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7 last-minute gifts to make for Christmas

How to spot gas-price traps PLUS: Retune your car for regular

Instant furniture from prefinished parts

New 4-wheel-drives for off-road fun

4 exciting new home-movie cameras

6 KIT CLOCKS: Make a heritage clock in a weekend

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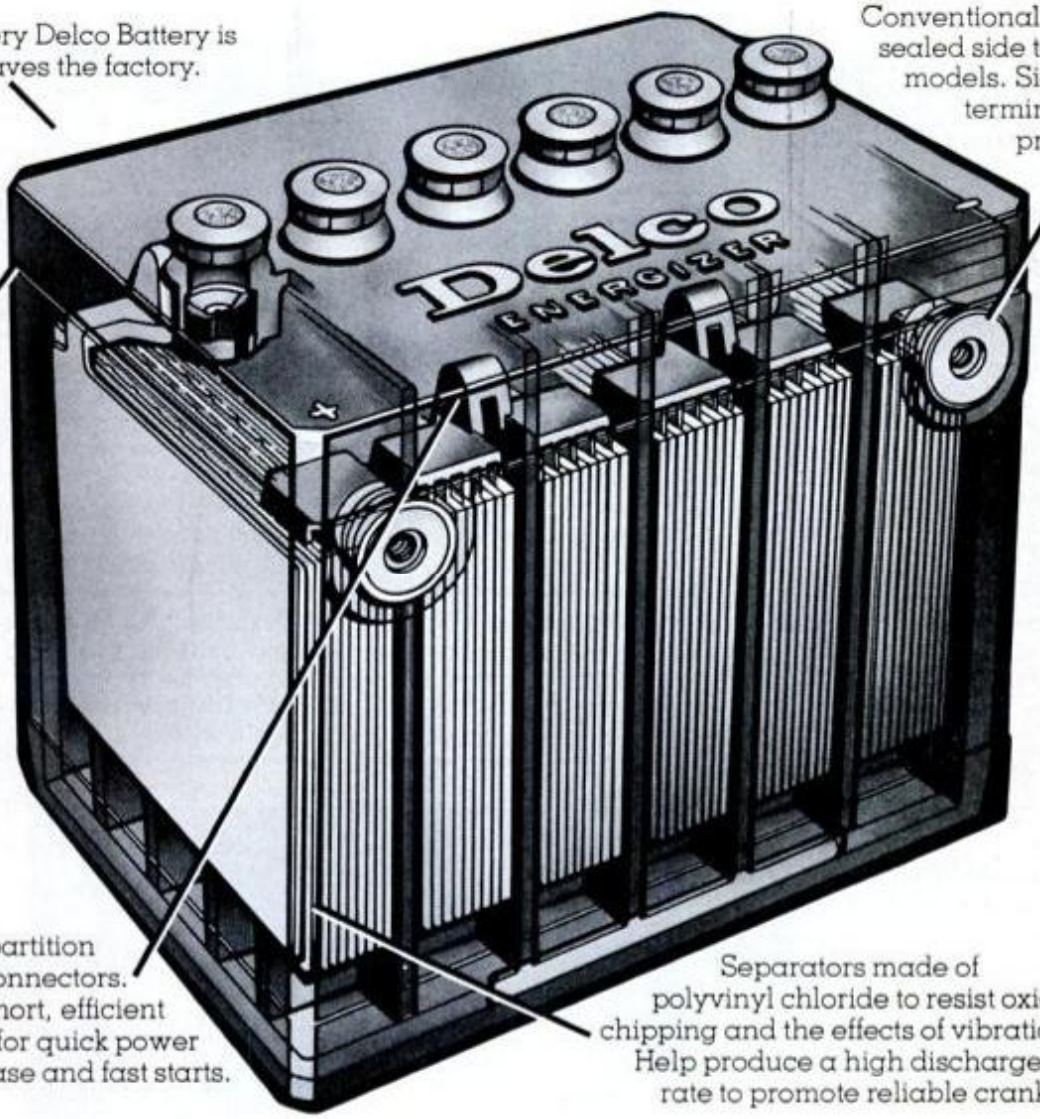

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Go with the names you know.

AC-DELCO DIVISION OF GENERAL MOTORS CORPORATION

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One of six handsome, heritage clocks you can build from kits in a weekend. See page 98. *Photo: George Ratkai*

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Popular Mechanics®

DECEMBER 1975 • Vol. 144 No. 6

INTERNATIONAL EDITIONS: Australia, Caribbean, Mexico, Southern Hemisphere

SPECIAL FEATURES:

Stretch your gasoline dollar. Beat premium-fuel prices by retuning your high-compression engine to run smoothly on lower-octane gas. Page 64.

Four new cameras for movie-making fun. Exciting time-lapse feature lets you shrink hours, race clouds, see a building rise in minutes. Page 60.

'Instant' furniture from kitchen cabinets. How you can save time and money when building storage walls by using these finished ready-mades. Page 70.

Radio on wheels: The CB communications freeway you use to call for help, obtain road information, even get relief from long-trip boredom. Page 80.

New 4WDs are right on for off-road fun. Here's a close look at the latest little 'truck' versions being offered by the major car companies. Page 48.

Seven last-minute gifts to make for Christmas: Pipe rack-humidor, cheese tray, three block cars, treasure chest and a dresser-top valet. Page 94.

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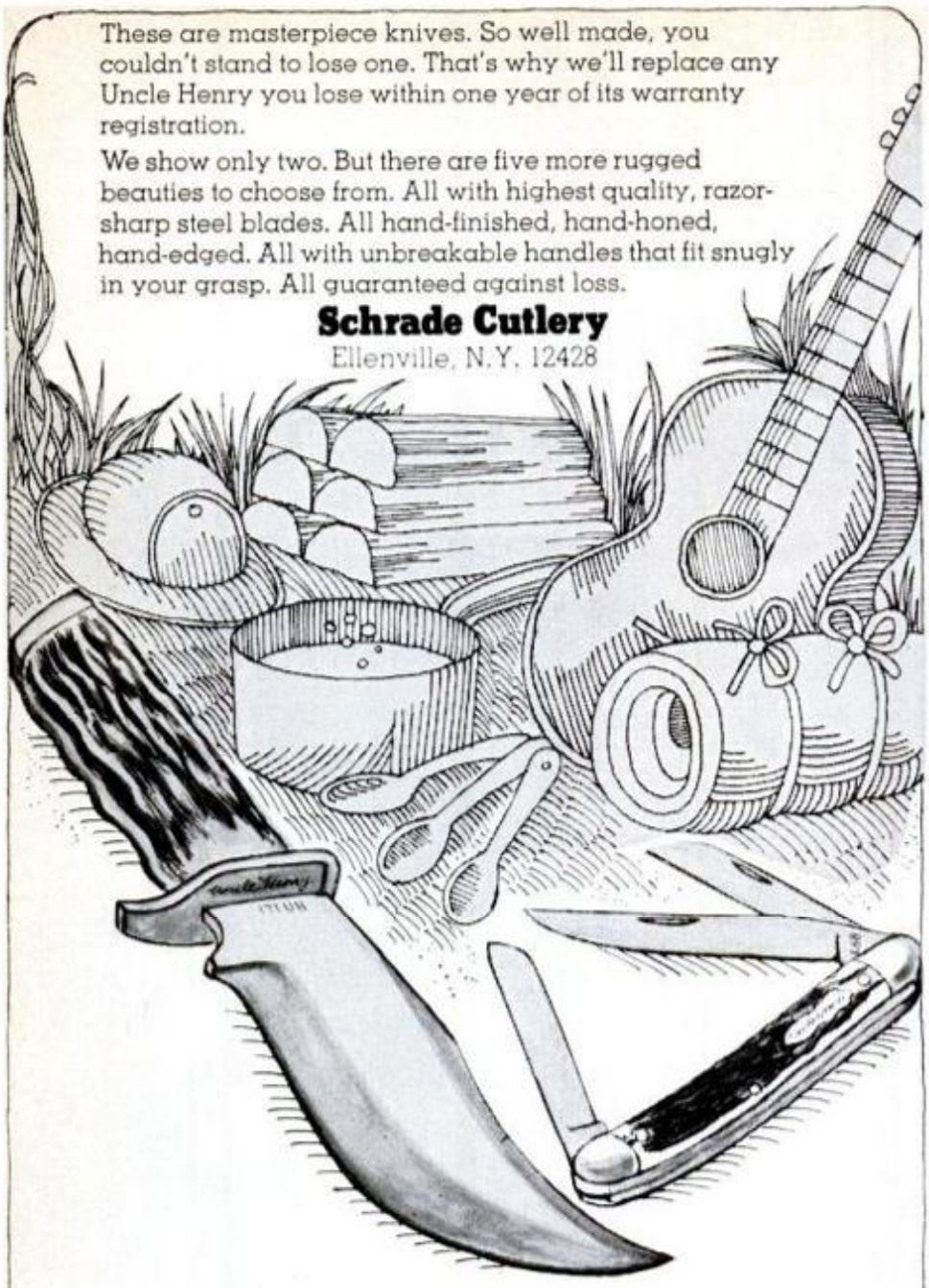

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JOHN A. REGINA
Advertising Production Manager

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JOHN R. MILLER
President
RANDOLPH A. HEARST
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RICHARD E. DEEMS
President, Magazines Division
JOSEPH F. KERN
Publisher

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We'd like to help you choose the right color TV. Even if it isn't a Panasonic.

When you plunk down several hundred dollars for a color TV, it had better be the right one. And it can be. With a little information about what to look for when you choose a set.

What to look for in a picture tube.

Don't fall in love with the first picture you see. Look at as many as you can. Side by side. Decide which ones you like best. Then compare their technology. We think a picture tube should have a black matrix around each color dot for greater contrast. You should also have a choice of delta or in-line guns. Panasonic has both. Another thing to look for is one of the latest developments in picture tube engineering. The Quintrix™ picture tube. With an *extra* prefocus lens to concentrate and focus the electron beam. For a sharp picture from edge to edge. Panasonic developed it.

What to look for in a chassis.

After you've test-watched the picture, look under the hood. And look for a powerful chassis. Because that can mean a brighter picture. Panasonic sets are about as powerful as you will find. Yet they use about as much electricity as a couple of 75-watt light bulbs.

Then check to see if the chassis is 100% solid state. That means no vacuum tubes to burn out. And greater reliability.

All Panasonic sets are 100% solid state. And use up-to-date solid-state IC technology. So there's less circuitry. Which means less can go wrong.

And make sure the set is designed for easy service. That's the advantage of a modular chassis. In the Panasonic Quatrecolor® modular chassis, most components are on five snap-out, snap-in modular boards. So repairs, should they ever be necessary, can almost always be made quickly and easily.

What to look for in controls.

You buy a color TV to watch color TV, not play engineer. Look for one button that controls color, tint, contrast and brightness. Panasonic calls it Q-Lock™. But you should also have the option to control your own picture. So we also include Manual Over-Ride.

What to look for in a warranty.

Look for a long one. While many other manufacturers are cutting back on warranties, every Quatrecolor set still has a 1-year warranty on parts and labor. And a 2-year parts and 1-year labor warranty on the picture tube. Our warranty card spells out the conditions of our limited warranty.

We hope these hints help you choose the right color TV. And who knows? It just might be a Panasonic.

Panasonic.
just slightly ahead of our time.

"The Quatrecolor with the Quintrix"

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LETTERS

TO THE EDITOR

Too slick an idea

Regarding Robert Widhelm's "Slick Oil Idea" (*Letters*, page 6, Oct. '75): I tried using plastic jugs once, never to forget it.

Oil was dropped into the trash can, the trash can was emptied into the garbage truck. When the garbage compressor was turned on, *poof* went the jug with the oil, and I had a very unhappy oil-spattered garbage man on my hands.

I suggest the jug should be marked "Drain Oil" and placed on top of the garbage can for pickup.

MILES C. BRICHTO
CICERO, ILL.

Most towns use trash vehicles which have compactors. For some time I thought a lot of cars around town were in deep need of new oil seals. Not so. Wound up behind a trash truck on a neighborhood street, and there was the answer in oil trickling out onto the blacktop.

Metal and plastic containers, if squashed, let the oil trickle out, while glass will make a quick spill.

C.E. KEMMERER
KERRVILLE, TEX.

Butchering block?

Your butcher block (*Build This Handy Butcher Block*, page 102, Oct. '75) looks like a true boon to any home cook, but it looks like an aptly named *butchering* block when the knife rack is viewed from the level of a small child or medium-sized canine. Obviously the designer has neither children nor animals in his kitchen—or won't have for long.

Other than that, very nice!

WILL TURRENTINE
GREENSBORO, N.C.

We'll agree that if you have small children, you would want to cover those blades. A clever way to do it—without changing the appearance of the table—is to fasten a sheet of Plexiglas on the knife rack so that it extends down slightly farther than the longest blade. The knives still show—but are harmless.

Don't use softwood in a fireplace

You recommend the use of softwoods either alone or mixed with hardwoods when building a fireplace fire (*How to Cut Firewood and Use a Fireplace*, page 60, Oct. '75). I must take exception.

My family has lived many years in upstate New York. Consequently, we have all had much experience with wood-burning stoves and fireplaces. Our experience indicates that burning softwood over a period of years will build up a dangerous coating of tars in the chimney. I have seen this condition become so bad that the tar has actually been running down the side of the chimney.

DONALD I. RASMUSSEN
ILION, N.Y.

Bicentennial racer

The *Mini-Indy Racer* (page 36, Aug. '75) was a very enjoyable project. It took me three weeks to build, working in the evenings. I have built a mini-bike and a go-cart before, but this is definitely something else.

I have also added wings to the front to give it added Indy look. The car is red, white and blue with gold stars and numbers. We call it "The Spirit of '76."

PHILIP D. ALLEN
TOLEDO, OHIO

More on window greenhouses

I'd like to comment on personal experience with window greenhouses (*Window Gardening*, page 54, Sept. '75).

There's no need for an electric heating system if one removes the window sashes, allowing free circulation of air with the room. It can't freeze, even on the coldest night. This also eliminates the need of ventilation, as it can't overheat on a sunny day, either. One can't control humidity that way, but plenty of plants will do fine anyhow.

Why use expensive ¼-in. acrylic sheets? At most glass companies, you can buy ¼-in. used plate glass, cut to your size, for far less money.

For a really good job, you can buy the plate glass plus an inner pane of window glass, for less than the acrylic, and cut your heat losses in half.

The plants will look nicer from the outside because they won't be obscured by frost or condensation. But glass is heavy; be sure the hooks are secure.

ROBERT D. SMITH
SWISHER, IOWA

We chose the acrylic plastic so you wouldn't have to worry about errant baseballs or other such hazards. But, sure, you can use glass.

Any electric Boonie Bugs?

I am planning to build your *Boonie Bug* (page 94, March '74), but to operate on battery power instead of the VW engine. I think I can couple a d.c. motor straight to the transaxle and store batteries in the engine compartment and in the midships storage compartment. I would like to know if any other readers have considered this project or if any have built battery cars.

ALAN RAYDO
SHAWNEE MISSION, KANS.

Judging from the sale of plans, several thousand readers have considered building the Boonie Bug. But we really have never heard from a reader who used electric power.

Don't talk about imported junk

Let's get off this kick of always talking about all that imported junk that is cluttering up our once-great country. We serviced imported cars for many years, and we know just what type of junk they are. Freeway driving and hot weather really knock hell out of them, and the so-called rubber components just don't last any time at all.

D. ROGERS
CULVER CITY, CALIF.

Foreign cars are better!

In *How To Stay Alive in a Small Car* (page 39, Aug. '75), you said that most people do not notice and respect small cars. This is very true, but after that you made a huge mistake. You said small cars do not have the power and acceleration of their big brothers. Not true! Most imports, which is all I would ever own, have more horsepower to weight than big American gas hogs. Also, imports

(Please turn to page 118)

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If I'm going to smoke, I'm going to do it right.

Some people smoke a brand for its image. I don't. You can't taste image. I smoke for taste. I smoke Winston. All Winston will ever give you is real taste. And real pleasure. For some of us, that's enough. Winston is for real.

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

20 mg. "tar", 1.4 mg. nicotine av. per cigarette, FTC Report MAR. '75.

BY JOHN F. PEARSON

SCIENCE WORLDWIDE

New ankle-joint replacement

In recent years engineers and surgeons have combined their skills to produce reliable "spare parts" for people. Joints that have degenerated because of arthritis are often replaced. Now a British bioengineering team announces an improved ankle-joint replacement that reportedly gets the patient back on his feet fast—often within a week—following the operation. No cast is needed. In contrast, say the Britishers, the conventional procedure that is most widely used requires the patient to wear a cast for as long as four months.

As is shown in the photo above, the convex element of the new joint is stainless steel and the concave element, polyethylene. The components are secured to bone with a special cement.

NASA paint resists rust

An improved paint developed by NASA as an anticorrosion coating for space program use is being tested on San Francisco's Golden Gate Bridge. The paint, applied to a six-foot steel panel mounted on the underside of the bridge, contains zinc and potassium silicate. In a previous lab test, the paint showed no sign of deterioration after 5300 hours of exposure to a continous brine spray. Unlike other zinc-rich paints, it sprays easily, according to NASA researchers, and requires no finish coat. A wide commercial market is foreseen.

Air much cleaner now

Some 14,000 years ago, during the last glacial period, air in the Northern Hemisphere was 100 times dirtier than in recent years. That conclusion can be drawn from the results of research by members of the Institute of Polar Studies, Ohio State University. A 1514-yard-long core taken from Greenland's ice sheet shows that a heavy concentration of particulate matter dropped with snow during the glacial period. Similarly, a core taken from west Antarctica indicates that snow deposited there 14,000 years ago was four times as dirty as snow deposited later.

The researchers at Ohio State attribute some of the increased "fallout" to prehistoric volcanic activity.

Now: the mineral crunch

Less well publicized than the energy shortage is our nation's growing dependence on foreign sources for important minerals. According to a U.S. Geological Survey report, we import 90 percent of our supplies of manganese, cobalt, chromium, titanium, niobium, strontium and sheet micas.

From 75 to 90 percent of eight other commodities come from abroad. They are aluminum, platinum, tin, tantalum, bismuth, fluorine, asbestos and mercury.

Forecasts for the year 2000, states the Survey report, indicate that the United States at that time will be completely dependent on imports for 12 minerals. We will also have to import 75 percent of 19 other minerals and more than 50 percent of 26 others.

Computer spots crop disease

Early detection of crop disease is made possible by a new technique—the computer analysis of infrared aerial photos—according to researchers at the University of Texas, Austin.

Manual inspection tends to be slow, causing a long time-lag between the discovery of a diseased crop and the taking of remedial action. Specially programmed, the computer can carry out a frame-by-frame scanning of a film and provide a printout of the location and condition of the crops pictured.

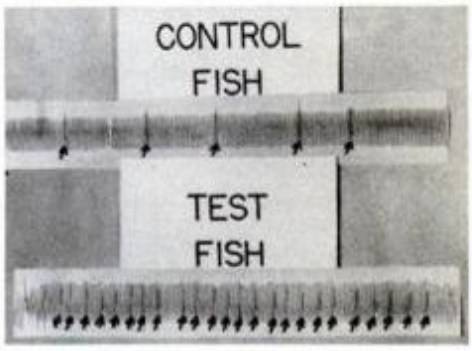
Use of this technique is expected to benefit farmers by helping them to reduce crop damage and thus improve their yield per acre.

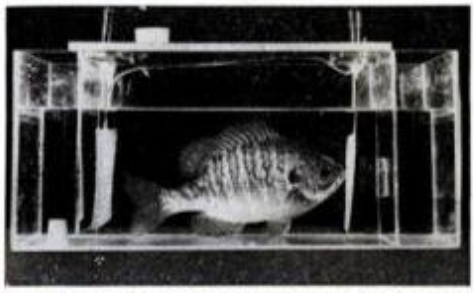
Pollution makes fish cough

An unexpected benefit has come from an Environmental Protection Agency (EPA) study into the effects of pollutants on freshwater fish. In a test program, trout, bluegill and other species of fish are used to monitor the pollution levels in lakes and rivers.

Fish respond to pollutants by "coughing"—clearing their gills. The higher the level of pollution, the more frequently the fish cough. At the EPA's National Water Quality Laboratory, Duluth, Minn., fish are held in individual, instrumented tanks. Coughs cause water motion that is picked up by sensors installed inside the tank.

The signals are transmitted to a machine that records the coughs in the form of a graph. In the tracings illustrated below, the "test fish," in more heavily polluted water than a "control fish," coughed more frequently.





"The ultimate use of our findings," the researchers reported, "could be a system for keeping tabs on concentrations of complex industrial wastes entering rivers from waste treatment plants and industry." ★★★

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All signs point to the new Volkswagens.

Our dual diagonal braking system gives you the protection of a back-up circuit.

VW's front-wheel drive pulls you around curves instead of pushing. Tracking stability is excellent.

Don't worry about acceleration. The Rabbit does 0 to 50 in 8.2 seconds, Scirocco in 7.5 and Dasher in 8.0.

The new VWs have suspension systems with a coil spring at each wheel so you can take bumps in stride.

Rabbit and Scirocco both got 39 mpg—hwy/25 city. Dasher got 37 mpg—hwy/24 city. These figures are based on EPA estimates using cars with standard transmissions.

The actual mileage you get may vary, depending on your type of driving, your driving habits, your car's condition and optional equipment.

Like many racing cars, new VWs have rack-and-pinion steering for precise control.

Rabbit has everything you need to help you cope with rough roads and hard times—performance, economy, and superior handling.

Plus a lot more. The Rabbit has as much head and leg room as some mid-size cars. More trunk space (with the rear seat folded down) than the 8 leading economy cars, according to Road & Track Magazine's '75 Comparison Road Test. And a hatchback at no extra charge.

No wonder Rabbits are multiplying.

Dasher is available as a 5-seater family sedan or as a wagon. And even though it's big and comfortable inside it's able to deliver incredible performance. Its handling is "outstanding" according to *Guide to Car Economy*. And few sedans can touch the Dasher's tight-fisted way with a gallon of gas.

Scirocco is a true 2 + 2 Sports Coupe with a powerful 1.5-liter overhead cam engine.

And styling created by Giugiaro, the man who designed the Maserati. Not only is it exciting to look at, the sleek wedge styling cuts wind resistance and improves forward visibility.

Inside, you'll find the same combination of style and function.

The trim is elegantly smart.

The hatchback (at no extra charge) is just plain smart.

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ALL OUTDOORS

WITH BILL McKEOWN

There are a number of rinkydink products around that might make good indoor toys but shouldn't go afield. There's the backpack with shoulder straps that start unstitching halfway through a hike, the rod that breaks once a lunker latches on, that tent with peg loops that let go on a windy night, an ammo box which comes unglued and spills your shells, or the boat with deck hardware screwed on instead of bolted. We all get little enough time outdoors, so for safety and satisfaction we deserve the best in equipment.

As a result, each year we like to salute a number of items that have worked particularly well. Not all are new, but each has earned approval as dependable, useful and pleasing to have along. Here, then, is PM's pick:

Casting can be more accurate with St. Croix Memory Lok (left) that can repeat depth, Lew Childre Speed Spool (right) that throws bait an extra distance.

CB convenience

Take it from our base, KSV-0468 (handle: Traveler), a Citizens Band rig adds more than you can imagine to any field and water sport. A mobile rig in our camper vehicle gives the safety contact of Channel 9 and an easy way to call for directions or campsite information. Handsets keep contact for hiking, hunting and fishing. CB is no substitute for a VHF marine radio/telephone in a boat that might need to call the Coast Guard or the telephone company ashore. But for short-range communication, it's an ideal answer. Our rig is the new Johnson Messenger 123SJ. Though we got the Johnson converter so that it can be used as a mobile 12-volt car unit or base unit on 110 a.c. at home, it worked so well both ways that we had to go out and get another one—as usually happens, we learned.

Citizens Band stations are easy to tune in from home or car with E.F. Johnson 123SJ.

Blow-hard gauge

Ask four people about wind strength on a breezy day (or wave height or boat speed any time) and you're likely to get four very different answers. Our answer is a small Sims Anemometer from R. A. Simerl Instruments, Annapolis, Md. We favor the model that shows wind speeds in knots and kilometers, with conversion for mph and the Beaufort scale on the back. Though hard to read in a bouncing runabout, it gives a useful approximation of boat speed.

Reel improvement

Considering the years that fishing reels have been around, you wouldn't expect any major changes. Now recent refinements for bait casting and spinning deserve recognition.

Lew Childre is introducing his new Speed Spool reel, and it's drawing wide approval from bait-cast experts. The level wind disengages for a long flowing cast and then switches in on retrieve. The Lifetime Model with its ruby line guide sells for a healthy $100, and the reel's popularity indicates its superiority.

St. Croix's Rangefinder spin model RF-76 provides added fun. Switch on its Memory Lok once you find the distance or depth of a honey hole and each cast will drop in automatically, with a "strike release" when the big one hits.

Potent patch

A neat new aid for many outdoor repairs is called Auto-Pak Lay It On Body Patch from 3M. It is 6x8 inches, costs about $2.69, and is recommended for car body repairs. We carry one, however, to quick-patch punctures in a boat, tackle box, RV top or piece of luggage. The advantage is that the sheet of fiberglass can be cut to cover the hole and already has its curing agent mixed in. No mess; simply peel off the paper cover, apply, and then give it a couple hours of bright sunlight (or a sunlamp) to cure it.

Marine muscle

Any year is a big one when outboards can take a magnum jump up to 200 hp. But the special credit goes to the engineers who packed more power into less space, yet made the mills as quiet and economical with fuel as earlier models. Better power for bigger, safer boats is the special advantage we see for the Evinrude and Johnson 200s and Mercury's 175.

Nikon mini-binoculars are powerful featherweights that pocket as easily as a pipe.

Closer look

Ernest Hemingway used to carry a little monocular or pair of opera glasses in his hunting jacket, and outdoorsmen have been hoping for years for something less bulky than binoculars. Now Nikon has lightweights that are amazingly small and easy to carry. Weighing less than a pound and no bigger than a couple packs of cigarets, they give a brilliant view in six, seven or eight power. Our choice was the 8x24 for about $120. They put the big view in the palm of your hand. ★★★

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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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In Canada: A. C. Simmonds & Sons, Ltd.

Pinto Pony MPG with optional WSW ($33), Luxury Decor Group ($263).

Introducing Ford's brand-new Pinto Pony MPG.

$2,895. Lower than Chevette Scooter.

($203 under Chevette's 4-passenger base car)

38 mpg highway, 25 mpg city.

(EPA estimates. See box at right)

More car for the money.

(627 pounds more road-hugging weight than Chevette Scooter)

See these other 1976 Pinto models (shown below) at your Ford Dealer.

Runabout with optional Protection Group, Squire option, Forged aluminum wheels, WSW tires and color-keyed mirrors.

New optional Alpine Plaid-cloth and vinyl trim.

Compare:	Pinto Pony MPG	vs	Chevette Scooter
Passengers	4		2
Engine	2.3 liter		1.4 liter
Horsepower	92		52
Transmission	4-speed manual		4-speed manual
Weight	2,558 lbs.		1,931 lbs.
EPA MPG Rating	38 highway, 25 city		40 highway, 28 city
Price	$2,895		$2,899

More about price. Price quotations are base sticker prices excluding title, taxes and destination charges. Actual prices and comparisons will vary by dealer. Pinto Pony MPG shown with optional wsw tires ($33), Luxury Decor Group ($263).

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

Pinto Pony MPG gives you more road-hugging weight.

Pinto Pony MPG is built with a strong steel unitized-body construction that gives you 627 more pounds of road-hugging weight than Chevette Scooter, for a smooth, solid ride on almost any kind of road.

Sticker priced less than the 2-passenger Chevette Scooter, $203 less than the 4-passenger base Chevette.

While the 2-passenger Chevette Scooter has a low price, don't expect carpeting (rubber mats), upholstered interior door panels (fiberboard), chrome window trim (rubber molding), chrome bumpers and hubcaps (painted), and many other interior convenience features. Don't even expect a back seat (the base Scooter doesn't even have one).

For a little less money than the 2-passenger Scooter, you can drive a Pinto Pony MPG that includes a lot of things the Scooter leaves out.

You can choose a 4-passenger Chevette, however. But it's sticker priced about $200 more than our standard Pony.

The inside story of the Pinto Pony MPG.

Our wide-body interior design gives you more shoulder and hip room (and about the same headroom) for more spacious comfort than the Chevette Scooter.

And our wide track in front and rear gives you excellent stability and handling.

It's a lot of little car.

Pinto Pony MPG offers a combination of 2.3 liter overhead-cam engine, 4-speed shift, rack-and-pinion steering for precise control, and self-adjusting front disc brakes. All standard. The 4-speed fully synchronized short-throw shift is floor mounted, as in some of the best European performance cars.

You'll find 40 more horses in every Pinto Pony MPG.

But it is still EPA rated at 38 miles per gallon highway, 25 city.

Compare the new Pinto Pony MPG to the Chevette Scooter or any other small car.

Pinto Pony MPG's road-hugging weight, wide stance, big engine, high EPA rating and low price all add up to outstanding value.

It's easy to see why Pinto Pony MPG is *more* car.

Pinto Pony MPG: More car for the money.

The closer you look, the better we look.

FORD PINTO

FORD DIVISION

gon with luggage rack, WSW tires, Protection Group and Squire options.

Runabout with optional Luxury Decor Group, half vinyl roof, styled steel wheels with trim rings, Protection Group, electric rear window defroster and WSW tires.

Omega Pro-Lab B66

The last word in medium-format enlargers.

For sheer ease of operation, no photo enlarger surpasses Omega's Pro-Lab B66 for 35mm and 2¼"negatives.

CARRIER OPENS EASILY

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.

SLIDING FRONT PANEL

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 2¼" format optical requirement. Or get the optional dichroic color head and dial in the exact filtration needed for color or variable-contrast printing.

RIGID GIRDER DESIGN

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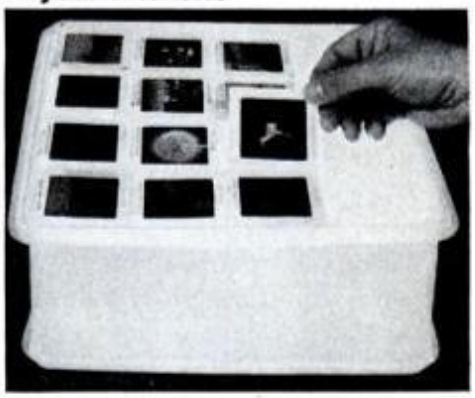
From under $100 to over $1,000.

PHOTO HINTS

FROM READERS

Is there a slide-sorter in your kitchen?



Large plastic kitchen containers used for storing vegetables, cakes or pies make ideal emergency slide sorters. Just place the container upside down over a light bulb, put the slides on the lid and place the lid on the bottom of the inverted container. The lip on the lid keeps the slides from falling off, and the plastic diffuses the light for even, glareless illumination.—*Ken Patterson, Regina, Sask.*

Cardboard barn doors for your strobe

"Barn doors" that will restrict your strobe's light spread are easy to make: Just trim two lengths of dark gray or black cardboard to fit and fasten them to the sides of the flash with a rubber band. If the cardboard strips are each scored down the middle, you can easily bend them in and out to get the width of the beam you want.—*Maj. J.P. Greeves, Alexandria, Va.*

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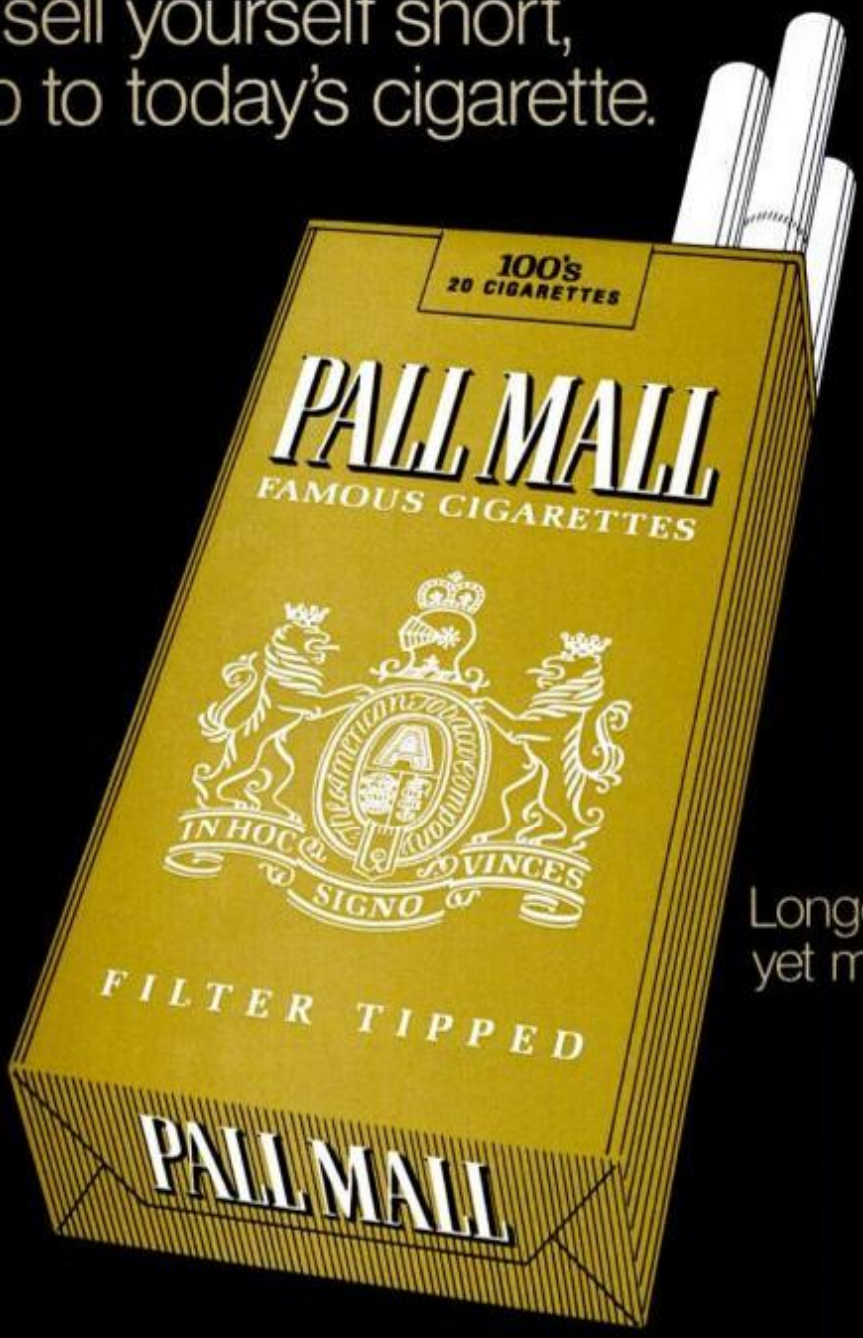
move up to today's cigarette.



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PALL MALL GOLD 100's ..... "tar" 20 mg. nicotine, 1.4 mg.
Best-selling regular size (70mm) .... "tar" 25 mg. nicotine, 1.6 mg.
Of all brands, lowest ..... "tar" 2 mg. nicotine, 0.2 mg.
20 mg. "tar", 1.4 mg. nicotine av. per cigarette, FTC Report April '75.

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

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(A TRUE STORY)

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A man can take a lot of pride in a highway he's designed. Jack Terry of Lake City, Fla. knows that feeling. (Photo: Yale Joel)

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Hidden beneath the smooth, sleek lines of the Invader GT5 is a VW bug. This fun and easy to build sports car kit results in a low cost, exotic GT machine. Send $2.00 for a 20 page, color catalog. Autokit, 2725 Magnolia St., Oakland, CA 94607. (415) 832-7737.

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HINTS

FROM READERS

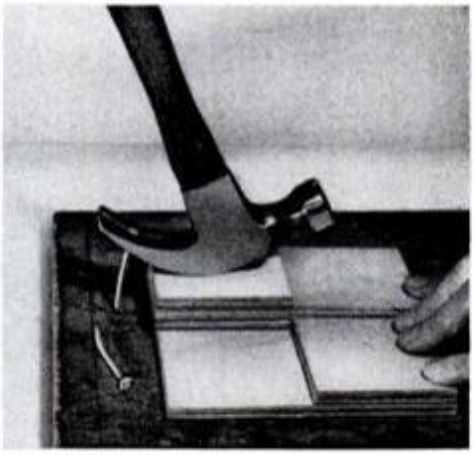
Quick tongs

Wooden tongs can be handy in the shop. They're quickly and cheaply made from Popsicle-type sticks, glued to a block of four thicknesses of the same stock, tapered slightly to the rear.—*Burt Web, Skokie, Ill.*

Cigar tubes hold tools

Cigar tubes make excellent storage for small tools such as drill bits and sabre-saw blades. In glass ones, put a cork or felt pad in the bottom to protect against breakage.
—*W. B. May, Oak Park, Ill.*

Nail-pulling block



To help in pulling nails with a hammer, a "four-thickness" block can be glued up from squares of scrap plywood. Block shown is 5½ in. square with ¼-in.-thick steps.
—*Walter E. Burton, Akron, Ohio*

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Who can save you money on your next utility bill?

Amana can.

SAVE OVER 18%*

IN THE COST OF AIR CONDITIONING WITH AN AMANA HIGH EFFICIENCY CENTRAL COOLING SYSTEM.

The Amana high efficiency 2½ ton central air conditioning system offers just what today's homeowner is looking for—maximum efficiency, proven reliability and fast, foolproof installation.

The high efficiency compressor is specially designed to save you money by reducing resistance and friction to increase operating efficiency. All this and more in a compact cabinet that's the same size as a standard Amana unit! Plus the same quality features that have made Amana cooling units famous for reliability.

*Compared to a conventional design, assuming the same electrical rate for both units with matching "A" coils operating at 95°F outdoor temperature.

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ON FUEL CONSUMPTION WITH AN AMANA ELECTRIC/GAS COOLING-HEATING UNIT.

Save money on heating your home. The Amana Electric/Gas cooling heating unit's savings come from the unit's unique Heat Transfer Module, the first major breakthrough in heating technology in years. The HTM uses outdoor air for fuel combustion eliminating much up-the-chimney heat loss common to conventional gas furnaces. Amana uses electronic ignition to eliminate wasteful pilot lights and two-stage heating to keep the unit operation at maximum efficiency. In addition to saving money on heating, the same Electric/Gas unit gives dependable central air conditioning in one compact comfort center.

*Based on Institute of Gas Technology laboratory tests and projected performance for a northeastern Ohio city, compared to a conventional gas furnace. Savings will vary with climate and weather conditions.

SAVE 26% to 61%*

IN HEATING COSTS (COMPARED TO CONVENTIONAL ELECTRIC FURNACE) WITH AN AMANA ELECTRIC HEAT PUMP.

In winter, the Amana Heat Pump uses an efficient source of energy, electricity, to take heat from outdoor air and warm your home. In summer the heat pump reverses itself; it removes heat from indoor air and leaves your home cool and comfortable. For colder climates there's space to add more heaters in the package system and both package and remote systems have factory built-in features to keep installation costs at a minimum. Like all Amana products, every heat pump is run-tested to assure you of greater reliability. And with almost 20 years experience Amana knows how to make a heat pump extra dependable.

*Over an entire heating season. Based on design conditions and Seasonal Performance Factors for these cities: Minneapolis, MN—26.58% Savings; Kansas City, MO—44.13%; Philadelphia, PA—48.72%; Atlanta, GA—55.56%; Tampa, FL—61.09%; San Francisco, CA—61.39%. Savings will vary with climate and weather conditions.

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AMANA GAS FURNACES WITH ELECTRONIC IGNITION ELIMINATE WASTEFUL PILOT LIGHTS.

Amana makes great gas furnaces and now they're even better with electronic ignition. With electronic ignition there is no pilot so there's no wasted gas. And because there's no pilot to light or relight, it's safe and more convenient for you. Amana gas furnaces also feature a durable heat exchanger that's designed for maximum heat transfer efficiency. When you're ready to buy a gas furnace, look at an Amana energy saving furnace with electronic ignition. Amana gas furnaces really are better than ever and can definitely save gas and help conserve energy.

Look to Amana today for the energy saving ideas of tomorrow.

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DETROIT LISTENING POST

BY ROBERT LUND

Electric, turbine cars coming

An electric car from General Motors and a gas turbine from Chrysler are good possibilities for 1980-81. These cars are much closer than the companies indicate in their official announcements. General Motors will soon make a decision on which division will make the electric. Chevrolet is believed to have the inside track at the moment. The first run of electrics will be limited to 50 to 100 units. They will be test cars for GM's own use and for loan-out to the government.

Chrysler is optimistic about putting a turbine on the road within four to five years. A lot of things have changed since the company started work on the turbine 15 years ago. For one thing, a car that might have to sell for $8000 to $10,000 doesn't make people flinch the way those prices did 15 years ago. There's also been a change in attitude at Chrysler on solving the problems of putting a turbine in a production automobile. At one time, the company added up all the reasons for not producing the engine and said, "Forget it. The obstacles are overwhelming." Chrysler has since taken a one-step-at-a-time approach to solving the problems, instead of viewing them as a total. The one-at-a-time approach has paid off. Chrysler is close to having a marketable turbine-powered car.

Ford building Granada specials

You could get more car than you pay for if you buy a '76 Ford Granada. The company hasn't said so, but it is apparently using Granada as an in-field test car to try out new materials it expects to use a year or two from now.

Ford wants to find out how cars made of different materials hold up in the hands of owners. But the company isn't telling which cars will carry the experimental materials and which will be standard.

AMC rules out one-seater

American Motors has ruled out a one-two car (one seat, two passengers) as a follow-up to Pacer. Ruled it out at least for the 1970s. The company confirms it is working on a new subsizer for the early 1980s and a four-cylinder engine to power it—a new engine, not the Four it is buying from VW. The engine will be ready before the car—by 1979 or '80. Why not a one-two car? "After people get used to the idea of smaller automobiles," a company official explains, "we'll think about still smaller cars. But it's too early to talk of scaling down from five and six-passenger automobiles to two-people cars."

For the man who has everything

If you look at a Caddy or Lincoln loaded with the whole A to Z of accessories and doodads, you wonder what's left. What can they possibly put on a car that isn't already on the market? Plenty, according to the guys who think up the gadgets. Cadillac has one coming later in the model year. It's a weather band on the radio. Punch a button and you get the weather report anywhere in the United States.

But that is toy-department stuff compared with a whiz-bang GM and Ford are working on for their luxury cars. It's a memory system for those items that require adjustment when two or more people use the same automobile. Things like position of the seat, angle of rear-view mirrors in and out of the car, temperature controls, a favorite radio station—anything different drivers might change when a car is shared by more than one driver. Once a driver has everything arranged to his satisfaction, the information is programmed on a plastic card. Insert the card in the memory system and, presto!, everything automatically jumps back in place after a "stranger" uses the car.

The idea is feasible, but it may be a while before it appears in the option catalogs. Detroit is trying to convince people it's serious about building simple, practical cars and the time and politics aren't right for gadgets that are too far out.

Numbers game

The Federal Trade Commission has finally come up with some rules automakers must follow in advertising miles per gallon. But the rules don't amount to much. They simply say if a car manufacturer advertises mpg, the company must publish mileage figures for both city driving and highway driving. Carmakers like to stress the highway figure and ignore the city figure.

The trouble with the EPA numbers is that they are arrived at in a lab under artificial conditions favorable to car manufacturers. They don't allow for the many minus factors encountered in real world driving. If you buy a '76 car expecting to get the mileage stated in the ads, you will be disappointed. You can't do it—even if you're a light-footed driver; even if you observe all the recommendations for stretching the maximum out of a gallon of gas. About the best you can do is 75 percent of the miles per gallon claimed in the ads.

You can "prove" just about anything with the EPA figures. For example, I did some horsing around with information supplied by EPA and came up with a car that gives no miles to the gallon. How? EPA says you lose a certain percentage of fuel efficiency under certain conditions. Knock so much off if you're driving up a hill, driving on other than a smooth surface, for stop-and-go, for driving in cold weather, driving into a headwind, stuff like that. I quit when I got to minus 100 percent. Maybe numbers don't lie. But they sure can confuse you. ★★★

New GMC bus called the "RTS" for Rapid Transit Series, replaces the current coach which has been in production since 1959. The 47-seat diesel will be in full production by summer of 1976.

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Filter Kings, 16 mg. "tar," 1.0 mg. nicotine; Longs, 17 mg. "tar," 1.2 mg. nicotine, av. per cigarette, FTC Report Apr. '75

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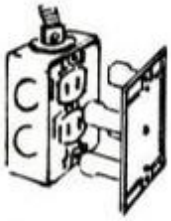

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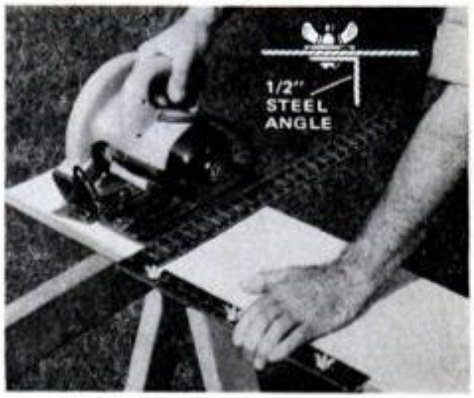
FROM READERS

Stay-put cutting guide



A framing square used as a crosscutting guide is unstable and can slip out of position—but not if you bolt a length of steel angle to the tongue to bear against the board's edge. The body of the square then provides a steady guide.

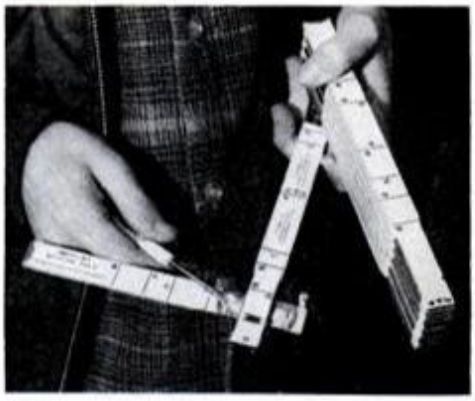
—Charles Perkins, Baltimore

Auto brushes in plumbing

Auto-battery terminal brushes are great for preparing ½ to ¾-in. sweat fittings and pipe for soldering. They clean pipe threads and tapped holes as well.

—Michael London, Rochester, N.Y.

Rule lubrication



Oil on the joints of a folding rule both stains pockets and tends to obscure numbers. Paste wax is better —and really cuts down friction wear.

—Richard Kreh, Frederick, Md.

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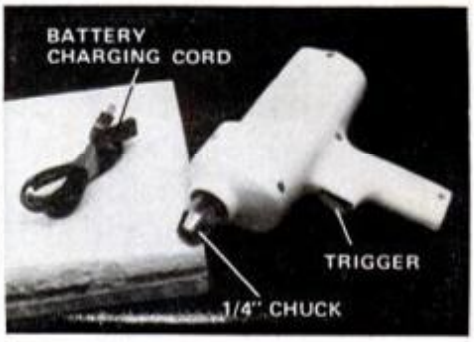
SHOP-TEST REPORT

Rockwell's cordless—and keyless—drill



Though not the first toolmaker on the market with a cordless drill, Rockwell Mfg. Co. recently jumped on the bandwagon with the version shown here. More than just another cordless, this one does away with the conventional Jacobs chuck key. Not having to worry about a chuck key is a distinct advantage; it's like being able to start your car without a crank.

To change bits you simply push the chuck lock forward as you rotate the chuck (top photo above). The lock will hold the chuck immobile while the jaws are adjusted as necessary.

As far as power is concerned, note that no cordless drills come anywhere close to duplicating the power or torque that their plug-in cousins have. When you buy this tool or any other cordless, remember that it is intended for light-duty capacity only. While it will drive an occasional heavy screw, don't expect that it will do so repeatedly.

All things considered, Rockwell's new cordless with its keyless feature has to be rated as a good buy when it comes to a drill. The price is $29.99.

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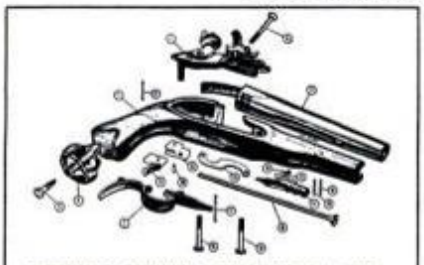

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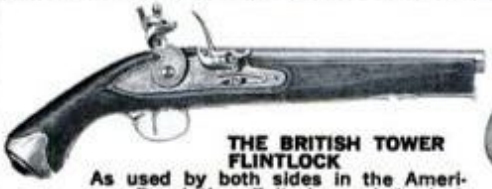

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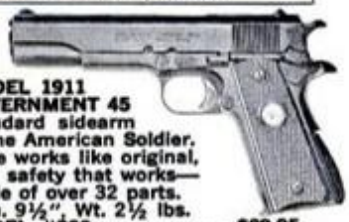

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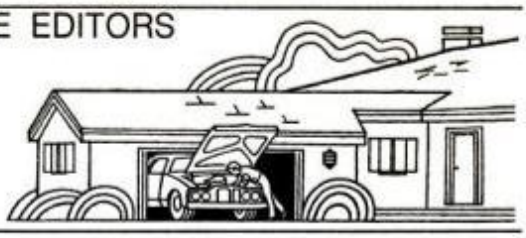
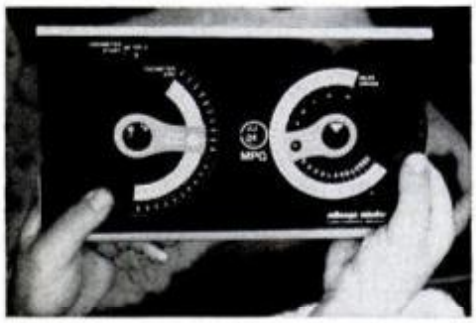


THE PM GARAGE

Mileage Minder

Sure, you can sit at the gas pumps with a note pad and pencil and work it out, but computing your miles per gallon is a lot quicker with this slick device. You use the left dial to read the miles you've traveled since your last fill-up, and the right dial for spinning-in the number of gallons used. You read the resulting mpg in the window in the center of the Mileage Minder.



My car has a trip odometer so I really don't need the left side of the computer, but I let the kids do the figuring anyway—it's that easy. I've always used a logbook to record the number of gallons I take when filling my tank, and the mileage, but seldom did the arithmetic to get mpg. Now it's easy.

The Mileage Minder is $5 from Designsense, Inc., 109 7th St., Atlanta, Ga. 30308.—*B.H.*

Lifetime mufflers

If you're the kind of car owner who keeps his car for many years, there's no reason to ever buy another replacement muffler. Guaranteed free replacement is being promised by more and more manufacturers and/or distributors for as long as you own the car. It's a great deal for those of us who don't trade in every three years. Of course, the guaranty isn't any indication of muffler quality: The "catch," if it can be called that, is that only a certain percentage of the original owners will still have the cars when the mufflers rust out—as even the best will in time.

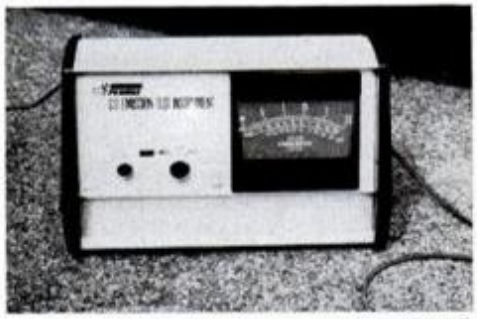
I recently installed a complete Stebro free-flow exhaust system on my Volvo. It has the full replacement guaranty and I hope it's many years before I have to take advantage of it.

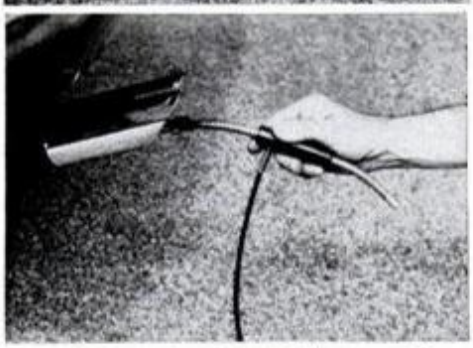
The system was $158 from B & B Auto Sport, Ltd., Box 82, Burnt Hills, N.Y. 12027.—*B.H.*

Emissions tester

Exhaust analyzers are a whole new breed of test instruments that the old shadetree mechanic never had at his disposal. Professional units cost thousands of dollars and are used by some service shops and by state inspection stations where an emissions check is required.

There are also many units now on the market for the do-it-yourselfer. Prices range from under $100 to over $400, and functions usually include measurement of hydrocarbons (HC), carbon monoxide (CO) and air/fuel ratio. Investing in one is not an easy decision to make because of the cost.





The one I borrowed from Sears is an excellent $200 unit that allowed me to get a good free tune-up before I returned it. At that price, however, it might better serve members of an auto repair co-op (see page 168, Nov. '75) than the individual car owner. It's No. 28G21011C in the catalog. Sears, Roebuck and Co., Chicago, Ill. 60684.—*B.H.*

Quick wax wipe

What'll they think of next? J Wipes are like hand towelettes, but they're for your car. The wax-saturated cloths are in a packet ready to use.

They give you a good, quick application of wax so long as you're wiping down a clean car. I find them perfect to take on long trips. It takes two to do a car. Box of four is $2.49. Johnson Wax, Racine, Wis. 53403.—*B.H.*

Quick on the draw

It's the only compression tester I know of that is so convenient to use. The pistol-grip design lets you press the tip firmly into the sparkplug hole and see the meter face without being a contortionist. But that's not all: The built-in remote starter switch is where the trigger of the pistol would normally be. You remove all sparkplugs, connect the remote starter leads and shoot. Model 357 is $15 from Sonco Manufacturing, Inc., 1402 Sabal Palm Drive, Box 416, Bonita Springs, Fla. 33923.—*B.H.*

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Introducing the new Dodge Charger.

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*Manufacturer's suggested retail price for a 1976 Charger (not shown), excluding state and local taxes, destination charge, and optional equipment.

Dodge

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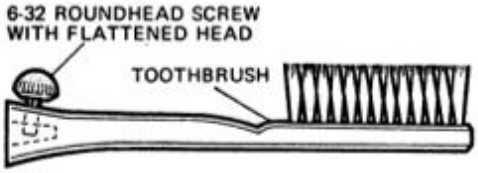
APPLIANCE CLINIC

BY PAUL MANN

Brush fix

Here's a fix I've made that has saved me money. It may do the same for others. It concerns a General Electric toothbrush (Model B1TB5-1907). Shortly after the warranty expired, the plastic brush-holding tip (wand) became badly worn and wouldn't hold brushes. I was told that the wand couldn't be repaired and should be replaced. The cost of a new wand is almost as much as a



complete new set, so I decided to see if I could fix it myself.

On the thickest part of each toothbrush, where brushes engage the wand vibrator shaft, I drilled and tapped a 6-32 hole for a ⅜-in. roundhead screw. I flattened the head of each screw to simulate a thumbscrew. As you can see by the drawing, the screw is used to hold the brush fast to the wand. The repair has been in effect one year without failure. Total cost to me was a few minutes' time and pennies' worth of screws.—Harry E. Brown, Oaklyn, N.J.

Great idea, Harry.

Ice begets ice

Our General Electric refrigerator (Model TB 14 SLC), purchased in December, 1970, forms condensation and ice on the outside *of the unit over the top and partly along the sides. This has been going on since 1972. My warranty expired before the trouble began, and a serviceman has told me that repair is going to be very expensive. I'm approaching retirement and can't afford extensive repairs. Can you tell me what is causing the problem and if there's anything I can do about it myself?—George Waldinger, Hawthorne, N.J.*

I can take a stab at what's causing the trouble—probably ice that has formed on the inside insulation. Ice on insulation is keeping the cabinet very cold; when condensation forms on the surface, it turns to ice.

How did the ice get there? Although the refrigerator section of the unit is self-defrosting, the freezer section has to be manually defrosted. The freezer section occupies the upper part of the unit—the part where the problem is occurring. One reason for formation of the interior ice could be incomplete defrosting. Midway through defrosting, when moisture predominates, the unit may have been turned back on. This would transform all that interior moisture into ice.

What can you do about it inexpensively? Turn the freezer off and allow it to thaw for several days. Then turn it on and see what happens. If the problem persists, defrost the freezer for a few more days. If this fails to rectify the trouble and you wish to proceed, you will probably have to have all new insulation installed—this is where the job becomes expensive. Sorry.

Steamer

Do you have any suggestions for repairing a Sears automatic drip coffeemaker that spurts steam instead of water and cuts off before all water is directed to the coffee? I've installed a new thermostat and cleaned out the inside of the heating unit.—Paul Amick, Louisville.

Sounds as though the washer-type pump in the base of the spout has fouled and is permitting air to seep into the pump, rather than its pumping all water. It can't be fixed—the washer is flared to the tube. But take heart. Sears has an extremely liberal customer-satisfaction policy. Return the appliance to the store where it was purchased, and don't be surprised if you are given a new coffeemaker.

Disappearing spots

Hey, Paul, maybe I can add some information to your helpful column. Regarding "Sudden Spots" in the August PM—in which Ben Sernentilli Jr. complained about clothes coming from his General Electric washing machine with grayish-white spots—I've run across the same problem. I am a serviceman for a coin-operated laundry company, and I work on GE models.

To solve the problem, I removed the agitator and found gray graphite grease packed into a little rubber cup on top of the transmission. I pulled the rubber cup off (it comes off easily) and cleaned out the grease. The problem disappeared. Maybe Ben's washer is similar to the GE commercial models. It's worth a shot to see.—Don Fecher, Bronx, N.Y.

You bet it is. Thanks for the help, Don.

Defusing

We recently purchased a Sears Lady Kenmore glass-topped, drop-in electric range. An aluminum pot of water was left too long on one of the enclosed burners and boiled out, leaving what seems to be aluminum fused to the glass. Is there a way of fixing this?—Gene P. Klarman, North Readington Beach, Fla.

If, as you say, aluminum has really melted into the top (it could enter the pores of the porcelain), then I'm afraid you will have to live with the results of this accident or replace the top. What's more likely—and let's hope—is that what you see are just surface marks made by the aluminum. These can be cleaned off with a nonabrasive cleaner made especially for cleaning stubbornly dirty white porcelain. Cleaners for this purpose are sold in supermarkets and hardware stores.

Thor lives

I have a Thor Model 16 sander for which I've not been able to get repair parts, because the Thor Co. is out of business. I need four neoprene balls (part No. D 3371) to make my tool active again. Can you help me locate the parts?—W. A. Alke, Theresa, N.Y.

Where did you hear that Thor Power Tool Co. was out of business? You can write to 175 North State St., Aurora, Ill. 60507 and find out differently.

If Thor is unable to supply these parts, write to the Power Tool and Industrial Equipment Service, Inc., at 12 West Elizabeth Ave., Linden, N.J. 07036. It should have the parts you need. ★★★

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.

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In chain saws, the greater the vibration, the greater the fatigue.

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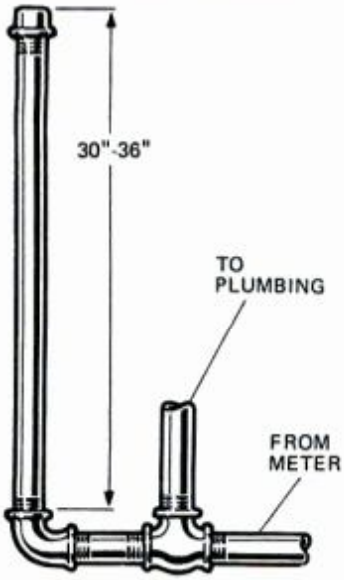
HOMEOWNERS' CLINIC

Air blast

After installing a water softener, I get a blast of air when opening faucets, often violent enough to knock a tumbler from the hand. Is my trouble in the softener or the plumbing?—Jim Smith, Lafayette, Ind.

If the softener has been properly installed, the problem is more likely to be in the plumbing. The common remedy for such difficulty as you



are experiencing is installation of an air chamber. These sometimes have been omitted from older plumbing systems; they generally look like the one shown in the drawing. The chamber is usually the same size pipe as that used in the plumbing lines, and should be at least 30 in. long —36 in. if you have the space.

How to reshingle

I plan to reshingle the uninsulated walls of my Cape-style home with white-cedar shingles. Two procedures are suggested: Strip the old shingles, apply ⅝-in. insulation board, paper and reshingle. Or leave old shingles, cover with aluminum foil and reshingle. Which would you suggest?—Bert Blais, Pawtucket, R.I.

I hesitate to suggest doing what *I* would do in such a case, as the procedure involves some waste, a messy cleanup and a lot of labor. I would remove the existing painted shingles, apply aluminum foil, reshingle and finish with a stain of whatever color is desired. This would eliminate paint and moisture problems and provide the insulating value of foil. Applying new shingles over old would probably not be practical; in most cases a double layer of shingles would not allow door and window casings to protrude as they should.

Crawl-space ventilation

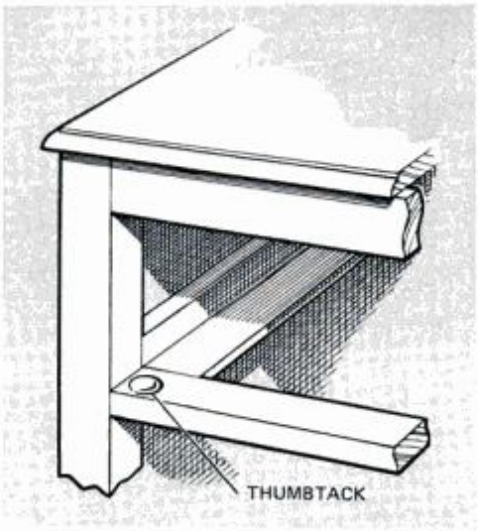
My home is on a slope with two of four 8x10-in. vents in window wells 20 in. below grade. There's a 27-in. insulated crawl space with a plastic-covered dirt floor. Do I have enough ventilation? And should the vents be open or closed in winter?—Edward D. Mattox, Lewisburg, W. Va.

If I understand your description correctly, you should have adequate vent area. The vents should ordinarily be left open during the winter months.

Quick drawer fix

I have an older chest in which the drawers have been heavily loaded at times. As a result, the bottom edges of the drawer sides are somewhat worn, making them difficult to slide in and out. There are no center guides. What can I do to make them slide more easily?—Mrs. J. Tenney, Fort Worth, Tex.

First, pull the drawers all the way out and check to see that the sides have not spread—that is, that the



corner joints have not opened; if they have, add glue and tap the sides until the joints are tight. Then drive a large-headed thumbtack in the position shown in the illustration, the head centered under the lower edge of the drawer sides. Spray the lower edges of the sides with a silicone lubricant, which you can buy from your paint or hardware dealer.

Floor holds water

My concrete patio floor has a low place that holds about ½ in. of water. The depression is 5 or 6 ft. in size, oval in shape. How can I correct this condition? Also, what makes a white shingle roof spot with brownish or black areas?—J. T. Ellis, Como, Mass.

There are concrete patchers that can be troweled into shallow depressions and swept to a feather edge with a whisk broom. Ordinarily these will bond to old concrete, but on so large an area as you describe I would first either etch the surface with a muriatic-acid solution (wear eye and hand protection) or chip it lightly with a cold chisel (with eyes protected) before applying the patchers.

Brownish-black areas on a white roof are usually caused by mildew. Large trees that overhang a roof are a common cause, as they reduce air circulation and shorten daily exposure to sunlight, which results in damp conditions that favor mildew growth.

Stained ceiling

My upstairs bathtub overflowed and the water stained the ceiling plaster below. Only a small area of the affected plaster loosened and had to be replaced; the rest seems solid. Can I repaint and hide the stain?—Mrs. Stan Smith, Buffalo.

If you are certain that the plaster is still solidly anchored to the lath or mesh plaster base and that this plaster is thoroughly dry, you can give the area one coat of pigmented or white shellac and then repaint it. I'd wait at least two months from the date of the wetting before you repaint. ★★★

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. HL5, Box 1014, New York, N.Y. 10019.

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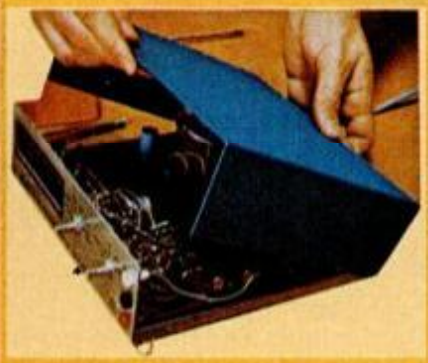

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SHULTON

BY EUGENE A. SLOANE

THE BICYCLE SHOP

GENE BUILDS A SUPERLIGHT TOURER

Every day, during my first bike trip over Vermont mountains, I mailed some of my equipment home. In a week I had stripped 10 lbs. of gear off the bike. Every day I could tell that just the pound or two I had removed made climbing those hills measurably easier, and at the end of the week I could hardly believe how much more easily I was pedaling

up fairly steep grades.

To get an idea of the way weight drags you down, heft just a 5-lb. sack of potatoes, then imagine trying to pedal up a steep hill with the sack strapped to your bike. The gravity that makes the sack feel heavy is the same gravity that pulls you back and makes you work harder on a bike trip.

If you're a real bike freak like me, you will go to almost any length to lighten the load, including the bike itself. Since you can readily control what you carry, we'll stick to getting control of the bike—by assembling a truly lightweight bicycle that will make hill-climbing and general touring much easier and more enjoyable. And if you're over 40 (like me), you need every advantage you can get to keep up with the kids. This bike won't be cheap, but it is a dream machine of its kind, and one that certainly isn't out of everyone's reach.

Most components I have listed in the chart at right are fairly standard and available from any good bicycle store. Those parts that are special and not yet broadly distributed can be purchased from the manufacturers. The frame is made of graphite fiber over aluminum tubing by Composite Sports, Inc., 3250 Wing St., San Diego, Calif. 92110. Arnold Industries, maker of the titanium parts, is at 6947 Washington St., Minneapolis, Minn. 55345. (When ordering a frame, give inseam measurement, height, weight and arm length.)

The tabular listing of parts is self-explanatory. Most metal parts, except for frame, seat and seat bolt, are made of aluminum alloy.

The completed bike weighs 19.6 lbs. A comparable off-the-shelf touring bike, in terms of quality of components and reliability, weighs 28 to 30 lbs. and costs about $750. The bike I've assembled here uses highest-quality silk tubular tires, the best components on the market and the exotic new, space-age graphite-aluminum frame set. You could shave $200 or so off the price, but add some weight, if you use less costly, heavier tires, rims and other parts.

Assembly is easy and straightforward, and if you have been following this column for the past two years you should have no trouble. If not, I suggest a good book on bike maintenance, such as my own (*The New Complete Book of Bicycling*, Simon & Schuster, $12.50).

I should add that I have put this bike together and it rides like a dream. It won't coast uphill, but in comparison to what I've been riding, it feels like it. ★★★

PART	WEIGHT (ounces)	COST	MAKE AND MODEL
Frame	48.0	$500.00	Composite Sports
Fork	22.4	*	Composite Sports
Seat post	11.25	*	Campagnolo
Seat bolt	.2	2.50	Arnold Industries
Rims (2)	26.0	17.00	Mavic "Piste"
Tires (2)	22.0	50.00	Clemente No. 50 silk
Hubs (2)	11.2	45.00	Hi-E
Spokes (72)	14.4	5.50	Berg-Union
Seat	10.0	26.00	Jacobs "Cool Gear"
Headset	8.0	25.00	Campagnolo
Stem	10.0	12.00	Cinelli 1A alloy
Handlebars	11.5	25.00	Cinelli Giro
Pedals (2)	11.5	55.00	Phil Wood
Toe clips, pr.	3.0	3.50	Christophe
Straps, pr.	2.0	3.50	Christophe
Freewheel	12.0	12.50	Milremo Alpine 14-30T
Crankset	30.0	85.00	T.A. 36-50T
Brakes	19.4	85.00	Shimano sidepull
Chain	13.5	12.50	Regina Gold
Derailleurs	11.9	43.50	Shimano Dura-Ace GS
Bar shifters	2.8	16.50	Shimano
Cables	12.0	12.00	Wescon
Totals	**313.05 (19.6 lbs.)**	$1037.00	

*Supplied with frame at no extra cost.

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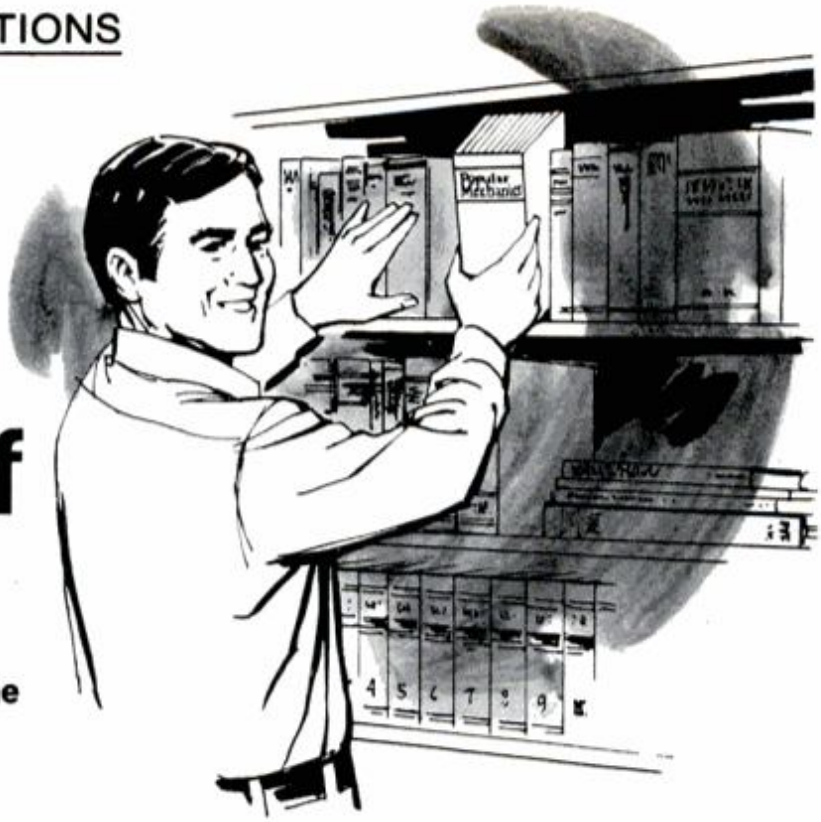

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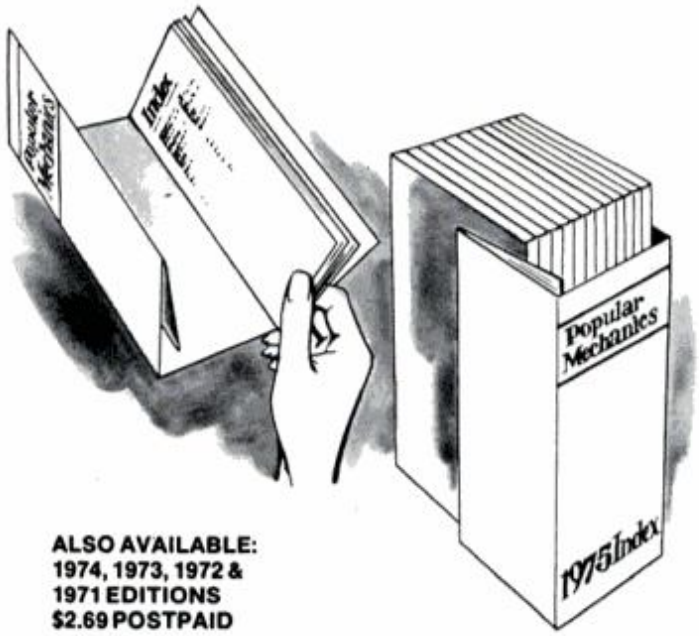

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CAR CLINIC

BY MORT SCHULTZ

What's up, Doc?

Maybe you can diagnose my problem with a 1973 Mercury Marquis brougham, which seems unsolvable. When I make a left turn, the steering wheel feels like it passes through a bind or high spot. The wheel sometimes does not return by itself, but stays in the turned position until restored to normal straight-ahead position. The power-steering pump was replaced, steering gears adjusted several times, and front wheels aligned and balanced many times. Please help.—Emaniel Kumin, Shreveport, La.

Your problem is typical of one being caused by a malfunction in the axial (control) valve and/or in the steering gear. The axial valve controls fluid from the power-steering pump to the power cylinder. If there is a malfunction in the valve which results in an obstruction to the passage of fluid, binding can result. The valve is a complex component consisting of springs, bushings, nuts, "O" rings, regulators and so forth. One may be overhauled, but the work should be done competently and cost may approach that of a new valve. I therefore suggest you replace the old valve with a new one.

At the same time, you should investigate the possibility that a gear in the steering-gear housing is too tight.

Holy Camino!

Can you tell me what's beneath the plate in the bed of the 1974 El Camino? I hesitate to break the seal to look, and my Chevrolet dealer doesn't know.—J.L. Fairchild, Cambridge, Ohio.

If you're speaking about the plate right behind the front body panel—nothing is there but a quite big hole. The El Camino uses a Chevelle floor pan, and this plate covers the part in the pan where seats would go if the vehicle were a sedan. Chevy doesn't recommend you remove the plate to use the empty space as a storage compartment, say. Once the seal is broken, there's a good chance water will leak into the hole. The plate is sealed in production with body sealer.

Ford's shifting problem

I own a 1975 V6 (2800-cc) Pinto. The car is equipped with automatic transmission, and therein lies my problem. Mileage is now 6000, but the trouble started at 300. The transmission won't shift to intermediate range about 90 percent of the time. When it does shift, there is a hesitation. The dealer has had the car tied up several times for band adjustment, replacement of a disc in a solenoid and various other checks. Have you heard complaints like mine?—Jim Atwood, Logansport, Ind.

Yep—and so has Ford, Jim. The company has issued service bulletins regarding "delayed upshift." Ask your dealer to consult article No. 1138 of service bulletin 90 (5/23/75), which tells him to check control pressure, timing and proper routing of vacuum hoses. Ask him also to look in the same service bulletin at article No. 1142, entitled *Soft or Slipping 1-2 Shift Condition—C3 Automatic Transmission.* This may apply. It calls for replacing the band release delay valve and spring with a service valve and spring kit (part No. D4ZZ-7D370-A).

Tipsy canoe and angled, too

Why is the master cylinder in a 1975 Pontiac Ventura SJ tipped so severely? The angle restricts the front section of the split system to being filled with less than one-half the amount of brake fluid. I have looked at other cars, and many cars are the same way. What's the secret?—Keith C. Heckel, Newport News, Va.

The secret is to mount the master cylinder without having it interfered with by the engine and/or steering shaft. In the engineering phase of automobile-engine compartment design, the master cylinder and power-brake booster, if one is used, are mounted and then designed for proper operation at whatever angle the cylinder takes. In other words, fluid level and fluid pressure are established for proper brake operation with the master cylinder and brake booster at whatever angle is necessary to permit clearance.

For LUV or money

I can use a fuel pump and carburetor kit for my 1974 LUV pickup, but much to my surprise I've been told the kit did not exist. Are parts this scarce?—Fred Watson, Ochelata, Okla.

First of all, Fred, there is no fuel pump *and* carburetor kit. They are two separate items, and by the time you read this you should be able to get parts you need from a Chevrolet dealer. When you wrote me, Chevy had just set up a carburetor repair kit and was in process of stocking warehouses.

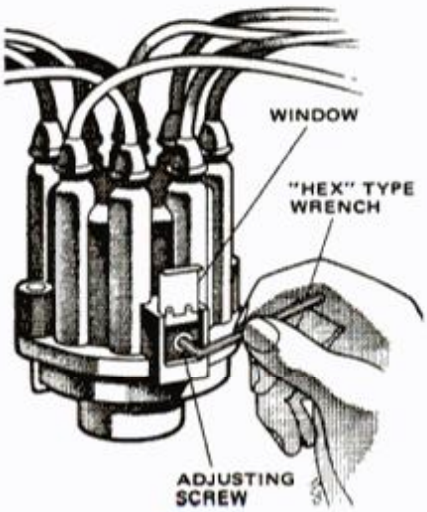
The part number of the carburetor repair kit for 1-2-3 series LUVs is 94024948. That of the carburetor repair kit for 4 series LUVs is 94024949. You can tell which series you have by checking the vehicle identification number (VIN) plate on the left door pillar. If your VIN begins with the numerals "82," you

(Please turn to page 42)

Close the window!

PM CAR CARE tip

In window-type distributors used in General Motors and some AMC cars with conventional ignition, the points are adjusted by lifting the window and inserting a hex-type wrench into a hex slot in the point-adjusting screw. If the window is left open, you can expect rapid burning of points due to dirt and foreign matter collecting on points. If your car has this kind of distributor, double check to make sure the window is tightly closed after making adjustments.



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Kings, 15 mg. "tar," 1.0 mg. nicotine; Longs, 17 mg. "tar," 1.2 mg. nicotine, av. per cigarette, FTC Report Apr. '75

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(Continued from page 40)

have a series 1. If it begins with "C L N 14282," you have a series 2; if "C L N 14382," you have a series 3; if "C L N 14482," you have a series 4.

Series 1-2-3 LUVs use a mechanical fuel pump. You can purchase a replacement diaphragm by ordering part No. 94020467. The series 4 LUV has an electric fuel pump which must be replaced if defective (part No. 94024731).

Left in the dust

The one and only frustrating problem we have with our 1974 Plymouth Duster is this:

Until the engine temperature reaches normal range (about 160°), the car won't perform. I mean I can't move it from idle. Any attempt at driving results in stalling as soon as I place the transmission into Drive or Reverse. The car needs a five to seven-minute warm-up period, even in summer. But when the engine is warm, the car performs admirably. My mechanic and local dealer have given up. Can you help?—Mrs. C. Galindo, Levittown, N.Y.

I don't know what your mechanic and local dealer have done, but I assume that they have tuned up the engine and checked the fuel system. I would now try this:

Have the vacuum line to the exhaust gas recirculation (EGR) valve clamped off and test-drive the car. If the engine now performs as it should, check to see that the routing of the EGR hose is correct, that the EGR hose is not damaged, and that the EGR valve is both clean and functioning.

Pooped pep

My 1973 Capri with a 2000-cc engine and a standard shift is a peppy car with good acceleration and gas mileage, but it has a terrible hesitation if the accelerator is depressed in a quick motion from idle. I have tried varying point dwell over the specified range of 37-41° varying the idle adjustment, removing and plugging the vacuum line to the retard side of the distributor vacuum diaphragm, and checking the distributor mechanical advance and timing chain position.

If I lead the action of the accelerator by manually pushing the accelerator-pump arm, there is no hesitation. This caused me to change the accelerator diaphragm and finally to drilling the pump-discharge nozzle a little larger to .018 in. There was an improvement. The hesitation is no longer terrible—just irritating. All filters, PCV valve, sparkplugs and points have been changed, and I have even installed electronic ignition. Do you have any other ideas?—Russell Gehrke, Mountain Lakes, N.J.

You bet I do. Why don't you start with basics, which is a carburetor overall, because you'll probably find one or more of the following:

1. A malfunctioning accelerator-pump circuit. Concentrate on the pump valve and see to it that gas isn't leaking past the ball on top of the accelerator-pump discharge valve.
2. An improperly set float level or a damaged float.
3. A misadjusted secondary throttle linkage. If the secondary is opening too quickly, hesitation will occur.

Capable capacitor

When I installed an FM radio in my 1974 Plymouth Satellite, I picked up a whining-type noise from the engine. My friend tried to place a capacitor on the alternator, but it didn't work. Can you suggest something?—V. Kazonfer, Smithfield, N.C.

I don't know what kind of capacitor your friend tried, but Chrysler Corp. makes a capacitor that attaches to the ignition coil and will solve your problem. Its part No. is 3501598, and you can buy it from the parts department of a Chrysler Corp. dealer.

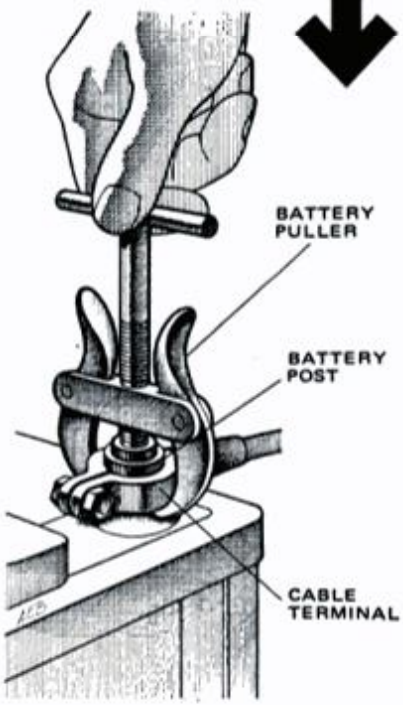
Caster and camber

My Mazda's front tires are wearing. I've taken the car to the dealer several times, and he just gives it to an independent front-end shop. I finally found a mechanic who says that caster and camber need adjusting, but there is no way to do this short of bending the frame. This seems drastic. Is there a better way?—A. Thornhill, Southbury, Conn.

I'd say so. Caster and camber are adjustable by shimming which requires special equipment found primarily at Mazda dealerships—some anyway. Your dealer obviously doesn't have it, so I suggest you see the Mazda dealer in Greenwich, Westport or New London.

One qualification: The adjustment will be impossible if the car has been in an accident resulting in front-end damage. If so, caster and camber cannot be adjusted. Damaged parts will have to be replaced.

PM CAR CARE **tip**



Use a puller

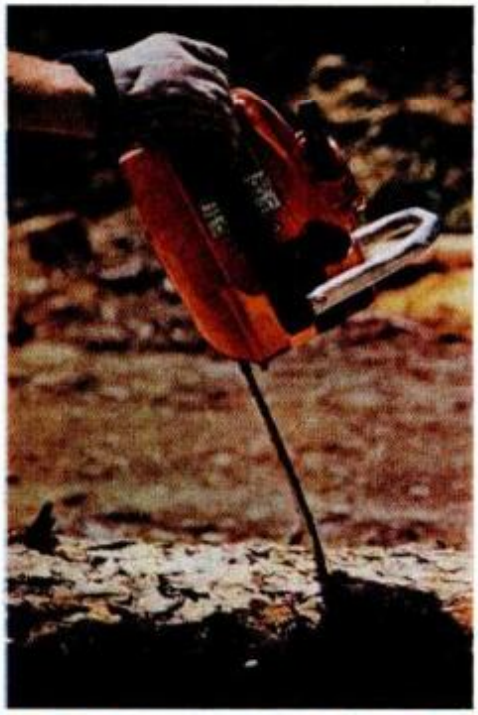
Removing a battery for periodic cleaning lengthens battery life, but only if you remove battery cables properly before you take the battery from the car. A special puller with two arms that attach beneath cable terminals is, for our money, the only tool to use. A central push rod is screwed down so that it pushes against the post and pulls up the terminal. Never pry with a heavy screwdriver; it can severely damage the battery whose life you're trying to extend by cleaning. It's best to leave the battery dirty if this is the only tool you plan to use.

SERVICE TIPS

■ Ford Motor Co. has issued very specific instructions regarding the power-steering fluid you should use in your passenger car or light truck. This recommendation concerns current and past models, and all Fords and Mercurys. Use fluid bearing Ford part No. D5AZ-19582-A.

■ If the horn of your 1975 Chrysler, Plymouth or Dodge toots by itself every so often, there's a simple procedure outlined in service bulletin 08-17-75 to make it cease and desist. Disconnect one horn if your car (or Dodge truck) is equipped with a dual-horn setup. Connect an ammeter in series with the *other* horn. With the engine off, have someone press the horn button. You should get a reading of 4.5 to 5 amperes. If the reading is below 4.5 amps., there's an adjusting screw on the horn assembly. Turn it counterclockwise to bring current draw into line. Test the other horn the same way. Now if either component insists on blowing its own horn, replace it. ★★★

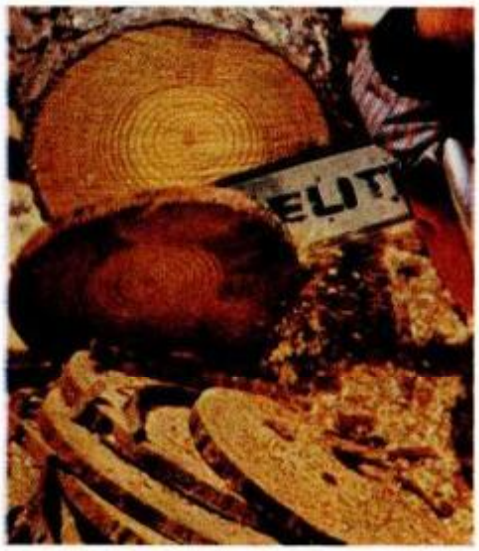
GOT A PROBLEM WITH YOUR CAR?
Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be published in the column.



Homelite's $99.99* chain saw may be inexpensive, but it's not cheap.

When you're America's largest maker of professional chain saws and you want to stay that way, you sometimes have to resort to brute force.

The chain saw you see being tortured is the Homelite XL, our lowest-priced homeowner saw. It was slammed and jammed into trees and logs so we know what to expect when it runs into the unexpected. And to prove that while it's lightweight, it's tough enough for all your cutting and pruning needs. (For safety reasons, please don't try this yourself.)



And while it's low in price, it's not low on professional features. There's automatic oiling so you won't inadvertently burn out the bar and chain; an exclusive Softone™ Muffler to make cutting easier on your ears; plus grouped controls.

So with a Homelite chain saw you don't have to be a pro to cut like one.

HOMELITE®

For the pro and the man who wants to cut like one.

*Suggested Retail Price: $109.95. Available at participating dealers until Dec. 28, 1975 for $99.99. Check the Yellow Pages under Saw. ™Trademark of Homelite, a textron Division, Charlotte, N.C. 28217.

Материал, защищенный авторским правом

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. GMC

Материал, защищенный авторским правом

The Christmas Day battle that began a legend

Though in action just six months, the famous Flying Tigers racked up an incredible record against the militarily superior Japanese in one of the most heroic sagas in aviation history.

by Roy Grinnell

Flight Leader Robert T. Smith put his P-40 into a screaming dive, held his gunsight on the looming Japanese bomber below him and pressed his stick trigger. It was Dec. 25, 1941, a day that would go down in the record books of aviation history.

While Americans at home, still numb from the horror of Pearl Harbor, were trying to have a normal Christmas, a small band of other Americans far across the Pacific were fighting desperately to stave off a massive Japanese air attack on the vital seaport city of Rangoon in Burma. Sweltering, smoldering Rangoon, hub of England's empire in Southeast Asia, had been the target of a paralyzing Japanese bombing raid only two days earlier on Dec. 23. Smoke still swirled from burning docks and gutted buildings, and thousands of homeless refugees choked debris-clogged streets, bringing the city to a standstill. A second attack could devastate the seaport completely, in the process wiping out millions of dollars' worth of American lend-lease military supplies stored there for shipment to the Chinese.

Rare color photo of Flying Tiger P-40s in formation shows famous shark mouth symbol—fearful sign of evil to Japanese. At top are portrait of group's commander, Gen. Claire Chennault, and squadron emblems.

The tiny force of Americans on that fateful morning were U.S. volunteer fliers hastily recruited under the command of Brig. Gen. Claire L. Chennault to stop the Japanese from destroying Rangoon and the Burma Road, military lifeline of the besieged Chinese in the early days of World War II. Officially called the American Volunteer Group (AVG), these were the men who were later to become affectionately known as the now famous Flying Tigers.

The pilots, while well-trained and dedicated, lacked combat experience. Their already outmoded P-40 Warhawks were no match for the new lighter, more maneuverable Japanese Zeros. Though the group supposedly consisted of 100 planes, scarcely more than half that number were ever operational at any one time, and these were patchworks of crude, makeshift repairs. Poor food,

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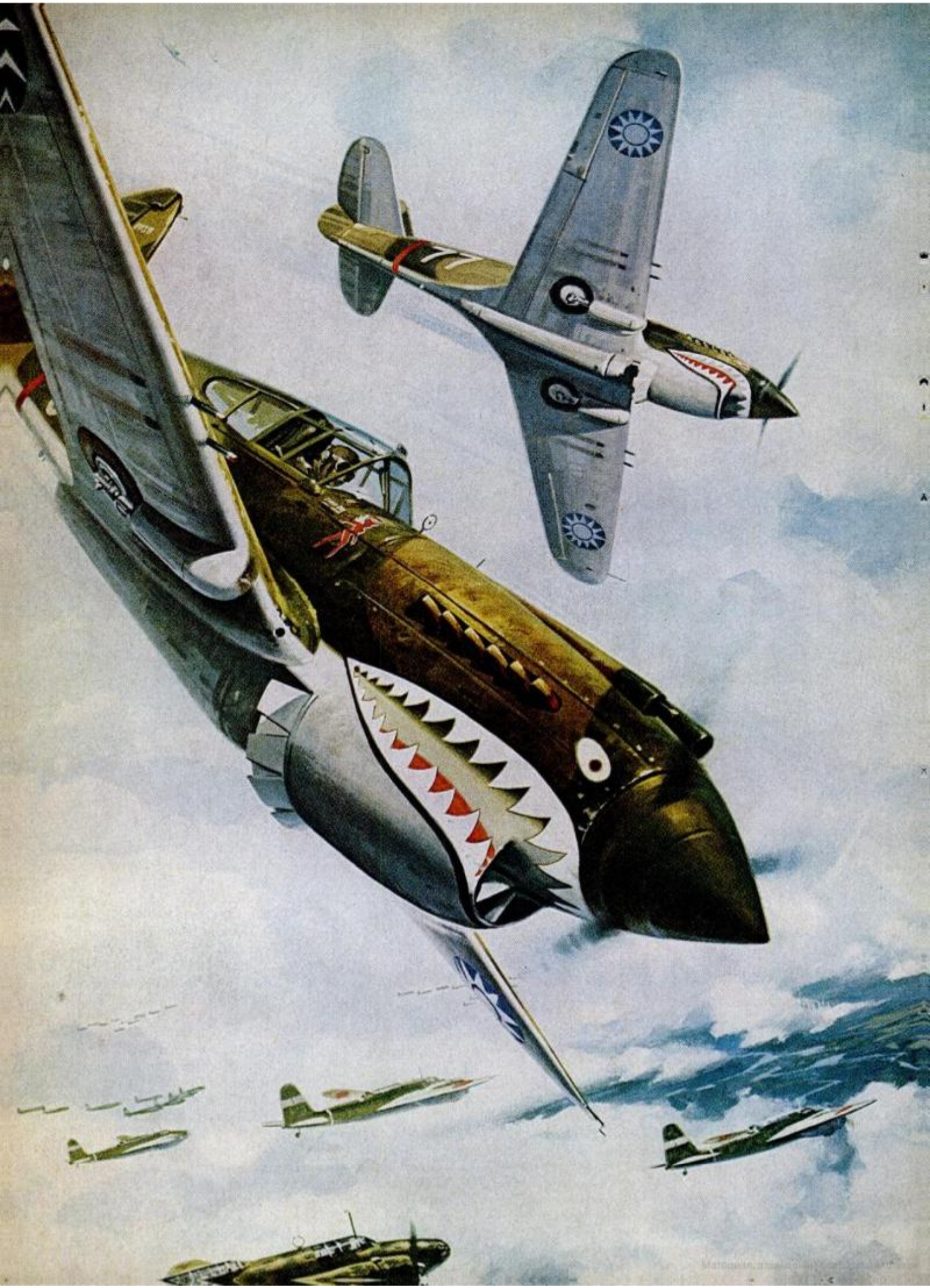

primitive living conditions, disease, insects and brutal heat all helped to sap the men's fighting strength.

That such a ragtag force could accomplish anything is amazing—that it could achieve such phenomenal success over the militarily superior Japanese is little short of a miracle. Because the Tigers' exploits were so spectacular and their fame so widespread, many even today are not aware that they were in action for only a relatively brief period—just a little over six months from Dec. 20, 1941, to July 5, 1942.

The Tigers were divided into three squadrons—the First, nicknamed "Adam and Eve"; the Second, called "Panda Bears"; and the Third, "Hell's Angels." The First and Second Squadrons were sent to Kunming, China. The Third, the Angels, was based at Mingaladon Airfield near Rangoon, with a small contingent of British RAF flying Brewster Buffalos.

Out on the airstrip at Mingaladon early that Christmas stood 12 AVG pilots on alert, peering anxiously into the bright morning sky. They had overheard on a radio broadcast from Bangkok that the Japanese were coming to deliver the final death blow to Rangoon, and they tensely awaited the alarm that would send them running for their shark-mouth aircraft. Minutes dragged as 0900 came and passed with no sign of the enemy. The men were growing nervous. Squadron Leader Arvid Olson, squinting into the glaring sun, revealed to Flight Leader Robert Smith how fearful he was of being taken by surprise.

Hunch pays off

Finally, at 0930, Olson decided to send up three P-40s to scout to the east. His hunch paid off. At 0950, George McMillan, flying lead position, radioed back that he had sighted a large formation of Japanese bombers coming in over the Gulf of Martaban, about 60 miles out. He stated quite loudly that the rest had better get their tails up there fast.

Taking off in twos, roaring down the single usable runway, the remaining P-40s raced to McMillan's aid. When they caught up, they were stunned by what they saw. Stretching to the horizon was a mighty air armada of some 70 Nakajima Ki-21 bombers (Sallys) and about 30 fighters—12 obsolete P-40s against 100 of Japan's best.

In the words of Flight Leader Smith, "We climbed as quickly as possible, checking gun switches and sights, then from about 1000 feet above made a diving turn toward the enemy formation. We each picked out an individual bomber and dove on it, ready to open fire at 300 to 400 yards. I had learned from the previous battle on the 23rd that it's practically impossible to score a hit with deflection shots from an angle unless you've had considerable aerial gunnery training. I had had none. Hitting a moving target is greatly simplified if you eliminate the deflection problem, but this meant boring in from dead astern and firing at point blank range. While the method worked, it was also a lot more dangerous since all those guns firing back at you had no problem of deflection shooting either.

"After the initial pass, it was every man for himself. Within 10 minutes, each of us had scored a hit or two, and the sky was filled with flaming, smoking bombers, twisting down toward the rice paddies below. I blasted two bombers, one exploding directly in front of me and the other going down out of control with an engine blazing.

There was no turning with the fighters in the classic dogfight tradition, as we knew they could outturn us. However, we could outdive them and get away if one got on our tail. Also, our P-40s were more rugged with armor plating to protect the pilot and self-sealing fuel tanks. The Japanese had neither of these and could not withstand much machine gun fire.

Close shave with a Zero

"On my last pass at the bombers one of my wing guns was hit in the electrical solenoid and continued to fire merrily away until all the ammo

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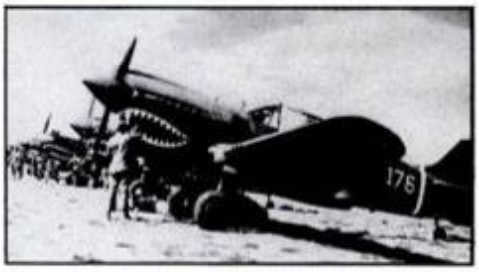
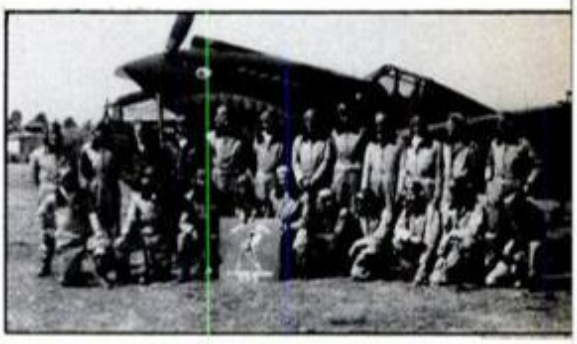
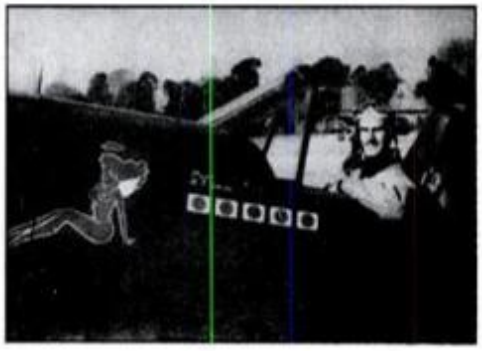






Nostalgic memories are caught in old photos, most never before published. Top left: A P-40 gets a tooth check as pilots await orders to scramble. Center left: Postwar reunion shows Chennault (middle) with ex-Tigers. Flight Leader Robert T. Smith, a hero of the Christmas Day battle, stands to left of Chennault. Bottom left: In rare moment of relaxation, Chennault at bat plays ball with his men. Top right: AVG airmen pose with one of their famed Warhawks. Bottom right: R. T. Smith was one of first to gain "ace" status with five kills, as indicated by decals on his fuselage.

Flying Tigers in action (facing page), painted by author/artist Roy Grinnell, depicts the incredible Christmas Day air battle—biggest single combat engagement fought by the Tigers—in which 12 volunteer American airmen took on about 100 Japanese bombers and fighters and downed 28 enemy aircraft—without a single loss of life of their own.

Материал, защищенный авторским правом

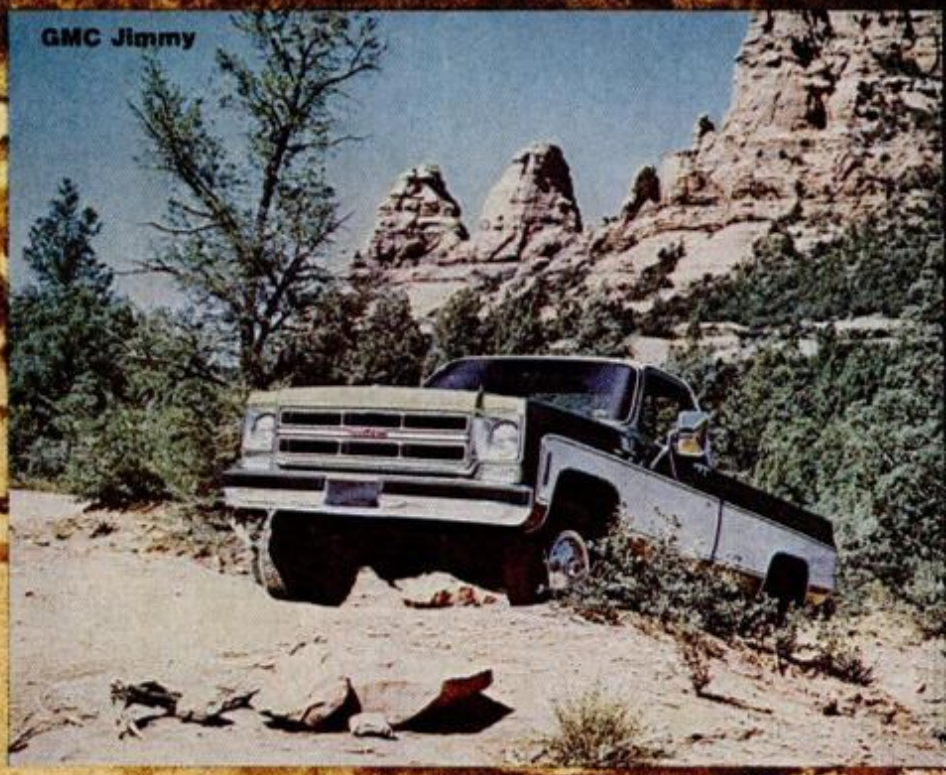
New 4WDs are right on for off-road fun

by Bill McKeown
OUTDOORS EDITOR

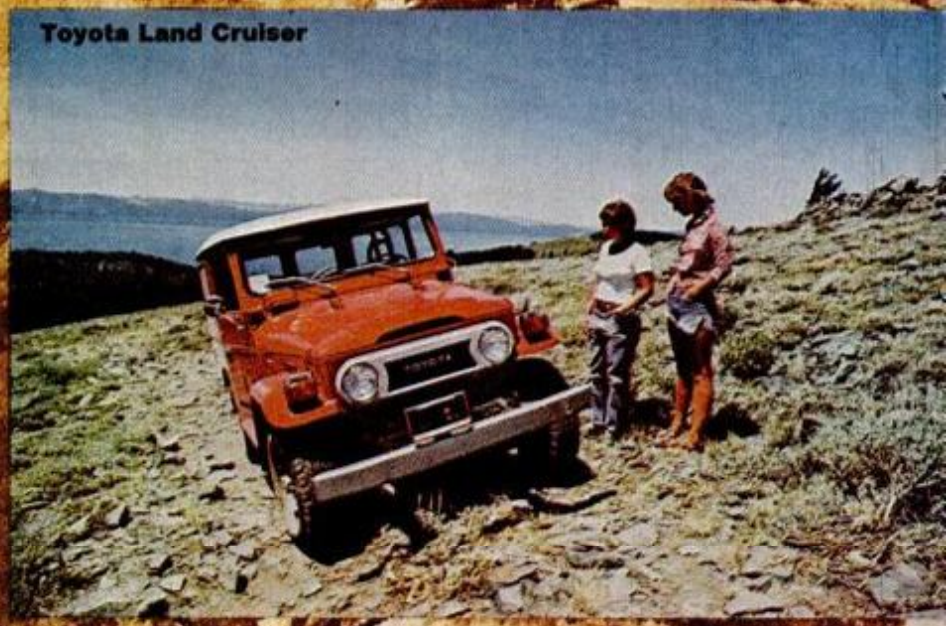
The end of the pavement is the beginning of the action for more and more drivers. Recent sales of the four-wheel-drives prove what many people are finding out—in these little rigs you can compact a lot of fun and utility for about $5000. Sticker prices for 4WDs are expected to accelerate by several hundred dollars next year, but that shouldn't slow down their popularity.

All the major car companies now sell a version of the little "truck" developed by Willys for World War II—the one the Army dubbed a ¼-ton 4x4 and everyone else called a Jeep. American Motors provides the greatly upgraded original that still proudly carries the name Jeep. New for '76 is the CJ-7 model, 10 inches longer than the basic $4199 CJ-5 with 83.5-inch wheelbase and 232-cu.-in. engine. Options will include automatic transmission and Quadra-Trac full-time four-wheel-drive plus engines up to 401 cu. in. for the larger models.

International's 4WDs are the 100-inch wheelbase Scout II, base-priced about $5500, and the new 118-inch Traveler and Terra models. Engines include a four-cylinder 196 cu. in. and V8s of 304 and 345, plus a new diesel. Ford's 92-inch wheelbase Bronco, with its 302-cu.-in. engine and new power brakes and quicker steering, is based under $5100. General Motors' Chevy Blazer and GMC Jimmy, with built-in roll bars and GVW options over 6000 pounds, are based just over $5100. The Dodge Ramcharger and Plymouth Trail Duster, on their 106-inch wheelbase,


GMC Jimmy

Chevrolet Blazer


Toyota Land Cruiser

Rugged-rig roundup shows that better performance of the new vehicles is packaged in better looks. Sizes range from compact 83-inch Jeeps up through 100-plus station wagons and trucks like the GMC Jimmy pickup above, to a 135-inch Woodsman motor home from Champion, upper right. Base prices rise from $4200 through a $5000-plus average to $16,500 for a fully-loaded motor home. Also on the off-road market is the Plymouth Trail Duster, similar in appearance to the Dodge Ramcharger. Land Rovers, however, are no longer imported from Great Britain.

Ford Bronco

Dodge Ramcharger

Champion Woodsman

International Scout Traveler Diesel

AMC Jeep CJ-7 Renegade

take engines from 225 cubes up to V8-440s. This year's base of $4531 will probably rise slightly. Toyota's 90-inch wheelbase Land Cruiser, with six-cylinder 125-hp engine, will be based at $5513 for the hardtop model in 1976.

Refinements for latest Toyota 4WD Land Cruiser include a new front hood design, and twin vertical rear doors for easy loading.

Why 4WD?

The advantages of this mountain goat of a vehicle make careful shopping worthwhile. Loyal owners of each make will give strong arguments about which is best for local conditions. The trend now is toward full-time front drive on-highway and off, with no need to get out and adjust front-wheel hubs. Short wheelbase and good road clearance handle narrow twisting trails, and engine options can be matched to steep terrain.

No other type of car converts so easily from enclosed sedan to open dune buggy—with the top lifted off and roll bars exposed. No vehicle gives quite the driving satisfaction as you steer carefully up what looks like an impossible abandoned logging trail.

When you hitch up a compact travel trailer or small tent camper behind, you can tow out across a prairie or set up camp in a remote mountain meadow where hunting and fishing are still unspoiled.

Yet the biggest advantage, of course, is the four-wheel-drive. With 4WD you can shift into low gear with the engine turning all four wheels to churn out of a gully or snowbank, or add traction over a slick surface or climb a steep grade without slipping or stalling. Oversize tires can provide an additional inch or so of road clearance and better "flotation" over beach sand and soft ground.

The minus side

The 4WD also has basic disadvantages, however. That short 80 to 100-inch wheelbase that gives such maneuverability and tight turning radius also allows little body space for passengers or piles of extra cargo. Those utilitarian bodies with their stiff sides get more than snug inside when a hardtop is added that may mount windows that cannot be opened for adequate ventilation. The heater usually works well because the small cab is not difficult to keep warm, but airconditioning is not a usual accessory.

No fancy styling—the kind that will provide planned obsolescence and make you look out-of-date next year—is added to the average 4WD. Instead, you get rugged construction that will last many years. And you'd better, because for a little square-shaped compact 4WD you pay a high price for all that durability. Gas consumption is also high, particularly when the engine is providing high rpm to power all four wheels, or is trying to push the rig at fast turnpike speeds through its modest gear ratio.

The bigger, higher-horsepower engine options available next year all deliver more muscle, but cost more to buy and feed gas. International for '76 is offering a Nissan diesel, a six-cylinder 92-hp model, for its new Traveler, Terra and Scout II. Lower fuel cost is the main advantage claimed for the $2400 extra expense, but longer life and less maintenance costs are also expected.

At highway speed, 4WDs have some additional problems that deserve driver attention. To supply the high road clearance, short wheelbase and adequate cab headroom, a high center of gravity results. Old Army Jeeps were noted for their tendency to snap-roll on a corner taken too fast, and today's models show off the same spectacular rolls during the new spectator sport of off-road racing in front of a grandstand. But traveling at normal speeds should cause no trouble if turns are taken with care.

Towing with your 4WD has great advantages when you travel back roads and trails to camp by trailer. The advantages diminish, however, as your trailer choice becomes larger and heavier. A weighty tongue-loading on the trailer hitch of a short wheelbased 4WD will try to tilt the front wheels off the ground and take away your steering control. A hitch load of 200 pounds or less is usually recommended; each vehicle will list maximum tow hitch and trailer weights in the owner's manual.

Larger 4WDs

Station wagons and pickups with four-wheel-drive solve some of the problems of the smaller compacts, yet they are larger and more expensive. But for towing bigger RV rigs, finding campsites off the beaten path, heading out across soft pastures or along beaches (with reduced tire pressure) they can't be equaled.

Choose one of the new pickups with

(Please turn to page 117)

First diesel power for a domestic 4WD is a 6-cylinder Nissan for International Traveler, Terra and Scout II.

Outside styling of new Scout II has only a small label by the fuel tank to indicate if model is diesel-powered.

Материал, защищенный авторским правом

Armchair studio for wildlife photos

by Charles Smith

Much as I admire nature photographers who stalk birds through chilly woods for days, I prefer to get bird shots like this without leaving my armchair—and I do.

My secret is a windowsill bird feeder, with a piece of one-way mirror backing up the window's glass. Invisible to the birds, I just sit back and click my camera. It takes some patience—but not the field photographer's dedication—and no discomfort.

You can have the mirror cut to any size you wish, according to your budget. I started with a 5 by 7-inch mirror, but soon found so many friends and family members nosing the glass to watch the birds outside that I soon switched to a 12 by 30-inch size. For safety and convenience, frame the glass. I used a rabbeted wood frame, but you could tape the glass in a frame of fiberboard just as well.

The mirror cuts down the light reaching your camera, but you can still shoot, hand-held or on a tripod, with high-speed films. Using these films means you can use natural lighting, and that you'll get natural-action blurs when the birds move. But it can also result in cluttered backgrounds, and the faster film has more grain.

You can use electronic flash

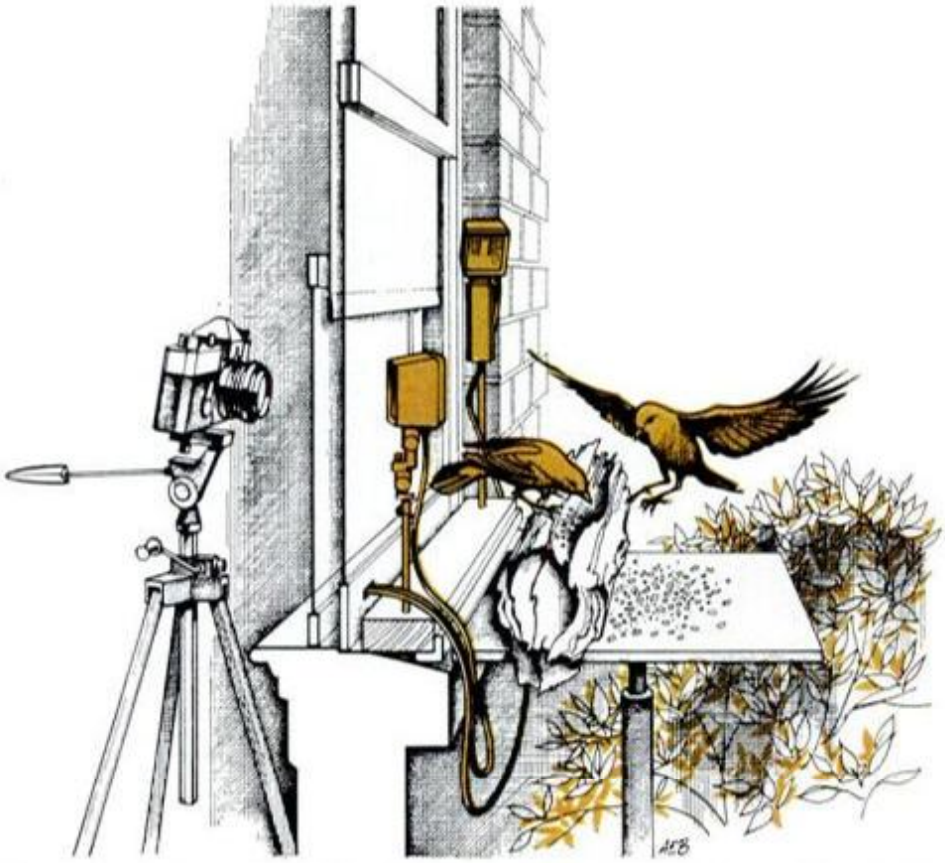
You can use slow black-and-white films or Kodachrome for wire-sharp, low-grain photos of unblurred action if you mount one or two electronic flash units on the windowsill as illustrated, and run extension sync cords to the camera. (Holes in the window sash or sill are optional.) Since this makes the birds much brighter than their background, there's no more background clutter.

My feeder is a log with holes drilled into it to hold seeds. It also makes a natural-looking setting. When I use flash, I attach my lights to a 2x4 base and adjust them before putting the light assembly outside, so as to disturb the birds as little as possible.

Fine gift for a shut-in

Don't count on good shots your first day—it takes several days from the time you first start putting seed out till your birds find out where it is. Even when you're not taking photographs, the endless antics of the birds entertain family and guests. And if you're looking for a gift for someone who must spend a lot of time indoors, the bird logs and mirror, installed, make a fine one, whether they are used with a camera or not. ★★★

This "deep-woods" bird picture was snapped from the author's easy chair.



Setup is simple: Log with holes to hold seed acts as feeder to attract birds, doubles as natural background. One-way mirror hides camera from birds, but not vice versa.

Ceramics: Fantastic new materials that will change your life

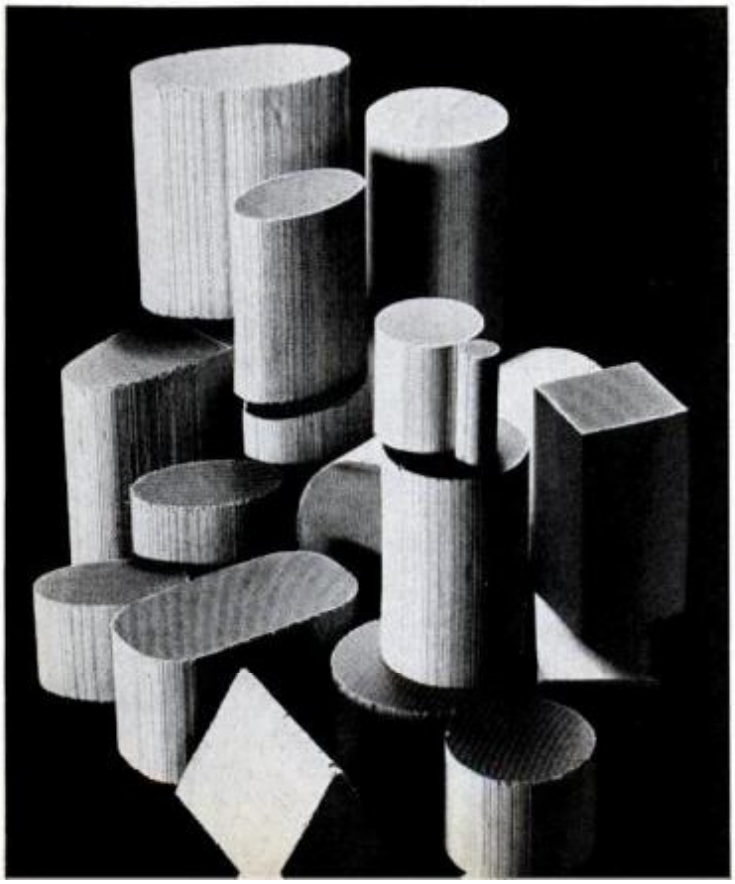
Ceramics engineering—that doesn't mean glazed pottery—is turning up amazing discoveries from bendable glass to houses that never wear out.

by Richard F. Dempewolff

Big news sometimes comes in small ways. Buried in the back pages of a small business journal was a recent item noting briefly that the Ford Motor Co. had built the world's first automobile engine made of ceramics.

Ceramics?

Yes, ceramics. It's a gas turbine engine, and while Ford isn't ready to announce it publicly, the company is known to be working on it. Ceramics take naturally to temperatures that would melt most metals, and the higher the operating temperature of a gas turbine, the



Exotic glass, a form of ceramic material, can be given virtually any properties you want. At top, new bendable glass flexes without breaking, may be used in car and train windows. At bottom, a length of tempered glass pipe is tough enough to drive nails like a hammer. At left are samples of porous honeycomb ceramic. Containing thousands of tiny holes, unusual material is used as superefficient heat exchangers and special filters.

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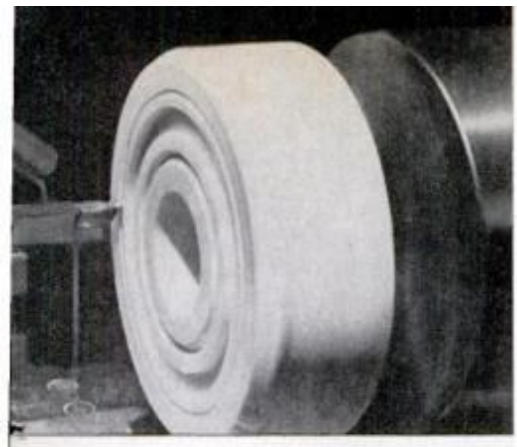

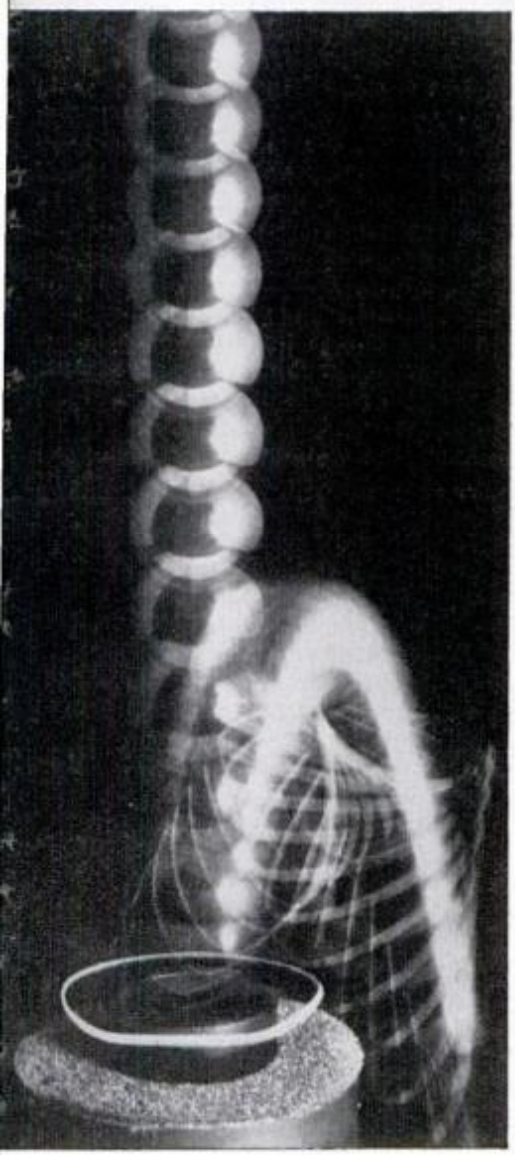

greater its efficiency. At about 2800° F.—possible with ceramics—a gas turbine could yield 50 miles to the gallon, cut pollution to almost zero and be fabricated from Earth's cheapest, most plentiful materials.

Ceramics—including glass, a form of ceramic material—are made from sand (silica), clays, rare earths and metallic oxides. Most have spectacular properties. One surprising glass-ceramic was born at the Corning Glass Works in Corning, N.Y., when an engineer put a thin plate of glass into a furnace accidentally set 600° too high. When removed with tongs, it slipped to the concrete floor—and bounced. Analysis showed it had crystallized and become harder, stronger and more heat-resistant. Out of that lucky slip came thousands of new high-strength, heatproof products from fine-mesh grids for electronic tubes to ceramic-topped kitchen cooking ranges.

Ceramic magic: At top left, ceramic disc is machined like metal, can be made any shape. Center left: A one-inch steel ball dropped from 10 feet bounces off new chemically tempered eyeglass lens, twice as strong as conventional glass and plastic lenses. Bottom left: Coated glass becomes electrically conductive, lighting bulb at end, may lead to entire illuminated glass walls and ceilings. Top right: Heat-resistant dish won't crack even when filled with molten metal while resting on ice.

No accident

But most ceramic discoveries come from painstaking research, not lucky accidents. For the past two decades, a whole new breed of pioneering ceramic engineers have been cooking up exotic brews at temperatures that may run to thousands of degrees. Out of their labs have come a vast assortment of new materials with fantastic characteristics. Today, ceramics include things far more startling than the familiar glazed pottery that many people—much to the distress of ceramic scientists—have come to associate with the word. From nose cones for rockets to arti-

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ficial bones for people, there's hardly an industry or science that could function without ceramics.

At the Corning Glass Works, I bent a 4-foot-long pane of glass around a curved form without breaking it, watched nails being hammered with a length of glass pipe and hurled ceramic dinner plates 30 feet across a room where they clattered to the floor without a chip or crack. I listened to a symphony concert on a light beam piped a quarter of a mile through a single gossamer strand of glass fiber capable of carrying hundreds of radio broadcasts and/or telecasts simultaneously. I saw a piece of electrically conductive glass light up a bulb and heard engineers talk of similar glass-ceramic panels that could illuminate—even heat—an entire room. Special coatings make possible these intriguing electrical properties.

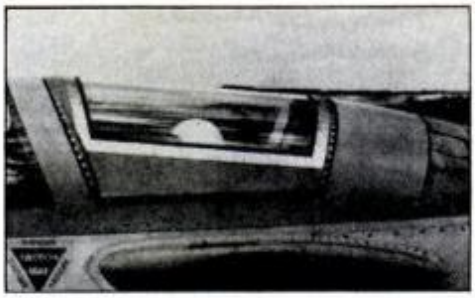
The igniter on some new gas stoves is a piezoelectric ceramic instead of a pilot light. When the knob is turned, a spring-loaded hammer strikes the ceramic element, generating a 20,000-volt arc that ignites the gas. Some small gasoline engines are using similar systems to generate sparks for their plugs, eliminating magneto and points.

Probably no other material on earth has such a vast range of potentially useful characteristics as ceramics. Today, they can be molded, stamped, extruded, even machined. They can be made hard or soft, flexible or rigid, soluble or insoluble. They can be made to conduct or insulate, to absorb or reflect. They can be made into just about anything.

Ingenuity is name of the game

It isn't all roses, though. Solving problems in ceramics requires inventive thinking and clever new approaches. When Princeton University needed ceramic insulating rings 40 inches in diameter for its new torus fusion device, contractors wouldn't even discuss it. A ring that size shrinks seven inches when fired and would pull itself apart on the floor of the kiln. At nearby Rutgers University in New Brunswick, N.J., Dr. Malcolm McLaren, director of the School of Ceramic Engineering, offered to take on the problem. A unique platform was devised to support the rings—spaced pie-shaped sections of refractory material with ruby bearings glued to the bottom. In the furnace, the glue evaporated and, as each ring shrunk, the refractory wedges rolled inward with it on their jewel bearings, preventing it from cracking.

Talk with anyone involved with ceramics and you get the same message: The whole field is exploding. New applications are being discovered every day. Dr. McLaren is excited by the proposal of a colleague, Dr. W. Richard Ott, to build solar-heat collection systems laid out on abandoned slag heaps of mines. The slag would provide raw material for grids of cheap glass tubing circulating water to collect solar heat and store it in slag bins for creating power. Thus unsightly, useless wastelands would become vital energy-producing powerplants at relatively little cost.



Frangible glass that shatters harmlessly into blunt particles can protect military pilots from sharp canopy fragments. In an emergency, pilot can eject right through the glass (lower photo) without injury.

Ceramic cooktops with heating coils underneath are forerunners of even newer types with elements built into surface.

Another Rutgers ceramics engineer, Dr. Alexis Pincus, has developed furnace refractories able to withstand temperatures well above 3000° F. Object: To incinerate municipal wastes, melting and separating out valuable metals and ceramic materials for reuse. John P. Bologna of PPG Industries in Pittsburgh envisions giant mirror-like dishes of high-temperature ceramic two miles wide to collect sun heat and focus it on a thermoelectric ceramic that would convert solar energy directly into electricity. They would work something like our present silicon solar cells, but with vastly greater output and at much lower cost. Such collectors might also be used for "splitting" water to obtain hydrogen—a clean, useful fuel that could become an important substitute for petroleum. Experimental auto engines have already been modified to run on hydrogen.

Why the rush to ceramics?

Aside from their remarkable properties, there's a more grimly serious reason for the rush to ceramics—we're rapidly plummeting to the end of the world's natural resources. Latest U.S. Bureau of Mines estimates on metal depletion give lead 8 more years; gold, 9; mercury, 10; silver, 16; copper, 17; zinc, 18; aluminum, 50; iron, 80; nickel, 100. Ceramics can be made from common earth materials in almost endless supply.

One example of how ceramics can not only replace metals but improve on them in the process is fiberglass-reinforced concrete—a coming "structural spectacular," according to PPG's John Bologna. Ideal for structural timbers, it's light, brute strong, self-insulating and can be molded into a variety of shapes.

At Georgia Tech's School of Ceramic Engineering, Dr. Joseph Pentecost, its director, talked of high-rise buildings built entirely of glass and ceramic materials far stronger than structural steel or aluminum. "We already have ceramics with a tensile strength of 150,000 p.s.i. and a compressive strength of over 400,000 p.s.i." By comparison, steel and aluminum have tensile and compressive strengths of about 50,000 p.s.i. Also, metal at 2000° F. will go limp and soggy; ceramics will not. Hence Ford's ceramic gas turbine, and there's word that the British are working on an all-ceramic turbojet aircraft engine!

How did it get so strong?

How come those materials we always thought so fragile suddenly have muscle? Glass you can hammer nails with? Unbreakable china? The answer is that ceramics have long been known to be strong under compression—when squeezed—but weak on the surface when stretched, scratched or point-loaded. The trick was to put that fragile surface into compression—squeeze its molecules so tightly together that flaws were

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PM'S DESIGN-A-BODY CONTEST:

Winner of the electric-car chassis: Steinn Sigurdsson

Six judges spent three weeks considering a total of 599 entries. Finally all focused on this exciting design from a 31-year-old Icelander.

It wasn't easy. There were so many fine body designs. Blueprints, drawings and scale models came in from all over the country, from England, from Canada, from every location where the English-language editions of Popular Mechanics' August issue fell into the hands of creative and imaginative individuals. Two New Jersey teenagers even rolled a handsome half-scale model into our offices in New York City.

Almost all entries were drawn to accurate scale. Each design represented what the originator envisioned he or she (several of the competitors were women) would do if he (or she) won the Elcar Model 2000 chassis.

The designs ranged from the classic, Model-T, old-timer styling to some that were so wildly futuristic that they looked like UFOs. In between were concepts that fell into various categories: pickups, convertibles, vans, Jeep-types. They had rumble seats, targa roofs, baby carriage hoods, gull wings, surfboard carriers, domes, curtains. Some had names: Firefly, Gopher, Tram, Amp Champ, Utilité, Lil Stake, Lumen, Bi-Electra.

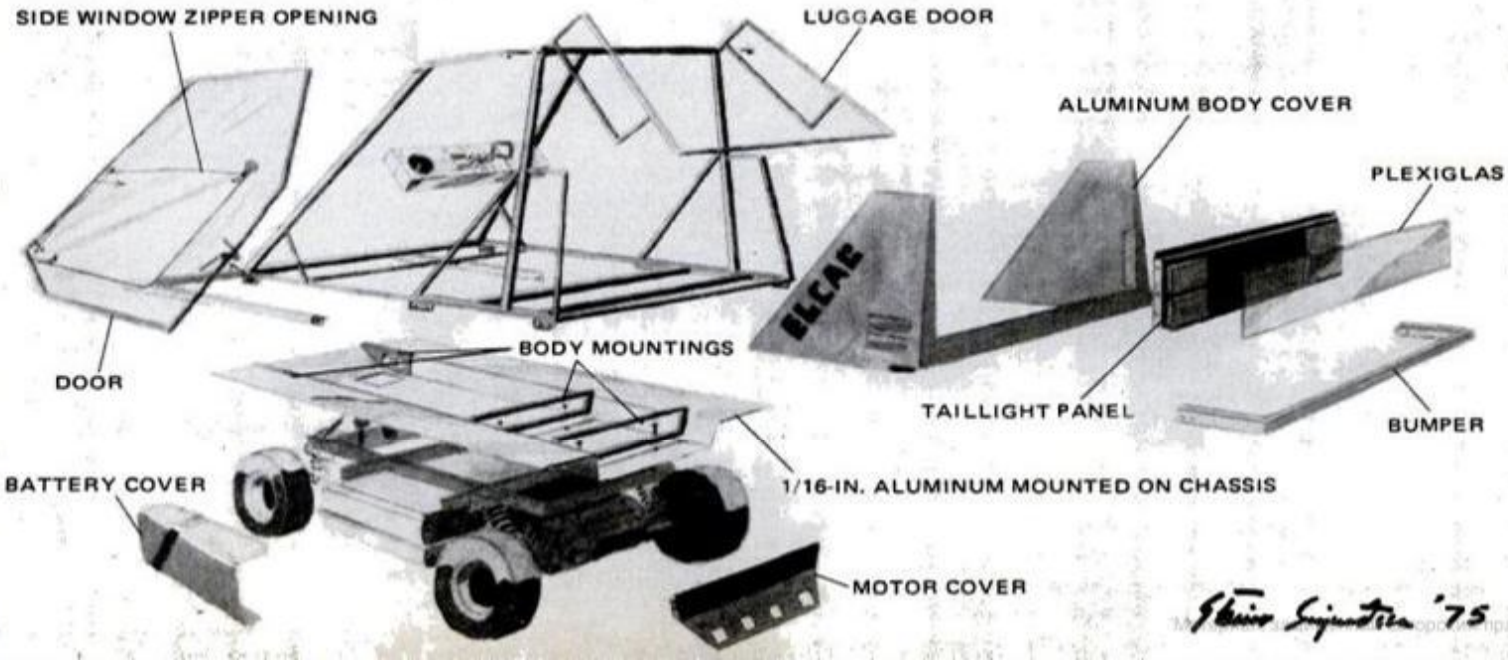
All the designs—even those that were obviously first attempts at vehicle design—were unique and individual. Great amounts of time and effort went into each entry, but only one could be the winner.

One by one, the judges singled out the water-color renderings that filled four sheets, Entry No. 0345. The concept was striking, original, modern, easy-to-build, lightweight, inexpensive and, as quite simply put by one of the judges: Fun!

The winner, Steinn Sigurdsson, is

(Please turn to page 126)

Assembly details of Steinn Sigurdsson's electric-car body are shown below. The exploded view is one of several detail drawings that he submitted.



How to stay alive on a motorized bicycle

by Bill Hartford
AUTO EDITOR

The day I picked up a motorized bicycle last August, the governor of New York picked up his pen and vetoed the bill that would have made it legal for me to ride it.

There I was, ready to do 120 miles worth of errands and chores per gallon of gas, and the man in the limousine stopped me short. I could pedal my 10-speed on public roads all I wanted to, but to use a bicycle with a helper motor would continue to be taboo. Why? Because motorized bicycles and limousines don't mix: That the bill would have allowed an "unsafe traffic mix" was the main objection.

In the governor's words, "Mopeds with a speed capacity no greater than 31 miles per hour would be permitted to travel on all roads of this state, regardless of the prevailing speed limits. Without segregating mopeds into separate traffic lanes, these slower-moving vehicles may well pose a traffic hazard where the speed limit exceeds their capabilities."

Safety is a genuine concern of the governor and everyone who uses public roads, but so is mobility. And mobility at 120 mpg or more concerns the individual pocketbook and the national one. Mopeds are gas-stingy, produce little noise and emission, don't cause traffic jams and park in bicycle racks. They make sense. Just ask the 12 million riders who use them in Europe. It was there the word moped was coined, by combining two words: motor and pedals.

When turning corners on a moped, keep your feet on the pedals. With feet on the frame footrests (inset), pedals can creep around and hit pavement.

Bicycle or motorcycle?

Here, unfortunately, mopeds are subject to the same rules, regulations and licensing procedures as motorcycles—with all the registration, insuring and inspection procedures involved. So far, only a handful of states have recognized the motorized bicycle for the special two-wheeler it is and removed it from the category of motorcycle.

The bike I picked up was borrowed from Bermuda Bikes, Inc. Shown in the accompanying pictures, it's the Hampton model made by Flandria in Belgium. As you can see, it has no turn signals and doesn't meet other requirements such as minimum speed needed to be considered a motorcycle in New York state. Therefore it can't be registered as a motorcycle and can't legally be used on public roads (just getting the photos took some doing).

The states that are avant-garde in defining the motorized bicycle as a bicycle are California, Hawaii, Michigan, Nevada, North Carolina, Ohio South Carolina, Texas and Virginia. Mopeds are considered bicycles providing they meet certain restrictions, depending on the state. Usually their

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engines must put out less than one horsepower and their maximum speed be 20 mph or less. (In California, effective Jan. 1, 1976, the maximum speed is 30 mph and maximum hp is 2.) This is a realistic way to consider the moped, and more states (New Jersey, Michigan, Rhode Island and Florida) have bills pending, some of which are sure to be enacted during the '76 legislative sessions. During 1976, legislation is expected to be introduced into a large number of other states.

Starting the engine

When you get on a moped for the first time you should first become thoroughly familiar with the controls. You can do this while pedaling offroad or on a quiet street before riding in traffic—just as you did when first learning to ride a bicycle.

Starting the moped can be done with the bike on its stand or by pedaling it up to speed and then popping the compression-release lever and giving the throttle a twist. Either way works well and I don't have a preference for one over the other.

Feet on the pedals

Keeping your feet on the pedals is a good habit and one that's very natural. You can put your feet on the frame footrests provided on many bikes, but there's a danger in relaxing that way: The pedals will work around as you ride and if you bank into a turn with the pedals in an up-and-down position you could catch one on the pavement and take a spill. That's something you'd be aware of if you're "moving up" from a bicycle to a moped, but could be overlooked if you're used to riding motorcycles.

Bicycle laws

Where mopeds are street-legal and defined as bicycles, remember that all laws that pertain to bicycles also must be obeyed if you're riding a moped. That includes such rules as not carrying passengers and obeying traffic regulations like using hand signals when making turns.

My riding on the Hampton model was a pleasure, and it should be the same for anyone who wants to extend his bicycling range with a helper motor. As a motorcyclist, however, I did become a bit impatient with the 1.4-hp performance: That can be a danger. Don't think you can compete with faster, heavier traffic. You may have the coordination and skill to steer clear, but not enough power.

Watch the road

Otherwise, your experience on a motorcycle or other two-wheeler can only be helpful. Anyone who's been up on two wheels knows how to keep a sharp watch on the pavement ahead. Gravel, sand or oil are potentially hazardous to the rider. If you can't avoid riding on them, ride through upright—even in a turn you can straighten up your bike and go straight while riding over a slippery surface and bank into the turn again. If you can't, you were going too fast!

Potholes, drainage grates and railroad tracks also can bring you low. Always approach tracks or other cracks in the pavement from as near perpendicular as possible. If potholes are seen too late to be avoided, always shift your weight from the seat to your feet and pedals to minimize the jolt. If you're a hot-dog rider who lofts a front wheel over curbs and obstacles, remember that a moped is heavier than a motocross bike or a 10-speed and you just might end up on your end.

Lights on

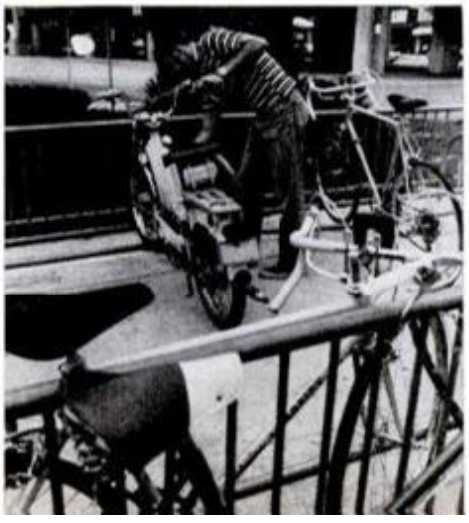
Going down on pavement will give you enough bruises, scrapes and, maybe broken bones, so you'll know better next time, but if you tangle with other traffic there may be no next time. The problem is not your seeing other vehicles, but their not seeing you, and respecting your right to the road. Nothing does more to kill this respect than the kamikaze actions of irresponsible bicyclists.

Daytime use of headlights is

For your own safety in traffic, rules of the road must be observed. Where mopeds are street-legal with no directional signals, use hand signals.

Small passengers can safely be carried (where the law permits). Frame footrests and luggage carrier on Bermuda Bikes' Hampton model do the job.

Photos: Irv Dolin



Parking is easy with a moped. The biggest advantage, though, is that fuel consumption is between 120 and 180 miles per gallon.

STATE LICENSING REQUIREMENTS FOR MOTORIZED BICYCLES				
State	Motorized bicycles defined as:		Operator license and/or vehicle registration required:③	
	Bicycle①	Motorcycle②	Yes	No
ALABAMA		X	X	
ALASKA		X	X	
ARIZONA		X	X	
ARKANSAS		X	X	
CALIFORNIA	X		X	
COLORADO		X	X	
CONNECTICUT		X		
DELAWARE		X	X	
D.C.		X	X	
FLORIDA		X	X	
GEORGIA		X	X	
HAWAII	X			X
IDAHO		X	X	
ILLINOIS		X	X	
INDIANA		X	X	
IOWA		X	X	
KANSAS		X	X	
KENTUCKY		X	X	
LOUISIANA		X	X	
MAINE		X	X	
MARYLAND		X	X	
MASSACHUSETTS		X	X	
MICHIGAN	X			X
MINNESOTA		X	X	
MISSISSIPPI		X	X	
MISSOURI		X	X	
MONTANA		X	X	
NEBRASKA		X	X	
NEVADA	X		X	
NEW HAMPSHIRE		X	X	
NEW JERSEY		X	X	
NEW MEXICO		X	X	
NEW YORK		X	X	
NORTH CAROLINA	X			X
NORTH DAKOTA		X	X	
OHIO	X			X
OKLAHOMA		X	X	
OREGON		X	X	
PENNSYLVANIA		X	X	
RHODE ISLAND		X	X	
SOUTH CAROLINA	X			X
SOUTH DAKOTA		X	X	
TENNESSEE		X	X	
TEXAS	X		X	
UTAH		X	X	
VERMONT		X	X	
VIRGINIA	X			X
WASHINGTON		X	X	
WEST VIRGINIA		X	X	
WISCONSIN		X	X	
WYOMING		X	X	

Note 1: In the majority of states which have enacted legislation, motorized bicycles with engines greater than 1 bhp capable of speeds over 20 mph (30 mph in Calif. effective Jan. 1, 1976), remain defined as motorcycles or motor-driven cycles and must meet all requirements for those vehicles. Motorized bicycles capable of 20 mph (30 mph in Calif.) or less are defined as bicycles, or defined separately and have reduced operating requirements than those required for motor vehicles.

Note 2: In those states where motorized bicycles are defined as motorcycles or motor-driven cycles, the motorized bicycle must meet all requirements for motorcycles or motor-driven cycles or it is not legal for road use. Check with local Motor Vehicle Bureau.

Note 3: States requiring operator licenses may also require special motorcycle test and license, and may also have minimum age requirement for riders of motorized bicycles. Check with local Motor Vehicle Bureau.

required of motorcyclists in many states—a good idea for moped riders.

Helmets on

Accident statistics in Europe show that mopeds are much safer than cars, but there are still many fatalities each year. One way to stay off the fatality list is to wear a helmet: There's no surer way to avoid the head injuries that account for most fatalities with two-wheelers. There's an alarming campaign being waged nationwide for repeal of helmet laws. It's regretful.

You're lucky if your state has stopped hassling moped operations.

Wheels are rolling

Legislators now are more aware of the motorized bicycle—many have even ridden representative machines —and know what they can do and what they can't. Since our last moped story (*Bicyclists, start your engines!* page 74, Aug. '74), more states have recognized that a motorized bicycle should not have to meet the multifarious equipment rules and regulations that a faster, heavier, higher-powered motorcycle must. Operating requirements in these states are not so restrictive as to make the moped impractical.

Clamp-on helper motors are available for standard bicycles. This one also comes with a cross-structure to join two bikes together. The Twin-Zip kit is $300 from Bensen Transpo Co., Box 2746, Raleigh, N.C. The two-stroke engine alone is $250.

A new organization has also joined in the battle to exempt mopeds from the motorcycle category. The Motorized Bicycle Assn. (MBA), 1001 Connecticut Ave. N.W., Suite 700, Washington D.C. 20036, has been extremely active in state capitols, exposing lawmakers to motorized bicycles. And many who ride one for the first time, don't want to get off. Mopeds are fun as well as practical. And they are *bicycles*. Tell your legislator. ★★★

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IT'S NEW NOW

No-drive test for drunks

If you're sober enough to trace this wavy path with your finger, you can start your car; if not, better get someone else to drive you home. The touch-sensitive electronic obstacle course mounts in the dash and is linked to the ignition system, prevents the car from starting if you wander off the wiggly lines. F.I.T. Patent Development Foundation, Florida Institute of Technology, Melbourne, Fla. 32901.

Space-saver bar: Now you see it, now you don't

Most objections to home bars are that they take up too much space or look ugly when not in use. This fold-up, roll-around Vertabar solves both problems. In use, it opens out to form a right-angle serving center with shelves in back for bottles and glassware (left, above). Closed, it's a room divider or credenza (right). Fronts and upper lips are fabric or vinyl-padded; tops and sides, wood-grained plastic laminate. TW and Associates, 4957 Hollywood Blvd., Los Angeles, Calif. 90027.

Super-souped-up racing plane

What may become one of the world's fastest prop planes is this highly modified World War II P-51 fighter believed capable of exceeding 500 mph. Changes include shortening the wings for greater maneuverability, increasing tail-fin area for added stability and installing a 12-cylinder Rolls-Royce engine rated at a whopping 3000 hp. (lower photo). Pilot Roy "Mac" McClain of the Red Baron Racing Team in Idaho Falls, Idaho, hopes to set a new world speed record for prop-driven planes.

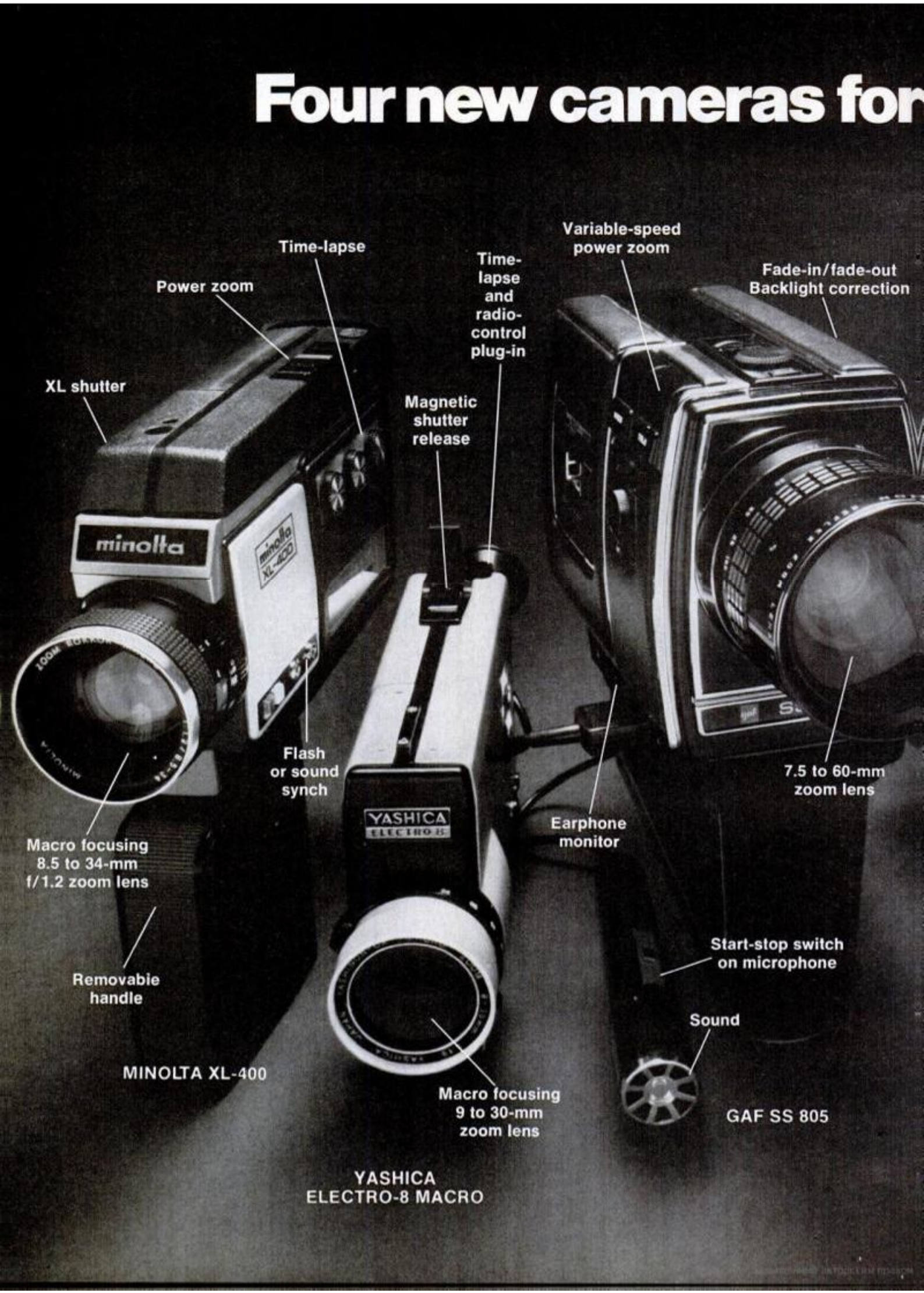
Kit-built RV can take to water

It doesn't look like an RV, but it is. It's amphibious—goes on land or water—has four-wheel drive for off-road use, can be made street-legal. Called the "BOX," it comes as a semi-kit with fiberglass body and plans for assembly. $945 and up. Monocoque Engineering, Box 906, Costa Mesa, Calif. 92627.

Rechargeable pacemaker

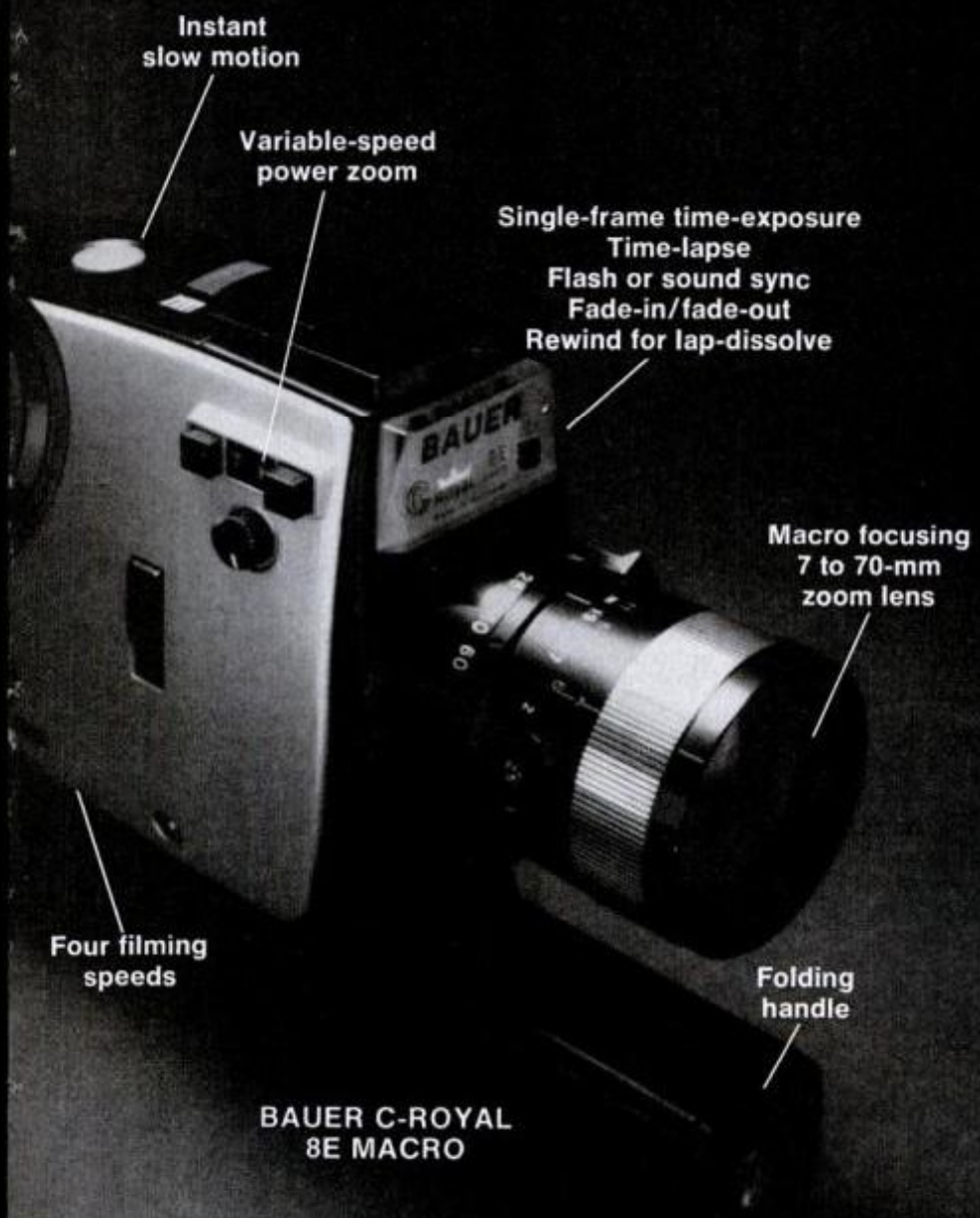
Heart patients with pacemakers no longer must have them surgically replaced when batteries run down. This new type is recharged painlessly from outside the body. A small device strapped over the chest creates a magnetic field that penetrates the skin to renew battery life. Developed by Pacesetter Systems, 12740 San Fernando Rd., Sylmar, Calif. 91342, and Johns Hopkins University.

Four new cameras for



movie-making fun

by Ivan Berger



BAUER C-ROYAL 8E MACRO

The trouble with shooting home movies used to be that you had to use home-movie equipment. But with cameras like these (and many others), that's no problem—it's a positive advantage.

Armed with these four cameras, I've shot time-lapse shots that compressed hours of slow action into exciting minutes on screen (with automatic flash or time exposures when the light got dim). I have photographed myself in action using remote radio control; taken tightly composed, clearly focused shots of people 50 or so feet away, and of insects a few inches from my lens; gotten accurate exposures even with back-lighted subjects; made slick transitions between scenes with fades or lap-dissolves; shot indoor action without special lights, and even made sound movies.

Yet for all their versatility, these cameras are easy to use and carry, and not impossible to afford.

Shrunken hours, zipping clouds

To me, the most exciting feature on these cameras is time-lapse, a slowing of the camera's shooting rate to speed up our view of slow action. Shoot 18 frames of film a second, and project it at the same 18-frame speed, and the action on screen takes just as long to show as it did to film; but shoot 18 frames per minute—one frame each 3⅓ seconds—and a minute's action will flash by on screen in just one second, speeding up the action 60 times.

The possibilities are endless: Rapidly unfolding flowers, 200-mph trips down peaceful country lanes, a building rising from a vacant lot in minutes, clouds careening across the sky as a day dawns, turns cloudy, rains, clears and dies into sunset. Ever since my first time-lapse camera, a Nizo, was stolen, I've wanted another chance to try compressing time. These cameras gave me three such opportunities: Of the four, only the GAF sound camera lacks time-lapse, probably because all you'd hear, from time-lapse sound films would be unintelligible gabble.

The Minolta's built-in time-lapse and the Yashica's plug-in accessory intervalometer both cover a range of filming speeds from two frames per second (nine minutes of action per minute of projected film) to one per minute (18 hours of action per projected minute). The Bauer's range runs from six frames per second (three minutes of action

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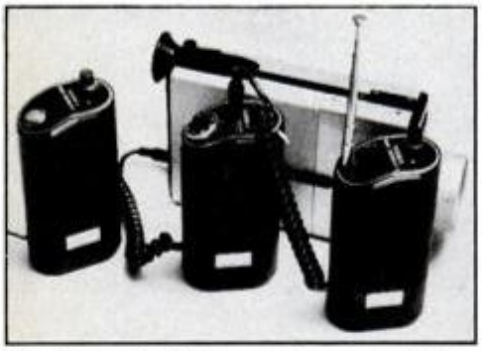

Time-lapse facilities on Bauer (top) include swing-out light cell (right) for time exposures in dim light. Yashica's time-lapse device plugs in (above), comes as set with radio remote control equipment.

per projected minute) up to one frame per minute. Both the Bauer and Minolta have flash sync plugs that fire electronic flash as each time-lap frame is shot. The Bauer also has a light cell that swings out to measure light for automatic time exposures of 1/10 second to one minute in dim light, and a knob that stops time-lapse filming after the desired scene length (1 to 12 seconds of projection time) has been taken.

Sound: your choice of systems

The flash-sync contacts of the Bauer and Minolta open and close once per frame during normal-speed filming, too. So you can use them to synchronize these cameras with recorders designed for double-system synchronized sound (*Home-movie Sound Gets Easier—and More Professional*, page 64, Oct. '75). Or you can shoot single-system sound, recorded on the edge of the film as you shoot, with the GAF camera.

I didn't try double-system shooting, but I did try sound with the GAF. It was a bit clearer than the sound of the Kodak Ektasound camera I've been using, and the camera itself (possibly due to its comfortable padded surface) was quieter, its noise less likely to be picked up by the microphone. I also liked the GAF's earphone monitor jack, which let me check the quality of the sound the mike was picking up, and its two-prong microphone jack, one prong of which connects to a start-stop switch on the microphone. The two-prong jack also let me use my Sony electret cardioid mike for even clearer results.

Zooms: Some easy, others easier

As with most Super-8s, all these cameras have lenses that zoom from "wide-angle" (actually no wider than a still camera's normal lens) to telephoto. Yashica, the smallest camera, has the shortest zoom range, from 9 to 30 mm, but even that proved surprisingly adequate for most shooting. Zooming is manual, but easy on the Yashica. The lens, focusing down to one foot, can fill the screen with objects hardly more than half as wide as this column. Focusing is reasonably easy if you first get the image fairly sharp on the ground glass, then finish using the somewhat-dim central microprism spot.

The Minolta zoom covers a slightly larger zoom range (8.5 to 34 mm), and focuses in a bit closer than the Yashica—right down to the front surface of the lens, in fact, where it fills the screen with objects as small as ⅞-inch wide (those objects must be transparent, though, or the lens will block any light from them); but to focus closer then four feet, you must switch the lens to a "macro" range. Focusing is a bit easier than Yashica's, too, with a bigger, brighter finder and a split-image circle in the center. The Minolta has power zoom (though its control feels backward: You push it *forward* to zoom *back* from the subject), but it's easy to zoom manually, too—a good thing, as the power is only on when the film is running.

Both the GAF and Bauer cameras have much bigger zoom ranges—7.5 to 60 mm. The GAF is easier to zoom, both manually (thanks to easy movement and a big zoom lever) and by power. You press the lever *forward* to zoom *in*, which I find more natural; and its zoom speed varies from about four to seven seconds, while the Bauer I used took four seconds regardless of its zoom-speed control setting. But the Bauer, with a big, bright screen and cross hairs is easier to focus than the microprism-equipped GAF. The Bauer has the edge in close-up capability, too: the GAF focuses only to five feet, though its 60-mm telephoto setting lets it fill the screen with objects about half as wide as this page; but the Bauer, like the Minolta, can be switched into a macro range and focused right down to the lens's surface for a close-up field of view that seems less than ½-inch wide (it's hard to measure). The lens snaps out of macro range if you move the zoom ring, and goes back to its normal setting, so you can start with a close-up of a slide, then zoom *through* it to show the real world behind that slide.

Exposure controls

Electric-eye, automatic exposure control is standard on all these cameras, of course. All but the Yashica also have manual exposure control to help you compensate for back-lighted or other unusual scenes, and to allow you to fade into the beginning of a scene, or fade out at the end. Since back-lighting is the commonest problem calling for manual control, both the Minolta and GAF have controls that open the lens one extra stop.

Fading in and out can also be done automatically on the GAF and Bauer. When fading with the GAF, you can see the needle move across the easy-to-read meter scale in the finder. On the Bauer, a yellow light glows when the automatic fade is working; that light is hard to see, but it's not too important, as the Bauer stops filming when the fade-out ends. Like the GAF, the Bauer has a meter scale in its finder, but in dim light its hard to see, too. The Yashica and Minolta have simpler indicators that warn of exposure problems but don't distinguish between over or underexposure. The GAF's meter can also be present to give lighter or darker results.

Shutters with tricks

All four cameras can take ASA 160 film, which permits shooting in moderately dim light—but only moderately: Effective exposure with most of these cameras is about 1/60 second at f/2. The Minolta, though, is an "XL" camera, with a faster, f/1.2 lens and a wide-opening shutter whose effective speed is about 1/30 second. Together, this lens and shutter let you shoot with one-fourth as much light as the others need.

But the Bauer's shutter has a number of other tricks up its sleeve, with variable opening, and speeds of 12, 24 and 54 frames per second as well as the normal 18 frames. Shooting

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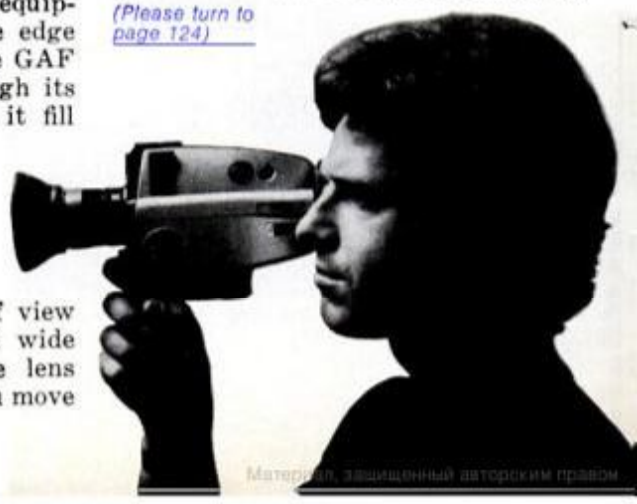

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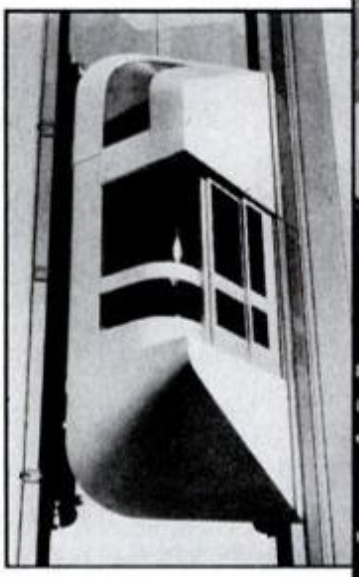
IT'S NEW NOW

Yep, it really flies

It's hard to tell whether you get into it or put it on—this mini airplane weighs 100 pounds, gets 50 miles on a gallon and practically flies out of a back yard. The Tally-Birdman TL-1 has a 15-hp engine, hits up to 60 mph, lands at 18, is FAA-approved. Kit, including engine, is $1395. An information package is $5. Birdman Aircraft, 1280 Wildcat St., Daytona Beach, Fla. 32015.

Wild ride up world's tallest structure



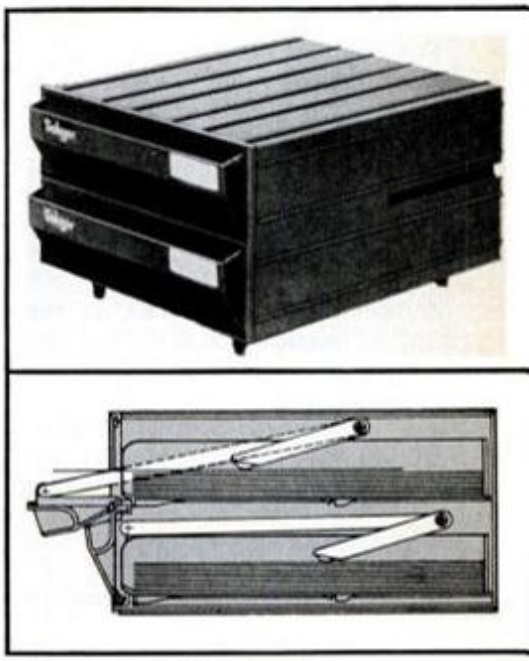
Visitors to Canada's new CN Tower in Toronto will get a spectacular view as they scale its heights in outside elevators. Designed by Otis, the glass-sided, futuristic pods (near right) ride in tracks up the walls, climbing one-fifth of a mile to an observation deck (far right). The 1815-foot CN Tower, nearing completion, will be world's tallest free-standing structure.

Bracket eases macro-photography shadow and exposure problems

Attach Spiratone's new $25 Macrodapter ($50 with flashguns) to your macro close-up lens, mount two strobes, and your lens barrel can't block the light. And as you focus closer, the flashguns move closer to the subject, giving just enough more light to compensate for the increased distance between film and lens.

Portable or permanent fuel tank

You can extend your cruising range with this auxiliary fuel tank designed for portable use or permanent installation. It's flat for easy storage under seats and splash wells and comes in four 12 to 25-gallon sizes. For permanent mounting, its mechanical fuel gauge quickly converts to an electrical remote-reading system. Mirax Chemical Products Corp., 4999 Fyler Ave., St. Louis, Mo. 63139.

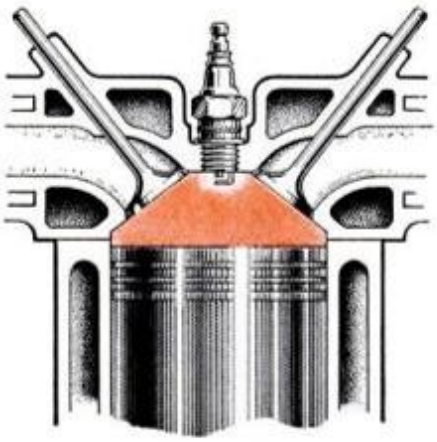


This paper safe plays right into your hands

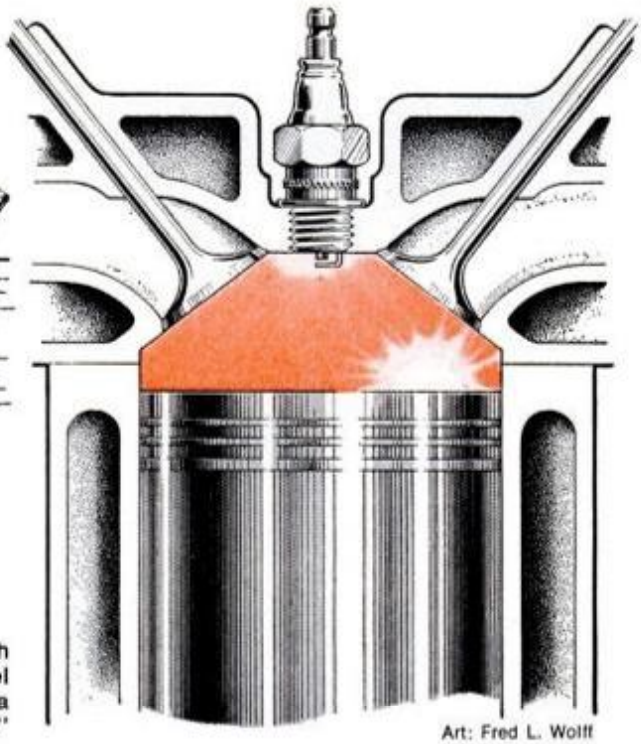
Put your enlarging or contact-printing paper into this new paper safe and it will feed one sheet each time you open the spring-loaded door. Each compartment holds 100 sheets of single-weight or 50 of double-weight or RC paper. From AIC Soligor, Store n' Feed is $30.

Retune for regular

If you're sputtering over the price of high-octane fuel for your high-compression engine, here's the surefire cure.



Normal combustion is a smooth and complete burning of fuel mixture. Detonation (right) is a sudden explosion or "ping."



Art: Fred L. Wolff

by Mort Schultz

You can beat the high price of premium fuel by retuning your high-compression engine to run smoothly on regular, low-octane gasoline. The best way is to do it yourself, but the job can be bought, also.

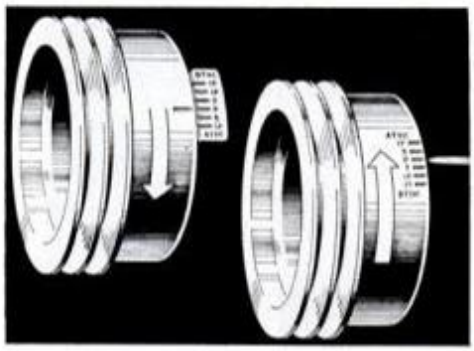
For example, Jim Judson, general service manager at Martin Motor Sales, Inc., a New York City Volvo dealer, has been converting four-cylinder, premium-fuel-burning Volvos to regular gas. Judson replaces the original head gasket with a thicker gasket to reduce compression ratio, and he retards timing 4°.

Judson says he has had no complaints of spark knock and the conversion lets owners save 5 to 8 cents per gallon when they switch from premium to regular fuel. He charges $150 to make the conversion. Six-cylinder Volvos are excluded because Volvo does not issue a thicker factory-made replacement head gasket for them.

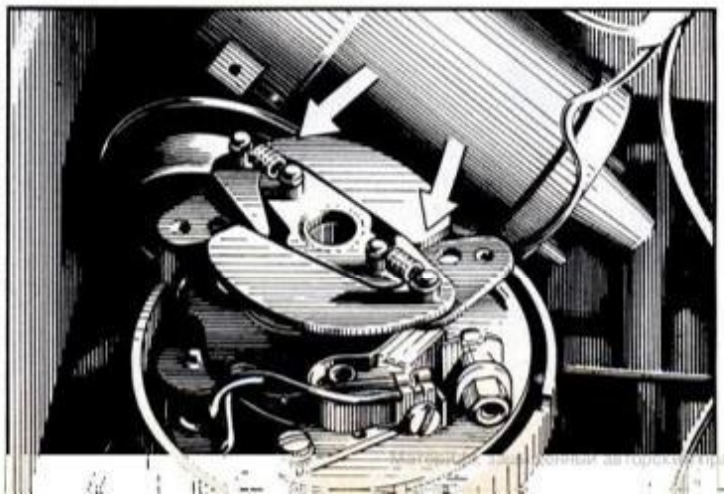
"If an owner can find a head gasket that fits the six-cylinder engine, there is no reason why the conversion cannot be done," Judson says. "We don't do it, because we can't back our work with a guarantee unless we use Volvo parts."

Saving money is one reason to do the job. Another: Premium gasoline is going out of style. Not all service stations carry premium, and it may be even harder to get in the future.

If you fill your tank with regular fuel and your engine requires high-octane, you'll get detonation. If you can control detonation (which most people call "pinging"), though, you can use regular fuel in an engine calling for premium.



Retarding timing is one way to lower octane requirement of an engine. Above are two arrangements of timing marks on the flywheel. Retard springs (arrows at right) can be installed in place of centrifugal advance mechanism springs in your distributor. They'll limit spark advance.



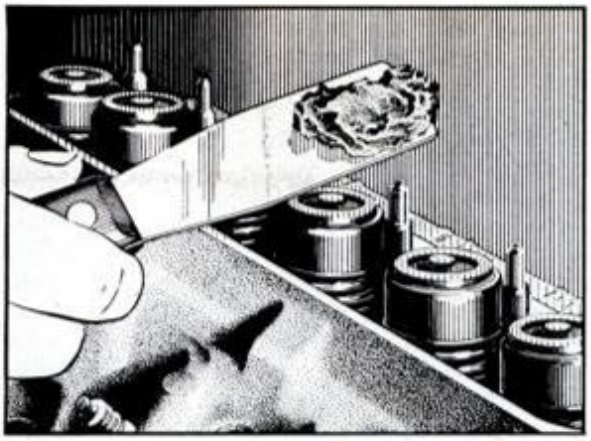
How the gas burns

In an engine with normal combustion, spark ignites the fuel mixture near the tip of the sparkplug. A wave of flame spreads across the combustion chamber to the other side, consuming all fuel. Gasoline is burned smoothly and evenly like a field of dry grass on fire.

In an engine experiencing detonation, the fuel mixture starts out burning smoothly. Then, suddenly, before fuel is consumed, the remaining mixture explodes.

(Don't confuse detonation and preignition, which is ignition of the fuel mixture in a cylinder before the sparkplug fires. Fuel is ignited by a hot spot in the cylinder, such as a piece of glowing carbon.)

It is not the actual explosions you



Removing engine head involves considerable labor. After engine is stripped and headbolts removed lift it off (far left). Remove carbon and sludge from head, valves and block (left). If a thicker head gasket (below) is made for your engine, install it to lower compression ratio and engine octane requirement.

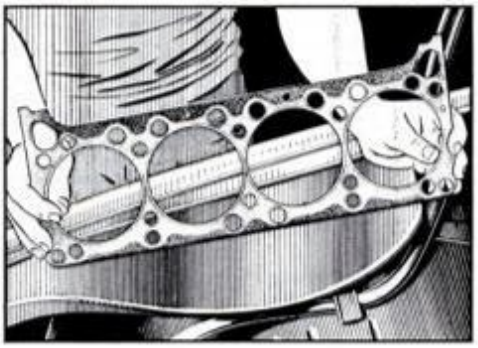
hear as "pinging." Rather, explosions cause a sharp rise in pressure, which shakes the cylinder head. The head vibrates, producing a metallic noise. This is pinging.

Heat is the primary cause of detonation. Certain factors, which will be discussed, increase the temperature of the fuel mixture. The higher the temperature in a cylinder, the greater the tendency fuel has to detonate.

The likelihood of detonation is increased if fuel doesn't possess the wherewithal to resist detonation. This "wherewithal" is called octane.

What is octane?

Octane is a measure of the gasoline's ability to resist detonation. The higher the fuel's octane number, the less likely it is to detonate.



Every engine has a recommended fuel octane number assigned to it by the maker. However, not even fuel of the recommended octane can resist detonation if you have the following conditions:

1. Deposits or defects in the cooling system which restrict heat transfer from combustion chambers to coolant.
2. A coating of carbon on the cylinder head or pistons which acts as an insulator and prevents adequate cooling. Carbon also increases an engine's compression ratio, another factor encouraging detonation.
3. Spark that occurs too early as pistons move upward on compression strokes. Overadvanced timing results in rising temperature that can cause detonation.
4. Overly lean fuel mixtures that tend to explode under full-load driving midway through normal combustion.

Controlling detonation

If your engine is detonating on the

At the gas pump . . . know your rights and know what's right for you

Whether you use leaded regular or premium, or unleaded regular or premium you should know certain facts to avoid gas-price traps and get your money's worth.

Price. Federal law requires maximum price per gallon to be posted. Service station operators selling gasoline for more than the established Federal Energy Administration (FEA) price may be subject to civil or criminal penalty, Gorman Smith of the FEA Compliance Office says. By law, dealers are held to the profit percentage of May, 1973, shortly before oil price controls were imposed. Except for the 3-cents-per-gallon authorized last year for higher operating costs, the only price rise allowed has reflected higher fuel costs to the dealer.

If you find a gas station operator does not have the required FEA sticker showing octane rating and price on his pumps, or if his price per gallon is higher than that on the sticker, a violation exists. You can determine the legitimate price by contacting the FEA Compliance office. If you want to take action, write to the agency at Washington, D.C. 20461, for the telephone number of its compliance office in your area.

More tips: Gas stations posting prices most prominently tend to charge less. In and near large metropolitan areas, the price of gas could swing widely. Two Citgo dealers in my area

(Please turn to page 66)

grade of fuel recommended by the manufacturer, you should be able to eliminate it. Furthermore, if your engine calls for premium-grade, you may be able to "tune it" for regular. The following are steps you can try to control detonation:

1. Tune up the engine to perfection. See that ignition timing and engine-idling speed are right on the money. Make sure spark advance and centrifugal advance controls are functioning properly. Defective spark and centrifugal mechanisms over-advance timing. See that other parts affecting proper tune-up are in good condition, including sparkplugs, distributor points and the carburetor.

2. Flush the cooling system and check condition of parts that, if defective interfere with cooling action, including worn drive belt, restricted hoses and faulty thermostat.

3. If premium fuel is specified for your engine, try the highest octane *regular* fuel you can find. Ratings for the same grade of gasoline vary from brand to brand.

Test for ping by accelerating in high gear going uphill. If you get no ping or mild ping, you've hit paydirt. Mild ping will not cause engine damage. A mild ping, or trace knock, is one that is just audible as the engine comes under the load of uphill acceleration.

If heavy ping results, you cannot use regular gas unless you take further steps to control detonation. A heavy ping or knock starts immediately when the car is put under load and is audibly loud as the car negotiates the hill climb. In such an engine, gas pressure at the point of detonation increases 200 to 300 pounds per square inch above the pressure existing in the rest of the combustion chamber. This places heavy pressure on bearings and pistons, causing damage. It should not be allowed to continue.

Returning and modifying

Procedures outlined next to bring detonation under control so regular gas can be used become increasingly complicated and expensive with each step. There comes a point where you'll have to judge for yourself whether it will pay in effort (or expense) to proceed.

■ Retard timing—the easiest step. It

(Please turn to page 144)

At the gas pump . . . know your rights . . .

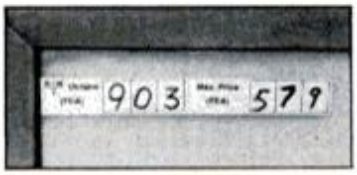
(Continued from page 65)

provide an example. One sells gas for 55 cents a gallon, the other, only a mile away, charges 59.

You can often save a few pennies per gallon buying gasoline from an independent dealer using an unfamiliar brand. The gas likely is supplied by one of the major companies. Here is what two "majors" told us:

"Gulf supplies gasoline to service stations other than those identified as Gulf."

"Shell supplies gasoline to commercial customers on a contract basis."



Always look for the price and octane (left) and the gasoline classification number (right) posted on the gasoline pump.

Octane number. Federal law requires that a decal with the fuel's octane number be posted on every gas pump. This has led to some confusion.

The octane rating of a given sample of gasoline is derived in the laboratory by using a special one-cylinder variable-compression-ratio engine. Under relatively mild conditions, it will run well with fuel of a certain *research octane number* (RON). Under more stringent lab conditions, the engine needs fuel with a certain *motor octane number* (MON). That may be up to 10 octane numbers less than the RON. But neither research or motor testing truly predicts the actual octane performance of gasoline under road conditions. And the octane number found on gas pumps is neither RON nor MON. That number is called the *antiknock index*.

The antiknock index—averaging of RON and MON—is a truer numerical measure of actual road octane.

Owners of pre-1975 cars who check their owner's manuals for octane recommendations have found this confusing. For example, some learn they should use *regular* gas with an octane rating of, say, 94. But when they go to buy gas, they can find no such fuel. That's because the octane rating in the manual is the RON, while that posted on the pump is the antiknock index—always four or five points lower.

Brand differences. The same gasoline grade, brand to brand, may not have the same antiknock index. The variation—up to one octane point—is often enough to make the difference between ping and no ping, or heavy and mild ping. So if you're getting pinging with your present gas, check posted antiknock index ratings. The chart at the top of the next column may be helpful:

ANTIKNOCK INDEX

Brand	Leaded Regular	Unleaded Regular	Premium
Amoco	90	87	95
Ashland	89	87	95
Citgo	89.5	87	—
Exxon	90.5	88.5	96.5
Gulf	89.5	87	95
Marathon	89	87	95
Phillips	89.5	87	95
Shell (east of Rockies)	90	90.5	95.5
(W. of Rockies)	89.5	90	95
Sun (East of Mississippi R.)	89 (grade 190)	87	95 (grade 240)
Sun DX (W. of Mississippi R.)	88-89 (Reg.) 90-92 (Plus)	87	95
Texaco	90	87	95

Gasoline classification number. Many owners manuals for 1975 models recommend a grade of fuel by means of a numerical value, such as 2, known as the gasoline classification number; it's from a system developed by the American Society for Testing and Materials. The relationship of this number and the antiknock index is as follows:

Gasoline Classification Number	Application	Minimum Antiknock Index*
1	For cars having low antiknock needs	Below 87
2	For most 1971 and later-model cars	87
3	For most 1970 and earlier-model cars designed to operate on regular gasoline, and for 1971 and later models requiring higher antiknock performance than that provided by designation 2	89†
4	A "mid-premium" or "intermediate" designation meeting lower antiknock needs of some cars designed to run on regular	91.5
5	For most 1970 and earlier-model cars with high-compression-ratio engines designed to run on premium gasoline, and for later-model cars with such engines	95†
6	For cars with high-compression engines designed to run on premium gasoline and requiring higher antiknock performance than that provided by designation 5	97.5

*Antiknock index of gasoline for use in areas where altitude is greater than 2000 feet may be reduced 0.5 for each succeeding 500 feet, but not to exceed 3 numbers.

†Minimum may be reduced by 0.5 in Arkansas, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, Oklahoma, South Dakota, Wisconsin and Texas west of 99° longitude.

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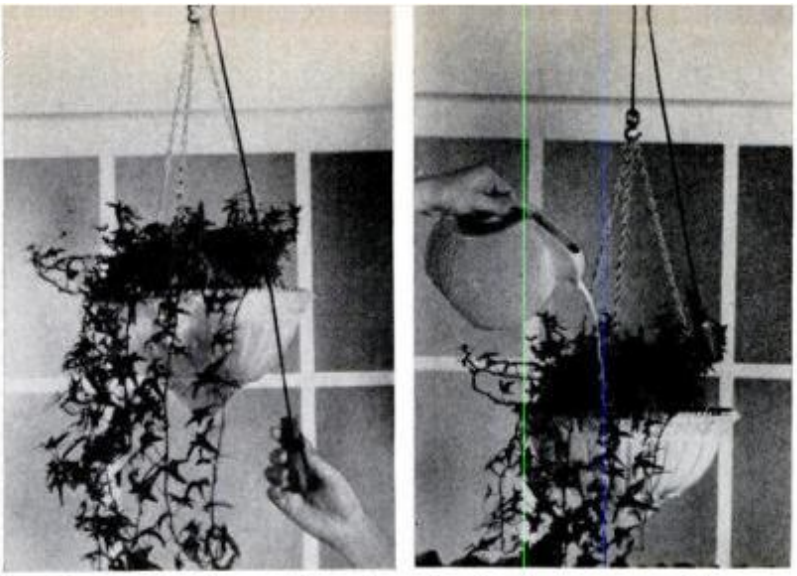
IT'S NEW NOW

Clever convertible: From sofa to pool table

If you're cramped for space, here's a nifty idea for quickly converting a living room into a game room. What serves as a sofa (top photo) suddenly becomes a regulation-size pool table when you flip the pivoted back down onto the arms (bottom). Called Hideaway, it comes in many fabrics and colors. TW and Associates, 4957 Hollywood Blvd., Los Angeles, Calif. 90027.

Rugged, versatile Franklin fireplace

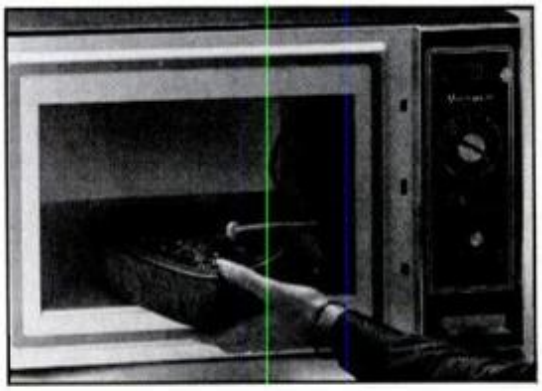
Patterned after the traditional Franklin fireplace, this plate-steel model—said to be the first—can't crack under heavy firing as cast-iron types sometimes do. Features include built-in damper control and accessories such as swing-out barbecue grill and Boston bean pot. The firebox burns wood, coal or charcoal and can be adapted to take gas logs. United States Stove Co., South Pittsburg, Tenn. 37380.



Locking pulley lowers hanging planter for easy reach

You don't have to climb a stool to reach a hanging planter rigged with this adjustable suspension system. A tug on the cord releases the planter from a self-locking ceiling pulley, lowering it to a convenient height for watering or other care. Hook swivels for turning the planter toward sun. Homecraft, 400 Beechwood Ave., New Rochelle, N.Y. 10802.

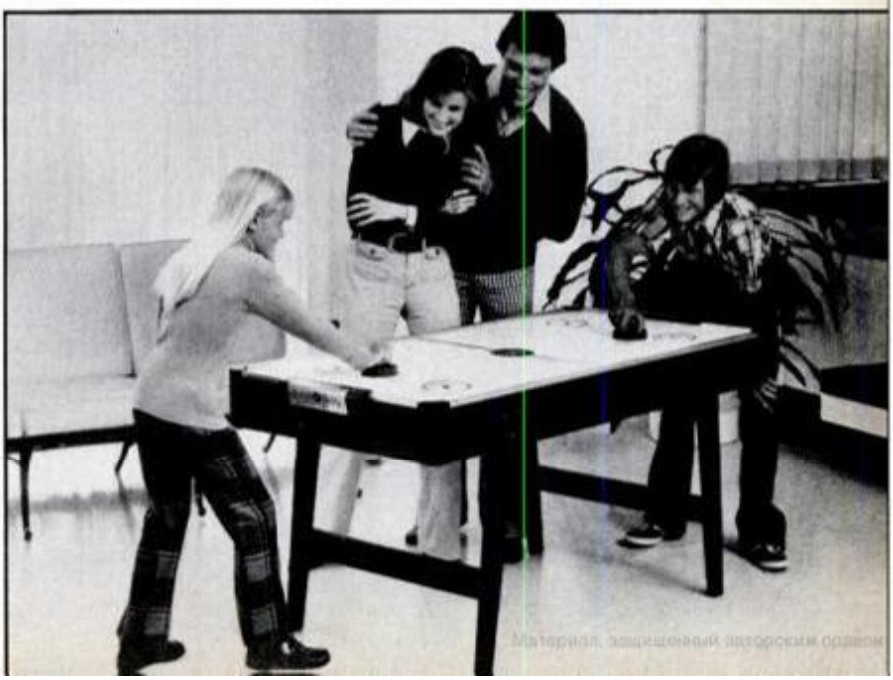
Microwave probe

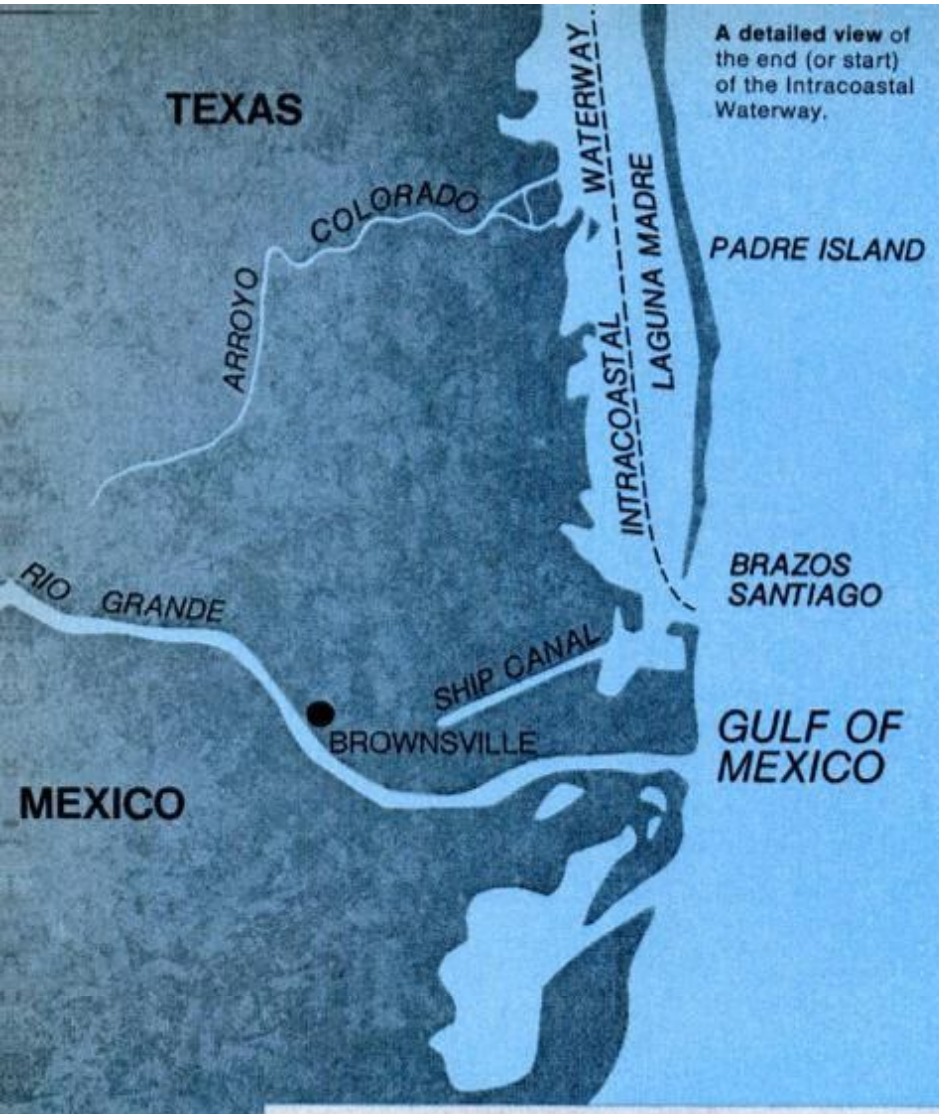


A heat-sensing probe takes the guesswork out of cooking with this Minutemaster microwave oven. Inserted in a roast, the probe shuts off the oven when a preset temperature is reached. $499, Litton Industries, 400 Shelard Plaza S., Minneapolis, Minn. 55426.

Low-cost Air-Hockey tables now for home use

The increasingly popular game of Air-Hockey, developed by Brunswick, can now be played at home as well as at public amusement centers. Two new models, created especially for home entertainment, are scaled-down versions of larger, more expensive commercial types introduced earlier. One, 5 feet long, sells for about $100; a 6-foot model is about $175. Available at Brunswick dealers, department stores and sports shops. Brunswick Corp., One Brunswick Plaza, Skokie, Ill. 60076.





A detailed view of the end (or start) of the Intracoastal Waterway.

Overall view of Gulf of Mexico coast with dotted line indicating the area covered by detail map.

Boating at the end of the rainbow

by Dan Fales MANAGING EDITOR

Two couples cruising in this part of the United States can find a wealth of fun things to do. There's beachcombing for Spanish treasure, boat fishing outside in the Gulf for big game fish or inside in the calmer Laguna Madre for tasty table fish. There's swimming and visiting nearby Mexico. There's anchoring and walking the flats, fishing with success (left) on the incoming tide. There's fixing fresh shrimp in a compact galley (far left; note the stove in a drawer). And finally, there's running flat out in a dry, responsive boat like this Glastron cruiser, shown kicking up spray above.

Here are Texas tales and boating tips uncovered during a tryout of Glastron's 25-foot Caribbean cruiser.

Why "rainbow" in the title? Two reasons. First, I ran Glastron's 25-foot flybridge cruiser at the Texas end of a channel that rings the Gulf of Mexico. It's called the Intracoastal Waterway. The Gulf part of this famous waterway is very much rainbow shaped.

Second, gold can, in fact, be found at the end of this particular rainbow. Doubloons from a 16th century treasure fleet of Spanish galleons wrecked on the shores of Padre Island during a hurricane are uncovered after almost every beach-eroding storm.

Though some beachcombers have filled their pots with gold, I brimmed mine full of local tips and tricks that will help you in your boating.

The first trick was learning to launch a 3650-pound, 25-foot flybridge cruiser with twin 170-hp Glastron engines and twin Volvo outdrives. Right at the start I learned there was a right and a wrong way.

As our boat and trailer pulled up to the launch ramp, another boat of similar size was being towed from the water on a hefty trailer hooked to a pickup truck. Just as the truck started to pull the rig clear of the water, disaster struck—a brake line broke, sending boat, trailer truck and all sliding down the slick ramp, stopping just short of an engine drowning. It took a hefty tractor from a nearby Coast Guard station to retrieve the rig.

So it was that my crew and I were extra careful as we backed Glastron, trailer and pickup down the Padre Island ramp. As the stern floated, we stopped the backward movement. After unlocking and lowering the outdrives, we fired her up and backed the boat off the trailer under her own power. The deep-V hull is great for this operation.

Power launching a touchy job

But remember to be very careful when attempting this power-launching. Double check everything. I saw the results of a quick takeoff on a launch ramp in San Diego last year. A hot-looking speedster with a 125-hp outboard rig was being backed into the water on a trailer attached to a small Pinto. Once the outboard prop was submerged, the driver fired up the powerful motor, slammed it into reverse and backed boat, motor, trailer, car and all right down deep into the roily waters of San Diego harbor. Only the tip of the radio antenna signaled the presence of a forgotten decision to double check the boat-to-trailer tiedowns.

Leaving dock against high wind

So with the Glastron launched and ready to go, it didn't take long to get involved with the next trick—leaving a dock in a high wind. It was gusting to 30 knots as we approached the gas dock a little later. I nosed my port bow to the dock and secured a line from the bow to a cleat located about half a boat length down the dock. Then I waited. With the wind on the beam, the stern quickly swung to the dock. The wind pinned us there.

Now the trick was to get free of the dock. Under normal conditions this would be simple with a twin-engine boat. But with the wind blowing you down on the dock you need extra help. In this case the bow line worked for us. With the helm to port and both engines forward, the stern quickly moved away from the dock into the wind. The bow rotated on a protective fender against the dock. With the stern almost perpendicular to the dock, it was an easy matter to free the bow line and back the boat off.

Seek overnight anchorage early

We learned our third and fourth tricks the next day. The third had to do with timing. When cruising, it's always nice to find an anchorage or dock early. There is nothing as

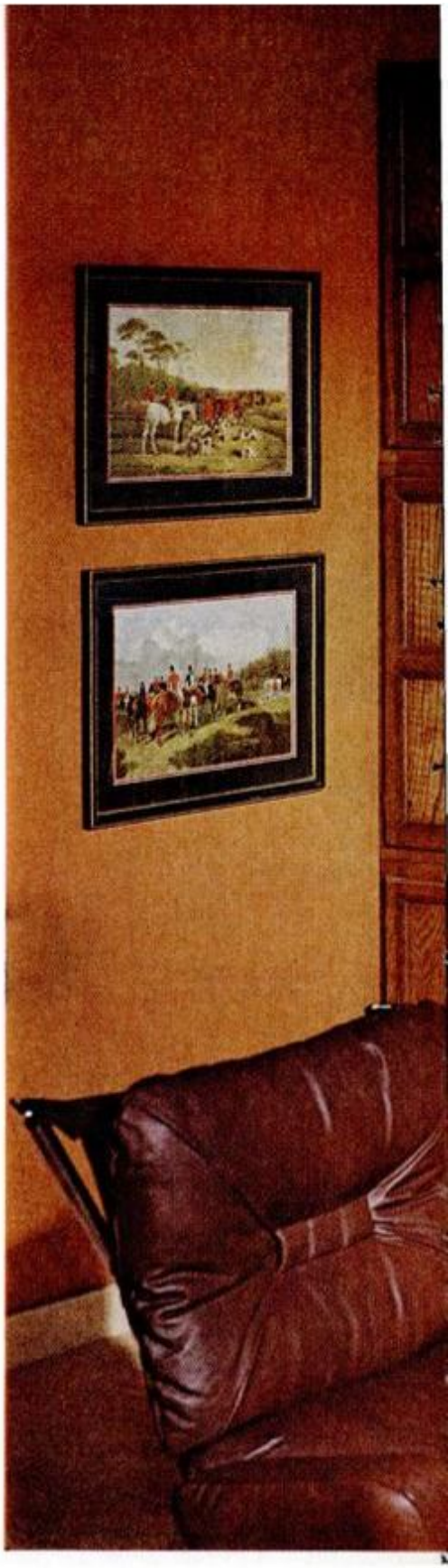
(Please turn to page 116)

Launching Glastron's 25-foot cruiser (top) is not difficult once you get the knack of handling trailer and pickup. With the outdrives lowered, you can power the boat off. Make sure all tiedowns are released. At dusk (middle) we started to light the lamps and ready the drinks. Getting bait (left) from a local fisherman assured us freshness.

'Instant' furniture from kitchen cabinets

Ready-made wall and base units are modules you can use to build your own custom furniture.

by Jim Liston



In almost no time you can build this entertainment wall in living room, family room or den—even if you're not a great carpenter. Yours will look every bit as good because you use ready-built modules—today's furniture-quality kitchen cabinetry.

Even experienced handymen like to work with ready-mades; with everything true, glued, hinged and finished, they're pretty hard to beat at today's prices for hardwood.

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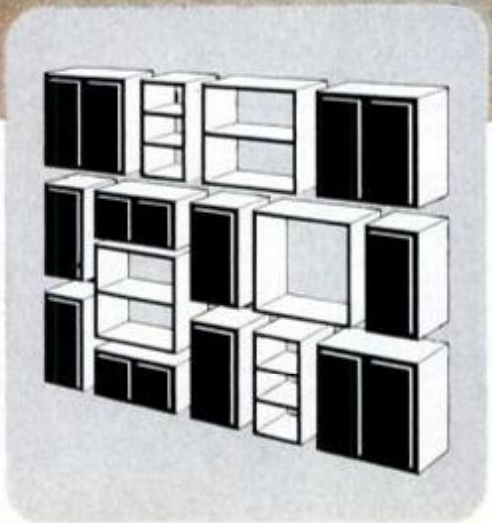
Color photos: Photography House

The free-standing entertainment wall, and other pieces suggested at left and on the following pages, can be built with any kitchen storage units. PM chose Olde Dominion, an all-oak line by Boise Cascade Kitchen Cabinet Div. These cabinets have a hand-rubbed wood-grain finish, and the construction equals that of top-quality furniture.

Like playing with building blocks, you simply stack the cabinets; their



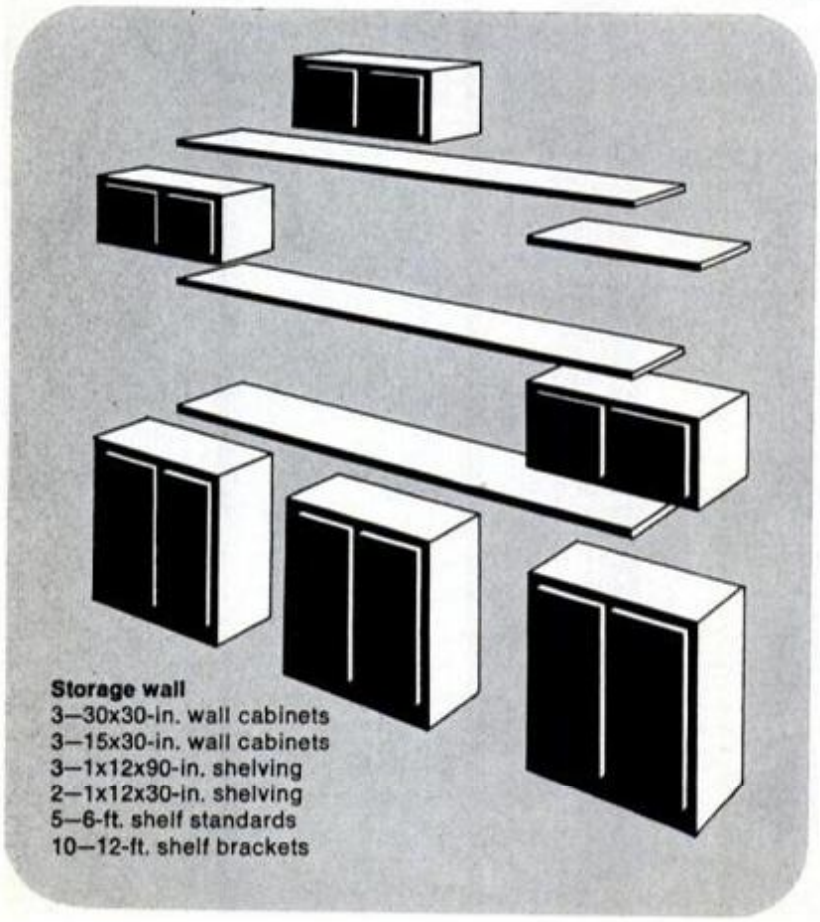
Entertainment wall

Basic units
5 15 x 30-in. single wall cabinets
3 30 x 30-in. double wall cabinets
2 15 x 30-in. double wall cabinets

Large open-back boxes (½" plywood)
6 pcs. ½ x 12 x 30-in.
6 pcs. ½ x 12 x 29⅛-in.
2 pcs. ½ x 11½ x 29-in.

Small open-back boxes (½" plywood)
4 pcs. ½ x 12 x 30⅛-in.
4 pcs. ½ x 12 x 14-in.
4 pcs. ½ x 11½ x 14-in.

Cost (cabinets only): Olde Dominion, about $600; Woodcrest, approximately $400.



Storage wall
3—30x30-in. wall cabinets
3—15x30-in. wall cabinets
3—1x12x90-in. shelving
2—1x12x30-in. shelving
5—6-ft. shelf standards
10—12-ft. shelf brackets

Wall-hung storage

This can be as high, wide and handsome as you like. There are various metal shelf systems; some finished with simulated wood grain to blend with cabinets and paneling. Shelf standards should be attached to wall studs for adequate support. Shelving can be finished to match cabinets or painted a bright contrasting color. Cost (cabinets only): Olde Dominion, about $400; Woodcrest, about $200.

weight alone is sufficient to keep them standing securely but it might be wise to anchor the upper cabinets. In the case of the entertainment wall, 10 standard-size, kitchen cabinets are grouped around five easy-to-make, open-back boxes of modular size, which you glue and nail together from ½-in. plywood, then paint.

The big plus in using kitchen cabinets is economy and availability. Lumber yards and kitchen remodeling dealers can offer almost immediate delivery, but there's often a long wait for furniture.

Decorate with Cabinets, *an idea booklet on how to build furniture from cabinets, is available from Boise Cascade Kitchen Cabinet Div., Box 514, Berryville, Va. 22611. Enclose 50 cents to cover postage and handling.* ★★★

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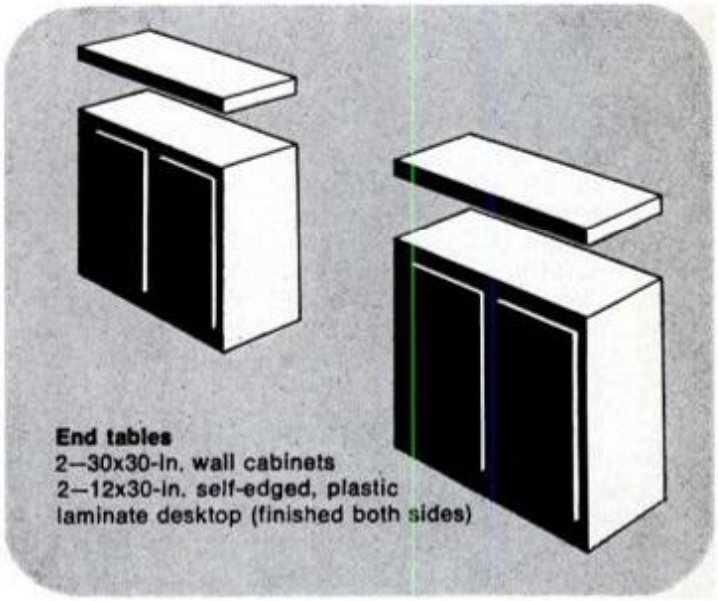
Night tables

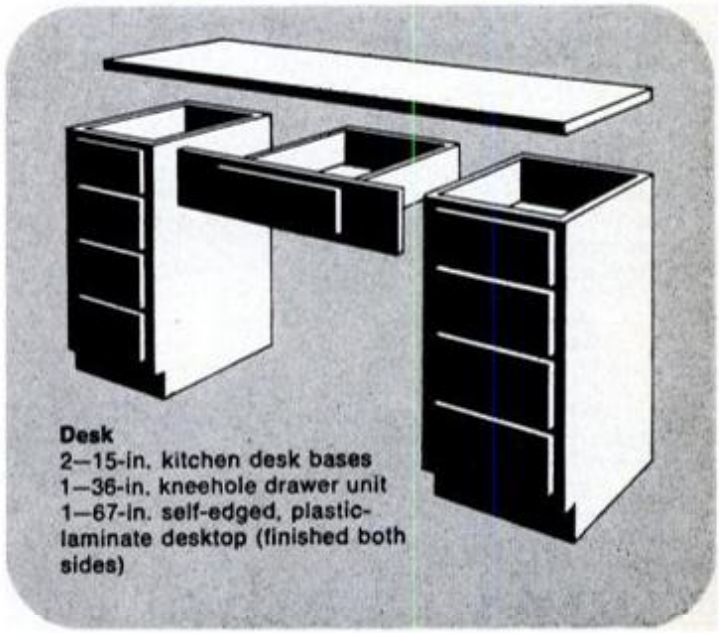
Tables from wall cabinets suggest all kinds of possibilities. Top them with self-edged, plastic-laminated plywood. Plastic can be wood-grained, white or a bright accent color. Cost (cabinets only); Olde Dominion, about $165; Estate Oak, about $100.

Desk

For student, menu-planner or budget-keeper, this good-looking desk can be made quickly and economically from kitchen-cabinet bases and a plastic-covered plywood top. Bases are available with deep drawers that take standard file flolders. Cost (cabinets only): Olde Dominion, approximately $225; and Woodcrest, about $150.



End tables
2—30x30-in. wall cabinets
2—12x30-in. self-edged, plastic laminate desktop (finished both sides)



Desk
2—15-in. kitchen desk bases
1—36-in. kneehole drawer unit
1—67-in. self-edged, plastic-laminate desktop (finished both sides)

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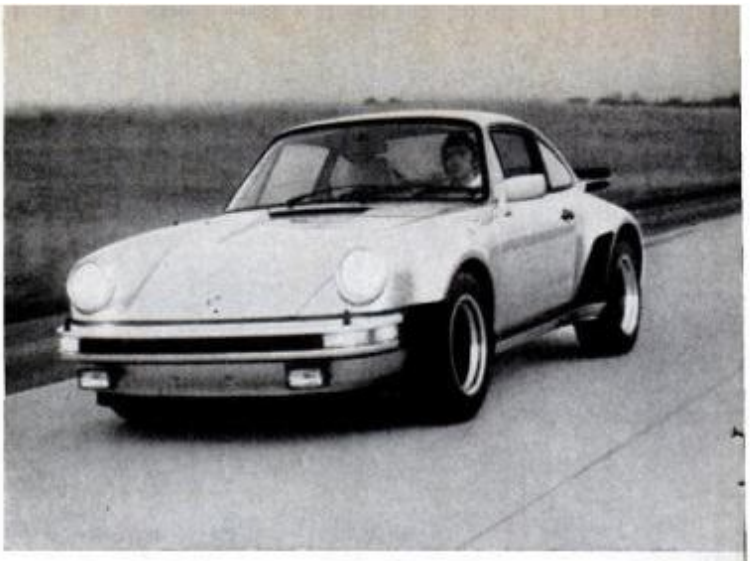
Turbocharging hits the streets...

... but are 55-mph streets ready for Porsche's new Turbo Carrera?



By Bill Hartford AUTO EDITOR

I had no trouble keeping the Porsche Turbo under 155 mph. That's top speed. I realized I was traveling at the national speed limit—plus 100—when I sat back and began scanning the instruments: oil temperature 250°F., rpm 6200 . . . I was not, of course, on any highway, but on the 7½-mile high-speed test track at the Transportation Research Center of Ohio.

The top slot on the turns at TRC is banked for 140 mph—you can go around with hands off the steering wheel if you want to. I tried that, too—quite a sensation. I also wondered how, and where, in the world were the buyers of the 1976 Porsche Turbo Carrera going to experience these sensations with their new cars. Why else own one?

At $26,000, the Turbo is hardly "transportation." It's pure experience—and one that only happens to take you from point A to point B. Driving it on the streets would be something like listening to music amplified by a 700-watt Phase Linear rig in a studio apartment: You'd never be able to appreciate its full potential. Well, maybe only in short bursts.

Still, turbocharging is a very practical thing to do: It boosts engine horsepower dramatically, and doesn't result in gas gulping or pollutant spewing. Turbocharging is a form of supercharging: forcing into an engine more air than it could breathe normally. Turbocharging refers specifically to the type of supercharger that's driven by exhaust gases from the engine (see technical drawing at right).

There are turbocharger kits you can buy and fit to your vehicle (see below), but you still won't stand much of a chance against the Turbo. The engine puts out 234 SAE horsepower—that's 77 more than the 911S for '76—and weight of the car is 2500 pounds.

The car is a marvel of engineering expertise, a lot of which was gained in racing, of course, but mostly it's just the way Porsche does things: exquisitely. ★★★

Turbocharger kits you can buy

Turbochargers increase horsepower and torque without raising fuel consumption. Thus they're gaining popularity rapidly in recreational vehicles, motor homes, campers and passenger cars.

The three major U.S. manufacturers of automotive-type turbochargers—AiResearch, Rajay and Switzer—do not sell directly to the public. Instead, they market compressors to distributors who sell turbo kits—usually with all the hardware that's needed to install the turbos on specific cars.

Listed below are names and addresses of some major U.S. distributors of turbocharger kits:

Accel Inc., Box 142, Branford, Conn. 06405 (203) 481-0341

Accel distributes AiResearch turbos and makes kits for the following auto, truck and RV engines: Chevrolet 265-400 V8s (about $700), competion Pinto 2000-cc ($641) and Colt 1600-cc ($641), plus a universal kit for engines with four-barrel carburetors ($264, turbos extra). In the works are kits for the Ford 232-351 V8s, Chrysler 273-360 V8s and a street version of the Pinto. Accel Inc. also markets eight different-sized turbos for engines ranging from 90 to 390 c.i.d. These sell for $386 to $400 without plumbing.

Ak Miller Enterprises Inc., 9236-38 Bermudez, Pico Rivera, Calif. 90660 (213) 949-2548

Ak Miller distributes turbo kits based on AiResearch compressors for truck and RV applications only—not for passenger cars. They fit the Chevrolet 350 V8, Ford 360-390 V8s and Dodge 360-400 V8s and cost $680 each. Miller also supplies kits for the Pinto 2000, Capri V6 and Toyota RC-18 at $550 each. Miller kits are sold in California only if the vehicle uses propane. Some 15 U.S. dealers retail and install Miller Turbo kits.

Crane Cams Inc., Box 160, Hallandale, Fla. 33009 (305) 927-4261

Crane distributes Switzer's automotive and RV turbos through some 200 U.S. dealer/installers. Kits available are the Vega ($796) and VW Beetle ($796).

Crown Mfg. Co., 858 Production Pl., Newport Beach, Calif. 92660 (714) 642-7391

Crown supplies kits with Rajay compressors for the Datsun 240-Z ($625), Porsche 914 ($595) and Datsun 1600-1800-cc pickups and sedans ($525). Crown kits are not sold in California.

Shelby-Spearco Dist. Co. Inc., 2054 Broadway, Santa Monica, Calif. 90404 (213) 829-1577

Spearco, primary automotive-application distributor for Rajay turbo kits, now offers kits for various Volkswagen models ($540), Pinto 2000-cc ($525), Mustang II 2.8-liter ($625), Capri V6 2.6-liter ($600) and Chevrolet 454 marine and competition installations ($1020-$1820). It is working on a small-block Chevy kit for RVs and passenger cars.

Turbocharger Inc., 12215 South Woodruff Ave., Downey, Calif. 90241 (213) 773-1880

Turbocharger Inc. distributes Switzer compressors on the West Coast. It makes kits for late-model Mercedes ($585) and Peugeot (about $500) diesel passenger cars—the 200-D, 220-D, 240-D and 504-D. The company is working on a kit for the M-B 300-D and also makes custom off-road installations that use both the Switzer and Rajay blowers.

Z-Car Care, 2458 Sabens Rd., Dallas, Tex. 75229 (214) 620-1683

Distributes and installs Crown Mfg. Co. kits for Datsuns.—*Mike Lamm*

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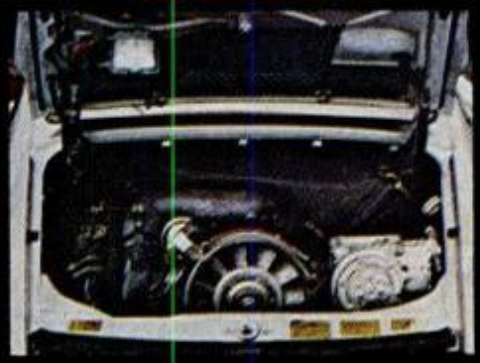
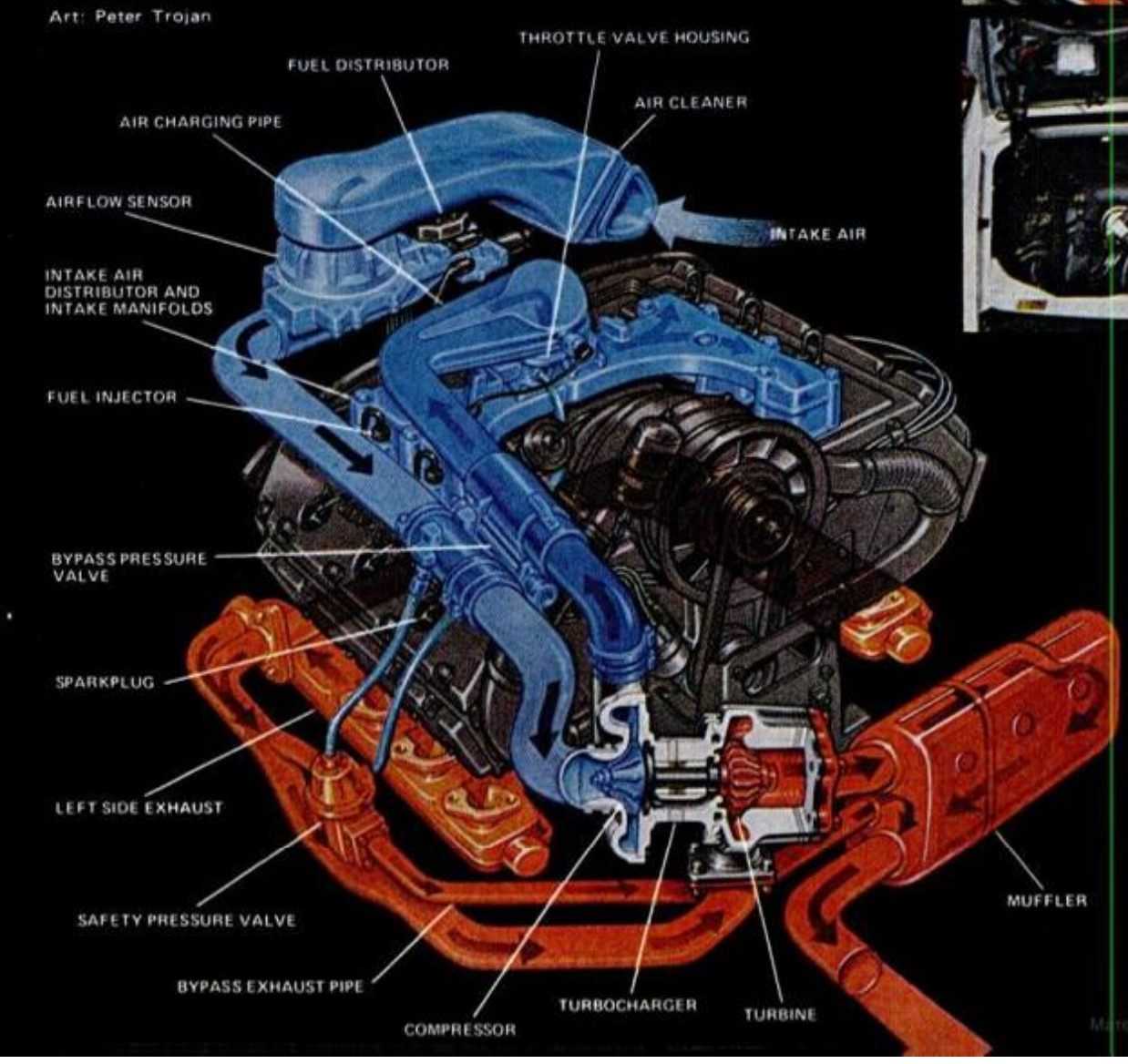
The Porsche Turbo is the ultimate street car, but you need a racetrack to explore its potential. The smooth and effortless glide through the gears to 155 mph is surprisingly quiet in the cockpit, with only the cool whine of the turbine spinning at 90,000 rpm to betray the secret of its performance to those outside the car. The impeccably engineered machine has coachwo. k and comfort to match: Seats are leather with plaid inserts, climate control is automatic and so are windows and antenna. Headlight cleaning is done at the push of a switch by high-pressure jets. The Turbo is now available here, and it's priced at $26,000.



Art: Peter Trojan



1976 PORSCHE TURBO CARRERA —HOW IT WORKS

The turbocharged engine in the new Porsche has six cylinders, horizontally opposed. It's air-cooled, fuel-injected, has one overhead camshaft for each cylinder bank and displaces 3 liters. The intake air is forced into the cylinders by the compressor, which is on the same shaft as the turbine and is driven when the exhaust drives the turbine wheel. The bypass valves and pipes maintain correct turbocharger speed and system pressure.

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Reward of refinishing can be the restoration of a quality-built piece of furniture bought for a few dollars at a sale. Those who know how to refinish furniture soon acquire a sharp eye for bargains. Surface scratches, stains and even coats of paint can, they know, be completely removed.

Color photos: Stephen Fay

Refinishing furniture is easier than ever

PART 2

by Rosario Capotosto

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Part 1 of this article, published in the November issue, covers what must be done to prepare the surface properly for refinishing.

Now let's talk about the actual refinishing. Raw or stained wood is relatively porous and will absorb too readily any finish applied to it. Sealer "locks" the pores and acts as a foundation for the top coat so it stays on top where it belongs. It also keeps oil stain from bleeding through.

There are three basic types of sealers: lacquer-based sealer, shellac and a home-brewed varnish sealer made by diluting varnish with thinner. The lacquer type is by far the best to use because it's fast-drying, assures excellent adhesion for the top coat and prevents the finish coat from darkening the wood. Brush on a coat of sealer, lightly hand-sand with 220-grit paper and wipe off all sanding dust with a tack cloth. The surface is now ready for a filler and/or top coat.

Filling open-grained wood

Some woods such as locust, mahogany, oak and walnut are open or coarse-grained and require filling in order to achieve a smooth flat surface. Paste wood filler, available in various wood colors, comes as a heavy paste which must be diluted with turpentine to brushing consistency. Brush the filler over a small area—about 2 sq. ft.—at a time. Work it well into the pores by brushing first with the grain, then across. Let it set until its "wet" look begins to dull. Don't let it get too dry. Wipe off the excess with burlap or other coarse cloth, first across the grain, then lightly with the grain using a soft, clean cloth. Let dry overnight. Sand surface lightly with very fine paper to remove excess surface filler.

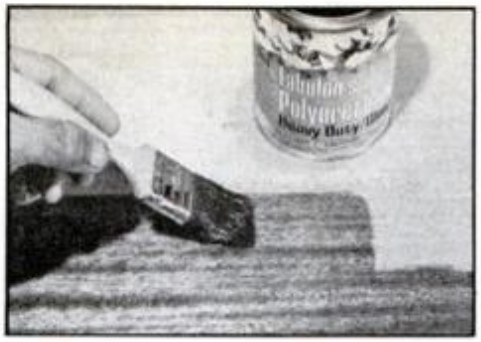
Dents, cracks or nail holes should be filled with wood putty or water putty tinted to match the wood color *before* the first coat of final finish.

Bleaching, removing discoloration

The natural color of wood can be lightened by bleaching. Commonly used, commercially available wood bleaches contain two solutions which may be mixed or applied separately, depending on the formula. Bleach may also be used in localized areas to remove stains or other discolorations—always pretest it on sample wood. The chemicals are quite harmful to skin, so wear rubber gloves and goggles. Simply apply the solutions, let them dry; and then sand lightly to remove residual salts. Some methods require a water rinse.

Applying the final finish

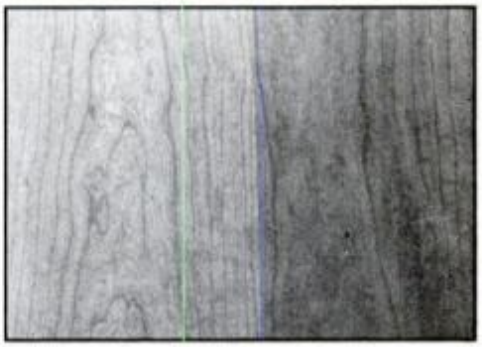
The top coat, or final finish, serves



Top coat accentuates the figure and color of wood while adding a protective coating. Here it brings out the "fire" of mahogany.

Fresh shellac dries faster. Make your own by dissolving shellac flakes in alcohol. The flakes can be weighed on a postal scale.

Two-solution bleach is quick. After A has soaked 10 minutes, work B into the wood with a sponge. When it's dry, you sand it.



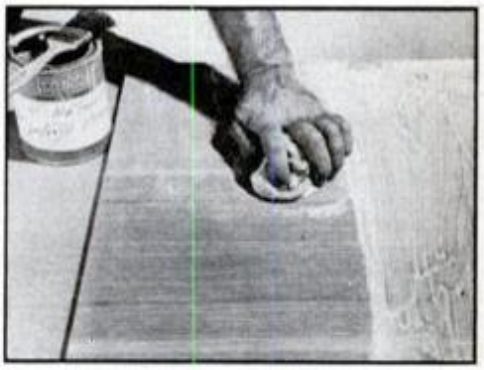
Primer-sealers prevent the top coat from darkening the wood. Sealed half of the panel is lighter than untreated portion.

Wide range of finishing products available may confuse beginners, but all materials are basically those described in this article. Shown are some of the top-quality products.

Paste filler check chart

Filler generally **used** on these woods	
ASH	OAK
CHESTNUT	ROSEWOOD
ELM	BUTTERNUT
HICKORY	LOCUST
MAHOGANY	WALNUT

Filler generally **not used** on these woods	
BASSWOOD	CYPRESS
CEDAR	BEECH
FIR	BIRCH
HEMLOCK	GUM
PINE	WILLOW
POPLAR	MAPLE
SPRUCE	SYCAMORE



Paste wood filler is used to get a smooth surface. When it begins to dry, just wipe it off across grain, then lightly with grain.

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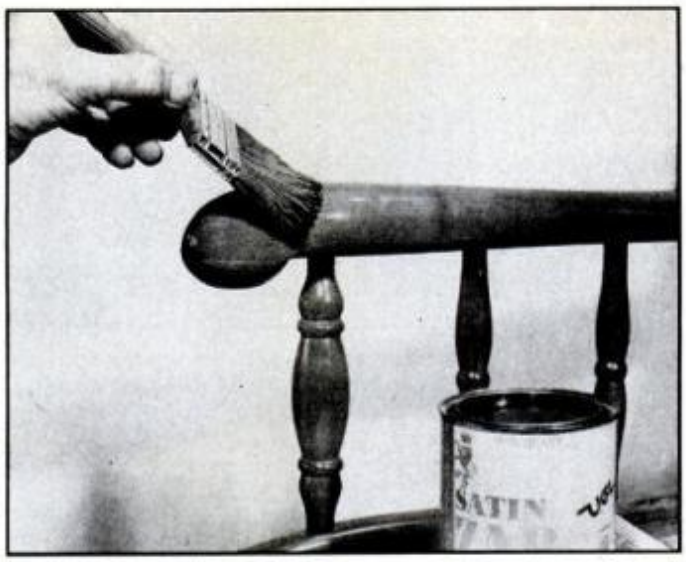
two purposes: It protects the surface and enhances the attractive color, figure and intricate grain patterns of the wood. Surface effects are optional —high gloss, satin smooth or flat. There are three basic types of natural wood finishes: surface—including shellac, varnish and lacquer—all-in-one and penetrating.

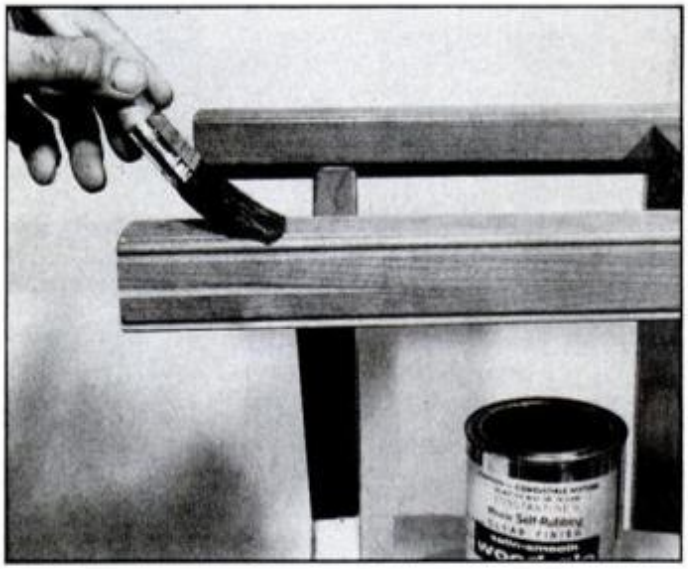
■ *Shellac* is available in orange or white types. It is easy to use when fresh, but seldom is fresh because its shelf life is only about four to six months. Stale shellac is painfully slow-drying. You can make your own shellac, however, by buying shellac flakes and dissolving them in denatured alcohol as needed. A common dilution is "No. 2 cut" (2 lbs. of flakes per gallon of alcohol). Shellac dries fast in a dry atmosphere, but very slowly when humid conditions prevail.

White shellac does not deepen the wood color to any extent, but orange will impart a rich amber tone. Always apply several thin coats, sanding lightly after the first. Since shellac has poor resistance to water, alcohol and heat, it is desirable to rub the final coat with fine steel wool (000), followed with a substantial coat of rubbing wax for maximum protection.

■ *Varnish* is available in the standard natural-resin type and in newer polyurethane and epoxy formulations. Standard varnishes are relatively slow-drying. The synthetics are easy to brush, fast-drying and have good resistance to wear, water, alcohol,

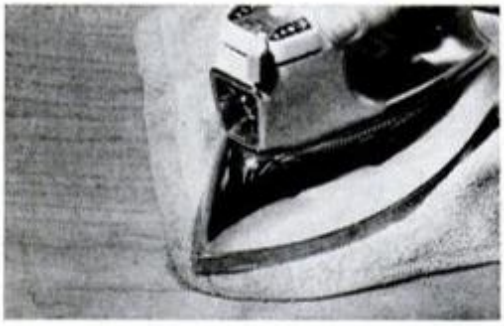


Satin-finish top coat goes on nicely if you use good-quality brush with flagged bristles. Apply varnish liberally with minimum number of brush strokes. You should finish each small area by lightly stroking it with the tip of your brush.

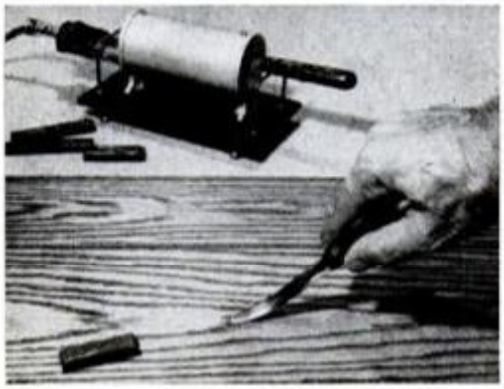


All-in-one finishes combine sealer and finish coat. They require two or three single-solution applications. A two-coat job will usually produce a finish having a fine, hand-rubbed look.

How to repair dents and scratches

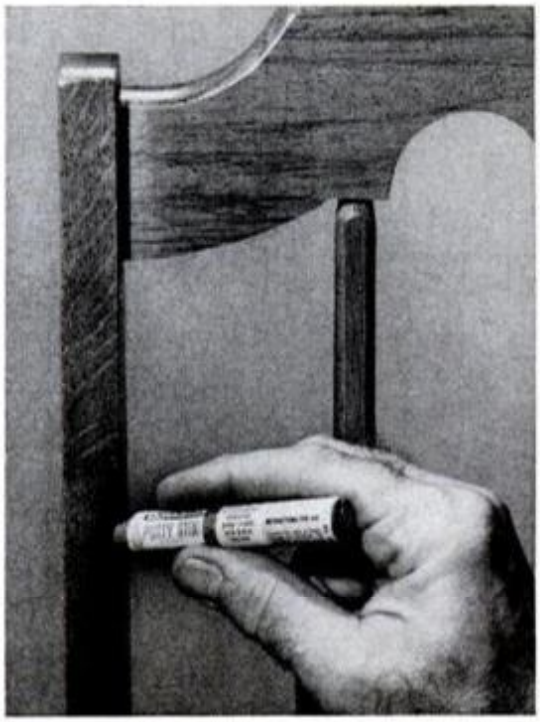


Shallow dents in wood can be removed by swelling the fibers. Place a damp cloth over the area and apply heat with an iron. Sand the area flush when it is thoroughly dry.



Putty sticks, available in many colors to match woods, are used to cover nailheads and small holes in a finished surface, but never used before application of top coat.

Shellac sticks are used for repairing damaged surfaces. Heat flexible burn-in knife (or grapefruit knife) with smokeless alcohol or Sterno flame, touch it to material and press molten bead into hole or defect. Keep knife moving to prevent burning of wood.



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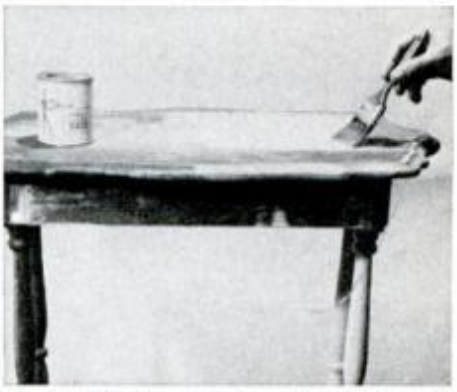
How to simulate a wood-grain finish

First fill cracks and dents with wood putty or putty compound; lightly sand loose finish. Don't remove firm finish.



Clean off grime and sanding dust with turpentine. Then apply latex base (see text below) and let dry for about an hour.

Glaze goes on next. Oil-based material dries slower than latex. Coat area and do next step before other parts.

"Comb" a simulated grain in wet glaze with stiff brush. Clear finish goes on last. (Edge shown has ungrained glaze.)

acids and alkalis. A decided advantage of the polyurethanes is that humid weather has no adverse effect on drying as with standard varnishes. Actually, humidity promotes quicker hardening.

Use a good bristle brush, dipping no more than one-third its length into the varnish. Flow it on liberally with a minimum number of brush strokes. Brush with parallel strokes, then quickly cross-stroke at right angles and finish by stroking lightly with the grain using only the top of the brush (almost dry). Never drag the bristles over the can rim to remove excess varnish because this will form tiny bubbles to mar the coating. Instead, gently tap the brush tip against the inside of the can above the liquid.

Regular varnish must be sanded with fine paper between coats, but the urethanes generally need not, provided each coat is applied within the time specified by the manufacturer. The time element is critical because chemical fusing between coats occurs only during the period indicated.

■ *Lacquer*. Regular lacquers are extremely fast-drying and are meant for application only with spray equipment. Excellent hard-wearing brushing lacquers are now readily available for general use. These, too, are fast-drying so you must work more quickly than you would with varnish. Flow on liberal coats with the grain as evenly as possibly. Avoid overbrushing to prevent brush marks. Apply successive coats after light hand sanding. Be sure you have adequate ventilation.

■ *All-in-one finishes* seal and surface-coat the wood in two or three single-solution applications. They require nothing under or over and dry to a medium luster simulating a hand-rubbed finish. Extra-fast-drying types should be brushed on like lacquer. Slower-drying types can be handled like varnish.

■ *Penetrating finishes* are actually resin and oil sealer which penetrate deeply into the pores of wood where they harden to protect the surface from within. Not intended as a surface film, these finishes preserve and color the wood with a flat look typical of Danish Modern furniture. Application usually requires flooding the surface of the sanded wood and letting the solution penetrate about 30 minutes. Then apply a second coat and let it soak in about 15 minutes. Wipe the surface clean and dry with a soft, lintless cloth.

Wood-graining and antiquing

Furniture too battered for barewood refinishing can be transformed into attractive pieces by wood graining or antiquing. Kits contain a base coat and glaze. You sand the pieces to remove loose, peeled finish and to smooth rough spots, then fill voids and cracks with wood putty or water putty. Apply the base coat and let it dry (latex type will dry within an hour). Brush on the glaze coat, then pass over it with a dry stiff brush to create a "grain" pattern. If you don't like the results, add more glaze and try again. With practice, you can get close to a new-wood clear finish. ★★★

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Radio on wheels: The CB communications freeway

by Leo G. Sands

A hand reaches suddenly to pull a microphone from a car's dashboard, and press the mike's talk button. Call signs are exchanged, then a brief but necessary message. Highway patrol in action? Maybe—but today it's more likely to be a trucker checking traffic conditions up ahead, or a businessman telling his wife he'll be home late for supper.

More and more Americans are communicating from their cars—and elsewhere—by two-way Citizens Band radios. But if the dashboard microphone is no longer just a symbol of the highway police, these police have played an ironic role in the growth of CB radio.

The Citizens Band—which lies between the shortwave broadcast and 10-meter amateur radio bands—was established by law in 1949; the "Class D" two-way communications service (CB also includes a class A business band and class C remote control frequencies) was opened nine years later. CB filled a real need for a two-way radio service that almost anyone could use without the detailed technical and Morse-code knowledge required for a "ham" license, or the expensive equipment needed for ham or business-radio operation. CB's growth was steady, if not spectacular, with merely a million stations licensed and about 6 million sets in operation (one license can be good for any number of sets used by a given family or business) by 1974.

But in 1974 came the fuel crisis and a national 55-mph speed limit that drastically cut truck-drivers' earnings. (Paid by the trip, the drivers are limited by law as to the number of hours they can spend on the road—lower speed limits mean fewer trips per shift.) The truckers' protests—including CB broadcast warnings of lurking patrolmen—became big news. And with all that free publicity, the CB boom was born. Today, 1½ million CB licenses are in force, and an estimated 6 to 7 million sets are in operation. Industry

Photo: Merle Morris

In the car, CB can help with emergencies, route planning, finding which diner has good coffee, or just breaking up a long drive's monotony. At least 6 million cars now have CB (such as this E.F. Johnson set); at least a million more will in 1976.

Dwarfed by its microphone, this Pierce-Simpson Alley Cat can fit even cramped car interiors, yet covers all 23 CB channels. Compact sets like this are now quite common.

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PocketCom sends and receives on two CB channels, costs $40 with crystal for one.

sources estimate that another 2 million sets will be added in the coming year.

Keeping drivers aware–and awake

"Watch out for Smokey Bear!" may have been the signal that got all the publicity, but truckers had already found important uses for CB before the fuel crisis—which is why they had CB in their cabs to begin with. Constant relays of information let truckers and other CB-equipped motorists avoid traffic delays, prepare for bad weather ahead and report accidents to police and emergency services.

Sometimes mobile CB can even help prevent accidents, whether by alerting police to drunk or reckless drivers before they hit something, by letting truckers warn each other of bad tires or sloppy driving habits, or even just by keeping CB-equipped drivers awake on long trips.

CB catches crooks–and husbands

And sometimes CB can even help fight crime, ironically bringing the CB user into closer, friendlier touch with Smokey Bear. Spotting a hit-and-run driver near Bristol, Va., a trucker used his CB set to summon other truckers, who banded together and surrounded the hit-and-runner with their 18-wheelers until the police could arrive and pick him up. In Twin Falls, Idaho, police quickly captured three suspects in a filling-station robbery, after the station attendant broadcast a call for help.

"CB radio is my security blanket . . . It's better than an insurance policy," says Sheryl Kovatch of Cleveland, who's used CB more than once to call effectively for help. Recently, when police arrived too late to catch some teenagers who'd been assaulting Mrs. Kovatch's father and mother-in-law, she broadcast a description of their car on CB. Within minutes, it had been spotted by CBers, and the police quickly apprehended the young men.

"I've been involved in CB for about two years," Mrs. Kovatch says, "and it's been a lifesaver more than once. About a year and a half ago, two men tried to break into my home while I was there alone. I grabbed my microphone and put out a distress call. Within five minutes, CBers in cars were pulling into my driveway, scaring the intruders away."

As much help as CB has been to Mrs. Kovatch, she also uses it to help others, as a member of the Cleveland Police Auxiliary, all of whom are CBers.

Sometimes, being a CB samaritan this way pays unexpected dividends: "I was on the radio one Sunday afternoon trying to locate someone with first-aid experience to help some accident victims," says Mrs. Kovatch. "The man who answered my call eventually became my husband."

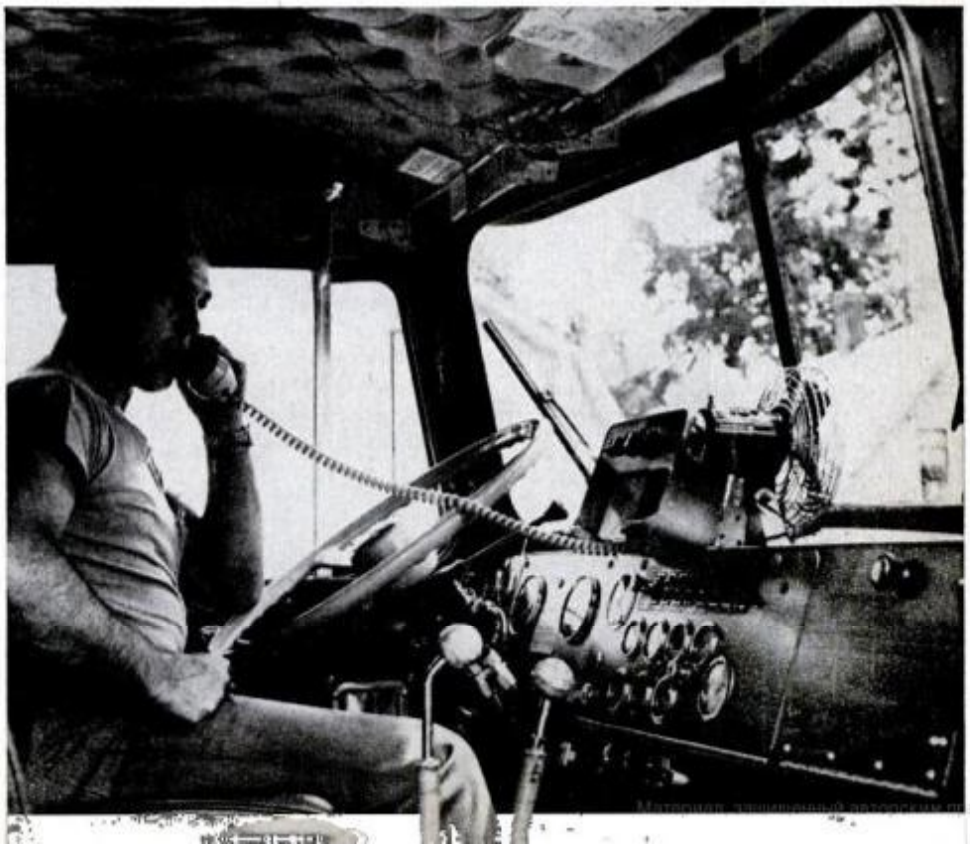
Other nice things have happened through CB for her: "Last year, I was driving through some lonely mountains in Tennessee, when my car broke down. There was no one for miles in any direction. So I put out a call for help, and within 15 minutes there were two cars and an 18-wheeler there to help me. One of the guys was a mechanic, and he got my car running again in short order."

Who listens?

But when you broadcast an appeal for help, for yourself or for others, who's listening? It's not just a random sprinkling of mobile and stationary CBers. Channel 9, now an official emergency channel restricted to emergency and motorist-aid communications, is monitored throughout the country by volunteer public service teams belonging to REACT (Radio Emergency Associated Communication Teams) or ALERT (Affiliated League of Emergency Radio Teams). If you're calling from a boat, your calls for assistance might be picked up by a REST (Radio Emergency Service Team) monitor. And some service stations monitor Channel 9, too. Any of these teams—or individual listeners with nearby phones—can relay your message to police or other emergency services.

But more and more, your call will reach these services direct. Highway patrols and State Police in Illinois, Missouri, Georgia, Ohio and other states now have or are installing CB. In some states, troopers even furnish their own CB sets.

Even during their first few trial months with CB, Missouri's State Highway Patrol received reports of 27 wrong-way drivers, and arrested 11 of them, booked 101 of 112 apparently drunken motorists, arrested 22 of 31 reported speeders, made 21 arrests in criminal cases such as kidnapping and theft, and responded more quickly to 120 accidents, 94



Truckers use CB for traffic and safety information, routing and scheduling, criticizing each other's driving, warning about highway police, helping police intercept criminals and just for company. Truckers gave CB publicity that helped spark today's boom.

Photo: Jim Elder

Marine CB won't get you the Coast Guard, but does let you chat about personal matters—and is more useful than marine-band radios on inland waters.

stranded motorists and five sick or injured persons.

The patrol's superintendent, Col. Samuel S. Smith, called the number of reports received "amazing." Even the "Smokey-Bear" warnings don't shake his beliefs that "the potential benefits of CB radio to law enforcement are so great that they far outweigh the disadvantages." Dismissing the idea that CB speed warnings are "a serious threat," Col. Smith reports cheerfully that "We've overheard warnings . . . being relayed to truckers long after our operations have been discontinued . . . so we actually receive a residual benefit from these warnings."

Assuming the purpose of policing speed is to minimize fast driving, CB warnings help, but not all police make that assumption. One Wisconsin CBer was arrested (but acquitted) for "obstructing justice" with just such a warning.

CB afloat

Nor is CB just useful at home and on the road. Many more boats are equipped with CB sets than have the standard, VHF/FM or marine-band radiotelephones.

CB is no substitute for VHF marine equipment, which carries many miles farther, is more immune to interference, and which the Coast Guard monitors constantly for emergency calls and uses to broadcast emergency weather bulletins. Nor can you get marine telephone calls on CB.

But outside the tidewaters, the Great Lakes, the Intracoastal Waterway System and the St. Lawrence Seaway, there are no VHF and Coast Guard stations to communicate with. Yet in inland waters, like Lake Coeur d'Alene in Idaho, you're surrounded by CBers on wheels, at home and on other boats. And CB equipment costs less than marine gear.

Even in areas where there are VHF and Coast Guard stations, countless boatmen use CB in lieu of marine radio (it's still better than no radio at all), or in addition to VHF gear. For, while marine radio operation is restricted to safety, operational and navigational communication and to marine telephone service, a CB radio can be used to ask where the fish are biting, where the cocktail parties are, or for any other legal purpose.

Obviously, not all CB talk is serious, whether afloat, at home or on the road. Motorists and truckers use CB for company, to cut the monotony of long, solitary drives. Shut-ins find it a godsend. Countless CBers have met on the air and, while some never meet eyeball-to-eyeball, many do.

And while the band was set up for use in personal or business activities and to promote safety, casual conversation has become so common that the FCC has recently bowed to reality and curbed their prohibition of it.

If you're listening, you'll find most of the action on emergency channel 9, and on the unofficial truckers' channels, 10 and 19. If you're calling, 11 is now the designated channel for contacting other stations; once you've made your contact, you agree upon another channel to conduct your conversation, leaving 11 free for others to make contact.

But you must obey the rules

Not that there aren't some restrictions on what you can and can't do with CB: You're not allowed to carry on a conversation with another station for more than five minutes at a time without taking a one-minute break to give others a crack at using the channel. You're not allowed to blast others off the air by overpowering them with illegally amplified transmitter power, or illegally high antennas. You can't use CB to promote illegal activities. You have to identify your official, licensed call sign at the beginning and end of every conversation. And you have to get a license in the first place.

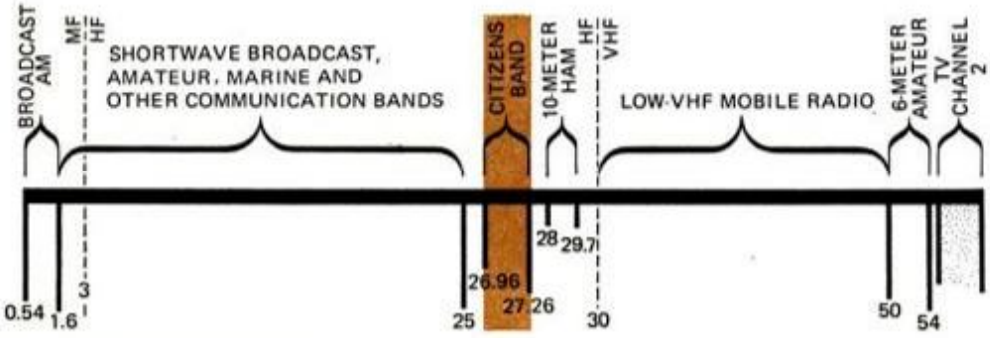
Getting the license isn't hard: You just fill out a simple form (there's one packed with every CB set) and mail it, with $4, to the FCC. There's no exam to pass, and you don't even have to be a citizen. When the license does arrive, it's good for five years.

Tempting as it is to use your new CB set before your license arrives, don't do it: The FCC's enforcement of the CB laws is spotty, but if it catches you, you can be liable for fines of up to $10,000, and jail terms of up to a year—and the same holds true for other violations.

What it costs

Equipment for CB costs less than for any other two-way radio service. Sets that can operate on all 23 of the Citizens Band AM channels start at about $100 for mobile sets, a bit more for 23-channel base units (which operate from 110-volt house current instead of 12-volt automobile electrical systems) or hand-held, 23-channel walkie-talkies. Home or mobile antennas will run from about $20 up, including cables and mounting brackets.

CB sets with fewer than 23 chan-



Two-way Citizens Band radio occupies the 11-meter band, about halfway between the AM broadcast band and VHF television.

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nels are available at lower prices, but they limit your communications to sets that are monitoring those few channels, and narrow your chance of finding a channel free to talk on.

There are also low-cost (about $8-$35) walkie-talkies that put out 100 milliwatts or less of power and require no license (licensed sets can deliver up to 4 watts).

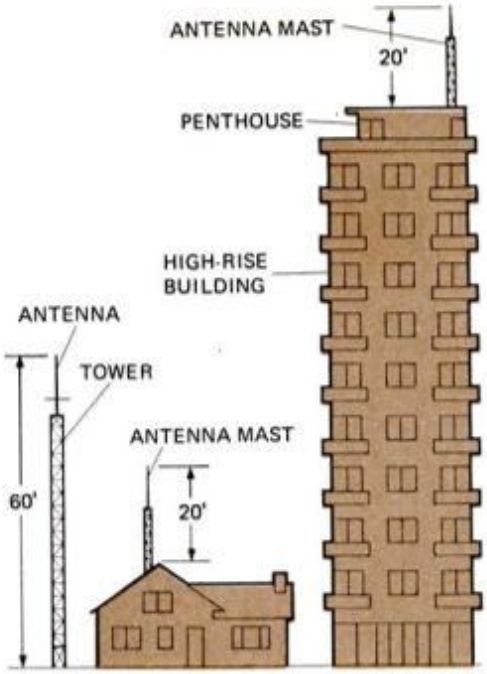
SSB transmission

There are also transceivers that offer more than 23 channels (69 of them, in a manner of speaking), thanks to a technique called "single sideband," or "SSB" for short. Twenty-three of an SSB set's channels are the regular AM ones, whose signals consist of a carrier at the nominal channel frequency, which is always broadcast when you're transmitting, and two identical sidebands that exist only when you talk into the mike, and which carry the actual speech information. With its sidebands, an AM signal occupies about 6 kHz of the radio spectrum, 3 kHz above and below the frequency.

Since both sidebands are mirror images of each other and contain the same information, you can halve your channel space by only transmitting either the upper sideband (USB) or the lower (LSB) one. And since the carrier contains no information, it need not be transmitted at all. By using all the available power for just one sideband, as SSB does, you get about three times as much useful power as AM, as well as an apparent tripling of the channels.

Actually, that channel tripling is more apparent than real. Though two SSB conversations can share one of the 23 AM channels, the sidebands do take up part of the channel space, so an AM set and an SSB set can't share a channel. And an AM set will only pick up an SSB signal as an undecipherable, Donald Duck yammer, though SSB sets are equipped to receive and transmit AM as well as USB and LSB.

SSB sets are more versatile, but they're also more expensive—about $250 to $800—and they're a bit more complicated to operate. Each signal must be fine-tuned with a "clarifier" control or it will sound unintelligibly boomy or chattery; this is a big drawback in mobile operation.



Maximum antenna heights for CB are 60 feet above the ground level, or 20 feet above existing buildings, as shown.

Still more channels are coming, but for special purposes. Channels restricted to SSB communications between transceivers owned by the same licensee will be added to the band very soon. And if other countries who use those wavelengths for other services agree, we may later get a new Class E band with 80 FM channels, probably restricted to serious or business purposes rather than the chatter on the current band. The old channels will still be used, and today's sets still usable.

Basic controls

All CB sets except the smallest walkie-talkies have an on-off switch, a speaker volume control (often combined with the on-off switch), a channel selector switch and a squelch control. The squelch circuit silences the speaker when no signals are being received—otherwise, a roaring noise would be heard through the speaker between transmissions. How you set the squelch control varies the receiver's effective sensitivity: Set it "tight" and the speaker will operate only when a very strong signal is received.

CB sets are switched from channel to channel like TV sets, with no knob-twiddling needed to tune them.

Additional controls

Nonetheless, some sets do have a "delta-tune" control that lets you tune your receiver circuits slightly up or down for clearer reception of off-frequency signals.

Noise limiter switches, another common extra, minimize ignition noise interference from your own vehicle or nearby ones. Noise blanker or noise silencer circuits give additional interference rejection.

RF-gain controls or "local-distant" switches reduce your receiver's gain to prevent overload when listening to strong signals from nearby transmitters.

A "PA" switch lets you use your set's microphone and audio amplifier to drive an outside speaker for public-address use. Not many people need this, but many sets do have it.

Most transceivers have S/RF meters that indicate the relative strength of received signals in "S" units from 1 to 9 and in dB (decibels) above S9. The same meter indicates relative power output when you transmit. Some sets may have modulation level indicator lamps that flicker as you talk into the mike. A few even have SWR (Standing Wave Ratio) meters to check antenna functioning.

Still other extras are available in higher-priced models, from the tele-

(Please turn to page 117)

Attractively-styled CB sets like this E.F. Johnson unit are available for the home, too. Telephone-style handsets give privacy in home use, help overcome noise in car.

Материал, защищенный авторским правом

You *know* that Seville owners are a fussy bunch. They're watching their cars like hawks, seeing whether they've bought *real* Cadillacs or simply reskinned Novas.

Hypercritical owners make dealers and factory reps nervous, so Cadillac is trying very hard to keep Seville owners happy. The question is: Are they? We asked Seville buyers how they really feel now that they've had time to live with their cars.

Basically, owners like their Sevilles just fine, but with some mild reservations. The most frequent gripes centered on gas mileage and workmanship. Nearly 17 percent find gas mileage lower than expected. Owners averaged 12.8 to 16.7 mpg **in our survey**. And 14.1 percent say workmanship could be better.

Latest EPA figures show that the Seville is good for 15 and 21 mpg—considerably higher than our averages.

In this report we'll give owners a chance to speak their piece one by one. We've chosen comments representative of the majority and balanced to reflect the data summary.

First, here are the words of a retired Sacramento farmer, aged 71: "We wanted a four-door car and were ready to trade our Coupe de Ville. I liked the Seville's handling—**it's like a friend's TR-3**. My wife grumbled about the front seat but agreed to the smaller size.

Flat cornering and maneuverability surprised many owners who'd been used to bigger Cadillacs.

Lots of gripes about the front seat. It seems the bottom cushion slopes downward at the front, giving too little leg support.

"I consider service excellent, and two leaks were corrected immediately. The car has beautiful engine response and absolute control of all driving aspects—short turning radius, no tilt on turns, effortless controls. I had anticipated better gas mileage on long trips, and my wife has had to reduce our traveling bags from six to three.

"A few complaints, yes. **The front-seat situation**; the right seat is too low. Knees bump when entering, and I can't figure out what should be done. The doors seem to be hinged too far forward. Also would prefer gas filler on left-hand side. But yes, I believe this is one of the best Cadillacs ever made, and I would buy another one."

Next we have a corporate vice president from New York, aged 41: "I bought this car because I wanted a well-built, compact, long-life car. Boy was I fooled!

"Coachwork is the worst I've had on any car. Front seat is uncomfortable—too short under the legs. As for mechanical troubles, I had to have the fuel-injection computer changed (replaced), and the clock likewise. The ventilating system blows nothing but hot air. The car has spent a total of **11 weeks in**

PM OWNERS REPORT: 1976 CADILLAC SEVILLE

Can it live up to Cadillac's 'standard of the world' claim?

A nationwide survey based on 354,214 owner-driven miles

by Michael Lamm WEST COAST EDITOR

Photos by the author

the shop and the following items still don't work: airconditioner controls, power windows and chimes. Parts delays, factory red tape, untrained personnel, buck-passing—I've had them all. The only good thing I can say about this car is that it gets pretty good gas mileage. But buy another one? Never!"

This is unusual. Dealers and factory people do their best to keep fussy Seville owners happy in the service department.

From a pharmaceutical sales manager in Jackson, Miss.: "I bought the car on the strength of reports in *Motor Trend, Popular Mechanics*, etc., touting this as the best-put-together car in America. It is, but I'd rate it not quite excellent—too many little faults at delivery. I had a body leak, axle whine, flooding and hard starting. Every complaint, though, was handled immediately and to my complete satisfaction. I can't fault the Seville, only the haste of assembly.

"If they could build the front seats with more rearward tilt, it might eliminate that feeling that you're going to slide forward at every stop. But I find the Seville comfortable and very plush, as it should be. Of course, I'd buy another."

A retired female U.S. Army colonel in St. Augustine, Fla.: "The excellence in all ways of **my previous 10 Cadillacs** gave me trust in the Seville. I was also promised 19 mpg in highway driving. If only the car would do that I'd be totally satisfied, but I get 16.9 at 55 mph without airconditioning and *with* a tailwind.

We didn't tabulate what cars Seville owners traded in, but a good number were Cadillacs.

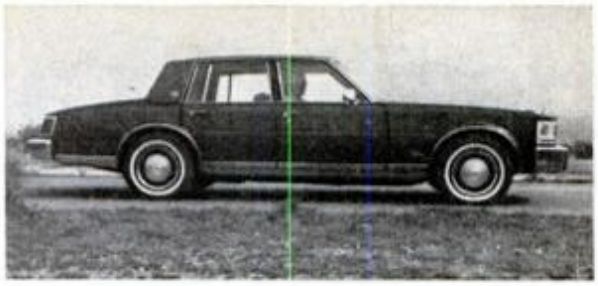
"I rate workmanship outstanding and I especially like the luxury in all appointments. The interior is beautifully done. That plus roadability plus silence, handling and comfort gives the solid feel of a big car. It's beautifully engineered. I don't think I'll ever give up the excellence of a Cadillac automobile."

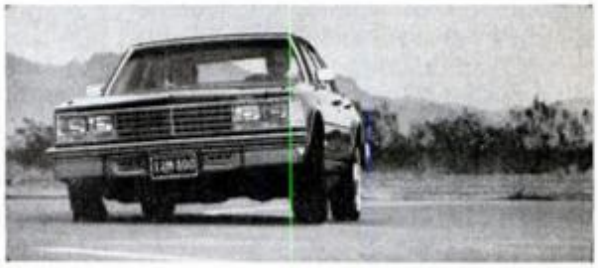
A 70-year-old Louisiana gentleman who says he's "a cardiac just seeing about my investments" writes: "My wife traded a 1968 Coupe de Ville. She wanted a four-door. I'd say the Seville is good, but not as good as my 1970 Eldorado. For one thing, the **fuel injection isn't operating correctly.** It consumes too much gasoline and it's hard to start up hot. The only thing I'd like changed is the Space-Saver spare tire—I'd be afraid I'd ruin it if I had a flat on a Sunday, because you're supposed to run it only 20 miles."

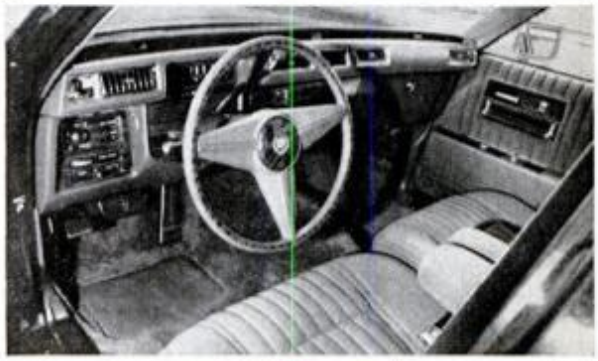
Early Sevilles apparently had computer and sensor problems. Many owners report replacements. Factory says that running changes eliminate failure now.

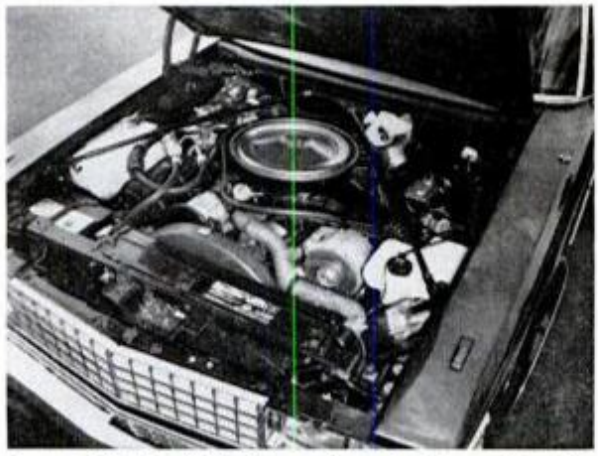
A Wisconsin boat-line president, 54, told

(Please turn to page 127)









Owners find Seville's size and angular lines attractive but consider handling the outstanding attribute. Seats slope downward at front, some complained. Fuel injection computer failures in early models were responsible for hard starting and poor mileage. Cadillac says such problems have been corrected.

Summary of 1976 Cadillac Seville Owners Reports*

Total miles driven 354,214

Average miles per gallon
- Local driving 12.8
- Long trips 16.7

Why did you choose the Seville?
- Size 64.8%
- Styling 29.5
- Economy 19.3
- Quality 8.0

Specific likes:
- Handling 51.1%
- Styling 48.9
- Comfort 28.4
- Economy 25.0
- Size 21.6

Specific dislikes:
- Mpg lower than expected 16.7%
- Workmanship 14.1
- Too little trunk room 9.0
- Price too high 9.0

What changes would you like?
- Seat shape 13.3%
- More trunk space 9.6
- Better interior design 7.2
- Better workmanship 7.2

Dealer service opinion:
- Good to excellent 75.0%
- Average to poor 25.0

Workmanship opinion:
- Good to excellent 74.4%
- Average to poor 25.6

Comfort opinion (front seats):
- Good to excellent 94.5%
- Fair to poor 5.5

Comfort opinion (rear seat):
- Good to excellent 81.4%
- Fair to poor 18.6

Number of vehicles owned:
- Seville only 21.1%
- Two cars 50.0
- Three cars 18.9
- Four cars 7.8
- Five or more cars 2.2

Makes of other cars owned:
- Cadillac 35.2%
- Chevrolet 23.9
- Mercedes 9.9
- Pontiac 9.9
- Oldsmobile 9.9

Had any mechanical trouble?
- Yes 64.8%
- No 35.2

What type of trouble?
- Fuel injection 35.1%
- Electrical system 12.3
- Fumes and gas leaks 12.3
- Airconditioner 8.8

Did you repair it yourself?
- No 98.2%
- Yes 1.8

Dealer repairs satisfactory?
- Yes 71.7%
- No 28.3

Age distribution of owners:
- 15-29 years 1.2%
- 30-49 years 36.0
- 50-plus 62.8

Would you buy another Seville?
- Yes 85.5%
- No 14.5

*Percentages might not equal 100% due to rounding or insufficient data.

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How to fix a vacuum cleaner

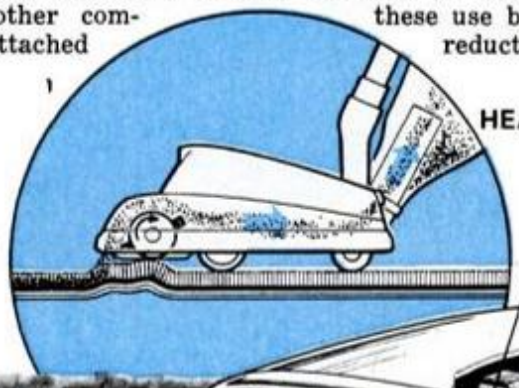
by Ed Franzese

A vacuum cleaner is a simple appliance; with the aid of trouble-shooting charts on the following pages, you should be able to deal with most of its common problems. The machine is basically a motor-driven fan with a nozzle attached, either directly or with a hose, to its low-pressure end. Atmospheric pressure forces air into the nozzle and dirt is carried with it and on through into the bag.

There are two types: the upright and the tank or canister. The upright usually, and the tank sometimes, has a motor-driven brush to loosen embedded dirt.

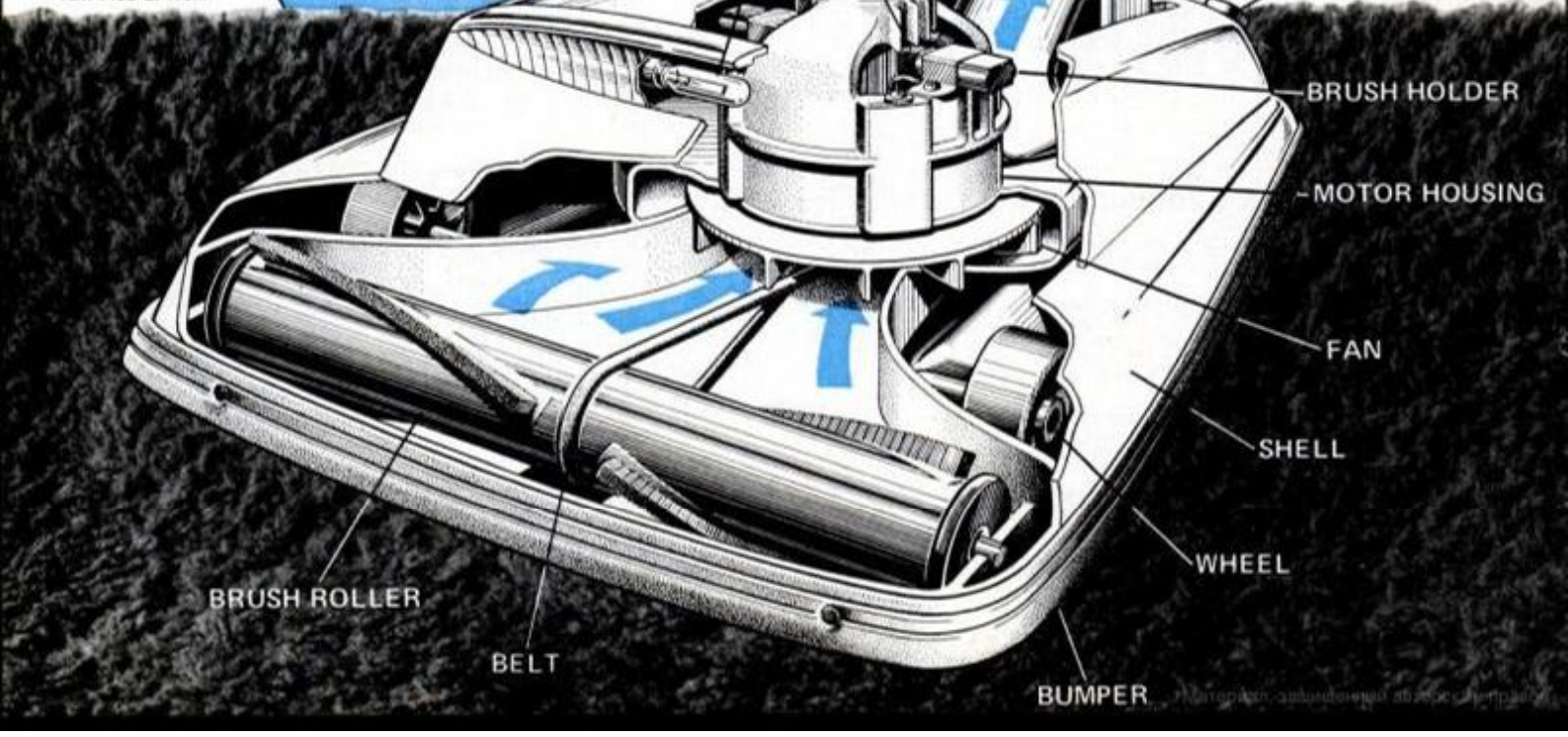
The upright cleaner's motor drives a centrifugal suction fan. Construction differs with motor position. In a straight-suction upright cleaner, as shown on the opposite page, the motor is mounted horizontally and air is discharged into the bag from an opening at the end of the fan; the motor housing is the frame of the cleaner and other components are attached to it. Air-friction losses in the straight-suction cleaner are low. A typical upright with a vertically mounted motor is shown below. In both types, a belt drives the brush roller. The pulley that drives the belt may be a grooved section of the motor shaft itself, part of the fan, or a separate piece held on the shaft by setscrews or a nut.

In a tank or canister cleaner, motor and fan are the only moving parts, and the dust bag is placed ahead of the fan. Fine dust particles may tend to go through the bag, so an additional filter is used between bag and motor. Most tank-type cleaners use two-stage fans. Their motors are necessarily more powerful than those in uprights and have rubber mounts to cut noise and vibration and provide a dustproof seal between motor and tank. The major difference in canister-type cleaners is that some of these use baffles or a reduction of air



Suction lifts rug, and beater action of brushes loosens embedded dirt, dust.

Art: Fred L. Wolff



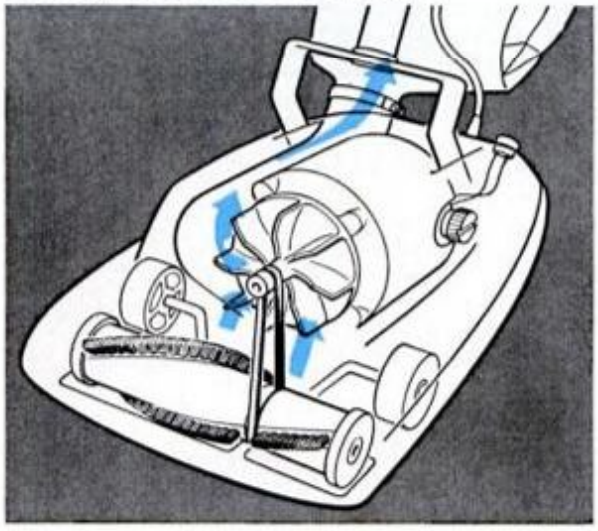
velocity to make dirt drop out of the airstream—one type bubbles the air through a water bath to remove dirt.

In uprights, the fan may be attached to the motor shaft by means of a setscrew, Woodruff key, nut or threaded hub on the fan itself—threaded to screw onto the shaft in the direction opposite to motor rotation. In tank and canister cleaners, the fan is usually attached with nuts threaded counter to motor direction.

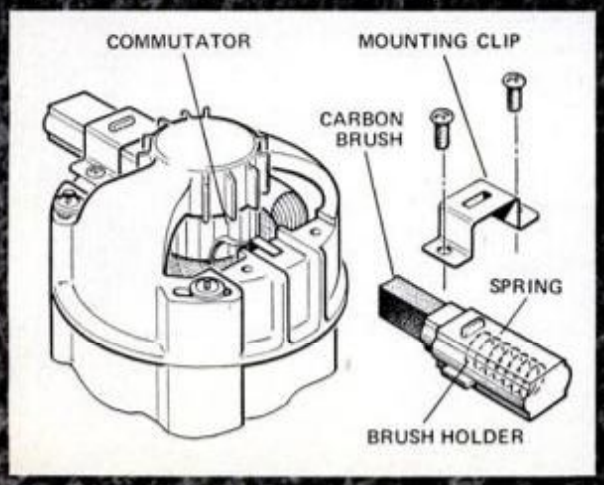
Nearly all vacuum cleaners use universal motors with replaceable carbon brushes. These bear under spring pressure on the commutator; they are eventually consumed and when worn, can cause problems. Many vacuum-cleaner designs offer direct access to brushes.

You can test the suction of a hose-equipped cleaner with a vacuum gauge, available through most heating and refrigeration-supply houses; it simply plugs into the hose. Vacuum

Straight-suction upright



Typical brush assembly



Motor will not run

POSSIBLE CAUSES	WHAT TO TRY
1. Fuse blown or circuit breaker tripped.	Replace fuse or reset circuit breaker. If blowing or tripping is repeated, disconnect power and check for shorts.
2. Line cord defective.	Inspect cord for breaks or fraying. Check for continuity by removing cord at terminals; placing one lead of tester on plug prong, other on corresponding terminal wire, flex cord. There should be an uninterrupted reading. Repeat for other prong, wire. Replace cord if there is no reading or flexing cord interrupts reading.
3. Switch defective	Place continuity-tester leads on switch terminals; turn switch on. There should be a reading. Turn switch off. There should be no reading. Replace switch if there is variation.
4. Connection loose at terminal block.	Check all terminal-block connections; tighten any found loose.
5. Motor brushes worn or sticking.	Check lengths of brushes. Replace them if ¼ in. or shorter. Check for free brush movement in holder. If tight, sand brushes just enough to make them slide easily.
6. Armature shorted or open.	Place ohmmeter test leads on brush holders, rotate armature manually. Resistance reading should remain fairly constant. Sharp decrease indicates short, infinite reading indicates open. Replace armature in either case; new motor may be required.
7. Fan jammed.	Check for obstructions, clear. Replace fan if bent or damaged.
8. Motor bearings frozen.	Disassemble motor, clean and lubricate bearings. Replace bearings if worn.
9. Motor defective.	Disconnect both motor leads; direct test with 110-v. jumpers. Replace motor if defective.

Motor stops and starts

POSSIBLE CAUSES	WHAT TO TRY
1. Intermittent break in line cord.	Shake cord while vacuum is running; inspect for wear. Test continuity as explained above.
2. Loose connection.	Check entire circuit; tighten all connections.
3. Switch defective.	Test switch as explained above.
4. Wiring shorted.	Locate short, repair, insulate with electrical tape.

Motor runs too slowly

POSSIBLE CAUSES	WHAT TO TRY
1. Bearings tight or misaligned.	Disassemble motor; check, realign and lubricate bearings. Replace bearings if worn.
2. Fan jammed.	See chart, "Motor will not run" (above).
3. Brush contact poor.	Check brush length as in chart, "Motor will not run." If length is okay, stretch brush springs slightly.

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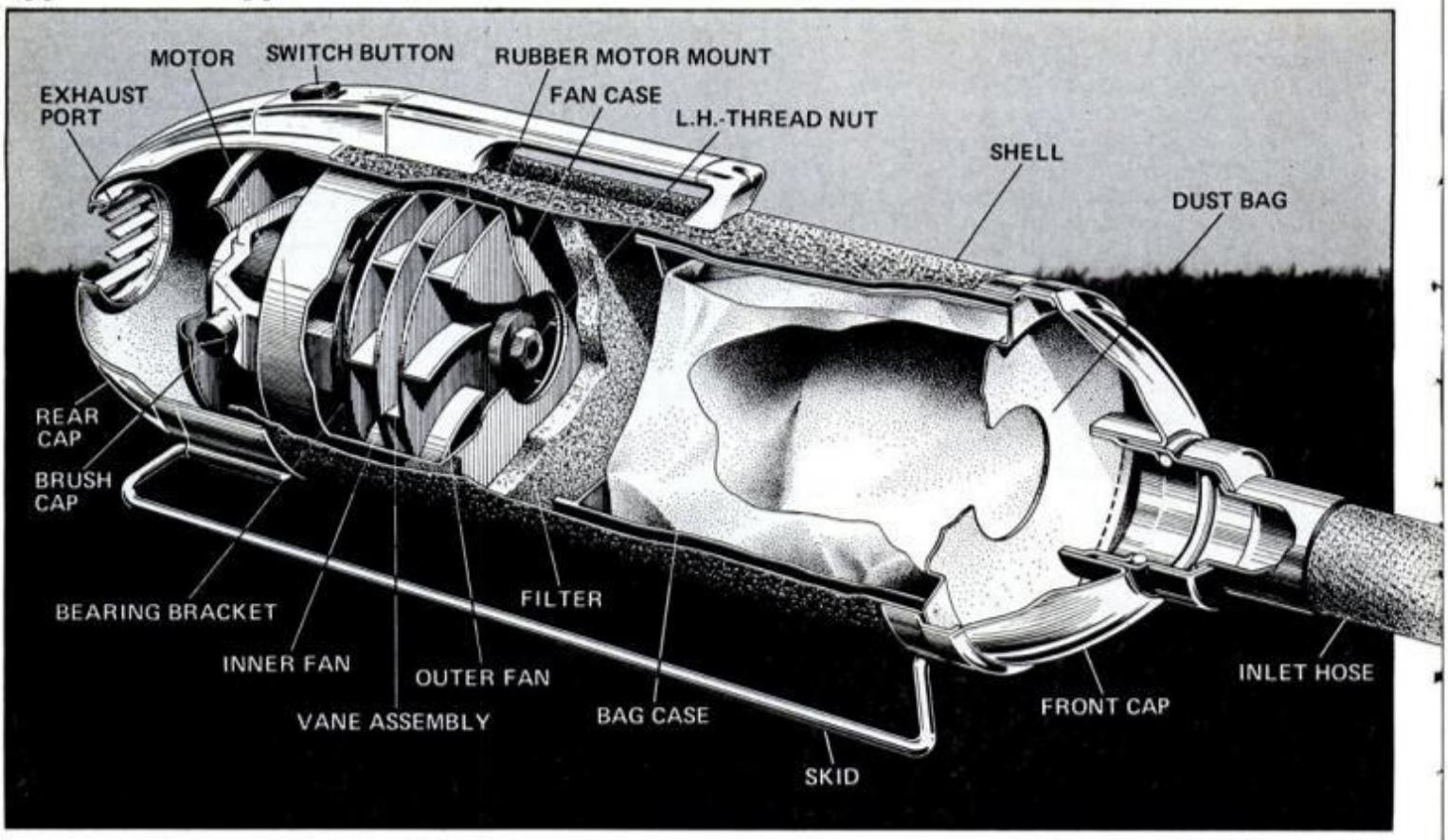
Typical tank-type cleaner



is expressed in terms of water lift —how many inches above its normal level a column of water is pulled— and between 50 and 70 in. is normal for most cleaners.

When motor armature and fan both turn freely, a malfunctioning vacuum cleaner's trouble is probably electrical. Tests are outlined on the next page. If the ohmmeter reading for the entire circuit is higher than 2-4 ohms, it may indicate poor connections; no reading (infinite resistance) may indicate an open or shorted circuit. You can also check the circuit for grounds by placing one lead of the ohmmeter or continuity tester on one plug prong and the other on any *metal* part of the cleaner, then doing the same with the other prong. There should be no readings. Most cleaners have one or more capacitors across the circuit to eliminate radio interference; if a short or ground is indicated, remove the capacitor and retest. If the short or ground disappears, replace the capacitor with one of exactly the same value. ★★★

Caution: Be sure unit is disconnected before you handle components or make continuity or resistance tests. Refer to maker's operating instructions and wiring diagram, and use only replacement parts that meet specifications.

Motor runs too fast

POSSIBLE CAUSES	WHAT TO TRY
1. Fan loose.	Check and tighten fan.
2. Armature shorted.	See chart, "Motor will not run" (page 89).
3. Dust bag overloaded.	Replace or clean bag.

Motor sparks

POSSIBLE CAUSES	WHAT TO TRY
1. Commutator dirty.	Clean thoroughly with trichlorethylene, sand with 2/0 or finer sandcloth.
2. Brushes worn.	See chart, "Motor will not run" (page 89).
3. Brushes new.	Normal. Sparking will diminish when new brushes wear to shape of armature.
4. Armature wire open.	See chart, "Motor will not run" (page 89).

Motor is noisy

POSSIBLE CAUSES	WHAT TO TRY
1. Foreign matter.	Clean out motor.
2. Brushes new.	Normal. Noise will diminish when new brushes wear.
3. Armature obstructed.	Check armature bearings for misalignment or wear; realign or replace.
4. Fan bent or loose.	Check fan, tighten on shaft. Replace fan if blades are bent.

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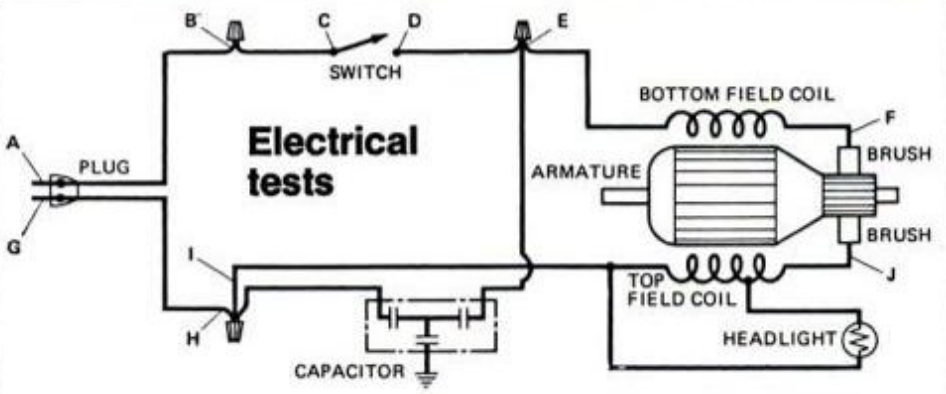
Suction is weak

POSSIBLE CAUSES	WHAT TO TRY
1. Attachment or hose connection loose.	Check hose, attachments to make sure connections are tight.
2. Obstruction in hose or attachment.	Check for large pieces of paper, pins, wads of lint, and clear.
3. Cover loose.	Check for correct insertion of bag. Adjust and reclose cover.
4. Bag overloaded.	Replace or clean bag.
5. Hose leaking.	Check entire length of hose for cracks, holes. Replace hose if any are found. Also check for tight connections between hose, tank and attachments.
6. Exhaust port clogged.	Clear exhaust port.
7. Belt broken.	(Upright models.) Replace belt.
8. Agitator brush jammed.	(Upright models.) Clear brush of all foreign matter—brush should turn freely.
9. Nozzle setting wrong.	Check nozzle setting according to manufacturer's instructions for type of cleaning being done.

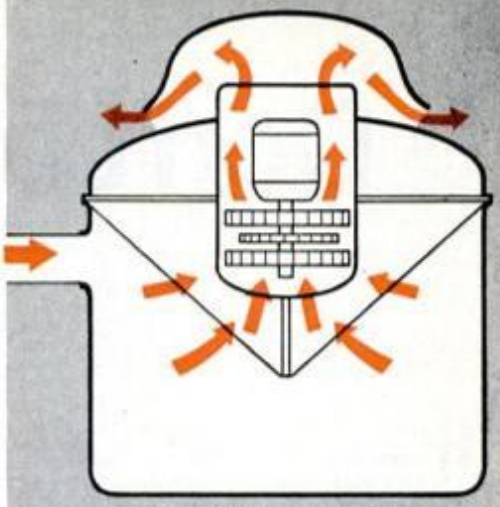
Dust leaks into room

POSSIBLE CAUSES	WHAT TO TRY
1. Holes in dust bag.	Replace bag.
2. Bag installed incorrectly.	Check manufacturer's instructions for correct installation of bag.
3. Sealing gasket defective or leaking.	Check gasket, replace if worn or broken. Also check gasket alignment where cleaner opens for insertion and removal of bag.
4. Bag overloaded.	Replace or clean bag.

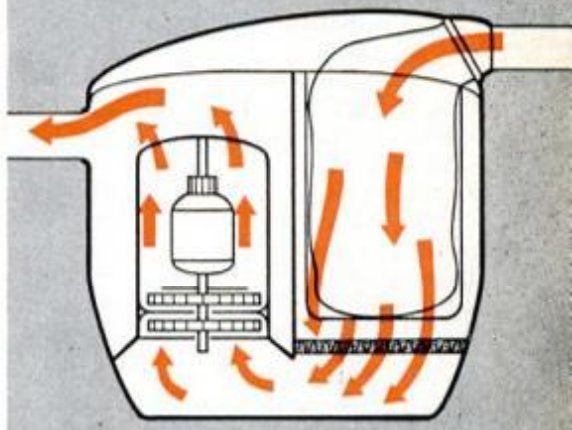


Place test leads across: 1. A and G to test entire circuit (should be 2-4 ohms); 2. A and B, G and H to test line cord (there should be continuity in each leg); 3. C and D to test switch; 4. E and F, I and J to test field coils (there should be continuity in each); 5. I or E and motor case to test for shorts (there should be no continuity); 6. F and J to test armature, turning it by hand (resistance reading should be constant). Tests 1 and 6 require ohmmeter; rest can be done with continuity tester. Power must be disconnected for *all* tests.

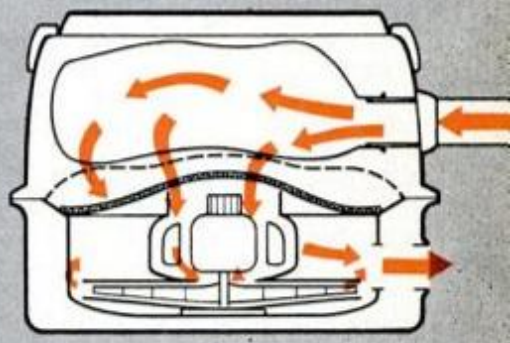
Canister variations



TOP-MOUNTED MOTOR (SHOP VACUUMS)



SIDE-MOUNTED MOTOR



BOTTOM-MOUNTED MOTOR

AIR CUSHION

Don't blow your gasket!

Here are the inside tips for checking and replacing all of your car's gaskets.

by Paul Weissler

The typical gasket installation is seemingly a simple, straightforward nuts-and-bolts job. Just remove the cover, peel off the old gasket, perhaps spread some sealer, position the new gasket in place and bolt everything back together. But there's a little bit more to it than that.

Your car has many dozens of gaskets, but only about 20 fall into the commonly-replaced category, either because they fail or one of the parts they seal must be changed. Gaskets seal in oil, air, water, gasoline, exhaust gas or air-fuel mixture, and there is one gasket that does most of these simultaneously—the cylinder head gasket. Let's look at this one first.

Cylinder-head gasket

The head gasket is made of asbestos and metal, usually steel but possibly copper, and may have some synthetic rubber, too. Although the materials list is small, the number of designs is not, and each design has a best-use aspect. So when you buy, order accordingly. Here are the most common gaskets:

■ **Embossed sheet steel**—often used as original equipment, but once it fails, the cylinder head probably is warped, and this design is too thin to compensate for warpage. If, however, the head is so badly warped that it must be resurfaced at a shop, this gasket can be used (in addition to another design) as a shim to restore compression ratio to specifications.

■ **Metal sandwich with asbestos filter**—a good general-purpose head gasket. It compensates for normal warpage (.001 inch up to .002 inch) and holds its seal for reasonably long periods without retightening bolts.

■ **Asbestos sandwich** with sheet metal layer in between—asbestos layers generally are thick to provide maximum sealing with warped surfaces (.002 inch up to .003 inch). If the cylinder head is machined to eliminate warpage, but the block is slightly warped, you can use this gasket in combination with an embossed sheet-steel design. Some asbestos sandwich gaskets have the sheet metal in between, plus a metal sheet over the asbestos on one side. This design is the equivalent.

■ **Permanent torque**—a head gasket that never needs bolt retightening. A common design is a metal sandwich with a thin asbestos filler, plus a second sheet of metal on one side. Its disadvantage is that it does not compensate for warpage as well as the other sandwich designs because of the thinness of the asbestos filler. There are other permanent torque designs which use a rubberized asbestos sandwich over a compressible steel core to improve sealing along a warped surface.

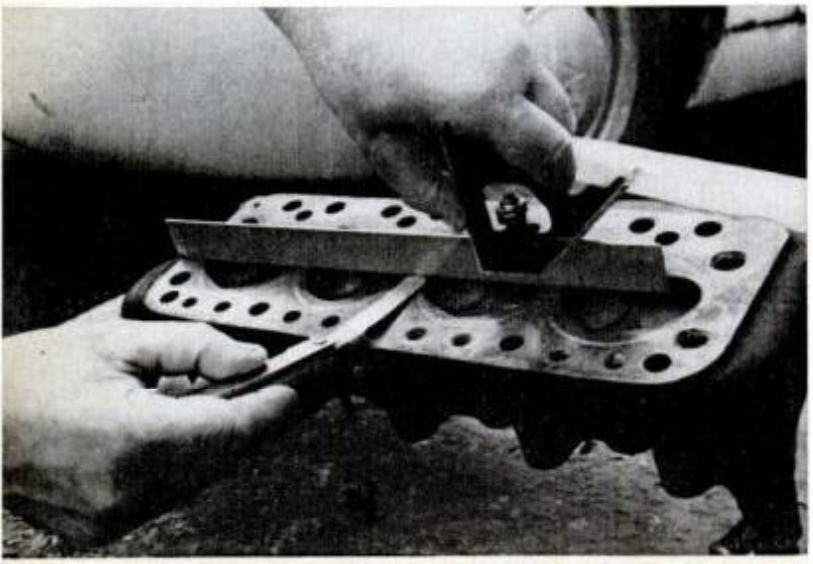
If you're going to install a head gasket, you should learn all the bolt-and-unbolt how-to for your car. A few ideas that can help you do a better job are:

■ **Check cylinder head and block warpage** with a feeler gauge and a machinist's straightedge. Lay the straightedge across the flat surface and try to slip a .003-inch feeler gauge underneath. If the gauge fits under at any point (move the straightedge all over the head and block flat surfaces), the warped surface should be planed in a machine shop. Fortunately the block warps very little, but the head often needs resurfacing—an $8 to $15 job at most machine shops.

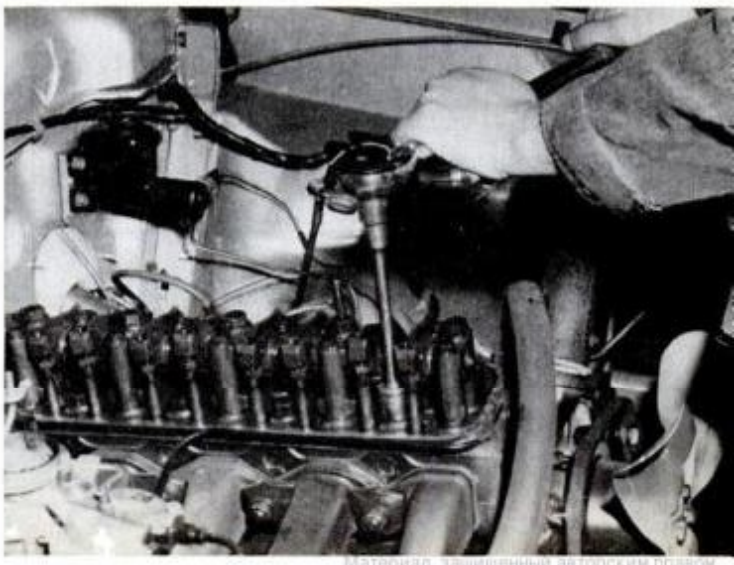
■ **Install the head gasket without a coating of sealer.** If it's difficult to keep the gasket in position, coat the head side with a non-hardening sealer (a spray type is the easiest to use). Never use gasket shellac or any hard-drying sealer. If you do, Murphy's Law says that the gasket will certainly fail again, sometime soon, and you'll go crazy trying to get it off.

■ **Tighten head bolts in stages.** Three equal stages are safe for the typical engine: If the specified torque is 95 ft.-lb., first tighten all bolts to 30, then 60 or 65, and finally to 95.

Engine cylinder head is checked for warpage with a straightedge and feeler gauge. Head can be resurfaced if necessary.



Cylinder-head bolts are tightened with a torque wrench. Make sure that tightening pattern is followed to seat gasket evenly.



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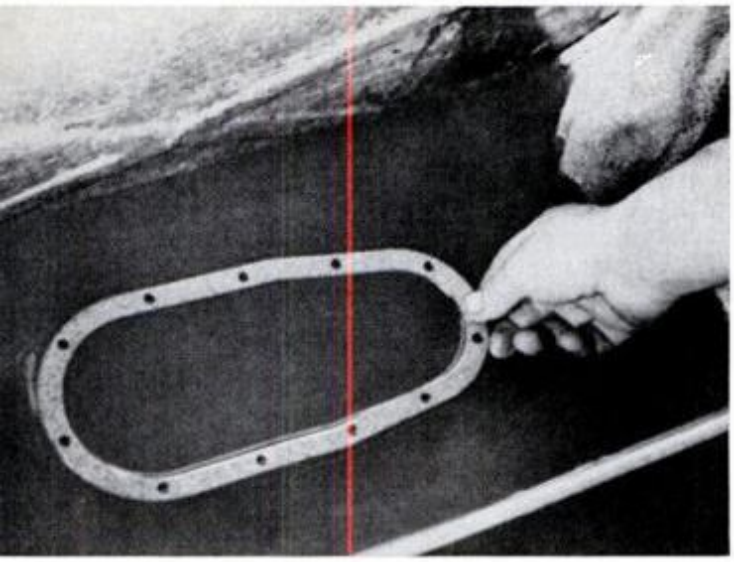
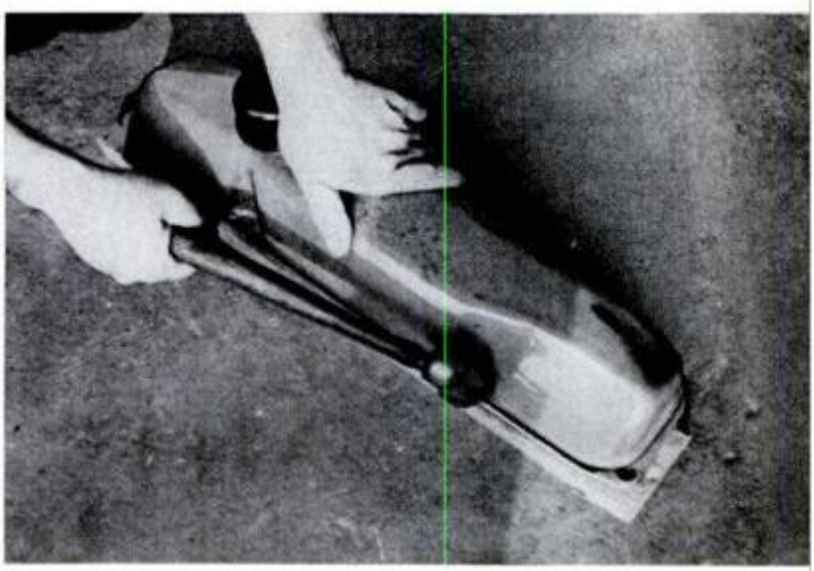


If cork-type gasket shrinks, you can soak it in water for about an hour to expand it so that it will fit.



Valve cover that has warped can often be straightened by tapping the metal with a mallet or a hammer.

Oil-sealing gaskets

In a car, there are more oil-sealing gaskets than any other type. Those you'll have to service most frequently are around the valve cover, oil filter, engine oil pan, fuel pump, timing chain cover, transmission oil pan and, on some cars, rear-axle cover.

These gaskets may be made of cork, vegetable fiber, a combination of cork and fiber, synthetic rubber (usually neoprene or silicone), and neoprene-cork and neoprene-fiber. You could flip a coin, but if you want to make an intelligent decision, consider these facts.

■ **Cork**—highly compressible, so you can really snug it down. It will do a good job of sealing—for a while anyway. If you ever have to take it off, it probably won't spring back, so a replacement will be necessary. It shrinks in dry storage and it breaks easily. However, it is the cheapest and if the gasket is left undisturbed for a long time, you can save money with cork.

■ **Fiber**—more flexible than cork, doesn't shrink or break as easily, but has less compressibility. Cost is pennies more than cork. If there's a chance of breakage during installation, and you still don't want to spend a lot, fiber is a good compromise choice.

■ **Neoprene**—unbreakable and won't shrink, but up to 50 percent more expensive than cork or fiber. Although it doesn't have the high compressibility of cork, it seals well, and normally can be reused. You'll never break it during installation.

■ **Neoprene-cork or neoprene fiber**—virtually the same unbreakability and shrink resistance as solid neoprene, but somewhat better sealing for warped sheet-meal covers. Slightly more expensive than solid neoprene and generally regarded as the superpremiums of the gasket field.

■ **Silicone rubber**—this comes in a tube and is a make-your-own-gasket product. It seals well, has great resistance to heat, good compressibility and is cheap. However, it takes some technique to spread an even bead and may be difficult to apply in tight quarters. Silicone rubber is so highly regarded that Cadillac uses it as a valve cover gasket on the new Seville.

Service techniques

Clean off all traces of old gasket material, including that which collects in the gasket surface grooves, before installing a new gasket. Next, check the metal cover for warpage by placing it face down on a level surface with a flashlight turned on underneath. If you see the light, the cover needs straightening. Use a mallet or hammer and brace the cover edge on a piece of hardwood.

Putting a film of sealer paste on the gasket surface for the sheet-metal cover is standard operating procedure for many professional mechanics. But, unless the cover is cocked and requires some straightening, it really isn't absolutely necessary. It doesn't do any harm (provided you don't lay it on thick, which would permit it to be extruded out into the engine), and it does help to hold the gasket in place. Just be sure to use a nonhardening sealer, so you don't run into headaches the next time the gasket must be replaced.

If you're using a cork gasket that seems to have shrunk slightly, soak it in water for an hour, then allow it to damp-dry before installing. Ditto for fiber. However, if a gasket with neoprene seems to have shrunk, you've got the wrong size.

Like cylinder-head bolts, oil-sealing cover bolts deserve respect. Don't lose the washers. They help distribute the sealing load, and in many cases are specially shaped to improve this characteristic. Tighten the bolts in criss-cross fashion and in stages, first finger-tight, next moderately tight, then finally tight. If there are many hold-down bolts, check a repair manual for a recommended tightening sequence.

Oil filter gasket

Your spin-on oil filter has a rubber gasket already attached. Don't ignore it. Apply a thin film of clean engine oil to the gasket before spinning the filter onto the engine.

Air-sealing gaskets

To operate, an engine needs lots of air which must be filtered to keep out abrasive dirt. Therefore, sealing gaskets are needed to keep out unfiltered air at the intake manifold-to-cylinder head joint, intake manifold-to-carburetor base, top of carb-to-air filter housing and filter housing cover. The filter element also must be sealed at top and bottom to prevent unfiltered air from leaking past. Usually the element has plastic seals to do this, but if it doesn't, rubber rings are built into the filter cover and housing.

There normally is little choice in air-sealing gasket materials, for the replacement parts usually duplicate original equipment.

The gaskets that can cause the most problems if they leak are at the intake manifold-to-cylinder head joint and carburetor base. They seal

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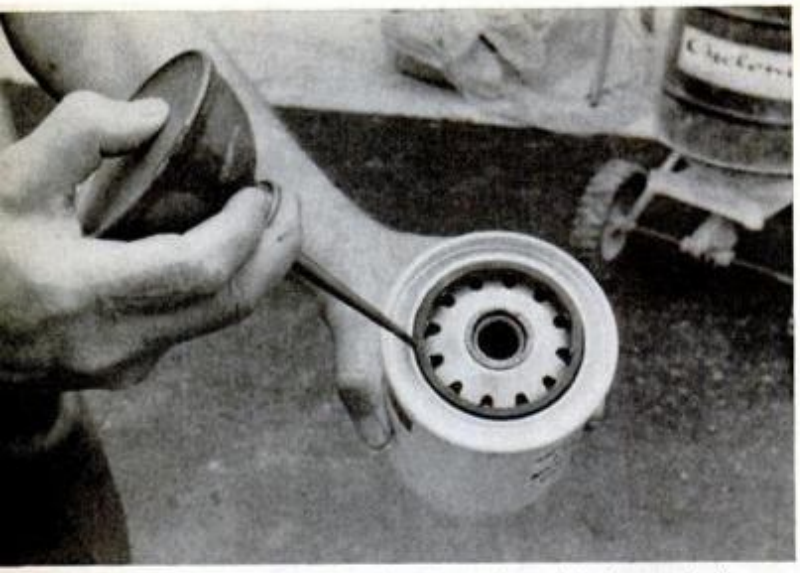
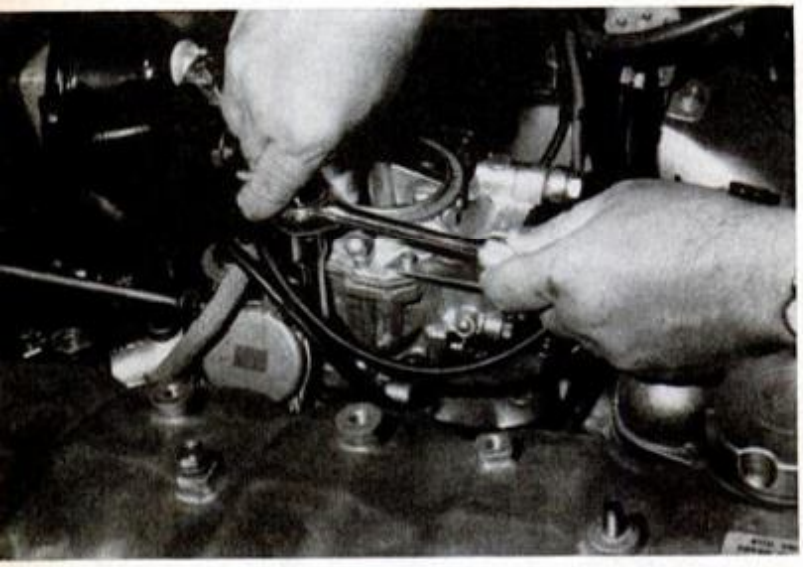
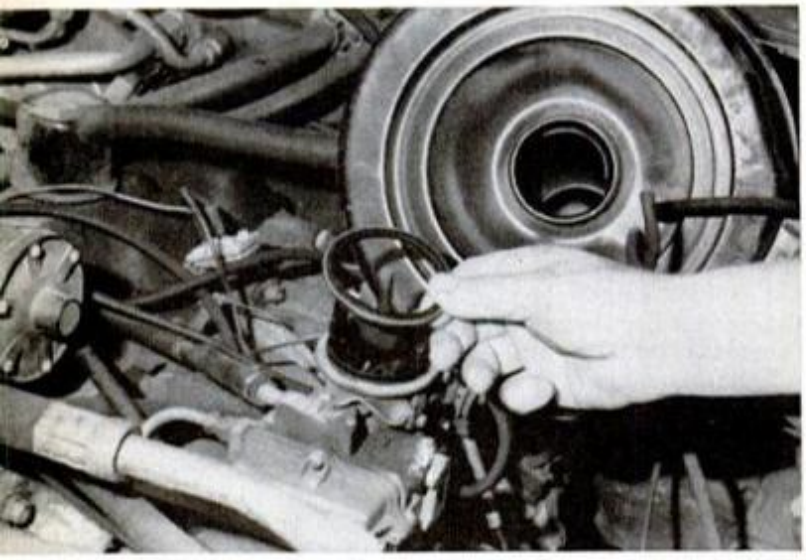


Oil-filter gasket should be lightly lubricated before spinning on. Spread oil around gasket with your finger.



Carburetor and intake-manifold nuts or bolts should be tightened periodically. Air leaks can lean out fuel mixture.



Gasket between top of carburetor air horn and bottom of air cleaner housing is easily missed. Make sure you check it.

after the air and fuel are mixed in the carburetor. If extra air leaks in, the fuel mixture is leaned out (too much air) and engine performance is reduced. Periodically retighten the nuts or bolts.

The gasket between the carburetor air horn and air filter housing is commonly neglected because most people don't even know it's there. It often sticks to the bottom of the housing and, unless you turn the housing over, you might never see that it's dried out, flattened or even torn, all of which let dirty air get into the carburetor and engine.

The gasket that seals the air-cleaner cover is noncritical, for so long as the filter element is sealed top and bottom, dirty air will not get through. Because virtually all replacement air-filter elements have top and bottom seals built in, you can also ignore the ones that may be built into the air-filter housing.

Fuel gaskets

The only fuel gaskets you'll normally encounter are those that seal the carburetor parts. They're usually a treated fiber, occasionally combined with synthetic rubber. If a leak develops, check the gasket surface of the part for warpage with a straightedge and a .002-inch feeler gauge. If warpage exceeds .002 inch, use two gaskets and a thin smear of nonhardening sealer on each surface and between the gaskets.

Cooling-system gaskets

Along with the multipurpose head gasket, the cooling system has gaskets at the thermostat housing, water pump and radiator cap.

The radiator cap on today's systems with the coolant-overflow reservoir has two gaskets: the conventional one on the end of the spring-loaded pressure valve and a second around the perimeter of the cap to keep air out of the system. Both gaskets are normally made of synthetic rubber and can be replaced only by changing the cap.

A gasket, usually made of treated fiber, is often supplied with a replacement water pump or thermostat, so obviously you're going to use what you get. If the gasket isn't supplied, or if you're trying to correct a coolant leak without replacing the part, you can make a gasket with silicone, and it will do a very nice job.

Exhaust system gaskets

Gaskets in the exhaust system rarely need replacement unless a part is removed, but you should snug down the nuts or bolts during a tune-up to keep the system tight. If you must install a new gasket, you'll find the following:

Manifold-to-cylinder head and exhaust crossover-to-exhaust pipe: Like the cylinder-head gasket, embossed steel, steel sandwich with asbestos filler and steel sheet with asbestos on one or both sides are the popular designs. The metal sandwich is the most burnout-resistant, but also the most expensive.

Manifold-to-exhaust-pipe: On some cars there is a sealing ring made of cast-iron, powdered metal or asbestos-compound packing. The latter two designs seal better than the iron ring.

Sparkplug gaskets

Although there is a trend to the tapered-seat sparkplug, which requires no gasket, most plugs still used have a soft metal gasket ring. It is threaded on the plug, so there's no buying decision to make. Just be sure the surface on the cylinder head is clean, and tighten the plug only as much as necessary to seat the gasket (about a half turn past finger-tight is plenty). This gasket seals in the air-fuel mixture, so treat it with respect. ★★★

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Exciting new hardware you'll see soon

When I entered McCormick Place, Chicago's huge exhibition hall, I didn't know I'd have to cover the area of some four football fields to see all products a record number of manufacturers displayed at the 1975 National Hardware Show. Here are some of the many new and exciting products that caught my eye; the others I plan to tell you about in future issues.—*Wayne C. Leckey, Home and Shop Editor*

Tom-Thumb-sized Moto-lathe (6 in. between centers with 1½-in. swing) will amaze you at what it can turn from wood, plastic and soft, nonferrous metals. Miniature 9-lb. lathe has 3450-rpm motor, is $39.95 ready to plug in. Optional accessory kit, $15.95, has four hardened-steel lathe chisels, 12 assorted 6-in. hardwood dowels, faceplate, wood-screw drive center, honing stone. Dremel Mfg. Co., 4915 21st St., Racine, Wis. 53406.

Stanley's one-piece molded miterbox is as simple for the homeowner to use as those used by professional carpenters on the job. It takes a backsaw or common crosscut panel saw in preset 45° and 90° cutting slots, handles up to 2x4 stock, hooks over table edge, can be fastened to bench and is used with ¼-in. cutting board in bottom. $2.99. Stanley Tool Works, New Britain, Conn. 06050.

A super garage and shop heater, Handy Master operates 9 hours on full tank of low-cost kerosene fuel, longer with optional thermostat. Starts when you plug it in 100-v. outlet, stops when unplugged. With high-capacity fan to move warm air and solid-state flame-out control, 28-lb. heater is 30 in. long, has 30,000 B.T.U./hr. output, is $99.95. Made by Koehring, Master Div., Dayton, Ohio 45401.

Antibreak-in unit called Stop-Alarm (left) gives piercing whistle to scare intruder trying to force door. Unit shuts off when pressure is relaxed, swings away when not used, $9.95. Sunbeam Appliance Service Co., 5600 West Roosevelt Rd., Chicago, Ill. 60650. **Shower-all**, in hand or on wall, will massage tired muscles, stimulate circulation, use less water than usual shower, $45.95. Jaclo Inc., 162 Carlton Ave., Brooklyn, N.Y. 11205.

Porto-tank, a lightweight 5-gal. tank compressor (left), gives constant air supply for spraying paint or insecticides; $149 as shown. W.R. Brown Corp., 2701 North Normandy Ave., Chicago, Ill. 60635. **Elmer's Carpenter's Wood Glue** grabs faster, sets quicker than his white glue, yet allows time to position work. Has extra strong bond, wipes up with water; regular sizes. Borden Chemical, 180 East Broad St., Columbus, Ohio 43215.

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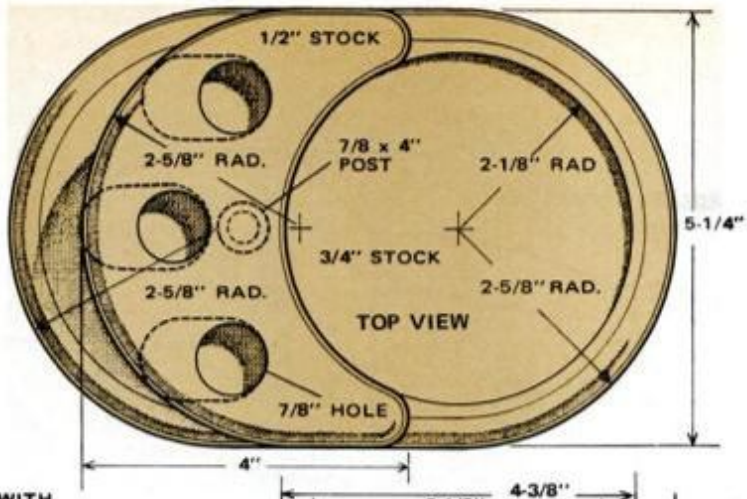
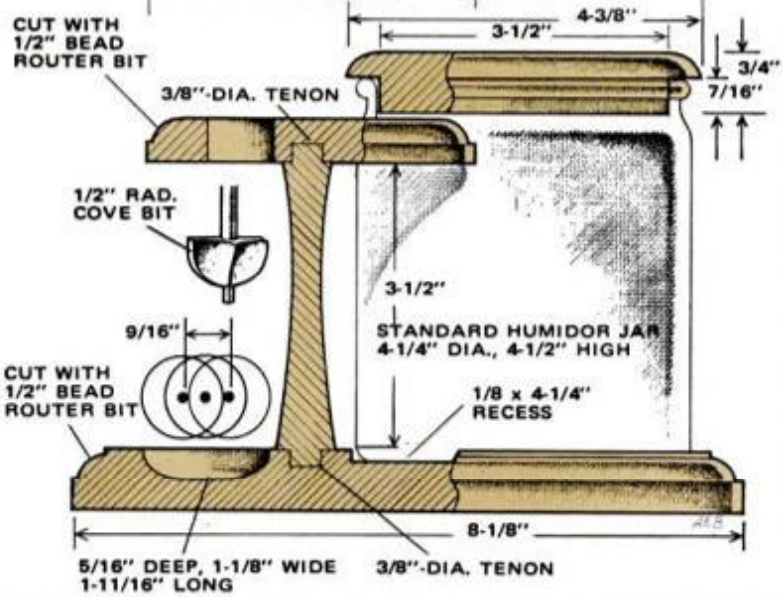
Seven last-minute gifts you can make for Christmas



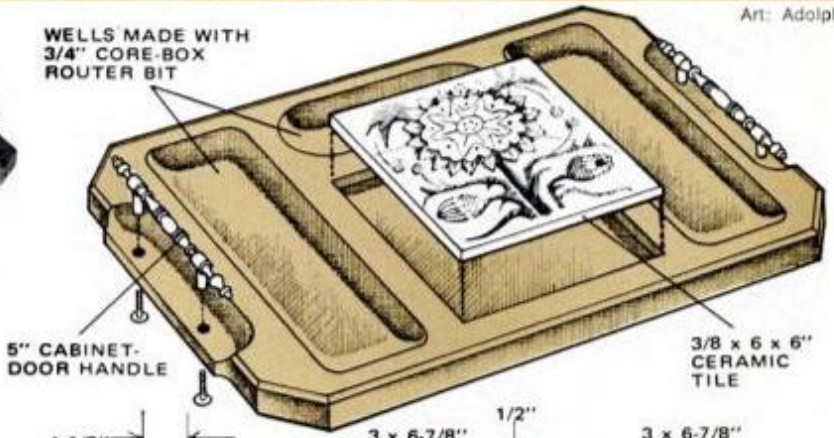
Pipe rack and humidor

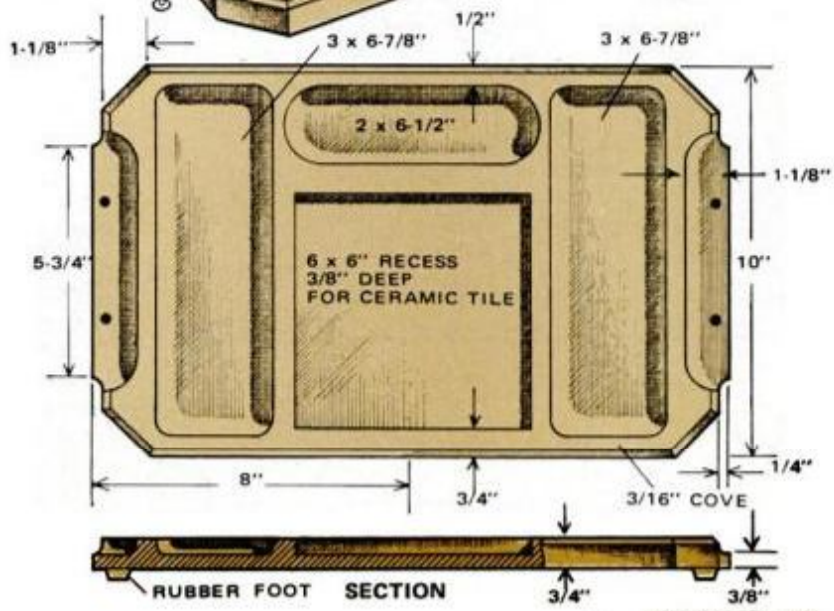


A pipe smoker's dream, this pipe rack and humidor set makes a great gift for a pipe lover. It's a lathe, router and drill-press project holding three pipes and a tobacco jar you can buy at any pipe shop. The jar rests in a ⅛-in.-deep recess you make with a circle cutter, then a router and a straight bit. The three oval wells for pipe bowls are made with a ½-in.-radius cove router bit chucked in the drill press. The bit is guided by three holes the same size as its pilot and lowered ⅜ in. into the work. Overlapping depressions are evened up with a wood chisel and holes filled with wood putty. If you wish, you can line wells with modelmaker's grass sprinkled in wet glue. The jar cover is faceplate-turned to fit, and a spindle made to support the rack 3½ in. above the pipe wells. Edges of rack and base are shaped with a ½-in.-bead bit. Green felt is glued to the bottom.

Art: Adolph Brotman

Cheese tray





A decorative 6x6-in. ceramic tile is used for the cutting surface of this handsome cheese tray. The four olive and cracker depressions, and the tile recess, are made with a router and a hardboard template that's used to guide the cutter. Openings in the template are made 3/16 in. less all around than overall sizes of the recesses to accommodate a shouldered guide ring that fits the base of the router. Short brads driven through ends of template hold it in place. A ¾-in.-dia. core-box cutter is used to scoop out the olive and cracker "trays" and a straight bit to cut the tile recess. Routed areas at h⁻ndle ends of the tray are made last with the core-box bit.

◄ Color photo: Cosimo

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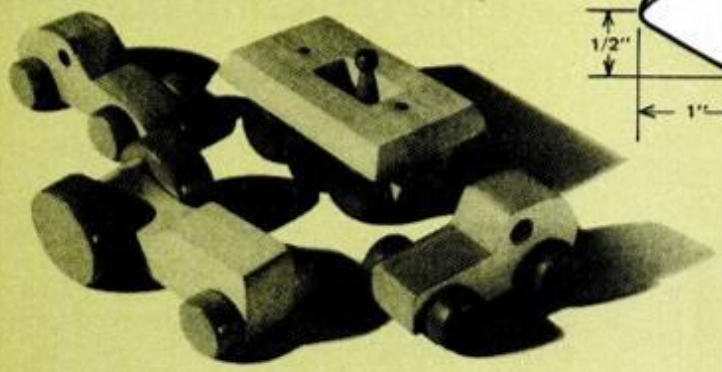
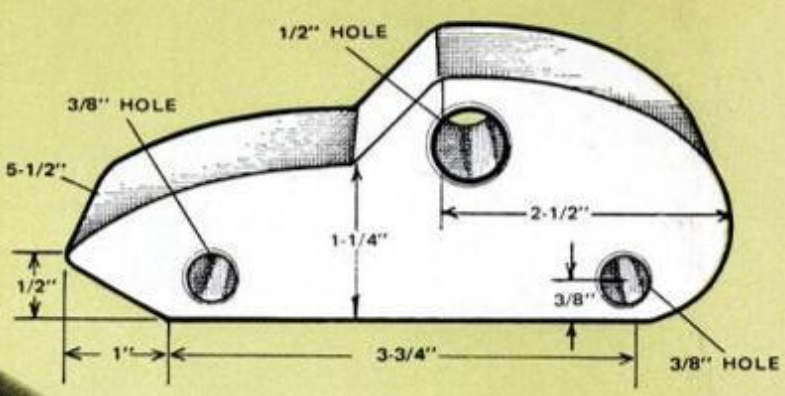
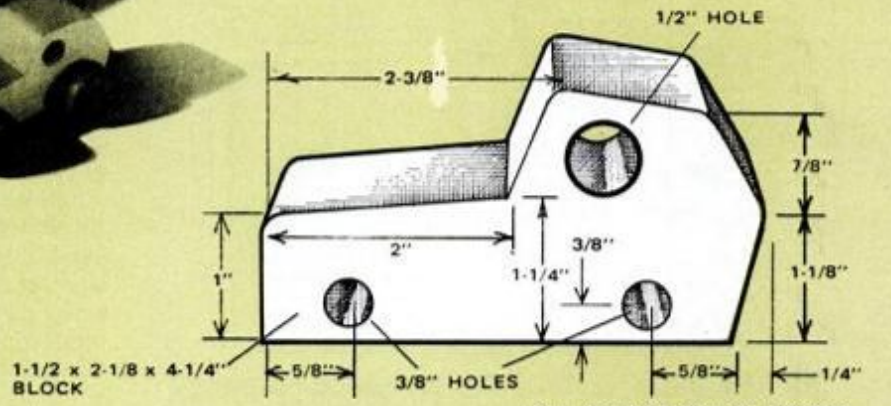
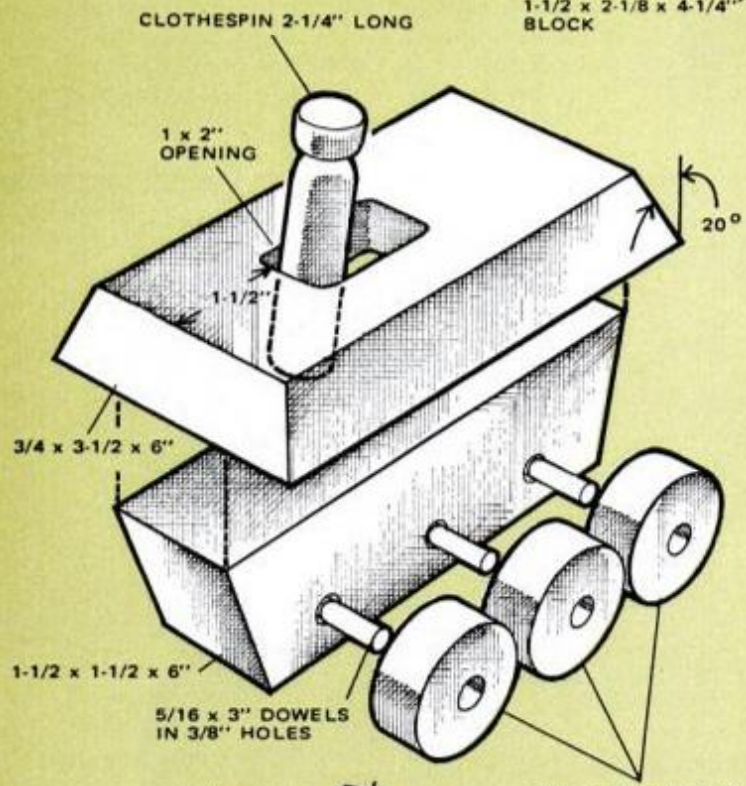
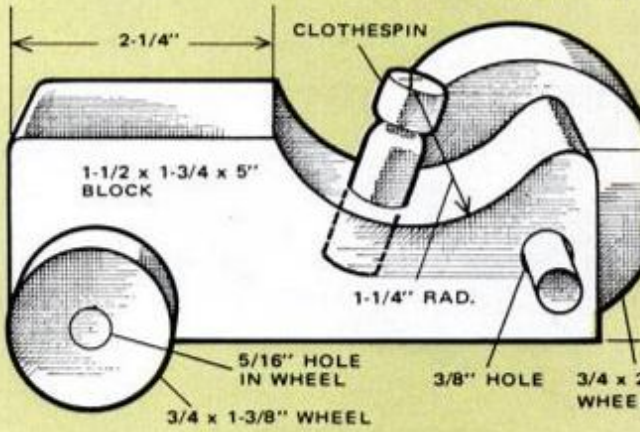


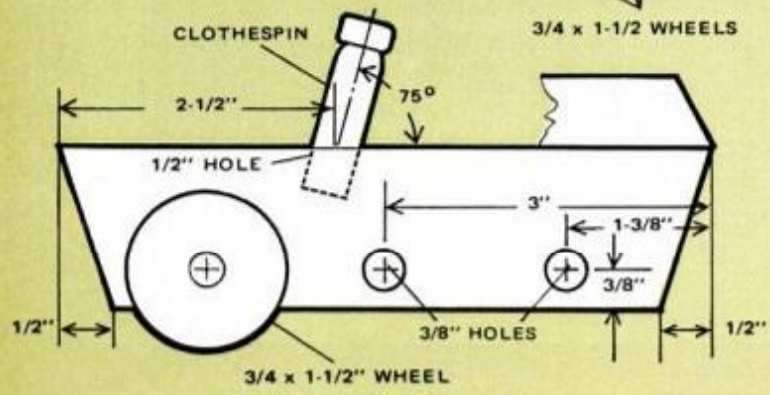
Block cars











Block toys are always favorites with little folks, and the four vehicles you see here can be turned out by the dozen from scrap wood for the most part. A quick way to mass-produce the wheels in quantity is to buy a a length of wooden closet pole, slice it up in a miterbox and drill holes in the centers. The wheels fit tightly on 5/16-in. dowel axles which turn freely in ⅜-in. holes. Wood clothespins are used for the drivers. All sharp edges including wheels should be rounded and surfaces sanded smoothly. Cars can be left unpainted; if you paint and varnish them, use nontoxic finishes.—*H.R. Haggerty*

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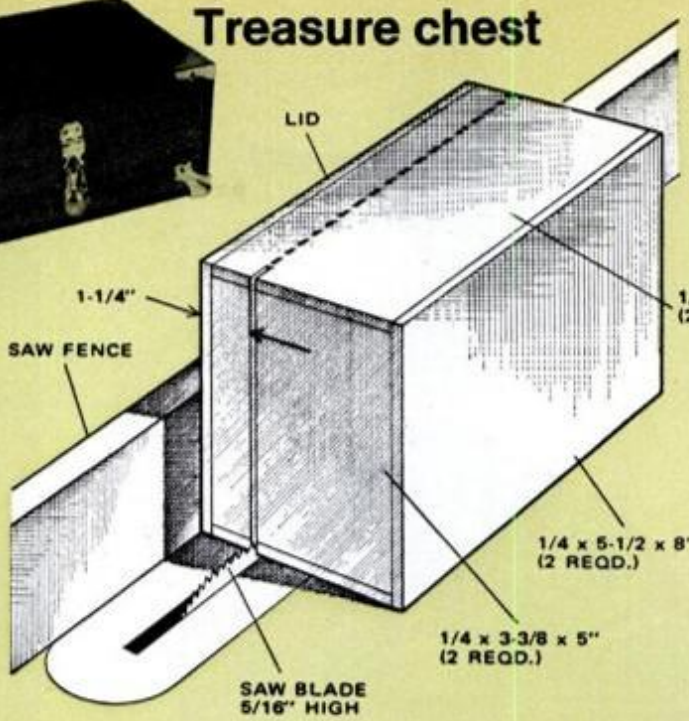
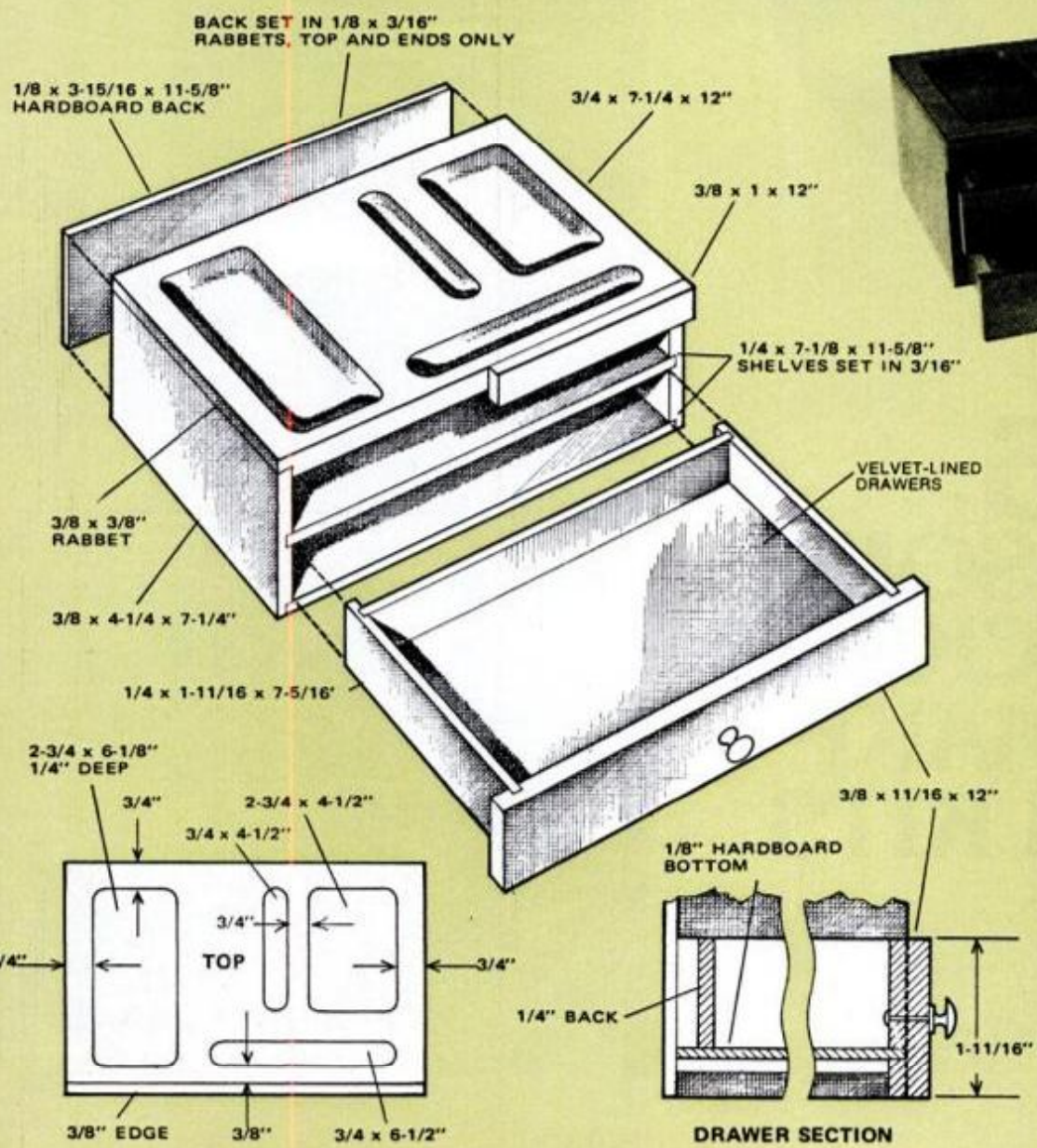
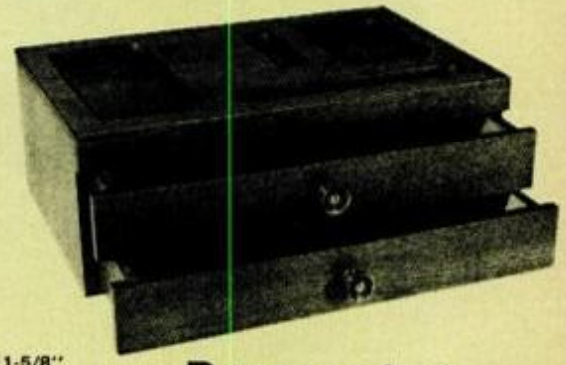
Treasure chest

It's little more than a plain wooden box, but add solid-brass hardware and a tiny padlock after giving it a hand-rubbed finish, and it takes on the look of a handsome miniature treasure chest. It's a gift most anyone can use to keep trinkets and other personal possessions under lock and key. Make it from pine or walnut, ¼ or ½ in. thick, and glue it together as a complete box. Sand it well and, with your table-saw blade projecting a bit more than the thickness of the wood, carefully saw around the four sides, as shown at the right, to form the lid. Some screws must be filed flush when the box is made of ¼-in. wood. Stanley sells the brass hardware—two hinges, four corners, four feet, a hasp, padlock—for $6.12. Red velvet lining adds the finishing touch.







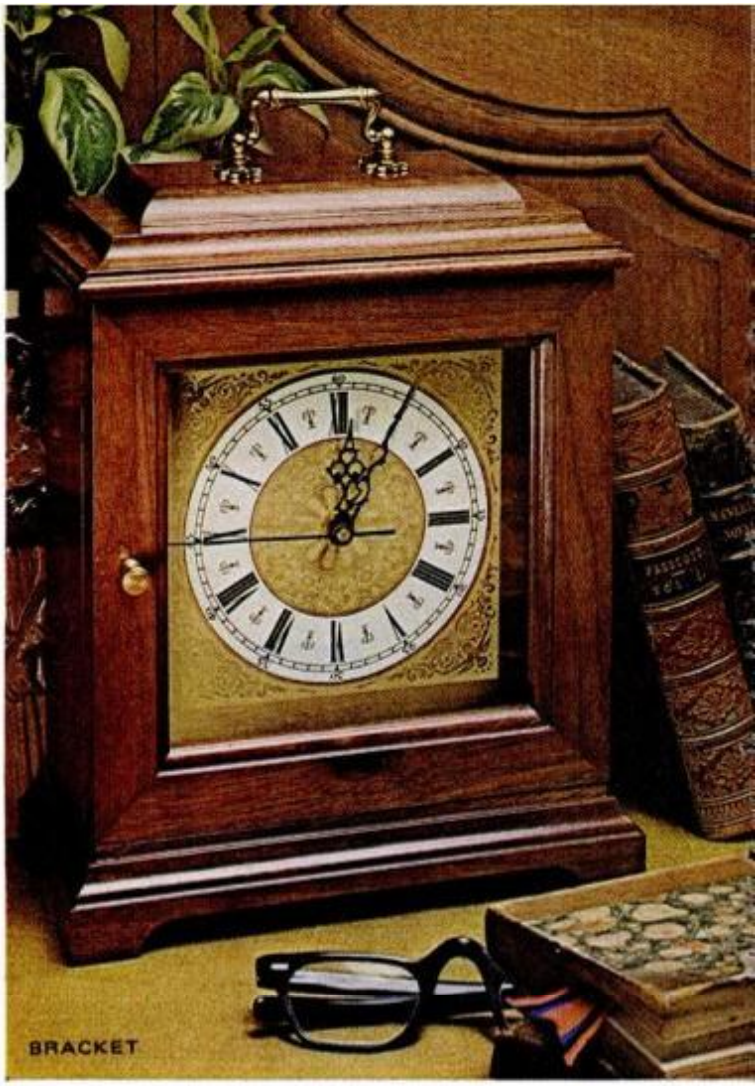
Dresser-top valet

Handy for overnight parking of wallet, watch, lighter and loose change, here's a gift a dad or son will appreciate. Its two velvet-lined drawers will keep tie clips, rings and cuff links in one handy place.

The recessed top is dished out in the same way as that of the cheese tray—with router, template and a shouldered guide. You start with a longer board than needed, and cut it to length when recessed. The two shallow drawers lap the openings on three sides, (bottom and ends). Use walnut or other fine cabinet wood and finish it with two coats of a self-rubbing polyurethane.

FLYING PENDULUM

6 HANDSOME CLOCKS YOU MAKE FROM KITS



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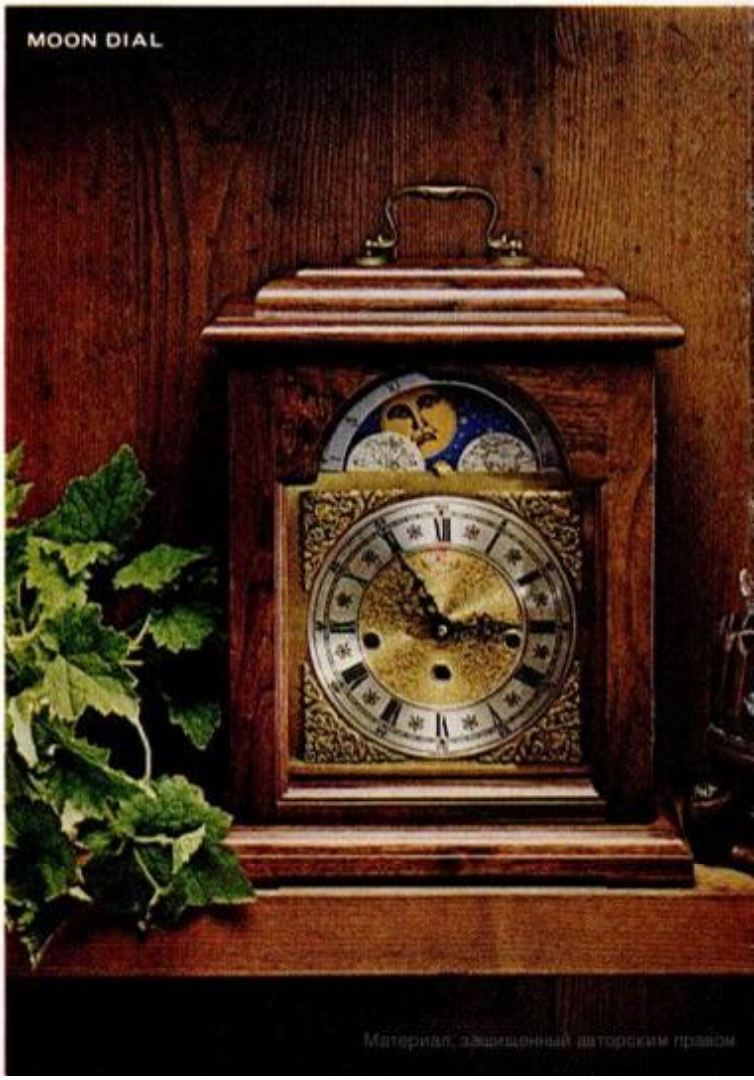

MOON DIAL

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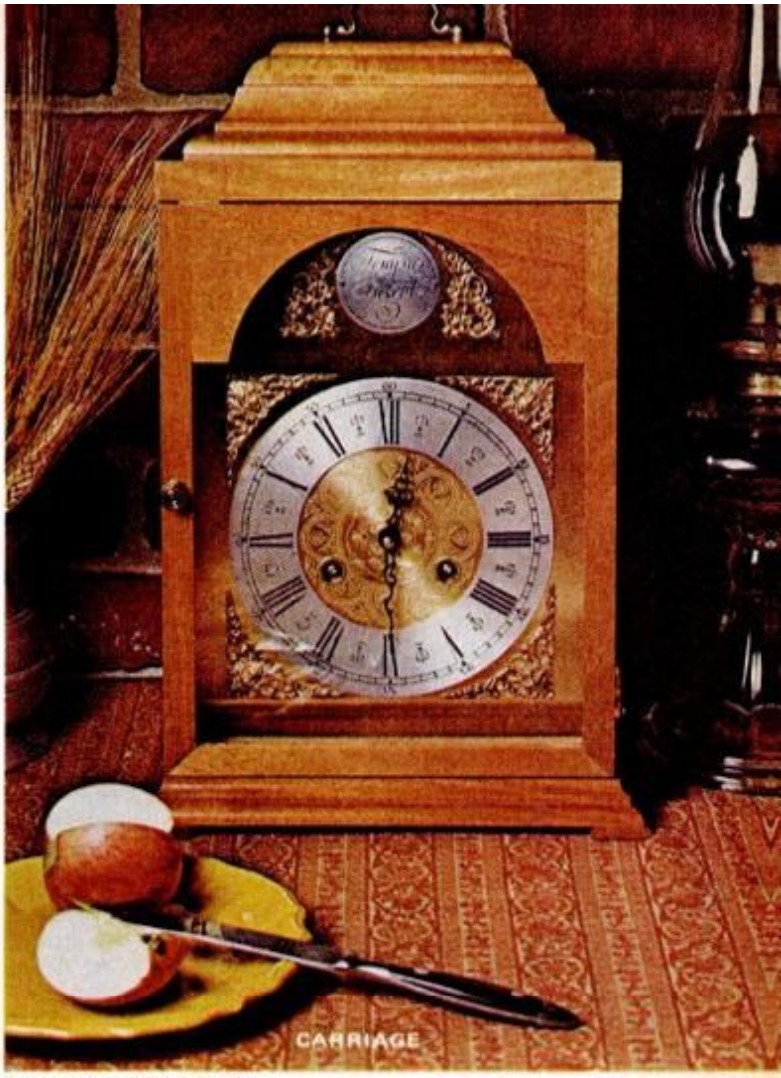
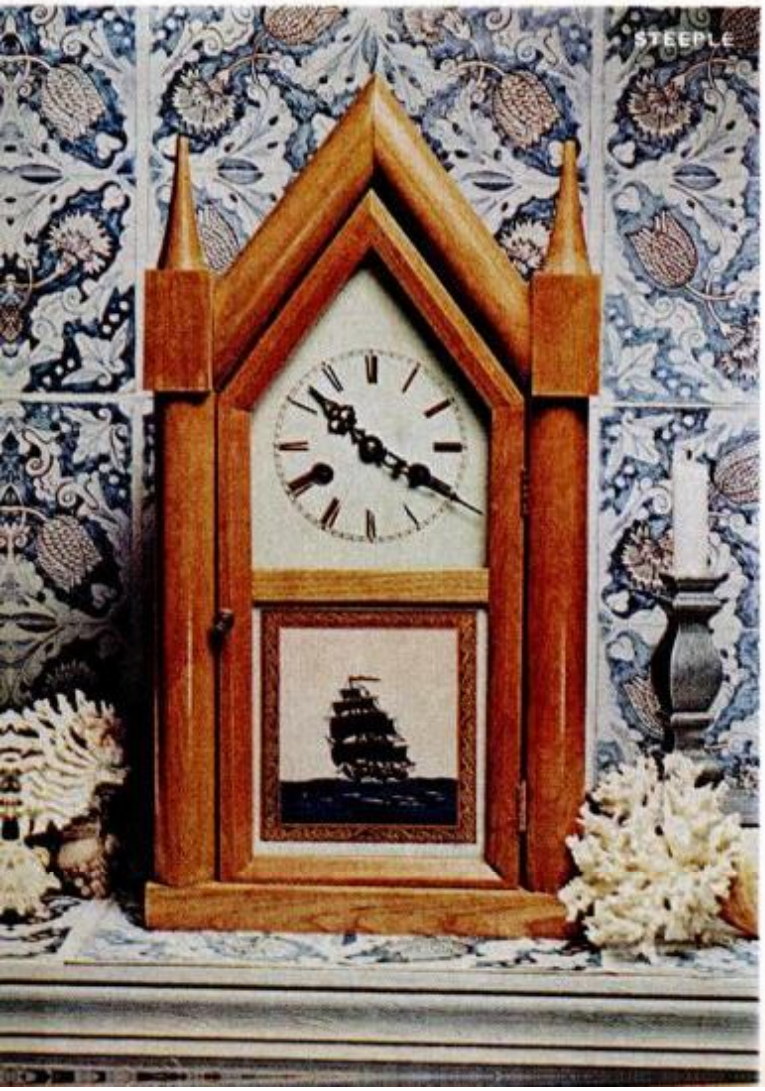


Color photos: George Ratkai



Building a clock is a fascinating experience, and few projects have been more popular with PM readers. As you watch the case take shape, hinge the glass front, apply a beautiful hand-rubbed finish and finally install the movement and dial, you feel you have created a masterpiece that your family will treasure for years.

The growing sale of precut clock kits is evidence of the popularity of clockmaking. To find out just what it's like to put a precut kit together, the editors of Popular Mechanics decided to see for themselves. Six kits picked at random from the catalogs of four clockmakers were assembled by five editors. Their comments and experiences, some good and some bad, in putting their respective clocks together are given on the following page. For the most part, they found assembling a kit an enjoyable experience and urge those who have yet to make a clock from a kit to do so—it's easy and fun.

Precut kits are offered by many clockmakers, complete with dial and movement and with either spring-wound or electric works. You have a choice of traditional, period and contemporary cases from stately floor models to graceful wall and charming shelf beauties in a range of prices to suit your pocketbook.

A typical clock kit is shown at the right—in this particular case, it's the moon dial model. As with most kits, you can't just stick the parts together and come out with an instant masterpiece—it isn't that simple. Kits vary in quality and complexity; some require more work than others. Trial-fit parts before assembly and avoid overgluing (a common tendency). Oozed-out excess glue spoils the finish. Movements come in several choices—wind-up, plug-in, battery, chime, gong. Pick one that suits your taste—some may find a striking clock annoying.

Flying pendulum

The kit came complete except for weights, and all the tools I needed were a vise, pliers, screwdriver and hammer. No gluing or nailing is necessary. I found directions clear with special attention given to critical steps. This American Buco clock (the original dates from 1880) is unique because all moving parts are visible, and both frame and works are mostly wood. Parts subject to wear, like gear teeth, are of hardened plastic which makes the clock run smoothly. I added a drop of light oil to the shafts for good measure. Price is $68 postpaid from Swiss Boutique, Dept. PM, 663 Fifth Ave., New York, N.Y. 10022.—*Mike McClintock, Associate Home and Shop Editor*

Carriage

Maybe the particular kit I chose happened to be a less-than-perfect one, but it took a lot of hand sanding to remove the many saw marks in the precut cherry pieces comprising the case. The splines for the corners of the glass door were too small to fit the saw kerfs perfectly. The instructions and plans left me wondering about the size of the chime bracket and where it should be mounted. However, the kit turned into a handsome reproduction of an ancient English carriage clock that strikes on the hour and the half hour. The complete kit (less glass) is $82.50 from Mason & Sullivan Co., Dept. PM, 39 Blossom Ave., Osterville, Mass. 02655. —*Wayne C. Leckey, Home and Shop Editor*

Bracket

Putting this kit together was fun from the beginning. The only unhappy thing about assembling this little beauty (it stands only 10½-in. tall) was a missing handle post from the bag of brass parts. Aside from this, I found the walnut parts nicely shaped and cut, requiring a minimum of sanding. To make things even easier, the mitered door came preassembled with glass. Fishing the (too-long) post screws through their counterbored holes was a bit frustrating at first, but a small magnetized screwdriver did the trick. Complete with battery movement and dial the kit is $34.95 from Craft Products, Dept. PM, Route 83 and North Ave., Elmhurst, Ill. 60126.—*Wayne C. Leckey, Home and Shop Editor*

Moon dial

Crown of Fairhope's moon-dial clock kit was almost too easy to put together. Precut parts fit precisely, and only fine finish sanding was required. Instructions were clear and complete. To finish the case, I used paste filler, stain on plywood panels only and two coats of low-gloss polyurethane varnish. The completed clock, more than 16 in. tall, looks rich and stately, keeps accurate time, chimes every quarter hour, strikes the hour and shows the moon phases on a beautiful moving dial. The complete kit (everything but glass) is $123.50 from Crown Clock Co., Dept. PM, Box Drawer G, Fairhope, Ala. 36532.—*Stephen Walton, Assistant Home and Shop Editor.*

School

In 14 hours I assembled this 32 by 16-in. pendulum clock. Because of a visible interior, I sanded, stained and waxed each piece (except gluing surfaces) before assembling. The instructions, I found, could be clearer on movement mounting. Before securing movement, use windup key to align dial paper, face-pan holes and windup shafts. No special tools or workshop are needed. Wood and glass pieces fit well. It ticks rather loudly, but it's a fine nonelectric, windup clock. The kit includes hardware, gong-striking Ansonia movement and arabic or roman numerals; it's $95 from Craft Products, Dept. PM, Route 83 and North Ave., Elmhurst, Ill. 60126.—*Dan Fales, Managing Editor.*

Steeple

It takes work to make anything beautiful—even if it comes in a kit. This handsome, authentic replica of an Early American steeple clock is no exception. It isn't a simple glue-together-and-you're-done job. I encountered a few bad fits, puzzled through vague instructions and wore out elbows hand-shaping and sanding. Assembly time—13 hours—was a bit more than anticipated. Still, the result is worth it—it looks like a masterpiece. The case stands 19¾ in. high, is $42.25 in cherry, $46 in walnut. Movements are separate, from $5.75 up to $31.50 for a fine hourly gong. Mason & Sullivan Co., Dept. PM, 39 Blossom Ave., Osterville, Mass. 02655.—*Sheldon Gallager, Executive Editor.*

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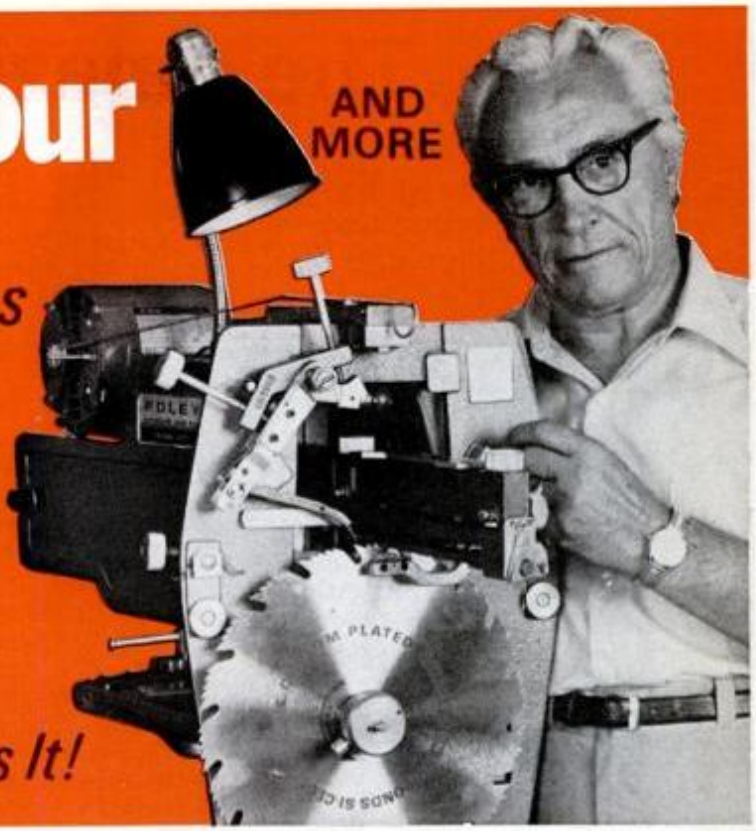

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The amazing ESP machine

This new electronic guessing game tests precognition, clairvoyance and telepathy—and is fun to play, too.

by Paul Wahl

Do you have ESP? Now you can check out your sixth sense—maybe even improve it through practice—with the ESP Test Machine recently developed by Edmund Scientific Co. in collaboration with Kreskin, the internationally known mentalist and authority on extrasensory perception. Although intended for a serious purpose, this new electronic gadget is easily the most fascinating scientific toy I've seen in a long time.

Like the card experiments traditionally used in ESP research, the Edmund device presents a guessing game—great fun for most people. Atop this mysterious little black box, are a control button and four symbols—triangle, arrow, dots and heart—each with its indicator lamp, a light-emitting diode (LED). For testing young subjects, an alternate series of color symbols is provided. You guess which symbol will be selected, the button is pressed and all four lights glow; when it is released a second later, all but one light will go out, telling whether or not you guessed correctly.

Kreskin's ESP Test Machine, which runs on four AA-size batteries, is a solid-state device with four integrated circuits. Two oscillators of different frequency—5 million and 20,000 cycles per second—randomly generate pulses. By means of a simple binary counter (stops at a number between 1 and 4) and a decoder, these pulses turn the indicator LEDs on and off millions of times per second while the control button is pressed. To the human eye, this appears as though all four lights are constantly on.

Memory can't beat machine

When the button is released, the decoder delivers the last random bit of information and only one LED remains lighted. Thus the ESP Machine is completely randomized so you can't beat it by memorizing a fixed selection pattern.

Repeating the test 100 times provides a statistically useful sample for rating a subject's ESP. With four equally probable target choices, the chance of a hit is 25 percent. In 100 trials, the chance score is thus 25. Thirty-four hits, at odds of 20 to 1, rate as "good," while 36 score "excellent" at 100 to 1. After much testing, I find that my own ESP averages just barely "good."

Parapsychologists, the scientists who study such phenomena, say everyone has extrasensory perception. We all have had experiences we dismissed as "coincidence," but were these simply matters of chance?

The dream that comes true, the guess that proves correct, the hunch that pays off are not uncommon—and have you ever answered the telephone to find the caller someone you had just been thinking of? These could be spontaneous ESP experiences. Research has established that those who frequently have such experiences do not necessarily score high in laboratory tests of ESP, and vice versa.

ESP is perception or communication without use of any of the five senses. It includes: *clairvoyance*, ESP of present events; *precognition*, knowledge of future events; *telepathy*, ESP of another person's thoughts or mental state. *GESP*—general extrasensory perception—can be either clairvoyance or telepathy or both.

A test of precognition, using the ESP Machine, already has been described. Testing for clairvoyance may be done solo, too, but a different procedure is followed. Without looking at the device, you press and release the control button, then record the symbol you feel was selected. Having done this, check the read out and note the actual symbol opposite your call on the test record sheet.

Since clairvoyance might be operative, a valid test for telepathy is virtually impossible. However, GESP, which may involve telepathy, can be tested with the machine. This experiment requires a sender and a receiver. The former controls the ESP Machine out of sight of the latter. Each time a target is selected, the sender enters that symbol on his record sheet, says "Ready," and concentrates on the target. The receiver makes his guess, enters it in the "call" column of his sheet, and says "Next," signaling the sender to repeat the procedure. After the desired run is completed, the sheets are compared and scored.

May improve your ESP

Recent laboratory research with somewhat similar ESP teaching machines suggests that practice with the Edmund ESP Machine could enhance extrasensory perception ability.

By now, some of you skeptics probably are asking "Doesn't the scientific establishment generally regard psychic research as humbug—not to be taken seriously?" A 1973 survey of its largely professional readership by the authoritative British journal, *New Scientist*, indicates to the contrary. Forty-two percent of respondents considered ESP a likely possibility, while 25 percent held it to be an established fact, and majority reported having had personal psychic experiences.

Kreskin's ESP Test Machine (catalog No. 72,090) may be ordered from Edmund Scientific Co., Barrington, N.J. 08007. Price (postpaid) is $29.95 (batteries not included). ★★★

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HENRY MORGAN SAYS:

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Did you know that there are over a billion appliances in use in the United States today? And three repairmen. At least that's the way it seems when one of mine goes on the blink. With more than two dozen electrical gadgets in my house going snap, crackle and pop, I finally got tired of trying to locate a guy with enough ambition to take my money and I decided to learn how to make the repairs myself.

When a well-aged comic like me decides to go back to school, you can bet the family jewels it won't be back at P.S. 93. I'm going to learn at home, or not at all. So I sent away for NRI's home study course in Appliance Repair . . . and I took the course.

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NRI's no fly-by-night outfit. They've been training men for more than sixty years . . . and they've had over a million students. It's the oldest and largest home study school in the field of electronics and electricity, so they know it better than anyone else around.

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With the tester and a few basic tools you probably have already, you're ready to service most electrical appliances. After a few months, you'll be fixing your own appliances like I do, or you can start earning spare time money fixing them for your friends and neighbors. Before you know it, you can have your own full-time business and be independent.

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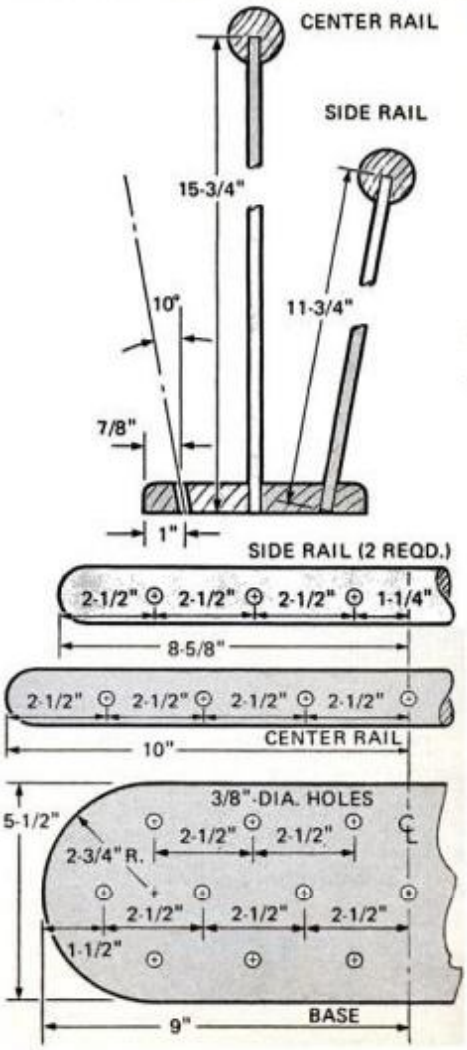

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"look for the stripes of quality"

was expended. Then I saw him—a Zero coming straight at me head-on. We each opened fire at about 400 yards. I could see the winking flashes from the muzzles of his guns. At our closing rate of about 600 mph, we only had a few seconds. I held my gunsight pipper directly on his prop hub and blasted away with all five guns, wishing the sixth hadn't been put out of use. He took no evasive action, and for a terrifying moment I thought we were sure to collide. Then miraculously he passed below me, our prop tips missing by bare inches. I immediately felt the turbulent wake of his prop wash and whipped into as tight a turn as I could without blacking out, certain he'd be on my tail. But I was lucky. Off in the distance, he was rolling lazily into a shallow dive, going down like a flaming Roman candle.

"By now the scattered enemy forces had turned tail and were limping back home to the east. A few of us continued to chase them far out into the Gulf of Martaban, but this was not a habit-forming practice as we were not equipped with survival gear for ditching at sea, and the gulf was notorious for the size and number of sharks it contained.

"Out of ammo, I now faced the prospect of getting back myself—not a happy one as home was still 50 or 60 miles away. My own plane had been hit many times, but in the heat of battle I hadn't been aware of it before. I was relieved to spot another P-40 headed my way. It was Bill Reed, wagging his wings and wanting to join up with me. What a welcome sight Bill was!

"We headed back to Mingaladon together and circled the field to see what shape it was in. The runway was pocked with bomb craters, especially along a third of its length at the upwind end, cutting short our landing distance. It would be close. A P-40 was upended in one crater—someone hadn't quite made it. We roared over the field low, did our victory rolls, then peeled off, got our gear down and managed to come in safely. Only then did I realize how really lucky I had been. One bullet had gone through a prop blade, fortunately in the thick part near the hub or it might have caused the prop to shatter. The resulting vibration would have ripped the engine from its mounts and possibly torn the entire plane to pieces."

Everyone was lucky that day. Of the 12 pilots sent up, all returned. Two—George McMillan and Ed Overend—were shot down, but succeeded in crash-landing without injury. Another, Parker Dupuoy, sheared off part of a wing in a mid-air collision with a Zero, yet skillfully managed to get his crippled P-40 down without mishap. Everyone in the group had scored at least one kill. Flight Leader Smith was one of several with three, which, together with two from the previous battle of the 23rd, made him one of the first AVG aces with five credited kills.

While the Tigers would fight on to other victories, none would equal the record achievement of that one Christmas Day—28 downed enemy aircraft without a single loss of life. The RAF, engaging another formation of 30 Sally bombers, added eight more kills to the tally, bringing the total to 36—approximately a third of the entire enemy force.

Downed 286 enemy planes

In all, over the short six-month period they were in action, the Tigers are officially credited with destroying 286 enemy planes and 1500 Japanese. Unofficially, the actual toll is believed closer to 600 planes. Against this, the AVG lost 13 men in combat. On July 5, 1942, the Tigers were officially disbanded to be replaced by the newly formed 23rd Fighter Group of the U.S. Army Air Corps.

Although early in the war, the Tigers' feat was to rank in importance with the later Battle of Britain and the naval air victories at Midway as a major turning point in the conflict. Much of the credit must go to the brilliant leadership of the group's commander, General Chennault. Inventive and unorthodox, he was a master at improvising methods of combating the superior Japanese. Recognizing that the heavy P-40s were outclassed by the lighter Japanese fighters, he developed special tactics for taking advantage of their greater weight and diving speed: Get above, dive, try to score a hit on the first pass, then continue diving and gain altitude again for another pass.

How Tigers got their name

Exactly how the Tigers got their name and shark-mouth decoration is still in some doubt. Most experts agree, however, that the shark mouth

(Please turn to page 117)

(Editor's note: Former Tiger Robert T. Smith, from whom much of the information for this article was obtained, is preparing a book, tentatively titled Tiger Tale, *to be published soon. It will be the first book about the Flying Tigers written by an actual member of the group.)*

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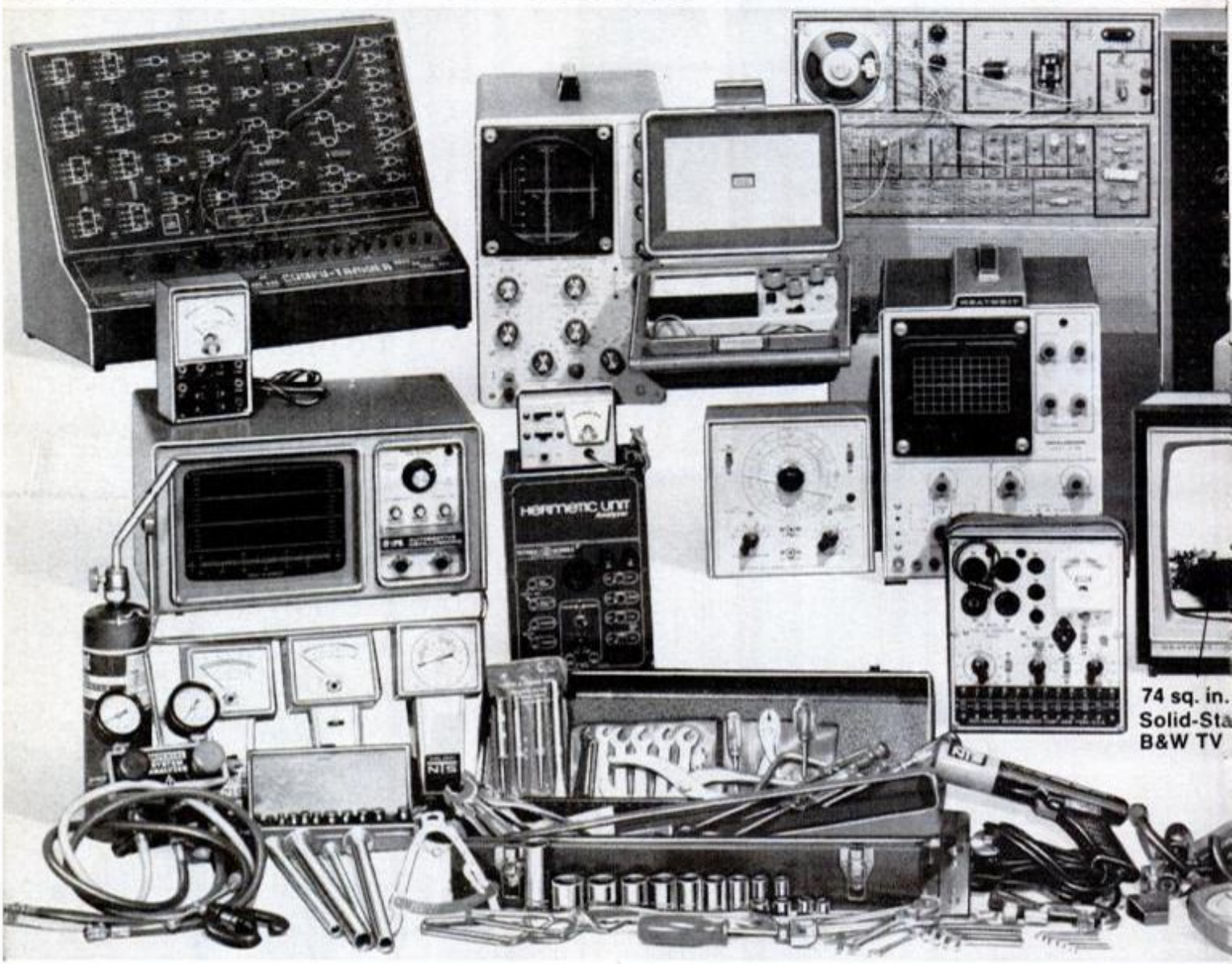

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BY BILL HARTFORD

IMPORTS AND MOTORSPORTS

More than skin deep

The 1976 Mercedes-Benz cars, including the 450SL and 450SLC, above, get some interesting changes this year, but almost all are under the skin. Only skin deep, however, are several new "safety" colors, formulated from Mercedes' visibility and perceptibility studies.

There will be a new model for '76, a 6.9-liter sedan, but we won't see it until spring. With a top speed of 140 mph, it will be the fastest *sedan* in the world.

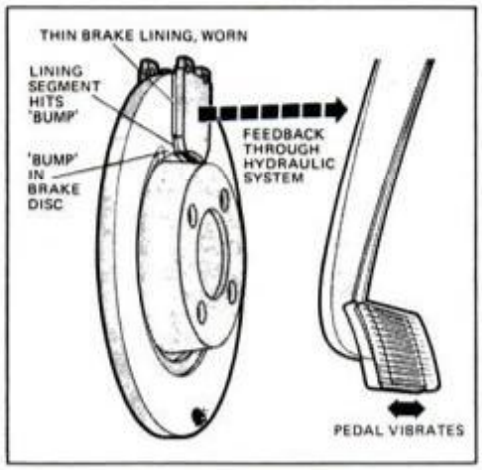
Model lineup continues with the 240D, 300D, 230, 280, 280S, 450SE/SEL and 450SL/SLC.

All V8s get an automatic valve-clearance compensation (a small hydraulic element in the adjuster stud of each rocker arm keeps valve lash at zero). They will also have the K-Jetronic continuous-injection system in place of electronic fuel injection; and an electronic ignition including a breakerless distributor.

New cruise control is on all M-B models except the 230 and 240D, and automatic climate control is new. The climate-control panel can be seen below in the console above the radio (450SE/SEL and 280S models).

'Talking' brakes

At a recent Society of Automotive Engineers (SAE) meeting, several new developments were announced by Volkswagen's Research and Development Div. Noteworthy because of its simplicity and ingenuity and because it'll save scoring discs is the disc-brake-pad wear indicator shown below. It's used on the front discs of Rabbits, Dashers and Sciroccos with automatic transmissions. The slightly modified disc and pad are all that's needed. When the pad wears down, pulses are felt as you apply brakes.



Artful dodge

Participation of Dodge in NASCAR Grand National stock-car racing is nothing new, but now a Dodge engine

is in an F5000 car. Its first appearance was in the '75 SCCA/USAC Formula 5000 series. The UOP Shadow DN-6 open-wheeler finished up the '75 season with the new 305-cu-in. V8 providing the power. The 305 is a derivative of the small block that's been used in drag racing and on the stock-car circuit, and, in an earlier version, in Trans-Am several years ago. The Shadow team has tricked up the engine somewhat, but it still uses many Chrysler high-performance parts. Jackie Oliver, '74 Can-Am champ, and Tom Pryce, from the UOP/Shadow Formula 1 team, did the driving.

I say! Most unusual

This six-wheeled Elf-Tyrrell is the first new idea in Formula 1 cars in some time. The front wheels are in tandem with the front axle linked to the second. The idea is to reduce the aerodynamic drag effects of larger front wheels by making them smaller. Then, to get more rubber on the road for cornering, a second set of wheels was added. The tires had to be made specially for the 10-inch wheels by Goodyear. The car is being tested now at the Silverstone track in England. If it works, you'll see the car on the Grand Prix circuit in '76.

Two up for Harley

The 250-cc Road Racing World Championship goes to Walter Villa (below) for the second consecutive year. He put the No. 1 plate on the Harley-Davidson RR-250 after the '74 season and he'll keep it again for the '76 season. Another Harley rider, Gary Scott, drops his No. 64 and mounts the prestigious No. 1 on his XR-750 as the American Motorcycle Assn. (AMA) champ for '75. ★★★

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BOATING AT THE END OF THE RAINBOW (Continued from page 69)

annoying as trying to find a proper anchorage late at night. The later you decide to put in for the day, the worse your chances are of getting a good boat berth. At most marinas the good, protected slips go first.

On another cruise, I arrived at a marina so late the only spot left was at the end of a long pier that kissed the edge of a deep-water channel. All night long, all kinds of wave-producing giants passed close by. Had I decided to stop running earlier I could have had a better slip and a better night's sleep. I suggest that you put in about 3:00 o'clock each afternoon. This gives you a chance to get fueled, secured, washed down, straightened up, supplied and ready to hoist the cocktail flag at the appointed hour.

The same is true when anchoring for the night. If you arrive late in the day, you are forced to take second-best anchorage. With this thought in mind we ended early our day's run up the protected waters of Laguna Madre. We decided to tie up for the night at one of many unoccupied fishing shacks along the ICW. We were about 40 miles north of Brownsville where the Arroyo Colorado meets Laguna Madre. The wind was blowing still, but the fishing promised to be good. We nosed toward the dock. A sharp warning from my stern lookout prompted utilization of the fourth trick.

Check tide when you anchor

I was in shallow water and suddenly the props were kicking up sand and mud. I backed off into the deep water of the channel. I rigged our Danforth anchor and lowered it in 10 feet of water. The boat drew 5½ feet. I slowly headed for the shack 100 feet away. After a quick burst of speed, I shut off the engines, raised the outdrive legs and eased in alongside the dock for the night. The anchor line streamed out from the stern, assuring a good retreat the next morning during low tide.

This throw-the-anchor-astern trick works wonders when you fear a falling tide will catch and hold you for six more hours.

It was over the next few days that we had a chance to really wring out this Glastron cruiser. Each day the wind climbed into the 30-knot range while the big red triangular flag announced small-craft warnings from the local Coast Guard station. But, in all, it was good boat-test weather.

This Glastron cruiser is a very dry boat. You can head into the waves at 2800 rpm and get little water on the bow and none on the flybridge. With the deep-V hull and a dead rise of 21° at the stern, the boat handles beautifully while on plane. She has all the advantages of a deep-V hull for both inshore and offshore running. She also has some disadvantages. She's 25 feet long and 8 feet wide. The 8 feet means the boat can be trailered, but it also means the boat is tender. If you are on the bridge during a tight turn, you feel that you can reach out and scoop up a handful of water.

The boat has trim tabs as standard equipment. These make all the difference in the world. With two people riding high on the flybridge, the boat's center of gravity shoots up, forcing a tippy ride at slow speed. However, high speed and trim tabs stabilize the boat on plane. Once set, the trim tabs make the boat ride bow down and level. Power steering is also standard.

When riding below, you get none of this tippy feeling. This boat without the flybridge in the hardtop and open cockpit model must ride like a dream.

Stove in a drawer

It's also below that you find one of the ingenious design features of this V-254. The cabin has seven-foot bunks, there are storage places galore and a well-designed sink. The stove-storage cabinet is a master stroke. The stove lives in a drawer. Though I hate alcohol boat stoves, I feel better about the position of this one. Should anything happen—spilled fuel, an out-of-control burn—you just yank the drawer free and jettison stove and drawer together. It's also nice to be able to move the stove dockside or down the beach for away-from-the-boat cooking. There's another nice feature: You can run both engines full out and the engine noise below won't ruin your eardrums. The boat runs quietly.

Another design aspect I liked was the fusing arrangement on the instrument panel. The fuses are right there in front of you—no searching for hidden casings down among a mass of multicolored wires. To check fuses, you just pull the plug and look. One other important feature is flotation. This is one of the few boats I know of that has positive flotation in a 25-foot cruiser. This boat will not sink from view should she ever be swamped. That's nice.

Bow design adds to cabin space

There was something else nice, too. With this boat you reap the re-

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wards of good overall design. Many people will praise the smooth, good-looking sweepback design of V hull and flybridge. They will also comment on the aircraft-carrier bow. You'll notice that the bow overhangs and seems squared off. This design feature permits a generous amount of cabin space below.

This Glastron V-254 is a boat that needs understanding. It is not a hot fishing boat that rivals the swift open-cockpit jobs or that runs with the huge offshore aluminum boats designed specifically for sport fishing. In some Texas waters where the shallows of Laguna Madre straightjacket a boat with five-foot draft to the dredged channels, this boat has limited use. For the hard-core sport fisherman, the V-254 offers more line-catching appendages than sunken wrecks.

Fine for weekend cruising

But for the cruising couple, the V-254 works. In deeper waters of the Great Lakes and East and West Coasts, the V-254 is well suited for the weekend and day cruising that's become so popular. With her trailering ability, you can move her from cruising water to cruising water.

She's a fun boat, and those who own one like her. And for about $14,300 with single engine and $17,400 with twins, that's some pot at the end of the rainbow. ★ ★ ★

NEW 4WDs FOR OFF-ROAD FUN

(Continued from page 50)

added seats behind the driver or four doors for the cab, load on a camper body in back (instead of those sand bags to give you adequate traction), consider accessories like a power take-off or front winch, or even a bolt-on snow plow and you have a year-round rig. There have been custom 4WD motorhomes in the past, and now Champion Home Builders in Elkhart, Ind., offers a 21-foot production Woodsman 4x4 sleeping five.

Go anywhere? During the more than 100,000 miles I put on my Jeep, I remember taking a drive along a hiker's trail up over the Alps and ending up by accident in a different country. It was hard to explain to angry customs guards at the highway border checkpoint just how versatile a four-wheel-drive can be. ★ ★ ★

CHRISTMAS DAY BATTLE

(Continued from page 108)

was adopted by the AVG partially for its psychological effect on the Japanese. The prewar, nonindustrialized Japanese were largely a nation of fishermen, and the fishermen dreaded sharks for the devastating damage they could do to their nets and catches. Thus the shark became a fearful symbol of evil to the Japanese.

The tiger, a national symbol of strength and vitality for the Republic of China, was reportedly used by Chinese newspapers in describing the heroic exploits of the AVG. They were hailed as the "Fei Weing"—Flying Tigers. Henry Porter, a Walt Disney artist, created the insignia—a winged Bengal tiger flying through the Allied V for victory.

The name will not soon be forgotten, and it is unlikely that there will ever again be a tale of courage and accomplishment against overwhelming odds quite like that of the Flying Tigers. ★ ★ ★

CB RADIO ON WHEELS

(Continued from page 83)

phone-type handsets that make listening easier in noisy conditions (in traffic, with your car windows open, for example), all the way up to digital clocks. In general, base stations tend to have more fancy features than compact mobile units.

Since the FCC imposes rigid limits on performance, most CB transceivers have nearly identical specifications; where they differ mainly is in adjacent channel selectivity or rejection, which is rated in decibels (dB). The bigger the dB number, the greater the set's immunity to "bleed-over" from adjacent channels.

Operating range

The range you can except from a CB set depends more on your antenna, the surrounding terrain and weather conditions than on the set's price. Range between mobile units is typically 5 to 7 miles, and as great as 15 miles when you're on the crest of a hill. Since base antennas can legally go higher (except near airports, up to 60 feet above the ground or 20 feet above an existing building—which could be a high-rise apartment tower), base stations can expect greater range. The low-power walkie-talkies, of course, have shorter ranges due both to their low output and small antennas; the cheapest may only carry for a block or two.

In cities, CB operation is complicated both by the many tall, steel-framed signal-trapping buildings and by the many, many sets (approximately 200,000 in the New York metropolitan area) competing for the same 23 channels. ★ ★ ★

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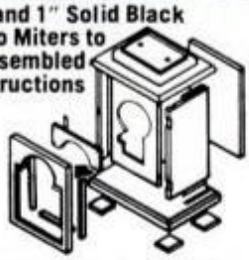

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(Continued from page 6)

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DAVE LAMBERT
MENDOTA, ILL.

Blue ribbon stowaway

I'm 13 years old, enrolled in woodworking in my 4-H club, and made this folding picnic table from your plans (*PM's Stowaway for Patio Dining*, page 116, April '75). At the

county fair I received the grand champion award for woodworking and got the purple ribbon at the Kansas State Fair. I'm sure the innovative plans helped a great deal for such outstanding awards.

PHIL MOLINA
SHAWNEE, KANS.

Looking for a hobby horse

When our daughter was an infant back in 1949, my husband made her a hobby horse from a PM pattern.

We are now grandparents and would like to make one for our grandson, but cannot find the original pattern. Is it possible to get this plan yet—or a more recent one?

MRS. F.C. ROTHERMEL
LINCOLNWOOD, ILL.

We have several. Write to the Bureau of Information, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019 for our list of all hobby horses we've published. Enclose a stamped, self-addressed envelope.

More shops, please!

15 Great Shop Ideas (page 106, July '75) is great. All of us who have shops want to see the other fellow's layout. More pictures of great shops, please.

C.O. JONES
LA JUNTA, COLO.

Okay, there'll be more coming. ★★★

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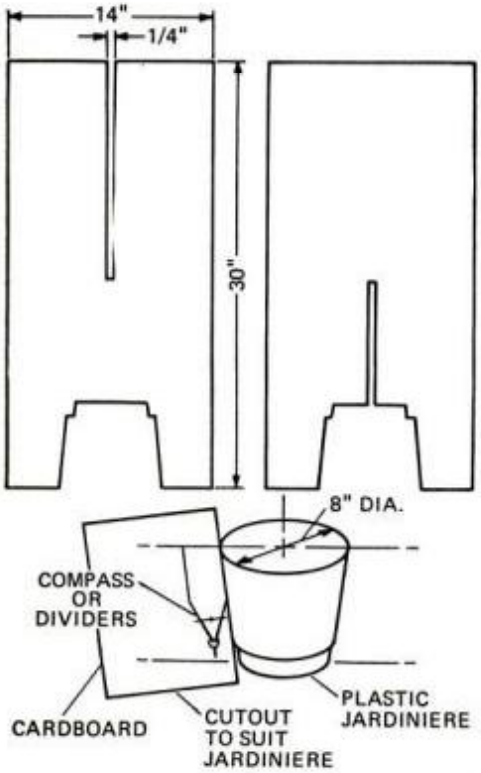
Acrylic plant stand



This attractive, contemporary plant stand is an easy one-night project. Following the plan, cut the two Plexiglas sheets (leave the protective paper on) and sand the edges. For best results, use a router with a ¼-in. bit to cut the slots; a bandsaw will also do. Use a template to transfer the pot outline to the sheets (a contour gauge is ideal). After sanding and polishing the edges, remove the paper and nest the sheets together in an egg-crate joint.—*Larry Cotton*

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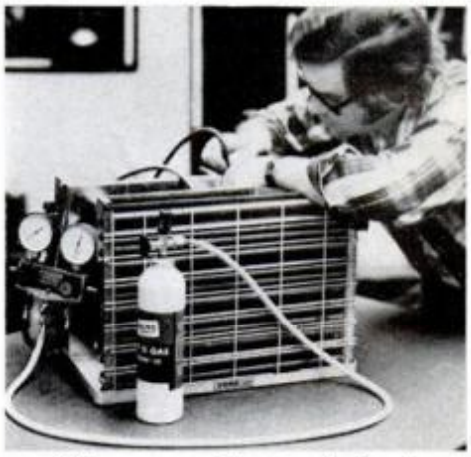

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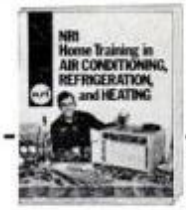

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FOUR NEW MOVIE CAMERAS

(Continued from page 62)

24 and 54 frames per second as well as the normal 18 frames. Shooting at 12 f.p.s. lengthens the shutter time to about 1/30 second for dim light, and also speeds up subject motion by 50 percent (which you may or may not want, depending on the subject). Twenty-four f.p.s. is the standard speed for much sound filming; with an 18-f.p.s. projection speed, it gives a slight slow-motion effect which is useful when panning or when shooting from a moving car. Pushing a handy button instantly speeds up the camera to 54 f.p.s., really slowing the action down to about one-third its normal pace.

At any speed, the Bauer's variable shutter can be speeded up for sharper shots of fast-moving action, or to force the use of a larger f-stop, reducing depth of field so you can throw bad backgrounds out of focus.

Further tricks? Bauer's got 'em

When Super-8 film first appeared, some film amateurs were upset because it couldn't be rewound. That meant you couldn't make deliberate double exposures, or fade one scene out as the next one faded in (a "lap dissolve"). Then Bauer discovered that there was enough space in the Super-8 cartridge to allow rewinding 90 frames worth of film. So the Bauer (and, more recently, one or two others) let you make 90-frame lap dissolves or double exposures.

Which to buy?

I could cheerfully recommend any of these four cameras—for different reasons—to film-makers who want versatility and can pay for it:

The Yashica is the smallest (truly pocket size) and the simplest to use. But at $240, it's a bit expensive. (The Command Set, with the radio control and time-lapse, is $160 more; but fits the other cameras tested).

The Minolta gives you more features (power zoom, manual and backlight exposure control, closer focusing, sound/flash sync, time-lapse, battery test and a removable handle) for just $10 more; while still easy to carry, it's bigger than the Yashica.

The GAF ($400) is a very well-thought-out sound camera, with more pure picture-taking features than many silent cameras have. I'd rate its control layout among the best.

The Bauer is priced ($830) and designed for the truly serious film-maker. It can do more tricks than just about any camera around. But its complex controls are labeled only with mysterious symbols; unless you use all its features regularly, you may have to keep the instruction manual handy for reference. ★★★

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★**complete**–right down to strap and batteries.

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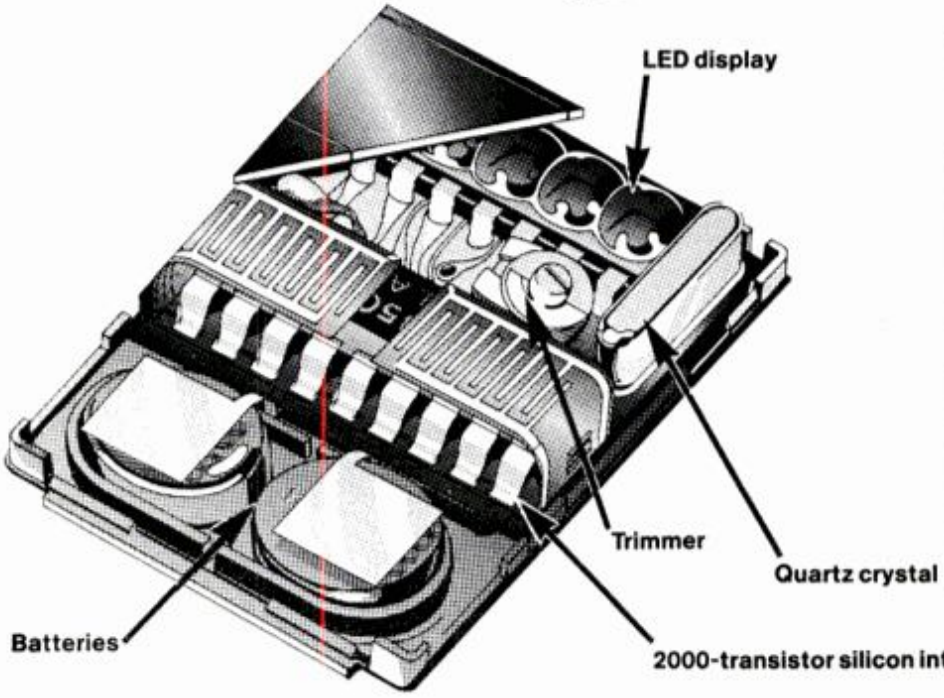

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4. trimmer
5. capacitor
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9. battery-clip
10. black strap (black stainless-steel bracelet optional extra-see order form)
11. full instructions for building and use.

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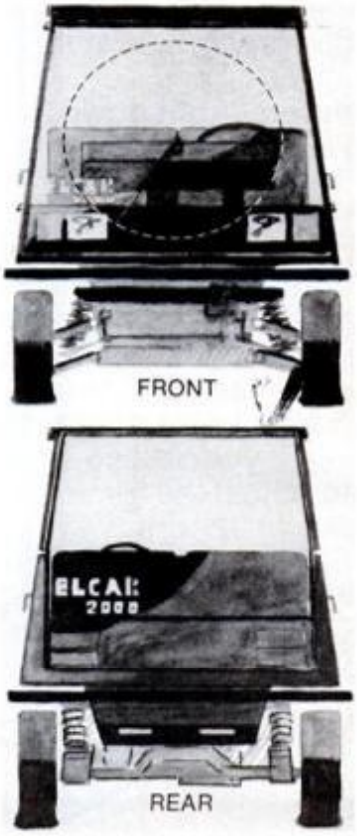
PM'S CONTEST WINNER

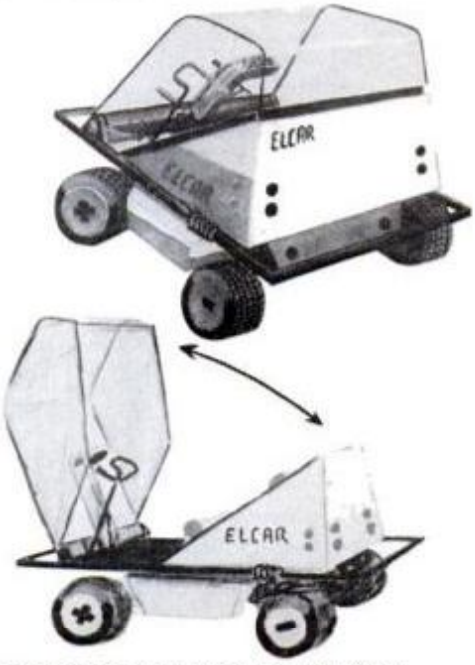
(Continued from page 55)

a 31-year-old Icelander, trained as an office-machine mechanic and currently working as a Mazda salesman.

We've shipped the chassis to Reykjavik where Steinn is anxious to start his project. We'll run plans for the car in a future issue. ★★★



Front and rear views of Sigurdsson design show its simplicity—and originality. Single windshield wiper, for example, sweeps entire safety-glass windshield by spinning continuously through a 360° circle. Frame is profile steel and aluminum plate; side windows, plastic.



Flip-top concept was also submitted by Steinn Sigurdsson. This design, however, requires more advanced construction methods and skills.

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 (Continued from page 85)

it this way: "I've bought three Eldorados from this dealer and know he's very interested in giving good service. The one and only problem with the Seville has been the computer on the fuel injection. The factory man said it could be fixed, but the dealer said replace it, so they did, and I feel they did the right thing. We bought this car because I got fed up parking the Eldo. I was considering a 450-SEL Mercedes but am glad I bought the Seville."

And a 55-year-old retired tanker captain: "My only complaint is entry to the driver's seat, which clips my heel. I bought this car because of size, handling ease and luxury. Workmanship is excellent inside, but the dealer had to repaint the exterior, which is now also excellent. I had some initial trouble with the fuel-injection wiring, but this was corrected the next day. I find the Seville very comfortable but would like a two-door with a little more entry room."

A California sportsman, aged 56, owns a Mercedes 280-SE and says, "I wanted to try a small Cadillac from a fine dealer. The only thing that's a disappointment is the Seville's seating. It's not as comfortable as it ought to be. If they'd contact me, I'd show them how to improve it."

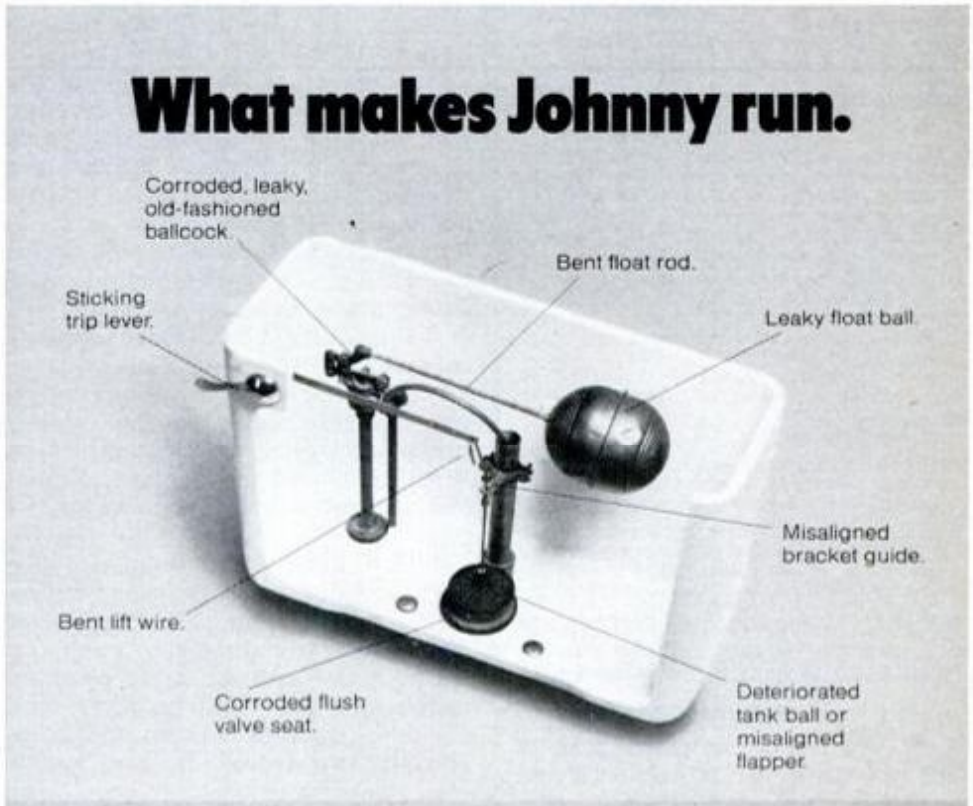
A 42-year-old Illinois grain broker: "Comfort is excellent, but for a $14,000 car, the workmanship stinks. It lacks the quality expected in a fine luxury car. However, I do like the luxury as it is; also the Seville's size and handling."

From a Florida boat dealer, 58: "I've had five or six Cads in the past and wanted a small, well designed, plush Cadillac that would give good mileage. I don't get good mileage, and I suspect the fuel injection might be to blame.

"Workmanship is excellent, but I have my doubts about the injector. The dealer hasn't had time to check the fuel-injection system—they say they've had four computers so far that didn't function. Could it be that they don't know how to operate these computers? For a smaller car, it's well built and drives well and is comparatively comfortable. I find the front a little cramped, even with the seats all the way back."

A retired Kansas realtor, 80: "Considering the shortened wheelbase, ride is good, with fair room for rear passengers. I've been driving Cadillacs for some years, and due to the gasoline shortage I decided to trade my larger Cadillac on this Seville. Dealer service is excellent, and so is workmanship. No rattles or squeaks or problems. They did have to change a sensor in the injector, but fuel injection is an improvement over regular carburetors. The car handles well in crosswinds, and there's very little noise inside the Seville. Yes, I'd go for another Seville, but I do feel the price is too high."

And finally, these words from a Texas college president and doctor of engineering, 51: "I particularly like the in-town handling, the Seville's agility and lack of bulk. It's small but very comfortable. Workmanship rates good. I'd suggest to Cadillac that it make the hood and decklid slightly stiffer—they're too flat and easily hand-dented. What I wanted originally was a high-quality smaller car, and I probably would have bought a Mercedes otherwise. The Seville offers the best combination of sports car, luxury car and four-door business utility in one vehicle. It's not the best in any single category, but I like being able to get all three in one." ★★★



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 (Continued from page 54)

pressed out. At Corning, one effort to do that began in 1957 when company president William C. Decker reportedly told his director of research, Dr. William Armistead, "Bill, glass is a good material, but it breaks. Why don't you fix that?"

A way was found to increase tensile strength by a chemical exchange that crystallized and compressed the surface. Researchers knew they had it made when they dropped a small white teacup nine stories from the roof of a Corning building onto a sheet of steel boiler plate—the cup clanged off the plate unscathed.

Suppose you deliberately want the glass to break? They can do that, too. One type, known as frangible or "command-break" glass, can be made to come apart in a controlled pattern on impact—to pulverize in harmless blunt particles the size of salt grains to beach pebbles. It's the ultimate safety glass for car windshields and is being tested for use in aircraft canopies. Ejection seats in military aircraft sometimes sent pilots bursting through tough, ragged plastic canopies, lacerating them severely. With command-break glass, a pilot ejects right through the canopy.

Living in glass houses

Practically every maker of ceramics plans a complete "glass house" and, in fact, could erect one now. Interior and exterior surfaces of ceramic materials would be permanent, durable, fireproof and maintenance-free. They'd resist dirt and stains, stand up to the worst weather, even come through a forest fire unscathed. In short, they'd never wear out.

So how come we don't have glass houses? The reasons are complicated and in part probably political. Some companies blame antiquated building codes that prohibit the use of unconventional materials. But a more realistic answer may be found in the cryptic comment of one ceramic engineer: "Who needs houses that last forever?" What he meant is that our present economy simply couldn't withstand a sudden appearance of houses, cars, appliances and other goods that never need replacement or repair—we'd all be out of a job.

Still, ceramic materials are finding their way into residential construction and will continue to do so. They're now in use in some solar-heating systems and in a kind of reverse material to reflect heat away. PPG, for instance, has "solar rejection" panels that can be installed like summertime "storm windows" to keep heat out—as much as 87 percent of solar radiation. In winter, they're turned around to reflect up to two-thirds of interior warmth back inside and keep it from escaping.

Also coming are heat-producing electroluminescent glass-ceramic wall and ceiling panels to provide both warmth and illumination in residential and apartment buildings. The trick here is a transparent metallic oxide coating on the surface, with hair-thin wiring around the edges. Etching the coating at the proper places provides the desired circuitry.

Conductive ceramic coatings will soon be appearing in other applications, too. Watch for fingertip touch-control panels for TV channel selection, telephone dials and light switches. They'll work like those elevator pushbuttons you see in office buildings—you just touch the number you want and nothing actually moves to activate the circuit.

One most interesting development is a grinding wheel that doesn't grind, a project being worked on by the Rutgers team with industrial sponsorship. Designed for machining the toughest metals and even tougher ceramics, it's an electrolytic silicon carbide wheel with a conductive ceramic bonded on. A charge is applied to the work and the wheel eats it away electrically without grinding it, eliminating heat buildup and softening of the material.

An outgrowth of photosensitive sunglasses that automatically darken in sunlight are large-scale windows for residential and commercial buildings. These variable-transmission windows cut out 66 percent of hot summer sunlight, then turn clear as the sun goes down. They can be made to operate automatically or, with the addition of a rheostat control, manually, giving you, in effect, a window with a built-in Venetian blind. But you won't see them for a while. Major reason: high cost.

Recovering lost heat

The problem with automotive gas turbines has been the need for high heat for efficient operation—and a lot of heat was blowing out the exhaust, wasted. Metal heat-recovery devices couldn't withstand the terrific 1900° F. temperatures of the exhaust gases. Now glass-ceramic ones can. At Corning, big extruded discs of thin-walled ceramic honeycomb rotate between exhaust and intake, picking up 1350° F. heat from the exhaust side and spinning around to release it at the intake side, preheating the incoming compressed air for more efficient combustion.

This rotary ceramic-heat exchanger (regenerator) is expected to be

operational by mid-'76. If it is, it could put the gas-turbine engine into passenger cars within a few years. It's also a natural for Ford's new 170-hp Stirling engine.

Ceramic wheels are finding other interesting uses in fields where high heat has been a stumbling block to efficiency, conservation and ecology. Recently, Corning turned out a granddaddy-sized rotary heat exchanger six feet in diameter for an industrial incinerator. Incinerators require tremendous heat—a lot of which goes up the chimney. The big ceramic Corning wheel soaks up 1400° F. exhaust heat and rotates it back to the incoming airstream. Heat recovery runs up to 75 percent.

"These ceramic heat wheels can solve environmental problems and save tremendous amounts of fuel for all industry," says a Corning spokesman. Right now we're heating up all the rivers so fish can't live when we should be heating apartments and homes. Research in this area will pay off for everyone."

The glass that shrunk

Another Corning development came about when scientists soaked a slab of glass in acid and fired it at high heat to measure what they thought was going to be its expansion. Instead, the glass shrunk. The acid had etched out the impurities, leaving 96-percent-pure silica. It remains solid and stable at temperatures above 3000° F. and can stand the shock of having molten metal on one side and ice on the other.

Something else strange happened. In etching out impurities, the acid left the glass riddled with pores so tiny one would have to be enlarged 12,000 times to admit the end of a human hair. The pores soak up moisture from anything they touch, causing engineers to promptly dub the material "thirsty glass." From this freakish event came the development of porous products that have an affinity for enzymes. These are trapped and held in the tiny mini-caves and can be used over and over as catalysts in many processes, most dramatically, perhaps, in medical use.

"With these devices, we can immobilize enzymes," says Corning's Dr. Harmon Goldfinkle. "Enzyme-deficiency disease, in which victims can't synthesize necessary body chemicals, can now be treated effectively at much less cost. Enzymes are expensive, hard to isolate, and could only be used once until thirsty glass came along."

Communicating through glass

One of the most promising potentials for ceramics is in communications. Today, with wires jammed and air frequencies all but used up, one ray of hope is fiber optics. Ten years ago this was a pipe dream. Laser information could barely make 100 feet along a glass fiber waveguide before an expensive repeater was needed to boost the signal. Now a single optical waveguide one-fifth the diameter of a human hair can carry light signals up to 10 miles without a repeater and do the work of 10,000 conventional telephone wires. By the 1980s, fiber optics are expected to play an important role in helping to take the load off our presently overburdened communications systems.

Glass light pipes are already in odd and unusual usage. A test truck fleet for Interstate Systems of Grand Rapids, Mich., is using fiber optic readouts to check critical liquid levels, such as oil, coolant and fuel. The pipes are unaffected by either heat or pressure and they provide early warning to prevent severe engine damage.

Glass bridges?

The possibilities are virtually endless. Malleable glass with the workability of plastics and the strength and heat resistance of ceramics is among many fantastic prospects for a not-too-distant future. With it could come lighter, stronger automobiles, trains, ships—even skyscrapers and bridges—with glass parts fused without bolts or rivets.

Georgia Tech's Doctor Pentecost, no idle dreamer, envisions the day when ceramics will move in to replace plastics while petroleum resources dwindle.

"There's no reason," he predicts, "why we shouldn't have ceramic camera cases, luggage and the like. We can even have light, thin disposable ceramic dishes."

How do you get rid of all that everlasting, unbreakable material? Don't forget—ceramics can be made soluble in plain hot water as well as other liquids. You'll just flush those disposable dishes right down the drain when you've finished dinner. ★★★

(Editor's note: The ceramics field is growing so rapidly there are many opportunities opening up for exciting new careers. Recent Bureau of Labor surveys indicate that in the next decade an estimated 5000 new ceramic engineers will be needed—more than twice as many as have been entering the field. A serious shortage of trained technicians is likely to exist. For more information on this rewarding field and how to get into it, write National Institute of Ceramic Engineers, 65 Ceramic Dr., Columbus, Ohio 43214.)

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Photographic equipment is a favorite target of burglars. An itemized list should detail all such equipment, approximate value, age, condition and serial numbers. A floater for $2700 worth of cameras and related equipment should cost about $35 a year.

What every homeowner should know about insurance

by M. Jay Wanamaker

Your home may be the largest single investment you make in your lifetime. When the value of your possessions is added, this amount becomes even more sizable. Insurance can protect you from losing all or any part of the cash investment in your property.

A second important reason for carrying insurance is that you can't get a mortgage without it. To protect its loan to you, a lending institution requires insurance to cover at least the amount of the mortgage it has on your property.

Another important consideration is that of protecting your possessions from loss (fire, theft). Tour your house and make some notes on what it would cost to replace your furniture, appliances, clothing, tools, cameras, stereo equipment, not to mention your investment in hobby and sports equipment. If your home is average, you should come up with a total that makes your head spin. What you have in your home is the result of many years' investment in living.

The last major consideration is your liability—perhaps vulnerability—to a lawsuit if your dog bites the mailman, a neighbor slips on your sidewalk or trips on your stairs. You need adequate protection against possible lawsuits and legal defense expenses growing out of accidents or property damage caused by either your own negligence or that of a member of your family.

M. Jay Wanamaker is the president of the National Association of Insurance Agents.

Types of insurance

There are two basic types of insurance available to homeowners: 1. Fire and extended coverage insurance policy. 2. Homeowner's package policy.

Each is available in several forms that provide broad flexibility to meet your specific needs. Most homeowners could use some help in assessing the needs. A local independent agent, since he represents a number of insurance companies, can select from the varieties of coverages available to fit your specific requirements.

The basic fire insurance policy is the essential policy to protect your home against its greatest perils—fire and lightning. It also covers the contents and is available with "extended coverage" against risks other than fire. Because of inflation, it's good practice to review your coverage every year.

"Extended coverage" adds protection against such perils as damage caused by windstorm, hail, explosion,

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 (Continued from page 130)

riot, aircraft, vehicles and smoke. While it's a pretty safe bet that an airplane won't fall on your house, it's a comfort to know your home is covered for such unexpected forms of damage as part of the extended coverage package.

Is fire and extended coverage enough? Probably not. Most homeowners want to add such protection as theft and personal liability. Thus, the homeowner's package policy. This policy brings together, in one package and at a reduced cost, many features which once required separate policies. And its flexibility can provide you with the exact type of coverage you require.

Homeowner's package

Specifically, the homeowner's package policy covers the following:

- *The home itself.*
- *Other structures* on your property, such as garages or tool and storage sheds.
- *Living expenses* in the event of severe damage to or destruction of your home by an *insured peril.* This item has been the cause of some misunderstanding. Homeowner's package policies *do not* protect you against earthquakes, floods and certain other natural catastrophes. Flood insurance is a separate coverage which is now available in many areas under the Federal Flood Insurance Program. What *is* covered are such things as hotel or motel bills and related expenses when your home is unlivable because of one of the reasons listed in the chart. These payments will continue until you can return home or find other permanent housing up to the limits stated in your policy.
- *Personal liability* and medical expense payments for accidents you may either cause or be responsible for. This is something of a catchall extending to your family, pets and the like, although if you insist on giving your 4-year-old a meat cleaver

(Please turn to page 134)

Guide to Home Insurance

	POLICY / COVERAGE	HOMEOWNER'S 1	HOMEOWNER'S 2	HOMEOWNER'S 3	HOMEOWNER'S 5
		Basic Coverage	"Broad Form"	"Special Form"	Comprehensive or "All Risks" Policy
	MINIMUM COVERAGE	$8000	$8000	$8000	$15000
A	Dwelling	8000 min.	8000 min.	8000 min.	15000 min.
B	Appurtenant structures	10% of A	10% of A	10% of A	10% of A
C	Contents	50% of A	50% of A	50% of A	50% of A
D	Additional living expense should home become uninhabitable	10% of A	20% of A	20% of A	20% of A
E	Personal liability	25000 min.	25000 min.	25000 min.	25000 min.
F	Medical payments	500 min.	500 min.	500 min.	500 min.
	COVERAGE OF HOME	Same as for contents	Same as for contents	All risks except earthquake, landslide, flood or surface water, tidal water or tidal wave, war, nuclear radiation, sewers and seepage.	All-Risk on dwelling and contents
	COVERAGE OF CONTENTS AGAINST:				
	Fire				
	Lightning				
	Loss of property through removal from endangered premises				
	Windstorm				
	Hail				
	Explosion				
	Riot				
	Aircraft				
	Vehicles				
	Smoke				
	Vandalism				
	Theft (except credit cards and checks)				
	Breaking of building glass				
	Falling objects	Not covered			
	Weight of ice, snow and sleet	Not covered			
	Collapse of building	Not covered			
	Certain accidental damage to or from plumbing	Not covered			
	Certain accidental damage involving electrical equipment	Not covered			
	All off-premise contents	10% of A	10% of A	10% of A	100% of A

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INSURANCE FOR HOMEOWNERS

(Continued from page 133)

or letting your pet lion roam loose, be prepared to worry about an assault charge for which there is no insurance. But if you hit someone with a golf ball or your dog bites the mailman, you're covered up to the policy limits for the ensuing claims. You are not covered for auto accidents, for normal wear or your puppy having an "accident" on your oriental rug, or for a few other exclusions that your agent can explain to you. If a guest is injured in your home or a neighbor's child is injured while playing in your yard, the medical payments section of your personal liability insurance takes care of these expenses.

■ *What is variously referred to* as "personal property," "unscheduled property" or simply "contents" is covered under the homeowner's package policy. This means the possessions in your home, with very specific coverage limits on furs, jewelry and other valuables, which you can get around by the use of "floaters" (more on floaters later). These personal items are insured both in your home and when you travel (surprised?), with some limitations. Your home can be burglarized or your suitcase can be stolen at the airport. In either case, a homeowner's package policy protects you and your family.

To determine the true value of personal property and to expedite payment of claims, make a complete inventory of personal property, including each item's cost and date of purchase. Remember, while furniture and clothing decrease in value with age, antiques, heirlooms and hobbyist's collections often increase in value. Photographs of the rooms and contents will also be helpful. Keep this inventory in a safe place along with other valuable documents. It will help validate your claim. Your home is not a great place to store these documents; fire can destroy the inventory record with the inventory itself.

Types of homeowner's insurance

If you decide a homeowner's package policy is for you, there's still a decision: Which one is right for you? There are six basic policies available for the owner of a house. ("Homeowner's 4" is designed for apartment dwellers and "Homeowner's 6" covers owners of condominiums).

■ *Homeowner's 1* is the basic coverage policy, covering the home, contents up to 50 percent of the face value of the policy, personal liability, medical payments, off-premises contents up to 10 percent of the policy value, coverage of contents against 11 of the most common perils (see chart on page 133) and appurtenant structures. (Appurtenant structures are such things as toolsheds, playhouses, cabanas, gazebos and, depending on your policy, unattached garages.) Also, should your home become uninhabitable, your living expenses are covered up to 10 percent of the value of the policy.

■ *Homeowner's 2*, known as "Broad Form," while basically similar to Homeowner's 1, expands the contents coverage against an additional five risks not accounted for in the "basic coverage" policy. Also, should your home become uninhabitable, you have twice the living expense allowance as the basic policy.

■ *Homeowner's 3*, also known as the "Special Form," has the same coverage on contents of the home as the "Broad Form," but covers the home itself against all risks except earthquake, landslide, flood or surface water, tidal water or tidal wave, war, nuclear radiation, sewers and seepage. The coverage of the home is so all-inclusive that it's easier to list what is *not* covered.

■ *Homeowner's 5* is the "Comprehensive" or "All Risks" policy. The coverage of the home is the same as for Homeowner's 3 (with the same exceptions). But, in addition, the contents of the home have the same all-inclusive (almost) coverage as the dwelling. There is one other difference. Unlike the other homeowner's policies, all off-premises contents, up to 100 percent of the policy face value, are covered. This is particularly important if you have a vacation home.

As you may notice in the chart, there are minimums listed under each of the homeowner's policies for dwelling, personal liability and medical payments. Each policy can be tailored to fit your requirements within the limitations of basic coverage, broad form, special form or comprehensive policies.

Insurance policy limitations

While there is a lot covered by a homeowner's package policy, there are certain limitations in the area of "unscheduled" property that you should know about. Your regular homeowner's policy is probably adequate if you don't own things of high value like furs, jewelry, original paintings or stamp or coin collections, although your protection is probably fine for furniture, clothing and the like. Most homeowner's policies, by the way, have a $50 deductible.

Coverage under the homeowner's policy for cash lost in the home due

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to fire or theft is limited to $100. As you can see, it doesn't pay to stuff your mattress with cash. There is a $500 limit on securities, I.O.U.s, airplane tickets, stamp or coin collections, jewelry, cameras, watches, precious stones and furs.

Included in the categories not covered are: loss of a diamond from its setting; boats, outboard motors or boat trailers while away from home; awnings or fences; pets (including birds and tropical fish); autos, motorcycles and other vehicles, except those used to service a premises; property of paying boarders or tenants; samples of goods for sale; property rented or held for rental; portable automobile tape decks while in car; dictation recording devices.

These are general categories. Exclusions vary with each policy and should be discussed with your agent.

Valuable and vulnerable items, like a diamond brooch or a collection of ivory carvings, require special protection. Often, all you will need is a "scheduled personal property endorsement." Your agent can add this to your homeowner's policy. In other cases, a separate "floater" policy might be recommended because it is more comprehensive or proves to be more economical.

The value of your jewelry, cameras or those fine pieces of crystal can be established in several ways. For newly purchased items, the sales receipt offers the necessary proof. A qualified appraiser will probably have to be consulted for the older, high-value items or antiques.

After taking the inventory of your property, be sure to keep a copy of the list of possessions and their values. It is also a good idea to have color photographs showing a unique item in relationship to a person or place in a room, to help establish ownership and identification should it be stolen. As with all valuable papers, the list and photos should be kept in a safe place such as a safe deposit box at your bank, so they cannot be stolen or destroyed along with your property.

Floater policies

In one form or another, you can get a floater policy to cover just about anything you might own or acquire. Here are some of the more common types of floaters:

■ *Personal furs:* This is probably one of the oldest forms of personal property coverage available to you. It is broad in coverage and there are only a few disasters that could befall your furs that you cannot insure against. Unfortunately, you can't insure against normal wear and deteri-

(Please turn to page 136)

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INSURANCE FOR HOMEOWNERS

(Continued from page 135)

oration. But you are covered against theft, damage from fire, smoke and water. In obtaining your coverage, list each coat, jacket or stole separately and establish a separate current valuation for each. Here, depreciation *is* a factor.

■ *Personal jewelry:* As with furs, each piece of jewelry should be listed separately for the amount of insurance and individual valuation of each piece. Since precious stones don't deteriorate, inflation has probably increased their value. It's a good idea to review and update the coverage you now have.

An interesting clause affecting jewelry insurance is that if you lose one of a pair of earrings, you can't recover the loss of the complete set, but only a proportional amount equal to the value of the lost earring. However, a new wrinkle on the "sets and pairs" clause states that for an additional 50 cents per $100 value, the insured can receive payment for the full value of the pair. In this case, the insurance company gets the remaining earning (to protect itself against false claims). The clause is in effect in every state but Texas.

■ *Silverware:* With silver prices soaring, this is the classic target for burglars. Floaters are available.

■ *Photographic equipment:* Good photo equipment is another favorite target of burglars. It is easy to carry off and fairly easy to dispose of illegally. Besides theft, photographic equipment is highly vulnerable to damage by fire, smoke and water. Accessories such as lenses, projectors, screens, lights, possibly sound equipment, and contents of a darkroom are covered, within certain limits, but new purchases must be reported within 30 days and the extra premium paid for increased coverage. Depreciation is a factor in loss settlement on camera equipment; wear and tear are excluded. Binoculars, telescopes and other optical equipment can also be covered in the same floater.

■ *Stamp and coin collections:* Here, as with jewelry, inflation may have made your collection more valuable. These categories are pretty wide-ranging. Stamp coverage includes, for example, proofs, covers, envelopes, reprints, and so on. Coin collections can also include medals, paper money, bank notes, tokens. Coverage includes mountings, albums, frames, containers and cabinets for each collection.

Insurance for these collections is ticklish. Damage from fading, creasing, scratching, thinning, transfer of colors or damage while you work on your stamps is excluded. There is no automatic coverage for new acquisitions. Unless individual stamps are specifically listed, mysterious disappearance is not covered. There are also limits on any single stamp, pair or block as well as on unscheduled coin property.

■ *Fine arts and antiques:* This is another category of value appreciation because of inflation. Fine-arts floaters cover paintings, sculpture, rare manuscripts and antiques. Unlike some of the other categories of floaters, fine art objects are usually covered on a valued basis rather than actual cash value. In other words, the insurance company agrees to the value of each object covered, and it is this value which is paid in the event of a loss. Usually the company has an appraiser advise on the value of an object. In the area of antiques, the object must have true antique value, which means that, generally, insurance companies believe an object must be at least 100 years old to be an antique.

■ *Personal property floaters:* You can insure just about anything against anything through the scheduled endorsement to the homeowner's policy or the specialized floater. In addition to the coverages mentioned here, there is also something called a personal property floater (PPF). This can provide a broad form of all-risk coverage on all your personal effects—owned, worn or used, and may be extended to cover the belongings of guests visiting your house.

The PPF can be had on a "scheduled" (where you list each item) or "unscheduled" (blanket) basis. However, there are limitations to the protection you can get. These policies don't insure against Aunt Fanny's dropping your antique vase or termite damage to the rosewood breakfront. Nor are you covered against destruction by your own pets. So, if your Siamese cat claws your oriental rug or your puppy decides to teethe on the Chippendale chair, it's . . . unfortunate.

There are other restrictions to consider. A blanket PPF policy normally sets a limit to 10 percent of the amount of insurance available at a secondary residence such as beach or mountain cottage. The maximum collectible for *unscheduled* jewelry or furs is $250, and there is a limit of $100 for loss of cash.

Tips that can save you money

Adequate insurance coverage for personal property and family treasures is a bit complicated but, considering the alternative, necessary. Since everyone has different requirements, it's best to get professional advice from an agent.

You can't change insurance rates for your location, but you can save premium dollars and still get the coverage you need. One way is to make certain you've insured your house for not less than 80 percent of its replacement cost. (Do not include the value of your land in determining the amount of coverage to buy. Land cannot be destroyed.)

If you insure your home for 80 percent or more of its replacement cost, in the event of loss—total or partial—the insurance company will pay you replacement cost for damages and repairs up to the face value of the policy. In most cases, homes do not suffer sufficient damage to be total losses.

Different companies charge different prices for the same type of homeowner's coverage. However, judging the value of insurance protection on price alone may be misleading. The policies of different companies are seldom identical. All companies do not cover all risks; the broader the coverage, the higher the cost. Also, the attitudes of different companies toward claim payments vary widely; this is reflected in the original price.

Higher deductibles cut premium

One way to cut your insurance costs is to take advantage of a deductible clause available with your homeowner's policy which makes it possible for you to assume responsibility for small losses, or usually the first $50 or $100 of larger losses. Insurance companies are able to set a lower premium for insurance sold with a deductible feature because it costs almost the same to process a $10 claim as a $300 one. Therefore, the higher the deductible, the lower the premium. Don't forget that casualty losses above the first uncompensated $100 of each loss are tax deductible for income tax purposes. For example, a person in the 25 percent tax bracket can reduce his tax $25 for every $100 casualty loss he can claim.

In considering deductibles, study your essential needs for protection, weighing these needs against the amount of risk you can reasonably assume. Can you afford the first $100, $200 or $300 of a loss in return for paying a lower premium?

Homeowner's policies provide a minimum of $25,000 liability protection and $500 medical coverage per person to pay for injuries or property damage to others. Since damage suits have been getting higher and higher, you may want to spend a few dollars more for the premium for buying $100,000 or more in additional liability coverage. ★★★

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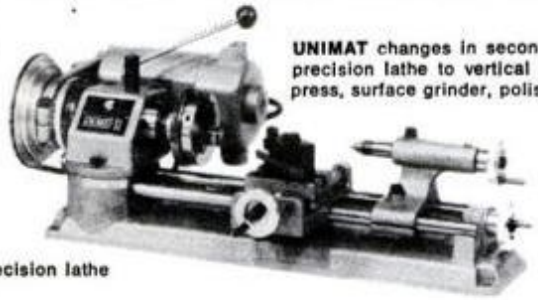

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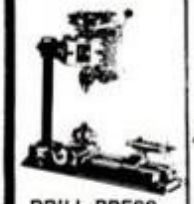

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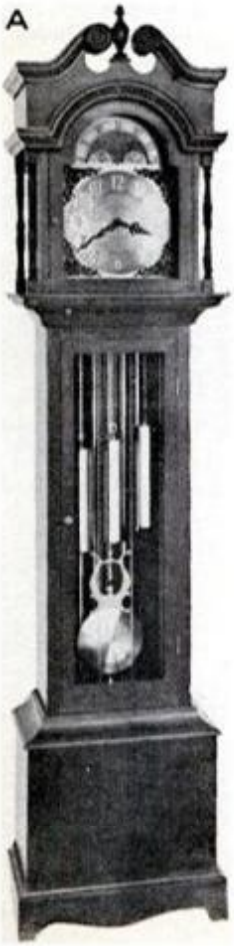

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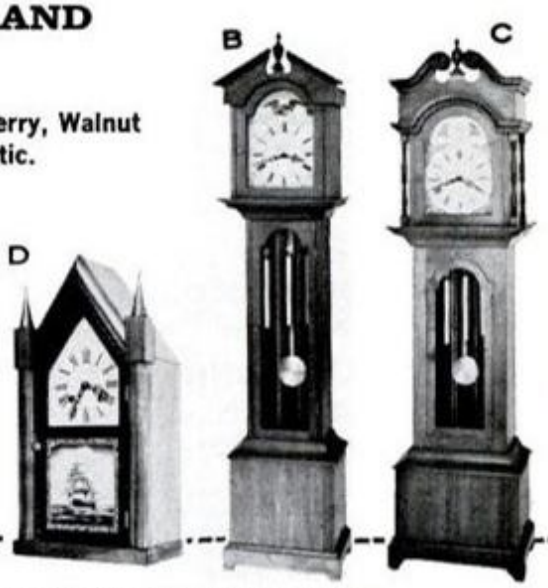

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With tape measure and some arithmetic you can rate your own boat the way experts do.

by Jim Martenhoff

A safe boat, the government thinks, is any hull that will carry a fair load, won't capsize or swamp, and won't sink if it does. The authorities figure it in advance by the numbers, and with a little arithmetic you can do the same. Chances are that if yours is a recently built boat, it's a safe one, and for this you can thank an occasionally cantankerous partnership between the boating industry and the U. S. Coast Guard.

Before the Federal Boating Act of 1971, most production boats were good, but anyone could turn out "back yard bargains." The Boating Industry Assn. (BIA) and American Boat and Yacht Council (ABYC) published standards followed by many builders—voluntarily. Any manufacturer out to save a production dollar could ignore them if he chose. Then in 1972 the Coast Guard, armed with the new Boat Safety Act, began to set standards with teeth in them. The result has been better boats—and controversy.

First the Coast Guard zeroed in on

Passenger capacity used to be figured by loading a crowd aboard. Now, with flotation between inner and outer shells, as in Boston Whaler above, you get added carrying ability. But new formulas make it possible to prefigure your safe crew number and weight.

Measurements and math can tell the story. Once a tape is strung across the static float plane, as shown at the right, verticals are measured down to fit into the maximum displacement formula.

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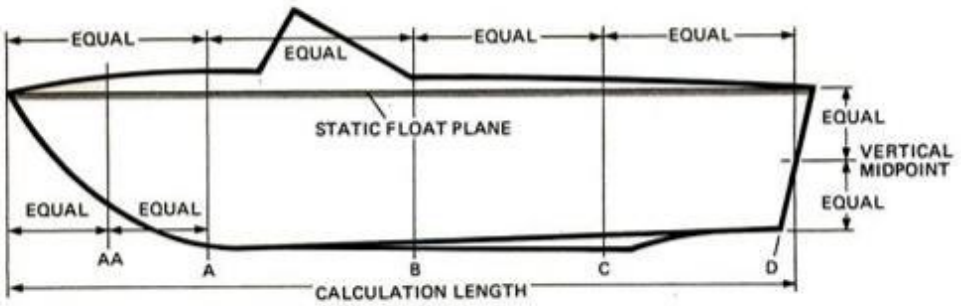

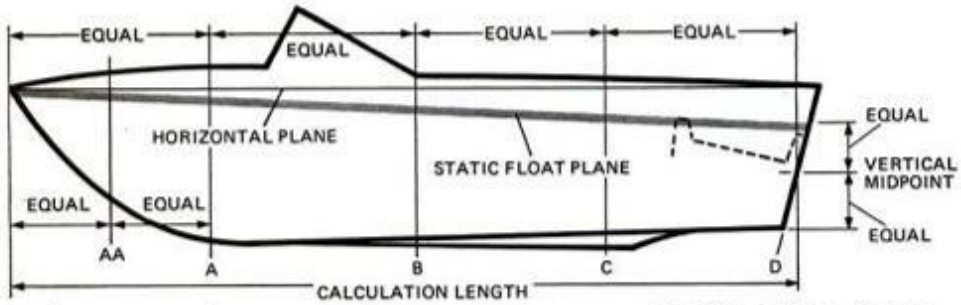

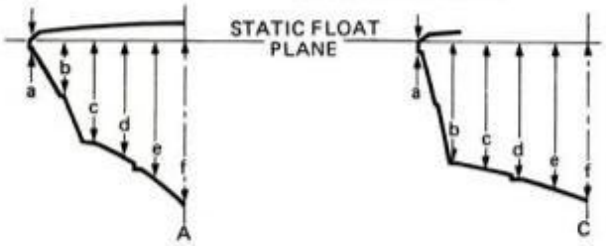

Static float plane, the line where water will start pouring in over sides, runs from stem to top of transom or outboard well. Six verticals are then measured down from it, as shown at A and C at left, for five positions, AA through D.

single-hull boats under 20 feet long, generally exempting canoes, kayaks, inflatables and sailboats. While some manually propelled craft came under the regulations, most attention was given to small powerboats.

Briefly, the regulations covered:

- **Flotation.** No boat was supposed to sink if capsized or swamped. Instead it could serve as a handy liferaft for the crew in the water.
- **Maximum horsepower ratings** for outboards. A label warns you not to exceed the calculated safe limit.
- **Weight capacity labels** for all boats in the group, determined from tests or mathematical analysis.
- **Hull identification numbers** (HIN) on all boats, much like those on cars.
- **A defect and recall program.** Should a builder goof in the safety area, he could check HIN records, locate buyers, and call back any model type for repair, at no cost to buyers.

It was those capacity rules that stirred up the controversy. The Coast Guard foresaw, in 1972, that such regulations might be out of line for "pirogues, whale boats, dories, skiffs and other boats of historical or unique design." They were—and the Coast Guard has been bombarded with bitter complaints ever since. The Banks dory, for example, is tender when lightly loaded and made a poor showing in prescribed capacity tests prescribed by the rules. Yet veteran cod fishermen know it can take the rigors of the open North Atlantic when loaded with two men and a ton of fish.

Builders of Adirondack guideboats petitioned this year for exemption and traditionalists continue to complain. Other builders maintain that creative and unusual designs are penalized. Some hot ski-boat types with low profiles and big engines computed out with negative capacity ratings and a claim they were overloaded with no one aboard!

So the Coast Guard modified the formula for computing inboard and stern-drive weight capacities to eliminate the prejudice against "hot" boats. It also modified measuring techniques for figuring "maximum displacement" on any boat, but not the formula for figuring outboard load limits or rules on pulling boats. Builders of guideboats, peapods, dories and similar classic craft are still angry, though it's true they are a fraction of the market, and boatmen who buy and treasure them are usually experienced and know what they're doing. Meanwhile, conventional small boats are somewhat safer because of the rules.

The Boating Industry Assn., with its "certification" program to label boats built to the association's careful standards, has also altered its formula to compute maximum displacement. Now it fits all hull forms —even trihull designs—and works well with minor Coast Guard changes in hull measurement. If you wanted to be a boat builder, you'd need to consult pages of CG rules and the BIA Handbook worksheets. Here,

(Please turn to page 140)

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HOW SAFE IS YOUR BOAT?

(Continued from page 139)

in more simplified form, is how pleasure craft are measured and tested today—and how you can do it with *your* boat.

Do-it-yourself measurements

How do you figure "persons capacity" (how many passengers a hull can carry safely) for a boat not intended for mechanical propulsion? That's easy. Launch the boat near shore in wadable water. Add weights to the thwarts or seats *along one side only*. Lay a plank between adjacent seats, against the side, if you need to accommodate more weights.

Now load the boat down until it lists heavily and is about to ship water over the side. Add up the total for your weights. Divide by 0.6. That's your boat's capacity in pounds of passenger and gear. Say you can load 300 pounds of weights along one side of your skiff before water is about to lap in. Your boat could probably carry 500 pounds, or two or three fishermen, on sheltered waters and under conditions for which it was designed.

Outboard horsepower

How big a kicker can you hang on the back? Multiply boat length by transom width to get what is called a "factor." Up to a top factor of 52, the Coast Guard provides a table of maximum horsepower ranging from 3 to 15-hp engines. If your boat factor is over 52 and has remote steering plus a 20-inch (long shaft) transom, you multiply the factor by 2 and subtract 90.

Say you have a 17-foot outboard with a 6-foot transom width. The factor (17 x 6) is 102. Double it and subtract 90. Your maximum horsepower is 114, which you round off to the next higher multiple of 5, or 115.

Powerboat load capacity

Now we get involved in some algebra, measurements and some reasons boat builders hire naval architects these days. You don't need a degree to figure the safety facts of life about your boat, but a tape measure, paper pad and a well-charged pocket calculator will help. All set?

For your outboard, the formula for your safe load in pounds reads: Maximum displacement minus boat weight (the engine excluded) and divided by five.

For an inboard hull, the new Coast Guard formula is: Maximum displacement minus boat weight (*including* engine) divided by *seven*.

Need for "maximum displacement" is the catch, and you can thank (or blame) Archimedes, who cried "Eureka!" when he stepped in his bathtub and it overflowed. He found that an immersed body displaces water equal to its own weight, a method still used. In theory, you could weigh down your hull until it is just short of swamping. Total of the added weights plus the weight of your hull would give maximum displacement.

The Coast Guard can do this safely with test tanks filled with water. A fiberglass boat builder could use a similar system by pouring water into a boat mold (not the boat) until it reaches the point where the boat would swamp. Weight of the water equals maximum displacement; for a hull just under 20 feet it can reach 17,000 pounds! Unfortunately, these shortcuts aren't practical for the average skipper. Pour water into your powerboat or load it down with weights and it will become dangerously unstable and tippy long before it reaches the swamping point.

By the numbers

A way to measure your boat to determine displacement, however, developed by the BIA, works remarkably well with all hull types. All measurements are taken to the outer skin, so you'll have to estimate how much to add if your boat has a double bottom, for instance. Measurements are vertical and taken in inches with decimal equivalents used for fractions. If the procedure seems complicated, look on it as a challenge or a puzzle, with your potential safety as the payoff prize at the end.

Divide and conquer

Establish the "static float plane" in our diagram on page 139. This is the line above which water couldn't rise without swamping your boat. It will extend from the stem, where the bow meets the forward deck, back to lowest point along the top of the transom—motor-well lip or cutout in the case of an outboard.

Now divide your boat into four equal sections. One will be amidships—we'll call it Area B. One will be halfway back to the stern (Area C), another halfway to the bow (Area A). Area AA is halfway from A section to stem. Area D at the transom is supposed to be a vertical cross section through the transom center for measuring purposes.

So far this requires only a few minutes with a tape and maybe a bit of chalk. Now you can go aboard and mark the upper edge of these imaginary sections—paper tape stuck across the boat will do. Final measuring involves dropping a set of six verticals (use your tape measure)

from the outer edge of the boat in to the static float plane at the boat's centerline. These six measurements are taken at each of the five area points we have designated back along the hull. (They are shown in detail on our diagram at points A and C.) The same six verticals are also measured and recorded at AA, B and D. Each of your six verticals, (a, b, c, d, e, f), records the static float plane to outer skin distance at each of the five area positions.

The outermost vertical at "a" for each position usually will be zero. The innermost vertical, "f," is on the centerline. Verticals b, c, d, and e are equally spaced between. You need only to drop and measure verticals on one side of your boat, from the centerline out. With an assistant, you should be able to get all the measurements made and recorded in half an hour or so.

Easier than your income tax

The actual computation of maximum displacement is a lot easier than battling with Form 1040, but you have to go slowly to avoid error. First you compute the areas of those five half-sections of your hull. Here is the formula:

$$\frac{\text{Beam}}{15} \times (a+4b+2c+4d+2e+2f)$$

The beam is measured in inches (and decimals—remember ½-inch equals 0.5 inches and so forth) and is recorded for the full width of the boat at each of the five cross-sectional areas. You divide the beam by 15, then multiply it by the sum of the verticals—"a" plus four times "b" plus two times "c" and so on. Work each station separately. You will end up with five answers.

The home stretch

Once you have a total for each section, AA through D, you are ready for the final formula:

$$\frac{L}{174600} \times (16AA + 13A + 27B + 27C + 9D)$$

In this computation, L is the length of the boat in inches; the divisor is a constant with a five percent margin for error. Totaling the sections is no problem, particularly if you use a pocket calculator with automatic summing mode and memory.

Your final answer is capacity in cubic feet (even though you recorded measurements in inches). Multiply this by 62.4 and you have the total maximum displacement to feed into your original outboard or inboard formula and your answer is obtained in pounds of maximum safe capacity for your boat. ★★★

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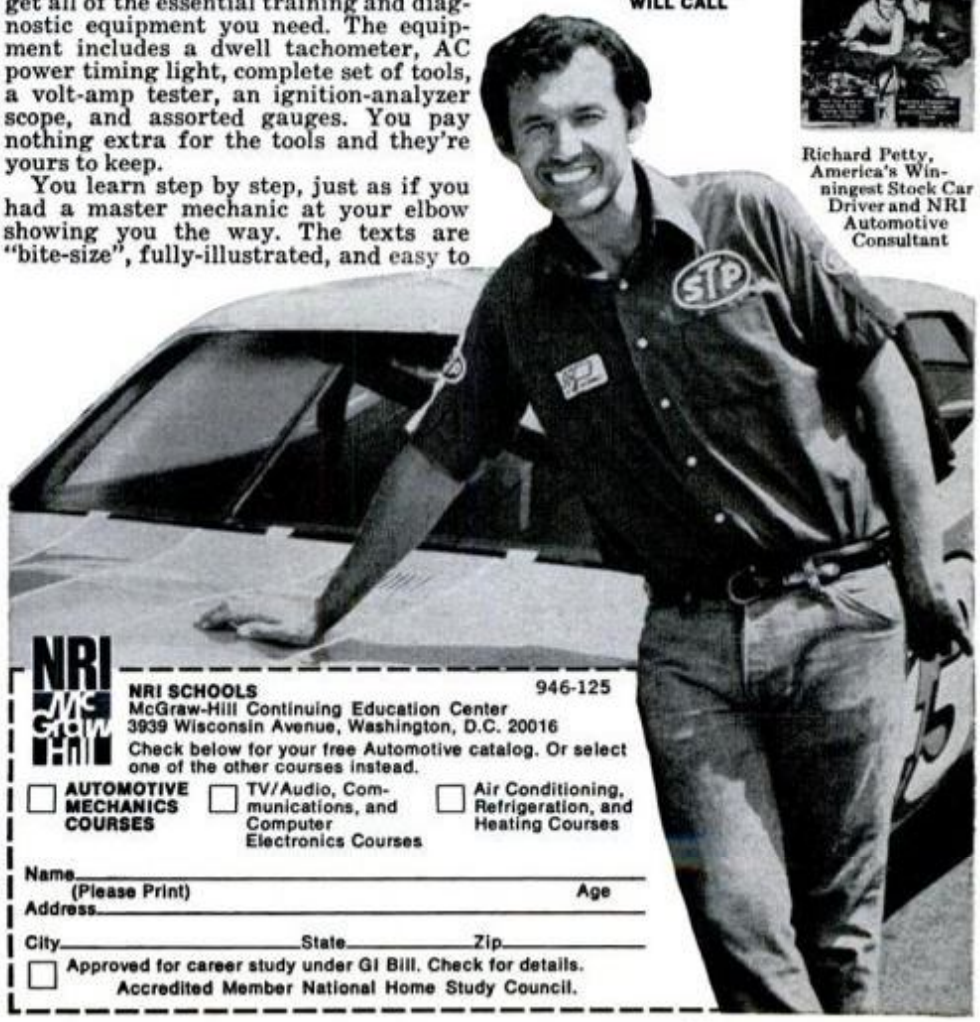

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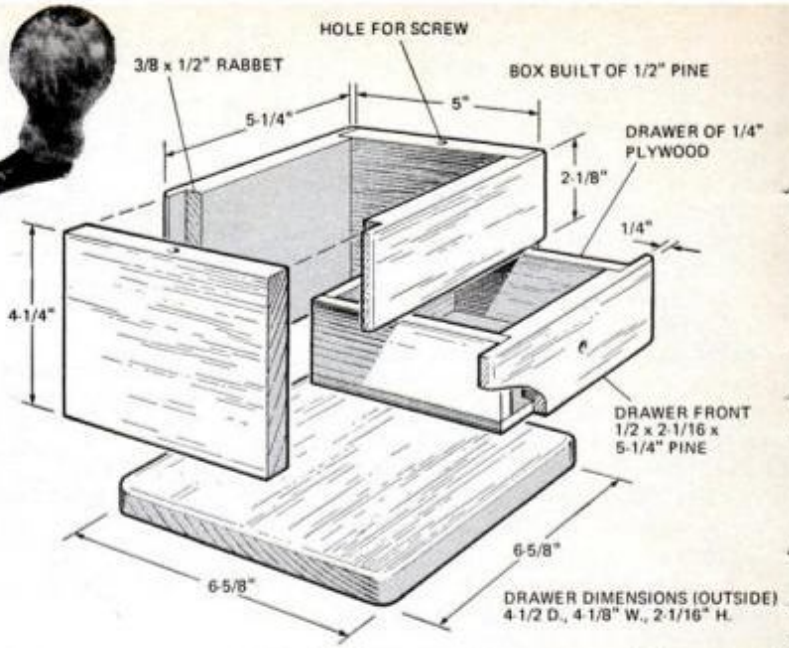

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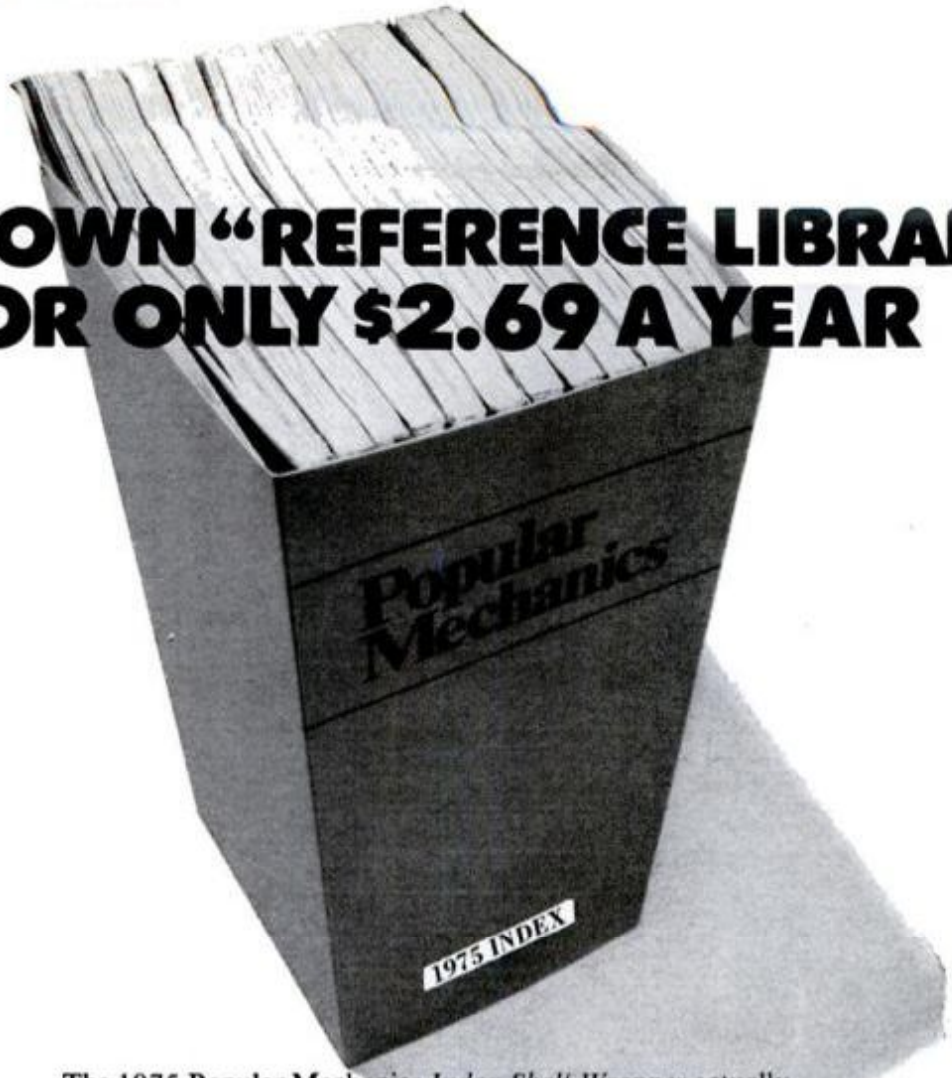

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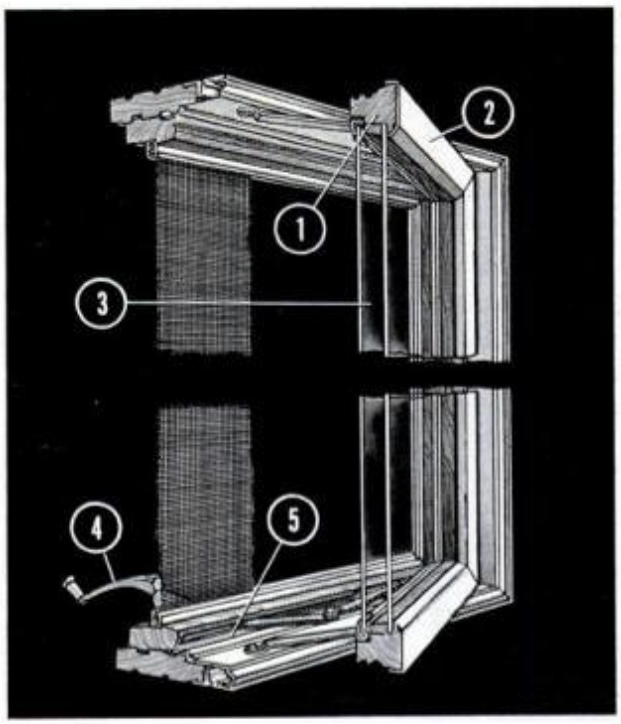

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RETUNE FOR REGULAR

(Continued from page 66)

costs nothing and takes little time. It will work if you have borderline-heavy ping. However, there is a limit to the degree of retardation before power loss becomes unacceptable. It's about 6° from the recommended setting, but I know some people who are happy with results achieved by retarding timing 10°. Retard timing 2½° at a time and test the outcome.

You should also install centrifugal advance-mechanism retard springs, if possible. They limit the distributor from advancing normally under load.

■ Purge combustion chambers of carbon. Try chemistry first. If the engine has a relatively mild carbon condition, it can probably be treated without removing the head. (Remember, you have two heads to remove if your engine is a V8.)

Buy some GM Top Engine Cleaner from a GM dealer. Pour it into the engine as directed. I can attest to the effectiveness of this product.

Removing the head(s)

If the engine is really bogged down with carbon (and sludge), you'll have to remove the head(s)—a time-consuming job (about 8 hours) if you do it yourself and expensive if a mechanic does it. Last time I checked, cost was $125 to $170, depending on carbon and sludge, parts to be replaced (such as lifters and seals) and size of engine.

With the head off, you can install a thicker head gasket, which decreases the engine's compression ratio and lessens the tendency of gas to detonate. However, such gaskets are not made for every engine.

If you decide you've had it, there is one other method you can try to convert, in part, at least, to regular gas. Mix premium with regular to raise the latter's octane.

Determine by trial the ratio which lessens or eliminates detonation. Fill the tank half with premium and half with regular. Conduct the hill test (page 66). Then vary the ratio until you find a suitable blend.

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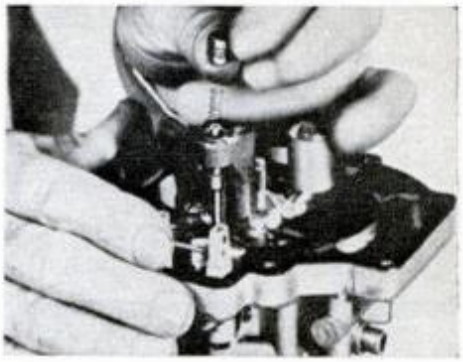

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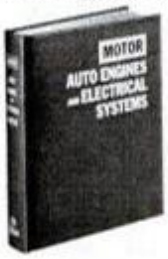

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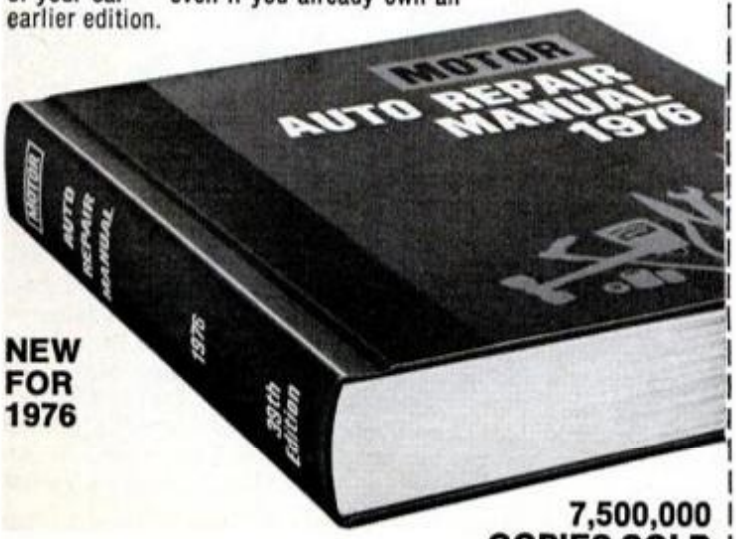

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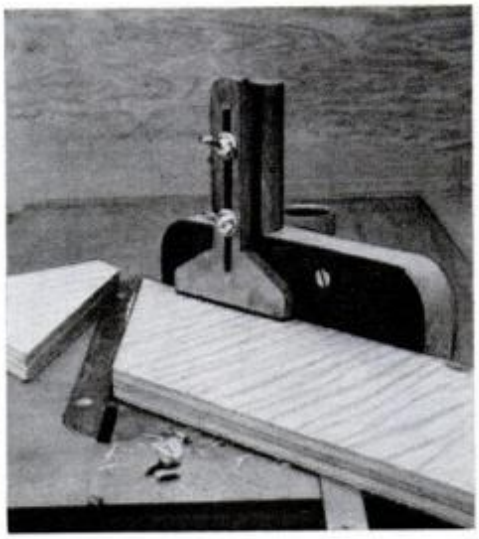
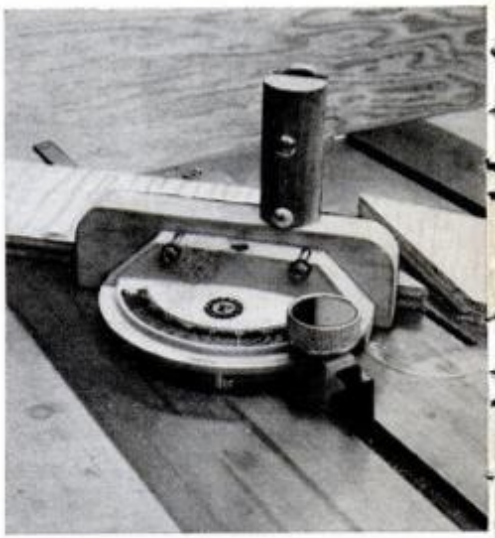
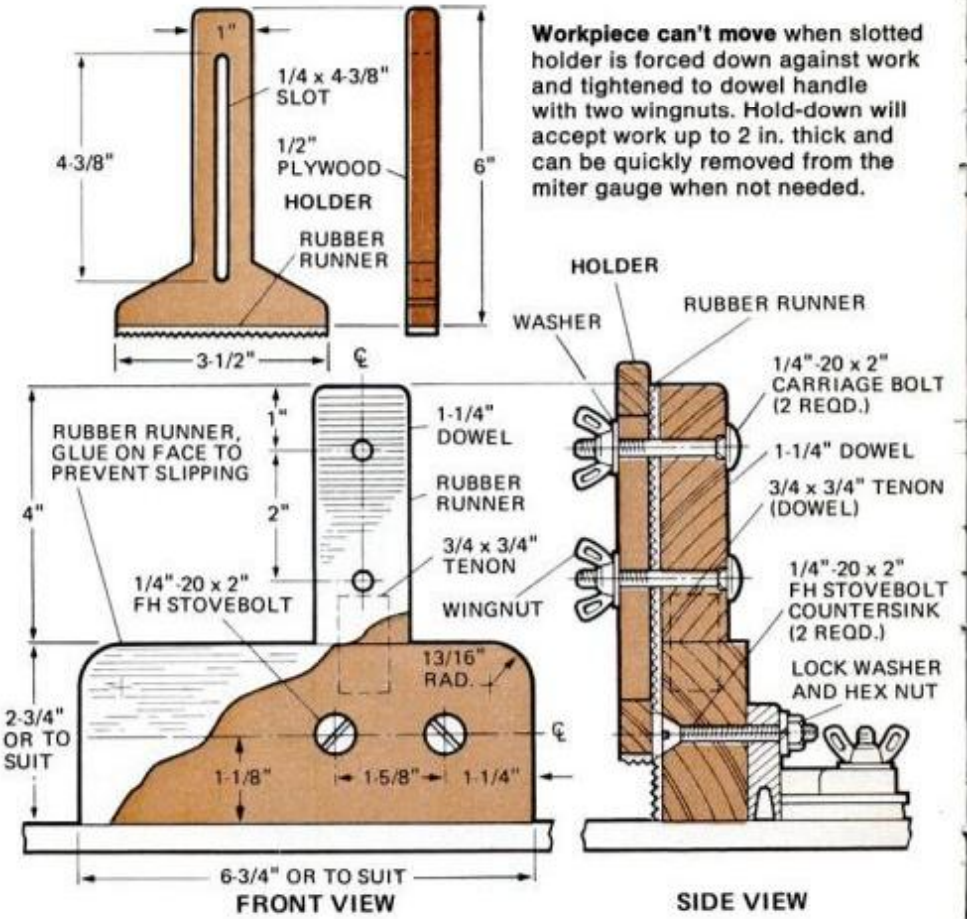
Miter-gauge hold-down with a supergrip





This saw aid grips with bulldog tenacity to prevent workpieces from creeping especially on angle cuts. At left, business side of hold-down; at right, how it is attached.



Workpiece can't move when slotted holder is forced down against work and tightened to dowel handle with two wingnuts. Hold-down will accept work up to 2 in. thick and can be quickly removed from the miter gauge when not needed.

When I spotted the supersafe pusher jig (page 188, Nov. '71) I quickly made one for my saw. The safety this clever ripping device has since afforded me inspired this equally safe jig for crosscutting with the miter gauge.

I made it from clear pine to suit my AMT miter gauge, although it can be made to suit other makes such as Rockwell's (above). I faced the front and the end of the slotted holder with pieces of rubber stair tread. Two stovebolts hold the hold-down securely to the gauge, yet allow it to be quickly removed when desired. What I like about it, besides the way it securely holds the work, is the handle which keeps my hand clear of the saw blade.—*John Bainbridge*

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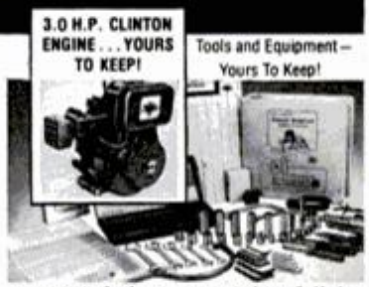

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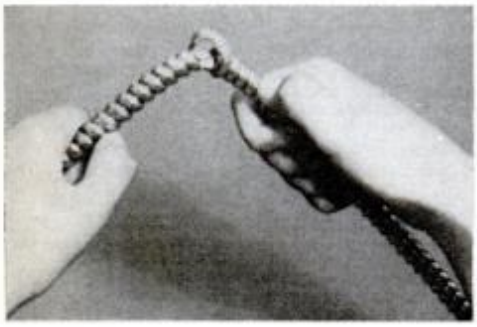
Cutting armored cable (BX)

Generally, flexible armored cable (commonly known as BX) is cut by holding the cable at an angle and slicing through the metal cover with a hacksaw. But there's always the possibility that you may cut a little too far and damage the insulation around the wiring inside.

My method is better. First, I break the cable with a quick, inward snap as shown below.



Next, I twist the armor, just as if I were wringing out a wet towel. This lifts a short section of the metal cover away from the wires so that it can be cut easily (below).

Then I clip the wires and twist off enough of the armor shield to expose at least 8 in. of wire for connections in an outlet or switch box. Finally, I snip off the unraveled armor and I'm all ready to hook up the wire.

—*Richard Braithwaite*

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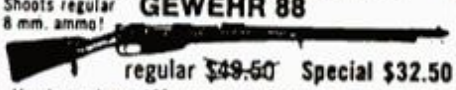

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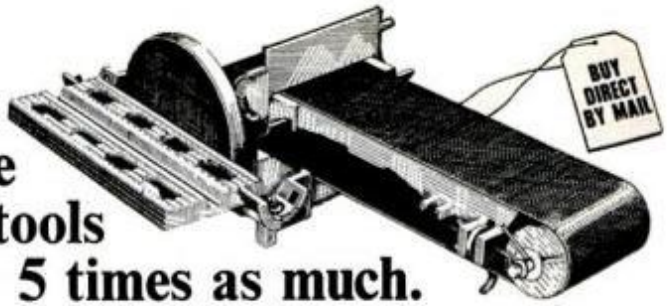

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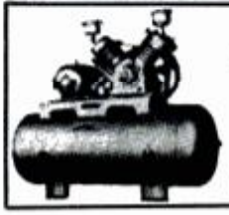

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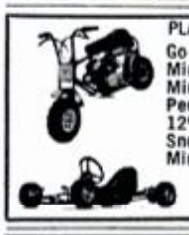

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In short, **Moneysworth** is a live wire sparking off hot information on the current money scene. It galvanizes readers all over the country into sending ardent letters like these:

• "The government has proven itself completely impotent in the fight against inflation. My only salvation comes from advice I find in **Moneysworth**. It save me as much as I lose through inflation."–*Theresa Ramseier; San Francisco.*

• "Your article on the 15% interest paid by Mexican banks has made it possible for me to retire in style." –*Eric T. Svenson; Fallbrook, Calif.*

• "Thanks to **Moneysworth**, I am $5,417 richer. I battled the Social Security Administration unsuccessfully for 18 months, then finally won out by following the advice of your article 'By All Means, Appeal'." –*S. Dominguez; Waterbury, Conn.*

• "Your article on air-fare 'triangular' routes was an astonisher. My wife and I saved $100 *each* on a trip to New York by stopping off at Las Vegas as you suggested."–*H. Kesselman; Los Angeles.*

• "Boys, you are not going to believe this, but I have parlayed $146 into *$90,000* thanks to your informative article on breaking into real estate."–*Horace T. Pinrose; Montgomery, Iowa.*

• "Your write-up on income averaging for tax purposes saved us $1,100 this year. We didn't realize retirees could do this."–*Mr. & Mrs. J.W. Long; Morro Bay, Calif.*

• "We salute **Moneysworth** for its excellent report on our free sex-counseling-by-telephone service. As a result of it, we've received calls from all 50 of the United States–including Hawaii and Alaska–and even a few from Europe and Africa." –*Community Sex Information; Boston; (617) 232-2335.*

• "Your recommendation that readers reduce orthodontic bills by having the work done at a university dental school saved me $1,350 on my daughter's teeth."–*Bob Walters; Oxon Hills, Md.*

• "Your tip on flying to Europe via Afghanistan saved me $450. You've made me a subscriber for life."–*Charles B. Fager, M.D.; Harrisburg, Pa.*

• "Your advice on Social Security resulted in a $3,135 lump-sum cash payment to my wife, and $171 monthly pension. The best investment I ever made was a subscription to **Moneysworth**."–*Dr. Herman W. Hortop; La Grange, Ill.*

• "As a result of your article on nonprofit, low-cost memorial associations, we have been receiving 400 inquiries *per day*. You'll get an inkling of the immense amount of money your subscribers have saved when you realize that *each* of our members saves well over $1,000 on a funeral."–*R.J. Stevens, President, Continental Association of Funeral and Memorial Societies; Chicago.*

• "Your tip about deducting the cost of transportation between my two teaching jobs saved me in taxes at least the cost of a ten-year subscription. Not only that, but your publication is lively, off-beat, a delight to read."–*Professor Reuben Garner; State University College; Brockport, N.Y.*

• "Thanks to your article 'How to Buy a New Car for $125 Over *Dealer's* Cost,' I just bought a Chevy at a saving that I estimate at $350." –*Ron Bromert; Anita, Iowa.*

• "Your article 'Inaccurate Billing by the Phone Company' led me to discover four years of overcharges. I got a $1,593 refund." –*Armand DiRienzo; Bristol, Pa.*

• "**Moneysworth**'s product ratings sure stretch the dollar. I bought the Canonet 35MM rangefinder camera you recommended, and saved 30%."–*R. Goodrich; Tucson, Ariz.*

• "Your article 'How to Fight a Traffic Ticket' saved me a $200 lawyer's fee *and* a ticket."–*W.R. Wendel; Hicksville, N.Y.*

• "Your article 'How to Avoid Paying an Exorbitant Doctor Bill' saved me $65."–*Carl Wagner; Yorktown Heights, N.Y.*

• "Your expose of charity rackets was a shocker. I've crossed several well-known organizations off my list, saving hundreds of dollars." –*Freida McMullin; Steilacoom, Wash.*

• "Your article on how to save $100 on a color TV worked. **Moneysworth** sure knows how to hold onto the green."–*P. Allen; Dir. Student Union; Henderson College; Arkadelphia, Ark.*

• "Your article on 'coupon refunding' got my husband and me hooked on the hobby. It saves us enough each year to pay for our vacation."–*Grace Ellen Feingold; Brooklyn, N.Y.*

• "By ordering cigarettes from Wilson, N.C., as **Moneysworth** suggests, I have cut my smoking expenses in half."–*R. Paniewski; Chi.*

• "Your suggestion that readers buy $200-deductible car insurance instead of the usual $50-deductible saved me *hundreds* of dollars. Insurance salesmen hate like hell to sell it because there's little profit in it for them, but it sure saves me money." –*Gary W. Goodwin; Sunland, Calif.*

• "For years I had always been the victim of greedy car mechanics till **Moneysworth** steered me to Jimmy's Service Station in Guttenberg, New Jersey. My old '66 Ford now runs much better than most new cars and the amount of money Jimmy has saved me–compared with estimates I've gotten from other mechanics–is *unreal*."–*Mrs. Dorothy Tyborski; Secaucus, N.J.*

• "You sure did us a good turn recommending Mayflower for our move from California to Minnesota. Would you believe the bill was a hundred bucks *under* the estimate?" –*D.J. Ganser; Owatonna, Minn.*

• "Upon **Moneysworth**'s advice, I asked the phone company for an itemized bill. As a result, I discovered that for years I had been paying for a nonexistent extra line. Result: A $550 refund. My trial subscription has paid for itself 110 times over!" –*George Petsche; Washington, D.C.*

• "Because of savings you just helped me make on a new car, I calculate that I can subscribe to **Moneysworth** for forty-six years and the subscription will be absolutely free. You're marvelous!"–*Mrs. J. Wilson; Philadelphia, Pa.*

• "**Moneysworth**'s investment news dispatches enabled me to make over $2,200 in less than a year. Yours is one of the most intelligent, down-to-earth, to-the-point periodicals I've ever read."–*Ruth Pantell; Yonkers, N.Y.*

• "Your article on TV game shows gave me confidence to try for 'The $10,000 Pyramid.' I won $850!"–*Ted Zammit; Franklin Square, N.Y.*

• "Your suggestion that I use a fake name in the phone directory, instead of paying $1 per month for an unlisted number, alone pays for my **Moneysworth** subscription several times over."–*C.B. Russel; N.Y.C.*

• "Your report that dentures cost only $40 at the Sexton-Shealy Dental Clinic of Florence, South Carolina, saved me *hundreds* of dollars. They fitted me up in 24 hours and I completed the entire procedure during a vacation to Florida." –*Mrs. H. Petruccio; Frackville, Pa.*

• "**Moneysworth** is aptly named. To paraphrase Churchill, 'Never have so many paid so little for so much'." –*D. Alpern; Pittsburgh, Pa.*

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