envelope. M. Willen Co., 18408 Evergreen, Detroit, Mich. 48219.

**OIL PAINTINGS** On velvet, from Mexico. All subjects; dealers only. Brochure \$1.00. refundable. Museo de Mexico, 105 W. 35th St., National City, CA 92050. Dept. P-5.

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**\$500** To stuff 1000 envelopes. For information write: James Ellis, 504 4th Street, San Francisco, Cal. 94107.

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**FANTASTIC COPYRIGHTED MONEYMAKING MANUALS: FREE BROCHURES:** Hampton's, 490 Schoolway, Redwood Valley, California 95470.

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**RACING Fans.** Beat The Races. Spot The TRUE CONTENDERS. Eliminate others. Send \$6.00 For Instructions. N. I. Enterprises, P.O. Box 816, New Brunswick, New Jersey 08903.

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**SANDBLASTER Distributor Wanted.** Free details. INKA, Box 66573-A, Houston, Texas 77006.

**PRINTING Advertising Salesmen—Excellent** money-making sideline selling Decalcomania Name Plates, small quantities. Advertising Specialties, sign letters. Free Samples. Raico XL, Boston, Mass. 02119.

**BIG Money as Manufacturers' Representative.** Details: United Association Manufacturers' Representatives, 808 Broadway, Kansas City, MO 64105.

## EMPLOYMENT INFORMATION

**HOW To get a job overseas.** A complete guidebook on finding and landing a lush foreign job. All occupations! Postcard brings details. Wyatt-PM15, 509 Ivy St., Grass Valley, Calif. 95945.

**MANY Job Openings in Oregon,** \$1.00 (Refundable). Prosper, P443, Bend, Oregon 97701.

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**OVERSEAS Jobs—Worldwide!**—All Occupations!—To \$4500/Month!—Directory includes: 150 U.S. Companies with Overseas Projects—Exposure Strategy—Resume Preparation—International Listings—\$2.00—Moneyback Guarantee—Global, Dept. E, Box 99494, San Francisco, CA 94109.

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**GOVERNMENT OFFICER:** Over 18? Have elementary education? You can become **COMMISSIONED OFFICER** under Oath. Now signing up. All localities. No examinations. Permanent. Profitable. Quick income. Please Contact: SCORE, Box 31A, Columbia, Maryland 21045.

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**MEN!—Women! Jobs on Ships!** American, Foreign. Worldwide travel. Information \$3.00. SEAFAX, Dept. Z-17, Box 2049, Port Angeles, Washington 98362.

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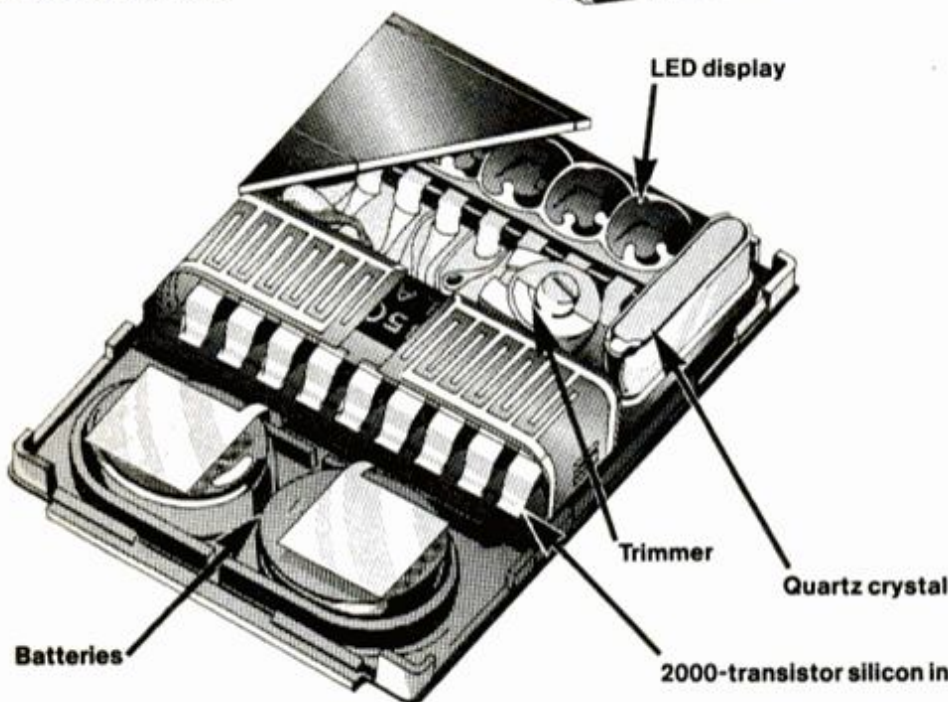
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