

AUGUST 1976 75 CENTS

**FUN WITH RADIO**

■ 9 new CB walkie-talkies

■ How to tune in spy broadcasts

# Popular Mechanics

## COMPLETE PLANS:

- PM's stylish greenhouse
- 2 stowaway picnic tables

**AT LAST:**  
Early warning against lightning strikes

25 high-spirited **MOPEDS** to pick from

10 easy shortcuts to make you a woodworking whiz!

New electronics head off

# MIDAIR DISASTER



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# The harder it is to replace your points and condenser,



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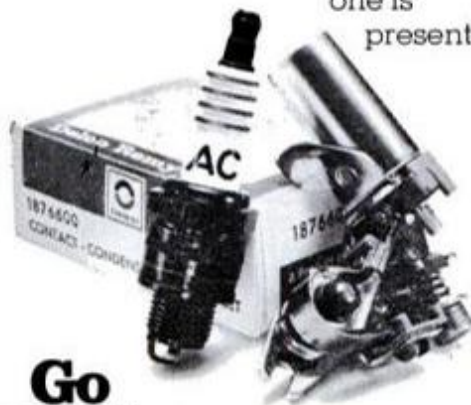
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**This One**



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AC DELCO DIVISION OF GENERAL MOTORS CORPORATION

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Ingenious new collision-avoidance systems are being developed to end the growing threat of midair disaster in crowded skies.  
*Illustration: Ed Valigursky*

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# Popular Mechanics®

AUGUST 1976 • Vol. 146 No. 2

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## SPECIAL FEATURES:

**New: Early Warning system for lightning.** It's being installed in many high-risk areas so that impending strikes can be anticipated. Page 49.

**Mopeds: Pedal home if you run out of gas!** PM's buyer's guide to the 25 models of motorized bicycles now available in the United States. Page 56.

**PM's greenhouse: An elegant home addition** that will work for you all year round. You can have roses blooming while snow is on the ground. Page 80.

**How to eavesdrop on cloak-and-dagger radio;** 67 frequencies used by spy stations, plus the complete radio spectrum and how to read it. Page 72.

**CB portables put ears in your hands.** Nine new walkie-talkies that will help you to keep in touch after you step out of your car. Page 86.

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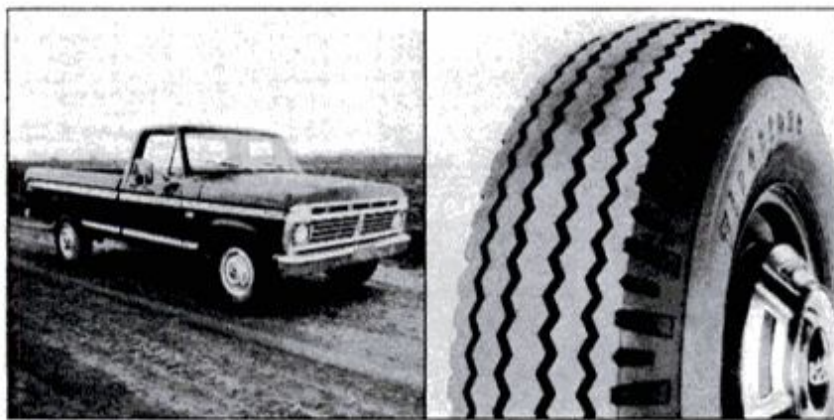
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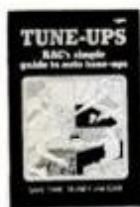
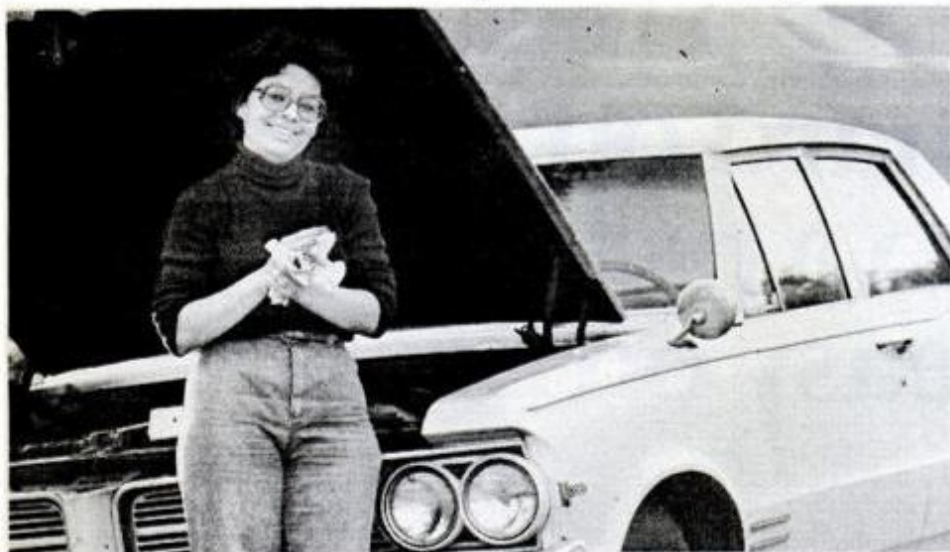
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It's true that you don't have to be a born mechanic to tune your own car. In fact, you don't even have to be born a *man*. All it takes is a strong desire to be liberated from the high cost of tune-ups!



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# LETTERS

## TO THE EDITOR

### Foiling CB thieves

I agree with Anthony R. Curtis's comparison of CB mounting locations (*How to Find the Best Spot for Your Car's CB*, page 88, May '76) with one main exception. He says that invisible locations in the glove compartment or under the seat are awkward and "not that theftproof, either." This is true, but he should have mentioned the new type of radio with volume, squelch, and channel selector in the mike. This type of radio can safely be mounted under the seat, with all the controls in the driver's hand.

As for theft prevention, I suggest buying a short length of coax with a PL-259 connector attached and leaving the plug on the center hump. Anyone looking into the car will think that the radio has been removed (even with the mike clip and antenna still present). If an extra mounting bracket were attached to the bottom of the dash, this trick may be even more easily believed.

ROBIN R. WISE  
ORLANDO, FLA.

### Commendation

I would like to commend John F. Pearson for his article, *A Roughneck's Best Friend is a Noisy Yellow Bird* (page 80, May '76).

The article describes one of our nation's largest helicopter operations with much professionalism and knowledge. All I can say is "a job well done."

HANK WISWELL  
SOUTH CAROLINA HELICOPTER ASSN.  
AIKEN, S.C.

### From a careful truckwatcher

I read your article *Truckwatcher's Guide to the Big Rigs* (page 76, April '76); I'm glad to see that I'm not the only one truckwatching.

Among your pictures of trucks was a Mack Crown 500. Mack doesn't make a Crown 500. Crown 500 is the make of the refrigerator unit on the reefer.

JOHN LYNFORD  
SUNDERLAND, MASS.

### Motorcycle intercom

J. C. Whitney may be smart to produce a motorcycle intercom (*Imports and Motorsports*, page 10,

June '76), but a one-way version was used in training pilots during World War I and was known as a gosport. I suffered with one during flight training in 1929, and it nearly drove me nuts. I hope the new type works better.

ALFRED STEVENS  
OLD LYME, CONN.

*The gosport was still used for pilot training during World War II, as two staff members recall. The louder the instructor shouted, the greater the blast of air in the cadet's ears—and the less he could understand. They, too, hope the new type works better.*

### Kudos for Car Care Guide

Being a woman, I had never purchased your magazine. But my boyfriend suggested I buy the May issue; he said there was a lot about car problems in it (*Car Care Guide*).

I've never seen anything as informative as that section. It even told me why my radio cuts out, and why my brakes squeal when I apply them. I have told all my girlfriends, my aunt, mother and any female I can think of who is interested in car problems, but doesn't know what to say when she enters the "mysterious realm" of a service station garage, about this issue.

Thank you for publishing it.  
KATHLEEN F. SMITH  
PITTSBURGH, PA.

With the extremely high price of auto repairs, your *Car Care Guide* helps a lot. Please keep this type of material coming.

HENRY C. LODS  
NEW ORLEANS, LA.

I've often doubted the cliché "They don't make 'em like they used to," but maybe that's not so far wrong after all. I own two high-mileage cars—a 1965 Olds 98 at 90,000 plus miles and a 1967 Cougar at 120,000 plus. I do all my own maintenance and, after reading about the "over 100,000" cars featured, I'll be expecting at least 200,000 on mine!

E. V. GUSTAVSON  
CASANOVA, VA.

My 1966 Ford Galaxie 500 had 149,000 miles on it when I sold it. It was running just as well as—if

not better than—the day I bought it with 62,000 miles on it.

The only regular maintenance that I followed was to change the oil every 2000 to 2500 miles. Every other oil change, I changed the oil filter, too. I think the thing that really helped most was adding a can of additive every oil change.

GENE CATLIN  
FREEVILLE, N.Y.

### Bicentennial kite wins

Thanks for your article on *High Flyers with the Spirit of '76* (page 98, March '76). It appeared just in time for my eight-year-old son, Mark, and I to build it for our Cub Scout kite fly. It was built to the exact dimensions in the article, though we changed the paint job a



bit. It flew very well and took "first place" in the pack for the "most original kite."

CLIFFORD KOCKS  
FORT WAYNE, IND.

### Tips for flying explorers

Your article *The Bahamas: Beachcombing Paradise for Flying Explorers* (page 248, May '76) was a treat. As a copilot in a Miami-based Coast Guard Search and Rescue helo, I'd like to pass on a few tips to prospective island hoppers.

The leading killer in ocean waters is loss of body heat—hypothermia. A life raft will separate you from much of the effects of hypothermia. And a search vessel or aircraft is 10 times more likely to spot a life raft than a person in a life vest.

Finally, my favorite trick for places without tie-down facilities is to carry a couple of burlap bags to fill with rocks and dirt.

JOHN B. MOORE, JR.  
OPA-LOCKA, FLA.

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\*Gross Vehicle Weight Rating

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X	X				
X		X	X		
X	X				
X	X				
X	X				
X	X				
				X	X



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At age 29, Jack Terry doesn't have it made yet. But he knows where he's going. And he's on his way.

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Jack Terry is one of our outstanding graduates. He's hard working. He's in a growing field. And he has good training.

Of course, we can't promise you'll be as successful as Jack Terry—no school can guarantee jobs or promotions for its graduates.

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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)*

# DETROIT LISTENING POST



## GM's pick-an-engine plan

When GM brings out an automobile powered by a new type of engine, the car will be offered in two engine versions: new or conventional. This is GM's solution to one of the problems automakers anticipate in marketing new powerplants.

Carmakers suffer a lot of flak for not moving more rapidly on alternate engines; for not being more daring and innovative. But they know from bitter experience that when something really new comes along, most people want someone else to sample it first. You take a bite and if it doesn't kill you, I'll try it. GM will use the either/or approach with two engines, two cars. One you know about is the diesel-powered Olds. Another is in the works for 1980-81. It will be a one-seat, two-person car with the Chevrolet nameplate, available with a four-cylinder piston engine or battery power.

## Newest new cars yet to come

The newest new cars for '77 won't appear until next year—as half-year models. GM is the only company that will have all of its '77s on the street in calendar '76.

Ford's little Lincoln, the 5700, is due in March, and Fiesta, the mini Ford is importing from Europe, may be out in April or earlier (see *Imports and Motorsports*, page 36).

Two luxury compacts Chrysler is working off the Volare/Aspen body won't go into production until 1977.

American Motors' Gremlin, virtually all new, will be out in the next few weeks. But the biggest mechanical change in the car won't come until after the first of the year. That's when Gremlin will switch from a six-cylinder engine to the four-cylinder the company is buying from Volkswagen.

## GM takes on CB thieves

GM has come up with a great idea for thwarting thieves who rip-off CB radios. If you have a CB set factory-installed on a '77 model GM car, the unit will be integrated with the car radio and use its speaker.

Smash-and-grabbers will still be able to steal your radio. But it won't be as simple as removing a couple

of brackets or screws. The thief will have to crawl under the dash head first and allow plenty of time to disconnect the equipment and then maneuver it out of the housing. If a crook has to go to all that trouble, he might as well steal the car. Or look for easier pickings.

## No big cars for AMC

How much longer can American Motors continue its commitment to mid-size and small cars to the exclusion of big cars? With the comeback of the big car during the '76 model year and a decline in sales of smaller cars, AMC took a pasting. Should the company throw in the towel and join the big shooters with the big cars or stay true to the little jobs?

That decision has been made and it's to stay with the compacts and minis. The advertising pitch will be changed—less emphasis on small car, greater on "big-car features without big-car bulk." But the cars will remain on the small side. This decision will dictate the size of two new products coming from AMC—a replacement for Hornet and either a mini-van or mini-pickup.

## T-bird: classic of the future?

Every guy who likes cars has this fantasy about buying a new automobile, hiding it away without driving it and then bringing it out in 5 or 10 years and selling it for a fortune. Or a variant of that dream—discovering a classic car in a farmer's barn and buying it for a song.

Well, gang, here's your chance to make the dream come true. If I had a spare \$8000 or so and a vandal-proof garage, I'd buy a '76 Thunderbird and put it away for at least 10 years. The '76 Bird will be just as much a last-of-the-breed car as the Cadillac Convertible. T-bird, like Chevrolet's Corvette, inspired a whole new wave of cars when those makes came out in the 1950s.

The Bird was for the guy who wanted something a little better and showier than a stock piece, but without the bulk and price of a Cadillac, Lincoln or Packard. T-Bird invented the idea of the personal luxury car. The car continues to enjoy something of that reputation today, although

the current version is much more of a fat-cat car than the original.

Ford is going after a much larger market for T-Bird with the '77 model. The '77 will still carry the Bird name, but it won't be the same car by a long shot. It won't have a separate body; it will be leaner, lighter, less of an eagle, more of a sparrow. I think in 10 or 12 years a '76 Bird will be just as much a museum piece as the original car is today. But who has \$8000 to put up on blocks for 10 years? Not me.

## Don't weaken your warranty

Here's something you should know in buying a car if you ask the dealer to make mechanical changes or to substitute parts or accessories other than original equipment. The car manufacturer does not have to stand behind the guarantee on any changes made by dealers. So if you have a problem, you fight it out with the dealer, not the car company.

GM even has a clause in its dealer contract requiring dealers to give the buyer a written statement that GM's warranty does not extend to anything added to or changed on the car after it leaves the factory.

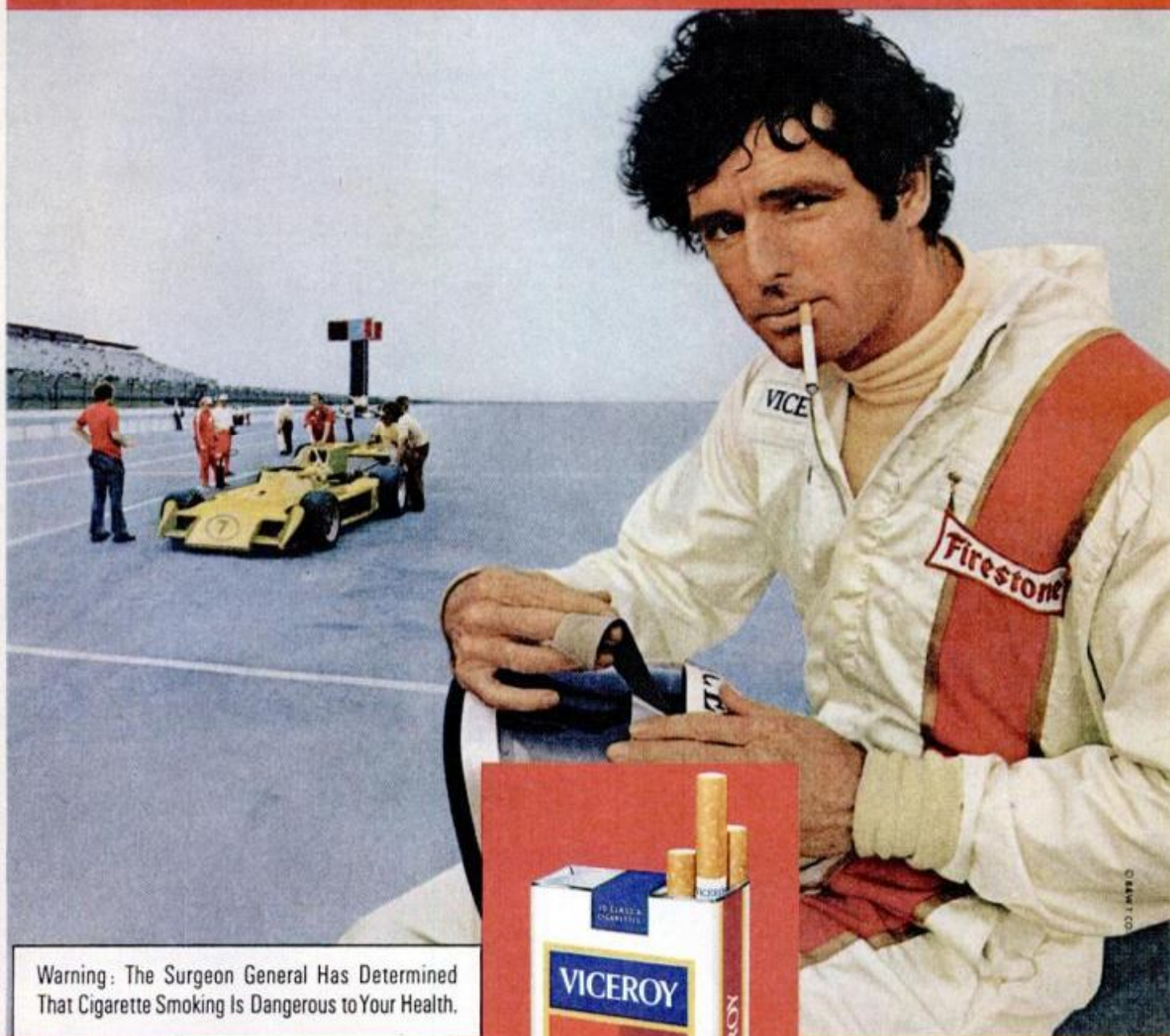
There's a big business today in making changes and conversions on vans and in converting small pickups to four-wheel drive. There have been warranty problems with some of these vehicles and the owners have been unable to collect from carmakers.

## Wrong forecast, right result

A year ago, just after the '76 cars came out, auto companies warned that the '77s would not give as good mileage. Reason: tougher government standards on controlling emissions. The prediction won't come true, but the companies were not shamming with their forecast.

If the new cars carried the same engines and same weight as the old cars, mileage would be down. But most '77s will weigh less than '76 counterparts and many will come with smaller engines. So something like 90 percent of the new cars should give better mileage. When it gets down to do or die, now or never, Detroit can still pull off some near miracles. ★★★

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smoke a boring cigarette.”



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

16 mg. "tar," 1.1 mg. nicotine,  
av. per cigarette. FTC Report Apr. '76

Viceroy. Where excitement is now a taste.

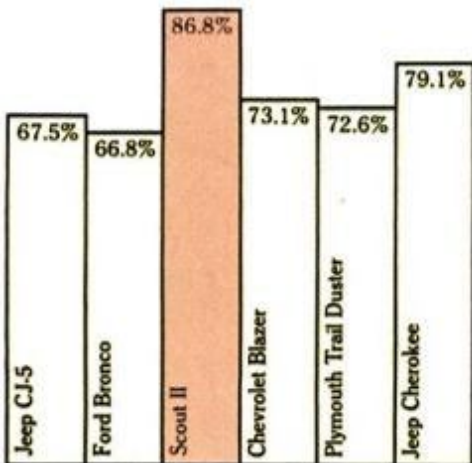
At the end of the week, it's  
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Scout II outperformed each of these vehicles in overall performance and engineering.

Built in the tradition of Scout® II, the machine that outperformed Blazer, Bronco, Cherokee, the CJ-5 and Trail Duster in Petersen Publications' big 4x4 competition last year. The only 4-wheeler rated excellent in 15 of the 17 engineering and performance categories.

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And Traveler is a tight maneuvering wonder. One hundred eighty-four compact inches bumper to bumper and 70 inches across, with a turning circle under 39 feet.

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It starts with the security of having 4-wheel drive when she needs it, sitting up high to see better, enjoying the passenger car comfort and ride, the easy handling, the super-wide doors. Options like air conditioning, automatic transmission and power steering, a big variety of color combinations and custom interiors.

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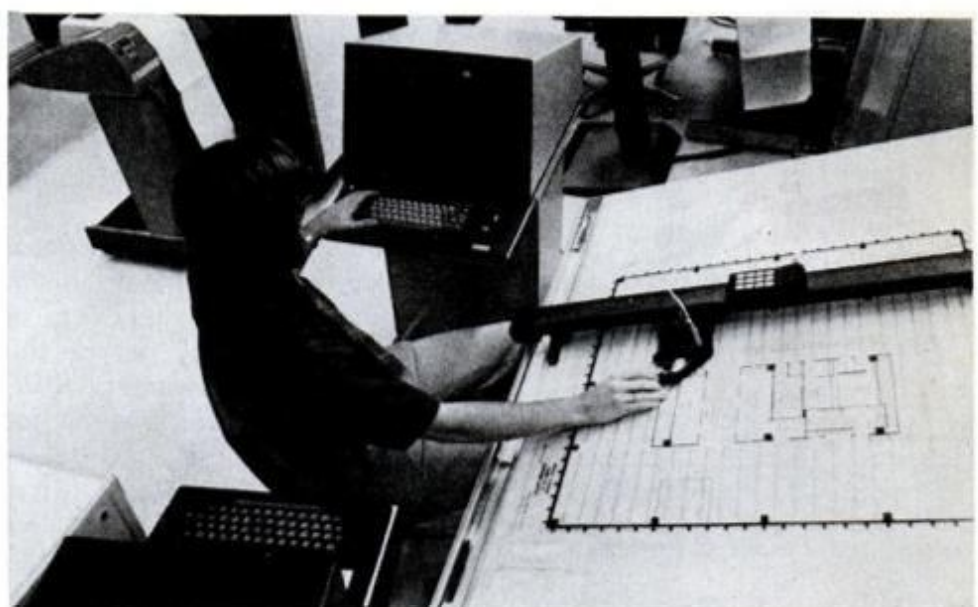
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BY JOHN F. PEARSON

# SCIENCE WORLDWIDE



## Let the computer draw it

By taking the drudgery out of drafting, a computer-driven system called Auto-Draft has tripled the output of the engineering graphics section of the Phillips Petroleum Co., Bartlesville, Okla. As shown in the photo, the draftsman uses a keyboard to give commands to a Varian mini-computer. The drawing appears on a video display unit and is stored in the computer's memory bank. Wet ink drawings are produced on a big flatbed plotter.

The system automatically handles tasks such as lettering, scaling, cross-hatching, erasing and dimensioning. The system permits the draftsman to automatically change scale or proportions, rotate images, make perspective drawings from projected views and repeat any often-used detail or symbol by calling it from the memory bank.

By hitting a few keys, the operator can, for example, draw symbols for 50 transistors on an electrical schematic—a time-consuming chore if done manually. The computer system does it in seconds.

## Edison wins top ranking

Thomas A. Edison, inventor of the electric light and the holder of more than 1300 patents, was recently named as the greatest of America's scientists, engineers and inventors in a Bicentennial survey conducted by

Chicago's Museum of Science and Industry. Benjamin Franklin placed second, ahead of Alexander Graham Bell, Luther Burbank (known for advances in plant hybridization) and the Wright Brothers, among others.

## Good news from the South

Contrary to some reports of worldwide cooling, a warming trend in the Southern Hemisphere may be more than offsetting the observed cooling in the high northern portions of the globe, according to scientists at the University of Arizona and University of Utah.

The scientists came to that reassuring conclusion after analyzing data gathered at 67 Southern Hemisphere stations, including 6 located in Antarctica.

## First film of active atoms

The first motion pictures of the actions of single atoms have been produced by two University of Chicago physicists, Albert V. Crewe and Michael Isaacson, according to university officials. Using a specially adapted scanning electron microscope, the scientists filmed uranium atoms placed on a bit of carbon only 50 angstroms thick (one-fifth of a millionth of an inch). The microscope achieves a magnification of 10 million diameters.

"We thought," says Prof. Crewe, *(Please turn to page 18)*



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lights, dwell/tachometers, accessories—as well as tachs and gauges, buy the No. 1 name in the industry. We don't believe in making anything but the best. We don't think you should settle for anything less. In the long run, it doesn't pay.



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**SCIENCE WORLDWIDE**

*(Continued from page 16)*

"that the atoms might just sit there, but they try to interact with the carbon and with each other, and they move around quite a lot."

"This peculiar activity shows up clearly in the film."

The film marks the first time that man has ever seen atoms—the tiny building blocks of matter—moving in their natural state. In time, this information may provide answers to various medical and chemical questions.

**All bull except for his heart**

He's a frisky six-month-old Holstein bull who makes his home at the Cleveland (Ohio) Clinic, a leading medical center. He eats well, is growing at a normal rate and exercises several times a day on a treadmill (as shown in the photo below). His state of health is remarkable considering that his heart is an artificial one that operates on an outside power source.

The heart has a new type of diaphragm (made by Goodyear) designed to be compatible with natural tissue. Unlike earlier types, the rubber diaphragm has a protein coating that is said to prevent the buildup of substances that could cause the device to fail.



At this writing, the Holstein has lived for 101 days with his experimental heart.

"This is certainly significant progress," says Dr. Yukihiko Nose, head of the Cleveland Clinic department of artificial organs. "But we still have to develop a fully self-contained artificial heart, and that's far off in the future." ★★

# There's good money to be made servicing audio systems and TV

Learn both at home for hundreds of dollars less than the next leading school.

With the boom of stereo and quadraphonic sound, the servicing of hi-fi equipment has become really big business. It's a business you can cash in on with NRI's Audio/Color TV Servicing Course. You'll learn to service all kinds of sound equipment and television sets at home, in your spare time, while building real professional equipment.

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# HOMEOWNERS' CLINIC

## Brass won't polish

*My home has brass switch and outlet plates. I don't know how old these are, but they won't polish bright even though I've tried several brass polishes. All have darkened in color, appear dingy. Is there some way of brightening them?—E. Rollins, Pontiac, Mich.*

Originally, the plates were coated with a metal lacquer which defies removal by most common metal polishes. This finish tends to darken, accounting for the dingy look. Remove the coating with a lacquer thinner. (Since the solvent is highly volatile and flammable, clean plates outdoors.) Then use your brass polish as directed.

## 'Drumming' heating unit

*Last winter my warm-air heater developed a peculiar "drumming" sound when the blower is running. Occasionally there's a sharp, rapid "ticking" noise that sounds like metal hitting metal, especially when the blower comes on. I've examined the blower and nothing seems wrong; the fan spins free at the touch. What's wrong?—Earl Trapp, Moline, Ill.*

From your description, it sounds as if the motor mounting is slightly loose. Thus, the running fan wobbles enough for the fan blades to contact the housing due to the torque developed when the motor starts. Tightening the mount and checking the duct system for loose supports should correct the defect.

## Too-tall antique

*I bought an antique having what I believe is called a broken-arch pediment top. At the center is a vase-shaped turning just 1 inch too long to fit under an 8-foot ceiling. I've tried to loosen this turning by twisting it gently and thrusting it sideways. No way. Cutting off part of the turning would ruin its symmetry. How can I preserve it intact?—E. Leonard, Utica, N.Y.*

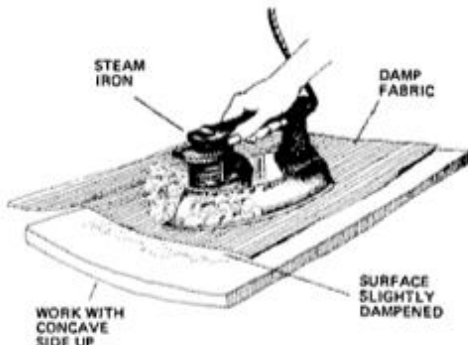
Old glues usually resist twisting or thrusting sidewise, but will often yield to a light tap. Try this, wrapping the turning with fabric to prevent denting. Tap lightly with a hammer. Vary the location of taps

and work from both back and front faces of the turning. If this doesn't work, wrap the lower portion of the turning with steaming hot "poultices" to soften the glue. I hesitate to suggest this step as it may whiten the finish, especially if it contains shellac. In some cases—but not always—the whitened finish can be restored with furniture polish.

## Uncupping thin boards

*I have two boards about 3/8 in. thick, 10 in. wide and 36 in. long which are old door panels. How can I remove the cup and flatten them?—Milton Conners, Perry, Iowa.*

I assume the panels are of solid stock, not plywood. Taking the cup out of thin stock is uncertain business at best, but I've had fair success with this method: Dampen the wood on the concave side, lay a damp cloth over the surface and go over



the cloth with a hot steam iron. Then place the board on a flat surface and weight it with a heavy object until thoroughly dry.

If this doesn't solve your problem you may have to sacrifice some thickness and have the boards run through a thickness planer to "flatten" them.

## Putting a table on its feet

*My dinette table has chrome legs and plastic tips on the ends. The tips are cracked and fall off when the table is moved. Where can I find replacements?—Anne Holston, Tampa, Fla.*

Contact the manufacturer (if the name appears on the table) or a local furniture dealer. If replacement pads are unavailable, use rubber crutch tips. These come in various fractional sizes up to 1 inch and are easily pressed onto the ends of the metal

legs. Measure the diameter of the legs to make sure you get the right-size tips.

## Buying rush seating

*In your Popular Mechanics Do-It-Yourself Encyclopedia, Vol. 3, page 458, you refer to rerushing material for repairing a cane chair seat. Where can I obtain this material?—Mrs. Joseph Bemann, Phoenix, Ariz.*

There are two types of rush seating: natural and the artificial or fiber kind. The latter is easier to handle and equally durable. Contact Albert Constantine & Son, 2050 Eastchester Rd., Bronx, N.Y. 10461. If you desire cane seating materials, contact Craftsman Wood Service, 2727 South Mary St., Chicago, Ill. 60608. (The latter supplies only the cane seating.)

## Painting old radiators

*I need to repaint old-style radiators. Some say aluminum paint should be used; others say enamel. Who's right? Should I remove old paint?—Frank Paine, Seattle, Wash.*

Any modern wall paint is fine; don't use aluminum paint or enamel. If the original coat is in poor condition, strip it to the metal with a wash-off chemical remover. Otherwise, clean off loose material with a wire brush before repainting.

## Lead-pipe solution

*I noticed a wet outside wall and found a leaking lead water pipe inside. I soldered the pipe with lead and added liquid solder around the joint. This held for a month, but the pipe is leaking again. Is there a cure?—Harry C. Cadorniga, Chicago.*

Get rid of the lead pipe. The cost of its replacement will be less than that of repairing the damage to the wall if the leaking is allowed to continue. ★★★

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

# *Treat yourself to light menthol Belair.*

*Now's the time for the  
light menthol cigarette.*

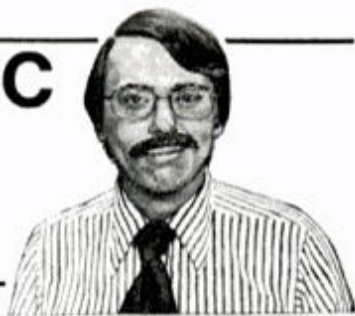


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# APPLIANCE CLINIC



QUESTIONS ANSWERED BY PAUL MANN

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### Fickle performance

*I own a 10-year-old Hamilton gas clothes dryer with automatic ignition. The dryer works fine for one, perhaps two loads, but not for a third. The clothes don't dry. The pilot light burns, but the main burner won't go on. There's no lint in the dryer or vent. What's wrong?—Mitchell Setlak, Omaha, Neb.*

The trouble could be one of several things:

■ A defective M404 safety switch. After a period of time, this switch tends to hang up.

"In 9 out of 10 cases of the type you describe, the M404 is at fault," says a service department spokesman for Public Service and Electric Co. in New Jersey. To determine whether the switch is causing your problem, bang the machine with your fist next time it fails to work. If the dryer comes on, the safety switch is to blame.

■ Dry rot. The solenoid coils are wound with string that may rot after a period of time, thus causing erratic operation. The coils—one for the pilot and one for the main burner—should be replaced.

■ Bad thermostat. To verify, make a continuity test with the machine under load.

### Command decision

*My five-year-old Hotpoint automatic washer (Model WLW2620LBCAV), has developed a high-pitched whine during the spin cycle. Otherwise, the washer works perfectly. A serviceman thinks the top bearing of the transmission is the culprit. Should I replace this now or wait until it gets worse?—Capt. Rafael A. Goyce, Langley AFB, Va.*

This machine is a tough one to diagnose when transmission or clutch trouble occurs. I said "clutch" advisedly because the noise may not be transmission bearing noise.

Normally, a bad bearing will rumble, rather than whine. Furthermore, the spin speed is usually reduced when a bearing begins to fail. Be cautious: You could incur a major expense for nothing.

A GE spokesman says, "Clutch problems are associated with this machine." It has been determined

that a faulty clutch usually whines.

If the bearing is indeed giving trouble and the machine is still under warranty (not older than five years), the company is obligated to replace the transmission, charging you only for service.

Assuming that the machine is out of warranty and the transmission bearing is causing the noise, then leaving it alone until it fails completely isn't going to cost any more. The repair price will be the same later as now, barring inflationary increases.

However, if the clutch is responsible for the noise, repair it now. Allowing a clutch failure to continue will only lead to greater damage, such as a gouged drum. Repair will become more costly as time goes on. The clutch in your machine is out of warranty.

Get more than one opinion before you proceed, making sure that one of them is offered by an authorized GE serviceman.

### Messy situation

*I own a food freezer that I purchased from W.T. Grant Co. The name inscribed on it is Bradford Products. The unit is still under warranty and is inoperative. As you know, the Grant Company has filed for bankruptcy and the store here is closed. I would appreciate your advice as to what should be done. One shouldn't have to discard a \$350 unit. —Mrs. Harry Androkavitz, Schenectady, N.Y.*

Predictably, with the country's second biggest bankruptcy in history, the situation is messy, but here is the latest information regarding the responsibility of the company to its former appliance customers.

You may be able to obtain parts for your freezer from one of the following two sources:

1. W.T. Grant Co., Parts Pool No. 9480, 8 Hixon Place, Maplewood, N.J. 07040. Phone: (201) 762-9485.

2. Franklin Manufacturing Co., 701 33rd Ave. North, St. Cloud, Minn. 56301. Phone: (612) 253-1212. The parts pool is still operating as I write this, but the Grant company hopes to sell it to a service

(Please turn to page 26)

What makes your car sag or droop? Heavy loads? Weak springs? Both? Monroe's Load-Leveler Stabilizing Units\* can give your car a real lift.

They're basically a Monroe heavy-duty shock absorber wrapped in a steel coil spring.

If you carry heavy loads, the shock and the spring work

together to keep your car on an even keel.

And if your car's springs are on the weak side, the extra springs are just the ticket—front and rear. They'll give your car extra support through the corners and the bumps.

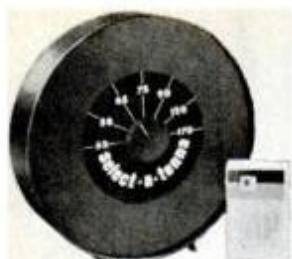
We're the people that invented Load-Leveler Stabilizing

Units. But inasmuch as Monroe's first in shocks, and has been for years, that should come as no big surprise.

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### APPLIANCE CLINIC

(Continued from page 24)

firm that will make the parts available. Franklin is the company that manufactured Bradford Products for Grant.

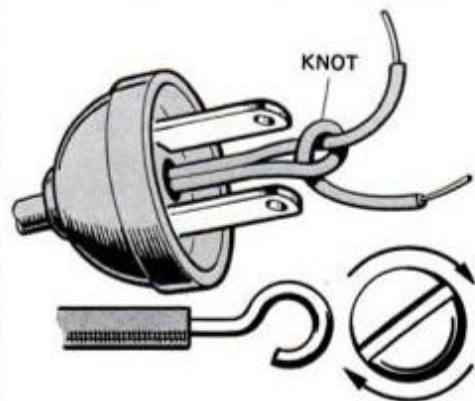
Regarding recovery of your cost, if your appliance is still under warranty, the situation gets a bit sticky. You will have to pay for parts and service. You can try to get restitution, but you'll have to file a claims form with the court. A Grant spokesman told me that customers may "possibly gain repayment, but there is no assurance."

The necessary claims form and any additional information can be obtained by writing to W.T. Grant Co. Bankrupt, 360 West 31st St., New York, N.Y. 10001, Attn: Proof of Claim. The telephone number is (212) 971-8400.

A company that services the Bradford products in your area is Hudson Mohawk Service, 1025 Hegenan, Schenectady, N.Y.

### Service tip

One of the most basic tasks in appliance and other electrical repair work is the replacement of bad plugs. Here's a trick that will relieve the strain on a line cord and hold the wires tightly



inside the plug. It is especially applicable to a zip cord.

Feed the ends of the wires through the hole in the plug and tie a knot in the two wires as shown, leaving about 1½ inches of wire free. Make the connections.

Be sure to attach the wires in a clockwise direction around the screw heads. Wires that are attached counterclockwise may work loose or they could be squeezed out from beneath the screw-heads when the latter are tightened. ★★★

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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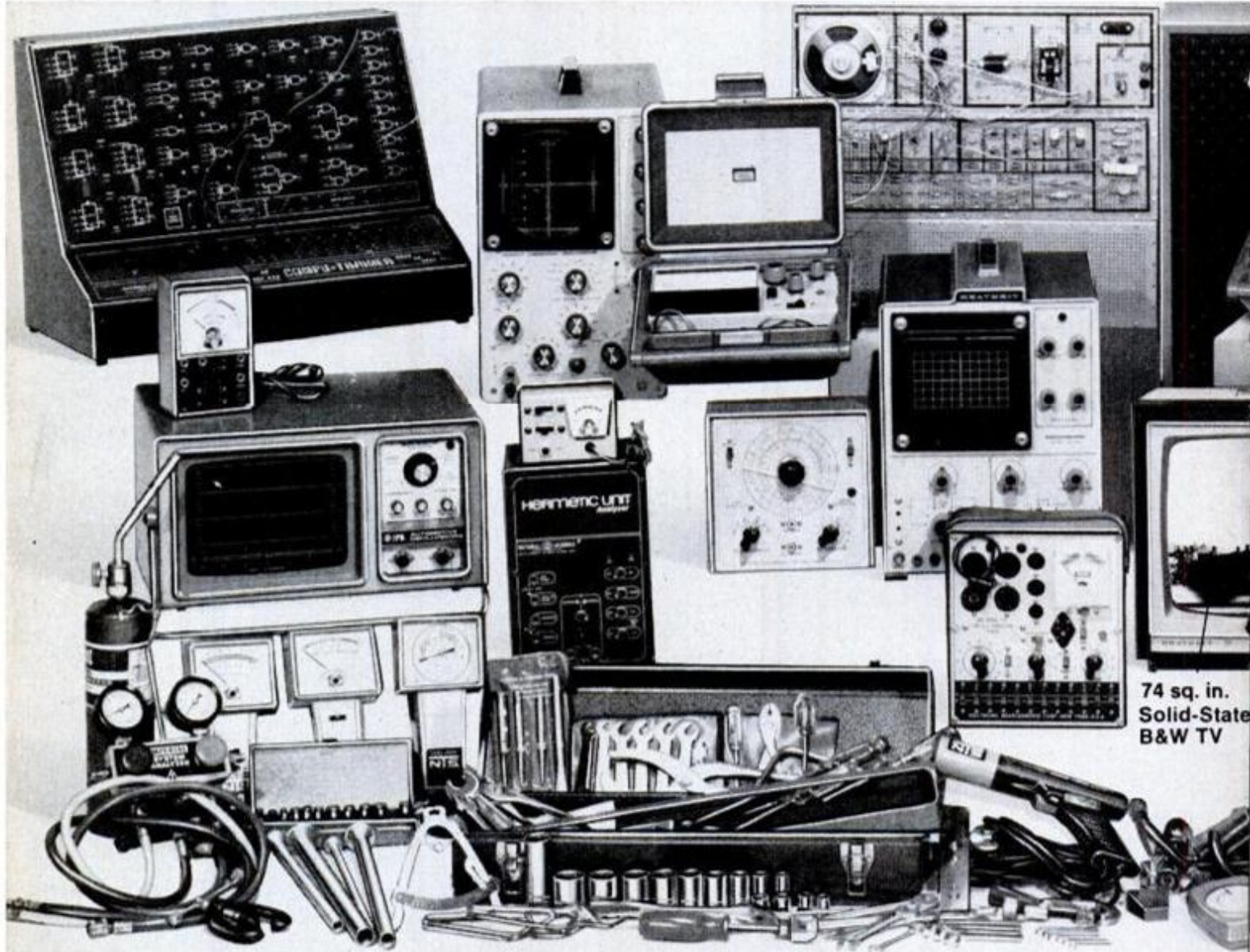
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# ALL OUTDOORS

WITH BILL McKEOWN



## Sounds of CB

Citizens band usually means two-way radio—sending and receiving—but we like the recent trend to producing CB receivers as pocket portables and add-ons so any car radio can pick up those 23 useful channels. They give outdoorsmen an ear on emergencies, highway problems and local weather comments. For \$40 or considerably less, you can tune in on what's going on, and though you can't transmit and call for help yourself, the reception on emergency channel 9 plus the trucker frequencies can be a bonus for any RV traveler. A CB receiver is an inexpensive aid.

Another refinement is the introduction of the quick-disconnect and camouflaged antenna. The latter looks like an ordinary car-radio antenna but handles CB as well without announcing that there is a set inside available for rip-off. Antenna Specialists Co., Cleveland, is among the makers of new disguised and quick-release models.

## Outdoor library

A *National Forest Guide* has been added to Rand McNally's growing rack of aids for sportsmen and travelers. As the new volume points out, our forests are regions of lesser-known campsites and hiking trails—areas often preferred by local residents who know where the best is. A study of this well-illustrated directory provides a bonus selection of woodland sites of special charm. It's \$4.95 at bookstores and camp shops.

Or to start your own forest, the Department of the Interior has prepared a booklet, *Let's Plant a Tree*, that is especially designed for young-

sters but useful for anyone. Sections cover plantings with seeds, seedlings and saplings and which trees to choose for city or country success. The booklet is available free from the Consumer Information Center, Box 278D, Pueblo, Colo. 81009.

The Bureau of Outdoor Recreation of the Department of the Interior offers a booklet, *Off-Road Vehicle Use on Federal Lands*. It gives good guidelines as to where your ORV will be welcome and where it won't, plus excellent tips for sources of detailed information and state-enacted legislation.

The Departments of Interior and Agriculture together have prepared *National Scenic and Recreational Trails*, a booklet available for 60 cents from the U.S. Government Printing Office in Washington, D.C. 20402. It covers 16 trails, from famous ones like the Pacific Crest, Lewis and Clark and Appalachian, to the North Country, Gold Rush, Natchez Trace and El Camino Real. It can be an introduction to thousands of miles by foot, car, bicycle, horseback or boat. One lifetime would probably not be long enough to see them all.

## Custom carvers

Several companies that produce replicas of classic muzzle-loaders in complete or kit form now are offering fine copies of great old-time knives as well. You can finish one as a collector's item or customize it to fit your own grip and specifications for field use. That frontier favorite, the Bowie, is available as a kit for \$30 postpaid (\$45 finished) from Classic Arms International, Ltd., 547 Merrick Rd., Lynbrook, N.Y. 11563. Max-

well Arms, Chicago, offers kits for a Kentucky Rifle Knife, a Bowie and a Skinner.

## Construction aids

Boats have been built from many materials, and two recent ones of interest are sawdust and C-Flex.

Ferro-Resin is the name given by the developer to a system which uses a hull form of wire mesh that's "plastered" with a mixture of polyester resin and sawdust. Substantial savings are reported, and since the mix forms satisfactory "cold joints," the work can be completed at any speed most convenient for the builder rather than rushing to apply the complete covering in one session. Swimming pools and dome-type enclosures are additional applications that have been considered by the developer. Information on the use of the system is available for \$5 a copy from William Hall Jr. & Associates, St. Leonard, Md. 20685.

C-Flex combines fiberglass cloth with long pencil-sized rods of glass that can make planking faster, easier and stronger for the home builder. To experiment with the system, one useful introduction is to build a small boat, and Glen-L Marine Designs, 9152 Rosecrans, Bellflower, Calif. 90706, has a new sailboat design available for C-Flex construction. The 11-foot sloop, Feather, is reported to be suitable for a home builder using the new material for the first time. Patterns, frame kit and supplies are available from the designer.

Used like fiberglass but said to be 30-percent lighter, stiffer, and have more impact resistance, a new Du Pont fiber called "Kevlar" has been introduced. Already used successfully in canoes and kayaks, it is now being employed in power and sail craft where lighter weight and increased strength are needed. Bass boats and offshore racing craft are now in production using the Kevlar 49 aramid fibers. Five times more strength per weight than steel is claimed.

## September 25th

National Hunting and Fishing Day, the outdoorsman's own event of recognition, comes on the last Saturday in September again this year. ★★



Convertibles may have had their day on the highway, but offroad and offshore they're still booming. Viking's V-19 Step-In adds a navy top and curtains to turn its Sport Deck into a cabin camper. Jeep Renegade riders can come in out of the rain as well.

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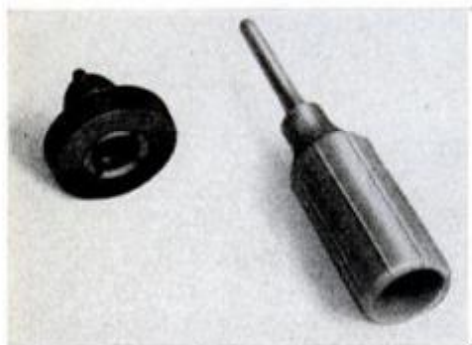
# THE PM GARAGE



## Quick-drain crankcase plug

Did I miss a design contest for a new type of crankcase drain plug? Or new techniques for draining engine oil? I've seen so many lately that I wonder what sparked all the activity. In May *PM Garage* we reported on a pump for your crankcase. Recently I saw a petcock type of crankcase plug—complete with cable control so you can dump your oil from the driver's seat! Now there's this "dripless, stripless" drain plug, or D/S plug as it's called by its maker.

The flexible plug inserts in your



crankcase in place of the conventional, threaded, metal drain plug. It's made of Hycar Nitrite rubber and is resistant to oil, acids and so on. To drain your crankcase you just insert the draining tool and let the oil run out.

It's simple, and my experiments found it indeed dripless. The plug and tool are \$3 and are available from L & J Products, Co., 448 Clearmeadow Dr., East Meadow, N.Y. 11554.—*B.H.*

## Poor pour spout



Here's a tool I can't recommend. It's an oil spout from Hollywood Accessories, and after about 20 cans of oil have been opened, the wear and tear

causes the rubber seal to split. At that time, the spout will start to leak.

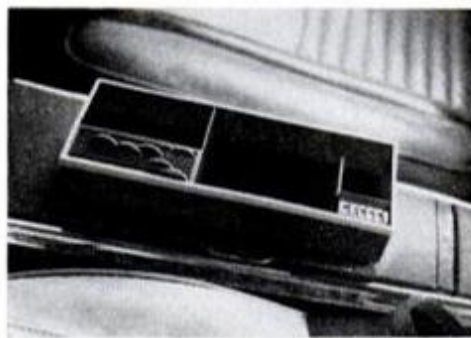
I've owned spouts galore, some costing as little as 19 cents and some as much as \$3. The cheap ones never seem to do the job. They leak from the very beginning. The \$3 jobs work and they never leak, but my problem is that I just keep losing spouts. I toss them out with my spent cans. So I'm forever buying more cheap spouts.

At \$1.69, this handsome, vinyl-clad, yellow spout looks like a good deal. The package promises no leaking and a sharp cutter. It is sharp, and at first it doesn't leak, but then it does.

This oil spout is available at most accessory stores or from the manufacturer, Orion Industries, Inc., Compton, Calif. 90220.—*M.L.*

## Dash or console tray

All that stuff that flops and slips all over the top of your dashboard—the comb, cigarets, loose change for tolls,



pencils and the like—now can have a home of their own. It's a tray with compartments built-in for toll change and the rest. Plus a built-in recording odometer that you can set when you tank up (your car) or change oil.

The tray will adhere either with magnets or stickum. It retails for \$2.49 and is distributed by the Allison Corp., Garwood, N.J. 07027.—*M.L.*

## Quick, inexpensive wire tap

Tapping into electrical wiring in a car usually makes for an un-neat junction. For example, say you want to tap trailer lights into your regular stop/turn/tail lamp wiring.



Ordinarily you'd scrape off the insulation somewhere in the trunk of your car, T-splice the trailer wire, and wrap everything in electrician's tape. While this gets the job done, it looks very unsightly and sometimes can be dangerous.

Along comes a little tap block from a Taiwanese manufacturer named Aris. All you do is lay your wires across the block and clamp the two halves together with a pair of pliers. Nothing to it. A small, slotted gate of galvanized metal cuts through insulation and makes a solid electrical connection.

Four of these taps are priced at 65 cents and they are available at most stores that sell car parts.—*M.L.*

## Lighter map light

You plug this map light directly into your cigaret-lighter socket. There's no wire and no switch. The light gives plenty of illumination, and it's reasonable enough in price (\$1.39).

Of course, as with all lighter-powered accessories, there's always



the question of where to keep the map light when it's not plugged in and where to put the lighter when it is. The light is available from Hollywood Accessories Div., Orion Industries, Inc., Compton, Calif. 90220.—*M.L.*

*The Shell Answer Man:  
"The more you know about motor oil,  
the easier it is to choose the one  
that's right for your car."*



## Try this Shell "Fact or Myth" Quiz

The right answers could save you some money on your next oil change

Which is fact and which is myth? If you don't know, you could be overspending when you change oil.

*Fact or Myth?*

**Motor oil must be changed when it looks dirty**

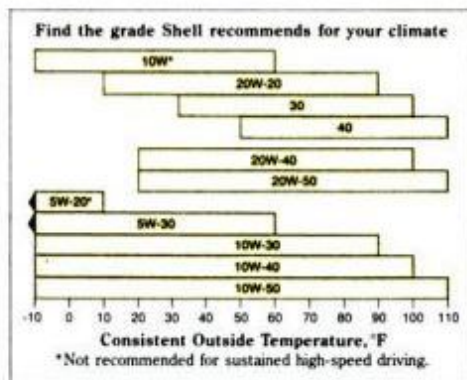
**Myth.** Just because your oil looks dirty doesn't mean it's dirty enough to require changing. High-detergent motor oils like Shell Super X® 10W-50 motor oil, Shell X-100® Multigrade and Shell X-100® can hold about a pound of engine dirt and contamination in suspension for draining at oil change time.

So don't rely on the appearance of the oil. Stick to the oil change schedule in your owner's manual. Don't change more often — or less often — than recommended there.

*Fact or Myth?*

**Motor oils made from Pennsylvania crude oil necessarily perform better**

**Myth.** Where oil comes from has very little to do with the quality of the finished product. The key things that make one motor oil better than another are how well it's refined and the additives that go into it. Those are the things that make Shell's high-detergent motor oils good enough to meet and exceed all U.S. car



makers' tough requirements. Look for Service Classification "SE" on the top of the can. It means the motor oil can meet your engine's requirements.

*Fact or Myth?*

**Viscosity grade is important in choosing the right motor oil**

**Fact.** Every can is marked with a viscosity grade number. If the number is low, the oil is thin, flows easily and can help engines start quickly on cold mornings. If the number is high, the oil is thicker and can help protect the engine as it gets hotter.

More than one grade is usable at a given temperature. But you can't always rely on a lightweight oil to stand up to severe driving and high engine

temperatures. A multigrade motor oil will often help solve this problem. The chart shows which grades Shell recommends for different climates.

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# IMPORTS AND MOTORSPORTS



## Ford Fiesta

The front-wheel-drive challenge to the Chevette has just gone into production in Germany. Several units of the European version of Ford's Fiesta have already been sneaked into FoMoCo grounds in Dearborn. The four-seat, three-door hatchback will look exactly as shown in these two views—our artist having "federalized" the car with such things as side marker lights, head restraints and 5-mph bumpers.



The car will go on sale in Europe next month, and Ford officials are still emphasizing that it won't be available here until 1977. Standard engine in the European version is an 1100-cc Four. Three versions—base, L and S are available in Europe. U.S. version will use 1600-cc Four. Base price of the Fiesta is expected to be close to \$3000, but you won't bring it home at that price after everything is added up. Options will be numerous—sun-roof, vinyl roof, wheel covers, side stripes and so on.

## Piston + rod

A swiss inventor, W. Salzman, heeding the exhortation to "simplify, simplify," has developed an engine in which the pistons are integral with



the connecting rods. The concept eliminates piston skirts and wrist pins, and has the advantage of fewer parts, light weight, reduced vibration and lower cranking loads on the starting system. Special rings are needed and the cylinder walls are arced. Intriguing.

## Renault 14



Another new front-wheel-drive model is in production in Europe—this one in France. The Renault 14 is built only as a five-door hatchback, so it doesn't compete directly with the Renault 5 which is available only as a three-door hatchback (see PM test, page 134, Jan. '76). The R14 is powered by a 1300-cc Four positioned transversely. There are no plans to bring it into the United States. The Renault that will be coming here next is the V6-engined R30, which will be its luxury model.

## Trick pickup



Would you believe it? This new accessory will make your mini pickup truck look like it's right out of the Grapes of Wrath. The Side Step Pick-up Bed Conversion kit fits short-bed LUVs, Couriers, Datsuns, Toyotas and Mazdas. The old-fashioned look is in, and for five or six hours of your time and \$395 you can have it. The conversion is a bolt-on type of accessory and attaches directly to

the stock bed mounting points. The bed and tailgate are cold-rolled steel with integrally welded, corrugated steel floor, and are finished in primer. Fenders and steps are reinforced fiberglass. It's from California Step Side Manufacturing, Inc., Box 60249, Sunnyvale, Calif. 94086. The company also has a \$2 catalog that shows other accessories like tonneau covers, flared fenders and so on.

## Missing: Maserati!

Our friends at Maserati Automobiles, Inc. (12615 Beatrice St., Los Angeles, Calif. 90066) were quick to point out that they are the sole importers for Maseratis in the United States, and that they were not in the list of imported car manufacturers in our May *Car Care Guide*. 'Twas an unforgivable oversight. I wonder if



they remember the smashing full-color spread and test we did on the Bora back in '72 (*In the World's Most Exciting Cars, the Engine's Breathing Down Your Neck!*, page 112, Oct. '72).

We tested the Bora just before it went on sale for \$25,000. Now it's \$30,900. But we've never even shown pictures of the other two cars Maserati sells here. That's the V8 Khamsin above (\$32,975) and mid-engine V6 Merak below (\$21,700). I hope all is forgiven. ★★★





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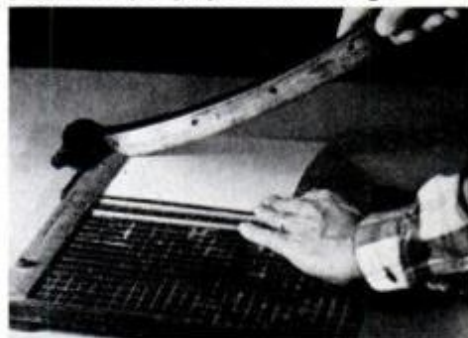
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## PHOTO HINTS

FROM READERS

### Tape helps paper trimming



Under dim safelight illumination, the markings on a paper trimmer become hard to read. Narrow strips of masking tape stuck to the cutter board at the most-used markings are easy to see and feel at low light levels, and they can be peeled off quickly whenever you wish.—Robert C. Barnes.

### Cellophane softens portraits



A really sharp portrait can sometimes show too many pores, pimples, lines and blemishes. But you can diffuse those blemishes away when you're printing.

Commercially made diffusers have been around for years, but it's a simple job to make your own. All it takes is a piece of wrinkled cellophane mounted on a wire loop and moved beneath the enlarger's lens for about 1/3 to 1/2 your total printing time. The more the cellophane is wrinkled and the longer it's under the lens, the more diffusion you'll get. Experiment to see how much you like.—Robert C. Barnes.

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# CAR CLINIC

BY MORT SCHULTZ



## Ball jointitis

*Why has my 1970 AMC Ambassador, which is lubricated every 1500 miles, needed eight ball joints in 55,000 miles? The top left has been replaced four times, the top right has been replaced three times and the bottom left has been replaced once. A qualified front-end shop has not found anything that would cause excessive wear. Please help.—Harry F. Kuli-gofski, Lutz, Fla.*

First, whoever greases your car may be using a high-pressure lubrication gun that is blowing seals. Dirt and water are getting inside joints, causing damage.

AMC recommends that ball joints be lubricated with a ball-joint lubrication gun, tool J-9670 (or equivalent), which delivers only six to eight pounds-per-square-inch of pressure. Only lithium-based grease should be used.

My second thought is that someone is assuming ball joints are worn when they aren't. Your mechanic may be basing his opinion on his experience with other makes.

The actual amount of play allowed by AMC depends on the tool used to measure play. If AMC gauge J-21240 is employed, the upper ball joints are tested under both load and no-load conditions. The difference in the two readings represents ball-joint clearance. Clearance in excess of 0.080 inch represents a worn ball joint.

If an ordinary dial indicator or wheel-runout gauge is used for testing, the allowable total travel is 0.160 inch or less.

The actual testing procedure is somewhat different from most. I suggest that next time you have ball joints tested you have it done by an AMC dealer, making sure that the mechanic does the job according to instructions in the service manual.

## Snake in the grass

*The power steering in my 1975 Ford Custom 500 "hisses" at me when I turn the wheel. The pump was replaced, and then the gearbox. The poor mechanic has called all over to try and get help. He says our only hope is for the factory to come out with a fix. Do you have any ideas?—Ted Fike, Fairport, N.Y.*

You've come to the right place. Tell your mechanic to go back in his tech-

nical service bulletin file and pull out No. 74 (8/23/74). He'll find that his hopes have been realized when he reads article 789, "Power Steering Diagnosis for 'Hiss Noise.'"

## Throwing away throw-outs

*Since I bought my 1972 Chevrolet 10 van from another party, I've had to replace the throw-out bearing twice at 3000-mile intervals. The former owner told me the dealer replaced the bearing once under the warranty. The vehicle is equipped with a 350-cu.-in. engine and three-speed manual transmission. What's the story?—Devin Richardson, Albuquerque, N.M.*

The two most common reasons for excessive throw-out bearing damage is riding the clutch and having the clutch adjusted too tightly, both of which I'm sure you considered. Then there's a third reason . . .

In the front of your transmission is a retainer through which the front pilot shaft extends. It's possible that constant working of the clutch back and forth has worn a ridge in this retainer. This ridge can be preventing full clutch movement, and the throw-out bearing is having excessive strain placed on it. Have the clutch taken down and this retainer examined. If it has a groove in it, replace it.

## Fussin' over fusin'

*My daughter's 1974 Vega Hatchback has been blowing taillight fuses for about seven months. A new fuse lasts a week to a couple of weeks. Taillights have never gone out while the car has been in operation. The dash lights, which are on the same circuit, attest to that. The problem shows up when lights are turned on before the car is driven. We've pulled every wire in the parking light, taillight and dash light circuit to try to find the reason. The fuse is a 20-amp. size and has been replaced with either a 20 or 30-amp. fuse. Can you give me some reason for the trouble?—H. D. Luton, Atlanta.*

There are reasons why fuses blow other than a fault in wiring. For example, the headlight or turn signal switch may be drawing excessive current when activated. This is indicated by the fact that the fuse in your Vega blows only when the headlight

switch is turned on. Another reason for fuses blowing is a bulb which may have been made improperly and/or isn't making good contact.

## Just the facts, man

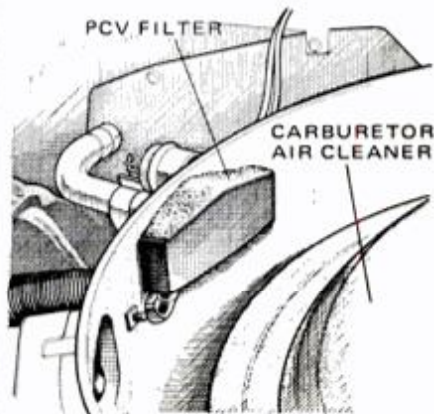
*My 1973 Oldsmobile Cutlass 350 four-barrel V8 overheated a few months ago, obviously affecting the fluid in the automatic transmission which has turned brown and smells burned. My mechanic changed the fluid and filter, but he removed only four quarts. He told me there's no way to get more out, and that fresh fluid mixing with fluid remaining in the transmission will be ruined. Is he right, and what do I do if he is?—Andrew Weinstein, Flushing, N.Y.*

I'll let you answer your own questions after I give you the facts. Your transmission has a 10-quart capacity, so six quarts of contaminated fluid has remained in the transmission. This fluid is being retained by the

*(Please turn to page 44)*

## Hidden and forgotten

**That's the only way to describe a positive crankcase ventilation filter. On many engines, this filter is located inside the air cleaner. Failure to replace a clogged filter leads to plugging up of the positive crankcase ventilation system. You should, therefore, inspect the filter every six months or 6000 miles and replace it if it's dirty. Normally, however, the filter shouldn't have to be replaced for 24 months or 24,000 miles unless you operate your car under dusty driving conditions.**



## CAR CLINIC

(Continued from page 43)

torque converter when you drain the transmission pan. There is no drain plug on the torque converter. The only way to fully drain the transmission, then, is to remove the converter. This is a big job that you don't want to do on a hunch. That's why I suggest you not be misled by dark fluid, which does not necessarily denote transmission trouble. If only the fluid has been contaminated, a fluid change is the only thing that's needed. I would install fresh fluid, run the engine sufficiently to get new and old fluid mixed together, and then drain fluid again. If the fluid is still dark, you still may not have a problem since dark-colored fluid is not always significant.

However, if fluid has been oxidized enough that internal surfaces of the transmission are covered with sludge, further action is needed. The transmission and converter should be drained, disassembled and cleaned. You and your mechanic should be able to tell if this has to be done by dropping the pan and looking for sludge in the fluid left in the pan and on transmission part surfaces. Good luck.

### Motorized teakettle

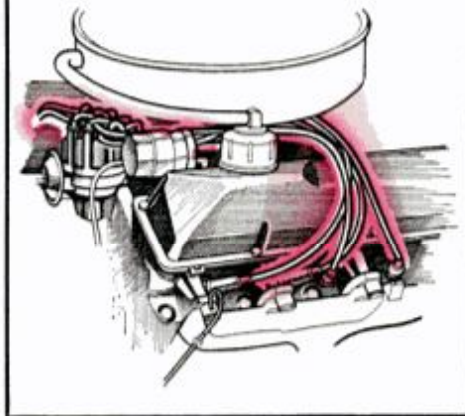
*My problem with a 1969 Pontiac Firebird Six is a loud whistle coming from the engine when decelerating. It happens when the engine is warm and continues until the engine is idling. I've replaced the carburetor, and checked water pump and exhaust. I hope you can steer me in the right direction, so I don't have to spend more money needlessly.—Edwin White, Auburn, N.H.*

I'd like to steer you right to the vacuum leak, but I'm afraid you will have to find that yourself. Let me give you a hand, though.

Fill an oil can with soapy water and spread it around each connection and joint on the intake manifold and carburetor with the engine idling. If there's a leak here, you will see the solution being drawn into the leaking area. There will probably also be a change in the way the engine idles. Once the leak is found, tighten down on connections and see what happens. One problem you may encounter is with the manifold mounting bolts. They may seem tight, but they may be too long. As the engine gets warm and metal expands, the bolts bottom out and allow a tiny opening to be pushed between manifold and carburetor. This creates a vacuum leak which produces a shrill whistle. If this seems to be happening, simply remove the bolts with the engine cold

### A light in the dark

How long has it been since you've given thought to your car's sparkplug wires? They are a major cause of ignition-related failures, such as hard starting and misfiring. Because wires frequently aren't considered, car owners have replaced an endless number of good sparkplugs, coils and distributor points to try to solve problems caused by faulty wiring. If wires are hard, brittle or cracked, replace them. You may be able to tell if wires are defective by starting the engine in the dark and looking beneath the hood. Bad wiring often glows in the dark, indicating leakage. It frequently makes a snapping sound as well.



and grind the ends down a bit. Make sure the bolts are retightened sufficiently.

Other causes for a vacuum leak and whistle are a damaged carburetor base gasket and faulty vacuum components and hoses, including vacuum-diaphragm air heater doors, air cleaners, and distributor vacuum advance.

### Milk—not honey

*My 1976 Dodge pickup with a slant-six engine has been driven 3000 miles. A white milky substance collects on the oil dipstick. The dealer has replaced the PCV valve, pressure-tested the cooling system, and changed oil and filter. The problem continues. The engine sounds okay, and I've been told not to worry. But I don't like pulling out the dipstick and seeing all this matter whether it's hurting the engine or not. I'm sure it's not helping.—Anthony Lamondo, Saratoga Springs, N.Y.*

As you've probably been informed, a white milky composition on an oil dipstick signifies the chemical reaction engine oil has when mixed with another fluid. In this case, the other fluid may be condensation or cooling-system coolant.



Have you lost coolant from the radiator? I would tend to say "no" since the pressure test indicated no problem. To be 100 percent sure, leave the pressure tester on the radiator overnight to see if there is a fall-off in pressure. There might be hairline damage to the head gasket that does not show up on the tester right away.

But I'll lay odds that your trouble is caused by a lot of short-run operation coupled with a PCV system not functioning as it should. This could result in a buildup of condensation that's mixing with oil. A defective PCV system would be instrumental in allowing this to happen. Changing the PCV is important, but it's only one phase. You should also clean the crankcase inlet air cleaner, the other instrumental part of the system.

Trace the PCV hose from the PCV valve, and you will find the inlet air cleaner. Take it from place, remove the hose, and wash it as thoroughly as you can in kerosene. Lubricate the filter inside the housing by inverting the air cleaner and filling it with SAE 30 engine oil, turning the part so excess oil drains through the vent nipple. Make sure that PCV hoses are in good shape—not cracked or clogged.

It's not good to have this condition continue. In time, it will lead to a buildup of sludge in the engine.

## SERVICE TIPS

■ For its part anyway, Ford Motor Co. has answered the question we are frequently asked: "How much oil consumption should be considered acceptable?" According to a graph it has provided us, from 0 to 50,000 miles, the acceptable oil consumption varies from one quart every 300 to 750 miles. When a car is new, acceptable consumption is a quart every 400 miles. It starts rising and reaches a peak of one quart every 750 miles at between 18,000 and 24,000 miles. Thereafter, oil consumption falls and reaches a low point of one quart every 300 miles at 50,000 miles.

■ Having hesitation and backfiring problems when you stomp down on the gas pedal of your 1976 Chrysler-built car equipped with a 400-cu.-in. engine and Holley 2245 carburetor? To stop it, have your dealership mechanic advance timing to 12° BTDC and readjust the power valve as outlined in service bulletin 14-09-76 (4/19/76). ★★

### 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.

# Famous projects from PM's Plans Library

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## ACTION



### PL-1407 Surf Sailer

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### PL-1270 Teenie Two

Daughter of Jeanies Teenie and slicker than Mom, Teenie Two is the second generation of PM's most successful VW powered monoplane. The rage of the homebuilts, if you listen real hard you'll hear her say "Come on and fly me." \$35.00



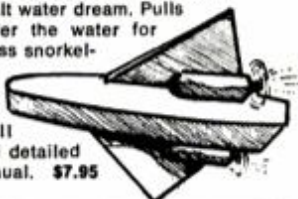
### PL-1406 Boonie Bug

Starting with a junked VW bus chassis, you add some work and love and presto! A smooth riding enclosed van with ATV capabilities plus sleeping and camping facilities. Show-stopping looks too! Truly a child of the 70's. \$14.95



### PL-1405 Scuba-Tow

A motorcycle battery powers this streamlined fresh or salt water dream. Pulls you on or under the water for hours of effortless snorkeling or scuba diving. Rugged and dependable. Big, full scale plans and detailed instruction manual. \$7.95



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### PL-1276 Quiet as a U-2!

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### PL-1272 Challenge of a lifetime!

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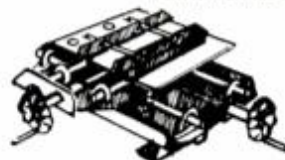
### PL-1401 Drill Press

"For pure pride of accomplishment, few things match the feeling you get when using a good tool that you built yourself." Dick Cutler should know. He designed this gem of a tool which you can build for about \$70. All parts are obtainable from hardware and hobby shops. \$6.95



### PL-1402 Milling Table

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### PL-1301 The Southern

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### PL-1300 The Storybook

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BY EUGENE A. SLOANE

## THE BICYCLE SHOP



### Soapy chainwheels

*An old bicycle mechanic told me bar soap is the best chain lubricant. Is this so and will it harm my aluminum chainwheels?—Bernie Reed, Altoona, Wis.*

Bar soap won't harm the chainwheels by itself, but it would take only one ride in the rain to wash the soap right out of the chain, leaving you with no chain lubrication. I can see you now, in the rain, leaving a wake of soap bubbles . . . Well, seriously, without lubricant the chainwheels and chain will wear a lot faster. Soap may be cheaper than lubricant initially, but it's expensive in the long run. I'd stick to Chainlube in a spray can, formulated specially for chains.

### Solid to quick-release hubs

*Can I convert my screw-on hubs to quick-release ones? If so, how?—Tim Quigley, Massapequa, N.Y.*

Since the bolt-on hubs have a solid axle and the quick-release hubs use a hollow axle, you would have to change axles and also buy a quick-release skewer. I'd also buy new cone and locknuts and spacing washers to fit the new axles, if the hubs don't come with them. Figure about \$5.80 for a pair of skewers and \$2 for each hollow axle. If your bike shop can't supply them, try a good mail-order bike supply firm, such as Wares Cycles, 2656 North 76th St., Milwaukee, Wis. 53213. Its catalog costs \$3.

### Wheels deserve a good lacing

*I've been lacing my wheels four-cross rear and three-cross front. Is this the most efficient pattern for my 145-pound weight plus up to 40 pounds of baggage on tours? Tires are wired-on. Also I understand some rims use washers under spoke nipples, others do not need them. Why?—T.L. Tisdale, Monroe, La.*

Standard European spoke lacing pattern is three-cross. This gives less wheel deflection, a harder ride, saves some weight because spokes are shorter. I prefer four-cross pattern for touring because it gives a bit more wheel deflection, hence more shock absorption. Four-cross is especially important for comfortable touring with high-flange hubs that

come on most 10-speed bikes. I prefer low-flange hubs because spokes are longer, and again I cross spokes four over. Lightweight tubular tire rims with no reinforcing ferrules on spoke holes need concave washers so spoke nipples don't pull through the thin aluminum rim. If you see ferrules, you don't need washers.

### How to match legs and frame

*In your book The New Complete Book of Bicycling you say there should be an inch clearance between crotch and frame top tube when straddling that tube in stocking feet. Even with a frame that comes almost up to my crotch, I cannot adjust the saddle and stem properly. With saddle at the right height, there's less than 2 inches of seat post in the seat tube. If the stem is parallel to the saddle, only 1½ inches of stem is in the head tube, above its split skirt. How can a bike frame be almost too big for me and yet not permit raising the saddle and stem the right height?—Daniel Fried, University Heights, Ohio.*

First, the frame is a bit too big for you. You need more clearance between top tube and you. Short of changing to a smaller frame, just be careful not to make sudden stops so you do not come down hard on the top tube. If the frame is a bit big, you should not have to raise the saddle or stem much.

There's no accounting for the infinite variations in human body dimensions, so frame size is only one solution. You should buy a longer seat post because you need 2½ inches of post inside the seat tube for safety. As for a stem, you must have 2½ inches of stem above the skirt split inside the head tube; otherwise the stem could break as you strain uphill, and you could have a nasty fall. You can't buy a deeper stem; they are standard at around 5 to 5½ inches. You can get by with stem top 1 to 2 inches below seat height. ★★

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



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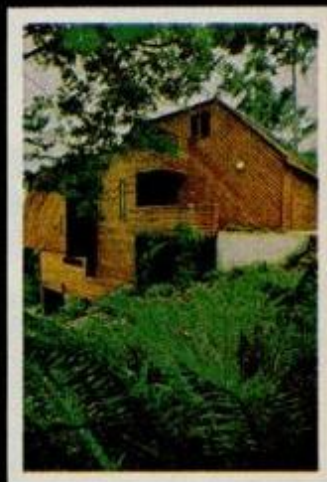
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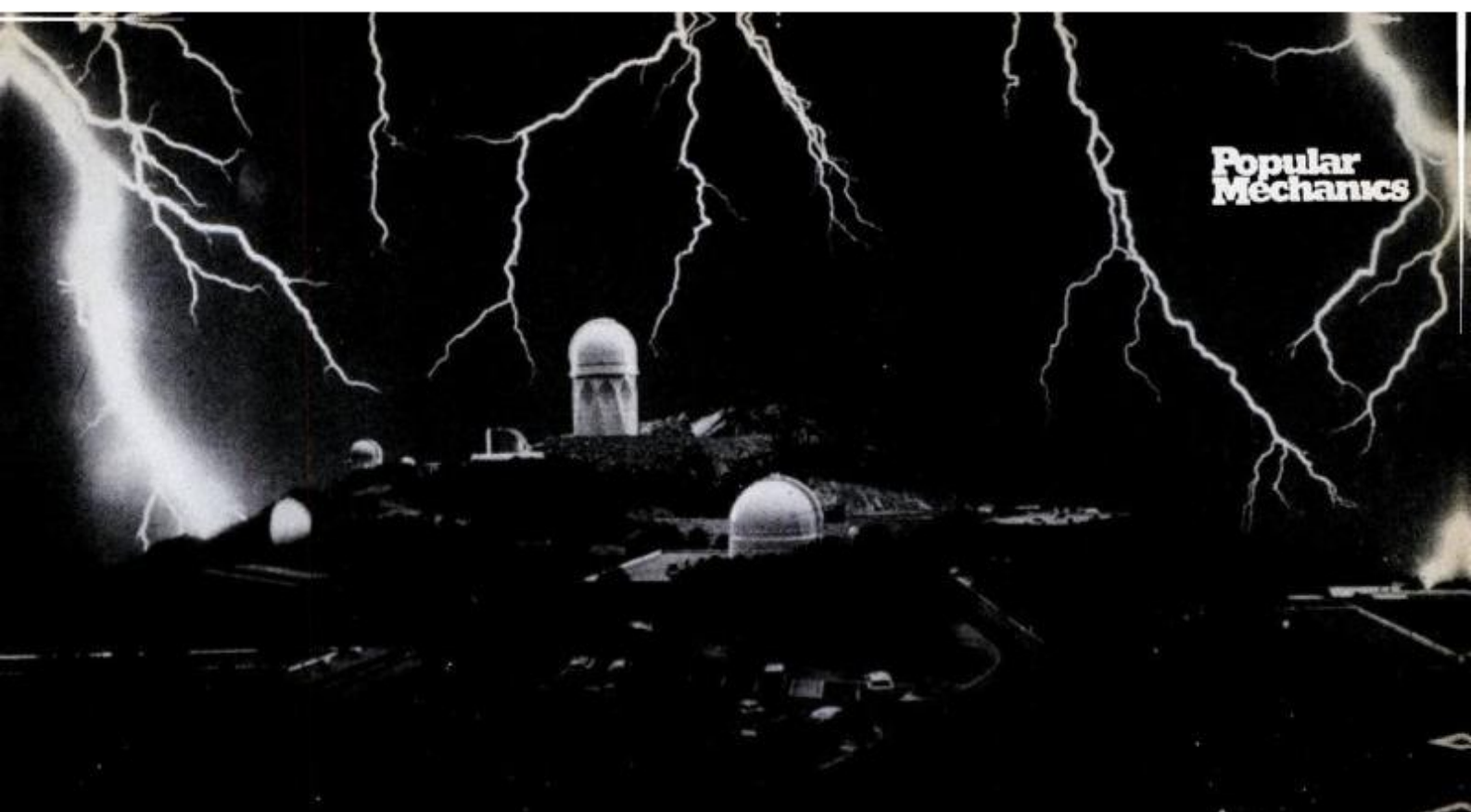


# I didn't always smoke Winston Longs.

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18 mg. "tar", 1.2 mg. nicotine av. per cigarette, FTC Report APR. '76.



**"H**e stood there as if struck by lightning." This old saw for describing total surprise is wrong on two counts. First, nobody struck by lightning remains standing. Second, lightning no longer strikes unexpectedly—at least not when you're using the new lightning-prediction equipment now being installed in many high-risk areas.

"We are no longer helpless against the threat of lightning," says Chester D. Slocum, president of Electrofields, Inc., of Miami, Fla. "Now for the first time we can anticipate a strike."

As inventor of the Thor Guard Warning System, Slocum has come up with the wholly new concept of a lightning predictor. His device works on the principle that lightning, contrary to popular belief, is not really sudden. It takes time to build up the electric field in the atmosphere that is finally discharged by the lightning bolt. The Thor Guard uses sensors perched on poles to monitor the electric potential between air and ground. These probes register electrical disturbances in the atmosphere from as far as 50 miles away and feed their data to a computer which analyzes the pattern and magnitude of electrical change.

The computer is programmed to issue three types of warnings: a "yellow alert" to indicate that a storm may move into the monitored area within half an hour; an "amber alert"

# Now: Early warning system for lightning

by Hans Fantel

to signal that lightning may strike within minutes (the actual time factor of the warning being adjustable within the computer program); and a "red alert" signaling imminent danger.

Obviously, such equipment provides only indirect protection: It gives you a chance to get out of the way. But in high-risk locations, this can be a real lifesaver.

Last October, for example, a bolt of lightning out of an almost clear

**The awesome display of aerial fireworks shown above was taken at Arizona's Kitt Peak Observatory—by far the best of 100 shots made on a stormy summer's night by photographer Gary Ladd. He used a tripod-mounted Nikkormat, placed 2100 feet from the telescope in center of the photo, and a 28-mm lens with skylight filter. Exposure was about a minute, according to Ladd, "and my luck was absolutely incredible."**

sky struck the football field of Columbus High School, just south of Miami, killing the local team's left cornerback and injuring 17 other athletes. The school has since installed a Thor Guard to prevent future tragedies of this sort.

In a similar incident, star golfer Lee Trevino barely survived when he and two other professional players were struck last year during the Western Open in Oak Brook, Ill. Like the football field, the golf course presented a high-risk area—a flat expanse in which the players formed living lightning rods, attracting the electric discharge.

Much the same pattern prevails at airports, where the high tails of planes parked on the runways make natural targets for lightning. While the planes with their metal skins are not particularly vulnerable, maintenance workers have been killed on several occasions by forming an electrical path between the struck fuselage and the ground. For this reason, many airports are now installing Thor Guard to warn of impending strikes.

With an estimated 150 to 300 people killed by lightning each year in the United States alone, an annual \$30-million damage to property and some 10,000 forest fires caused by lightning, research on thunderstorms has lately been given high priority by the National Oceanic and Atmospheric Administration.

As the most dramatic of ordinary



1



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natural events, lightning has fascinated and puzzled mankind since its earliest days. To the ancient Greeks and Romans, lightning was the weapon wielded by angry gods, and the Middle Ages blamed lightning on sky-riding demons. It was not until the time of the American Revolution that Benjamin Franklin's famous kite finally provided the key to the true nature of the lightning bolt.



3

In Franklin's day, scientists had just begun to explore electricity, which they produced by rubbing glass plates with leather. What Franklin proved with his metal-edged kite—at the risk of getting barbecued—was that lightning resembled the sparks that had been electrostatically generated in the laboratories of that time. He theorized correctly that thunderclouds and the earth contained opposite electric charges and that lightning "jumped the gap" to equalize these charges.

Knowing also that sharp metal points concentrate an electric potential and discharge it into the surrounding air, Franklin then invented the lightning rod, the first electrical device for practical use. By charging the surrounding air with ground potential, the lightning rod literally draws the thunderbolt into a presumably safe path to the ground, thus preventing damage to the building.

Little was added to our knowledge

of lightning until more systematic investigations got under way within the last two decades. We know that most lightning is "incubated" within towering thunderhead clouds, technically called cumulonimbus, which grow up to six miles tall. Just how the electric charge builds up in this cloud is still something of a puzzle. It has to do with the fact that—due to cosmic rays charging the higher atmospheric layers—the earth is 300,000 volts negative relative to the ionosphere. Consequently, electrons constantly get pulled out of the ground to zoom up into the sky, and the thunderclouds get caught in this high-powered electrical traffic.

Picking up charges from the electrons streaming upward between earth and ionosphere, ice crystals and water droplets in the clouds become electrically polarized by a process not yet fully understood. The base of the cloud is usually



4

negative (having absorbed all those electrons) so that the earth becomes positive in relation to the cloud bottom. The positive ground charge follows the cloud like a shadow on the surface of the earth, growing stronger as the charge in the cloud increases.

#### Step leaders start path

The ground charge creeps into tall structures, such as steeples, trees and roof gables, literally reaching for the cloud. But the air between cloud and ground is a poor conductor, and a very high charge—as much as 100 million volts—must be built up before the lightning stroke can break through the insulating air.

Contrary to appearances, lightning

# The short, violent cycle of a stroke of lightning

A thunderstorm induces a growing positive charge in the earth, and the electrical potential between cloud and ground increases (1) until lightning pilot leader (2) shoots down from cloud to create first portion of stroke path. Surges of current called step leaders (3) follow, moving the conductive path of electrified (ionized) particles close to the ground. Discharge streamers from the ground intercept the step leaders (4) to complete the conductive channel between ground and cloud. A return stroke from ground leaps upward, illuminating the branches of the descending leader track (5). When return stroke has ended, dart leaders from the cloud initiate secondary returns (6, 7) until the opposing charges are dissipated or the ionized path is broken up by air movement (8). Elapsed time: about one second.



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5



Adapted from *Lightning*, a National Oceanic and Atmospheric Administration publication.

is not a simple flash but a complex series of events. A typical cloud-to-ground stroke starts with a series of so-called step leaders—preliminary surges of electricity, not yet luminous, tentatively reaching downward like invisible fingers from the sky. For about 0.002 second, these electric surges may shuttle back and forth, never quite reaching the ground, until they establish a well-ionized conductive path through the air.

At the same time, the ground charge gropes upward, trying to meet the step leaders from above. As they make contact, the ground charge leaps into the cloud and the sky lights up as the surrounding air molecules are heated to blazing incandescence.

This visible phase of lightning is called the "return stroke" because it actually travels skyward from the ground. Our impression that it comes from the sky is an illusion caused by the fact that the stroke follows the downward-pointing path established by the initial step leaders. The luminous stroke usually consists of several separate gushes of electrons and ions, and the duration of the lightning depends on the number of these surges.

A typical single bolt has about four surges and lasts about 0.2 second, while the longest recorded flash lasted 2 seconds and consisted of 26 separate surges. The thunder following the stroke stems from the violent pressure changes in the air as it virtually explodes around the pipe-thin, superhot lightning channel.

### Startling research data

Much of this information has been developed quite recently, mainly by Professors Richard Orville and Ber-

nard Vonnegut at the State University of New York in Albany. Using high-speed photography and sophisticated instruments to measure optical spectra and electromagnetic fields, they explored the physics of lightning and developed some astonishing data:

Lightning bolts range anywhere from 1000 feet to 100 miles in length, with the most common type about one mile long. The energy content of a typical lightning stroke is about 400 million hp. Lightning bolts striking the earth each day generate a total of 3456 trillion hp—enough energy to lift, to a height of 100 feet, a weight equal to 200,000 big aircraft carriers. The return stroke—the visible part of lightning—travels at 61,000 miles per second and has a temperature



Lightning sensor is "tuned" by Chester D. Slocum, developer of Thor Guard System.

### DOs and DON'Ts during a storm

1. Stay indoors if you can, but keep away from open doors and windows. Also stay way from fireplaces, radiators, metal pipes, sinks and stoves—all natural lightning conductors.

2. Taking a bath or shower during a storm invites electrocution.

3. Don't use plug-in appliances. Power lines may carry lightning surges. Circuit breakers may fail.

4. Don't phone. Lightning might strike telephone lines.

5. Put down your fishing rod or golf clubs. Take off metal-cleated shoes. Keep your feet together. If they are apart, current from a nearby strike may flow up one leg and down the other because the wet inside of your body offers less resistance than the ground between your feet.

6. If driving, stay in your car. The safest place is inside a shielding metal structure.

7. Get off your tractor or riding mower. Metal implements in contact with the ground invite a strike.

8. If swimming, get out of the water. If in a small boat, head for shore.

9. Never seek shelter under an isolated tree. Keep away from such trees—at a distance at least twice the tree's height. Your best protection is in a ditch or other low-lying area.

10. If you feel your skin tingle or your hair stand on end, lightning is about to strike near you. Drop to the ground at once. Better wet than dead.

of 50,000 °F., five times hotter than the sun's surface.

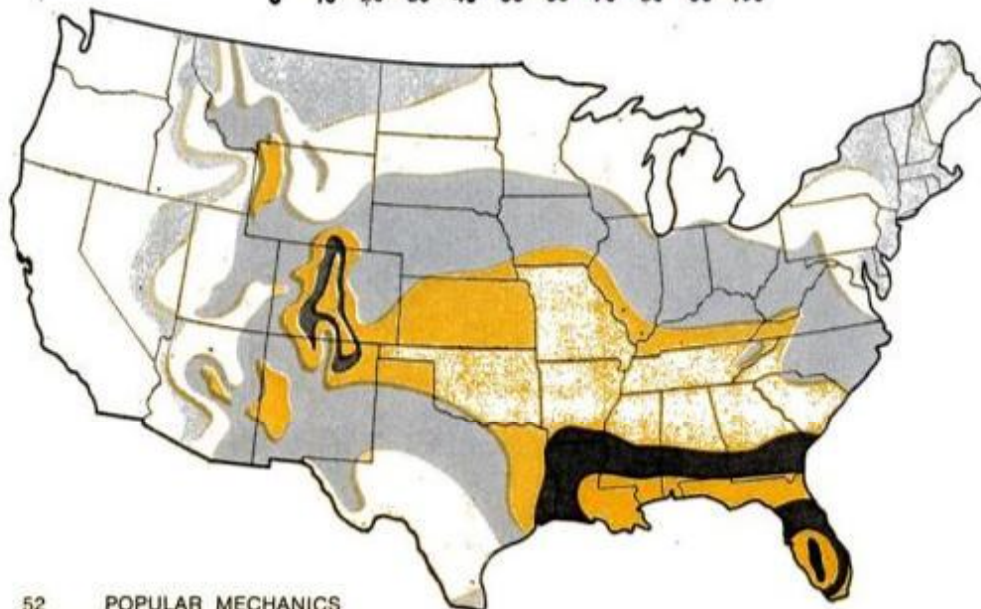
As everyone has observed, lightning takes many different shapes, depending on atmospheric conditions. Often it forks into multiple paths, striking simultaneously in two or more places. Cloud-to-ground bolts are the most common type. But there is also sheet lightning, which occurs between differently charged areas of the same cloud or between two clouds.

### 'Heat' lightning

So-called heat lightning is simply lightning beyond the horizon that illuminates the sky by reflection. Such lightning seems orange because the longer reddish lightwaves penetrate the atmosphere better over long distances (which is why the rising and setting sun seems red).

Finally, there is the rare "ball lightning"—a clump of glowing air, heated and ionized by the electric discharge, which may roll around the impact site for several seconds, giv-

(Please turn to page 107)

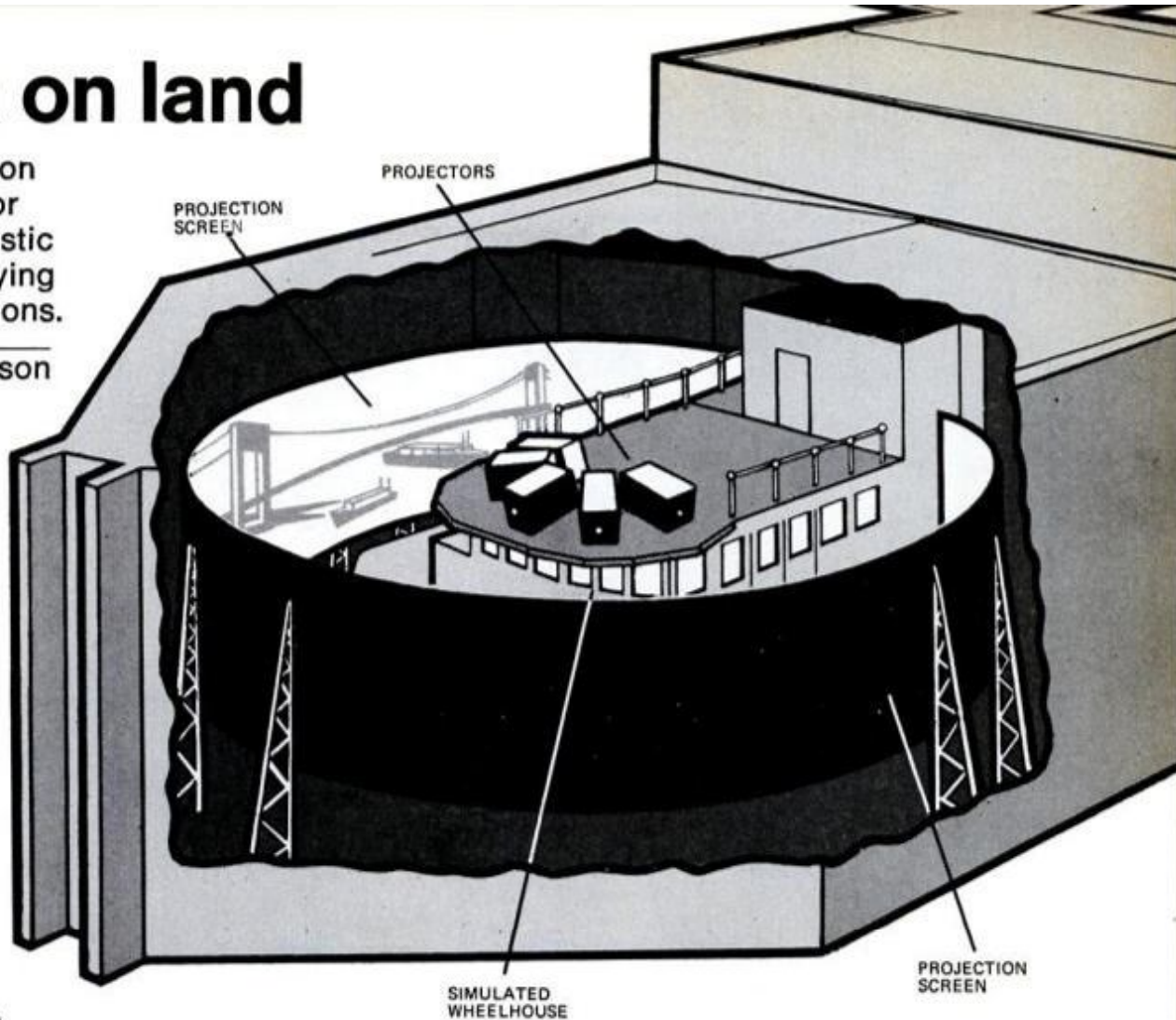


# At sea on land

A new \$12-million marine simulator provides a realistic setting for studying big-ship operations.

by John F. Pearson  
SCIENCE EDITOR


Computers respond to steering or propulsion commands from the bridge by altering the images on the screen, signals to the radar displays and other data used by deck officers in handling of the ship. Below, projected image of New York Harbor is seen through windows of wheelhouse. Bridge controls (bottom photo) are the real thing.



**W**e're on the bridge of an 80,000-ton tanker moving slowly through New York's lower bay. Now that the fog's lifted, we see the Verazano Bridge and massive towers of the World Trade Center. We see other ships in transit. The harbor pilot keeps a close eye on the scene as he issues commands to the helmsman.

It's a simulation—and a good one. The harbor trip was demonstrated at the recent unveiling of the Maritime Administration's Computer Aided Operations Research Facility (CAORF) at Kings Point, N.Y. Said to be the world's most sophisticated marine simulator, CAORF will be used to study such things as collision avoidance, groundings, navigational standards and equipment.

CAORF can be programmed to provide the ship-handling characteristics of any size vessel—from small harbor craft to giant tankers. The bridge is equipped with the latest navigational and communications gear. Two radars provide appropriate information for a given situation. The view from the bridge can be adjusted from day to night and from zero to full visibility. The system can be programmed to portray the configuration and landmarks of any harbor in the world. ★★★

A photograph of a man in a small white boat operating a white and blue Chrysler outboard motor. A woman in a pink and white bikini is sitting in the boat behind him. The boat is on dark water.

Little kickers are also getting big attention from the engineers. Chrysler's new single-cylinder four-horse shifts to neutral for starting, has 360° swivel steering and uses loop charging of the big mills for improved economy and performance.

# Preview '77: Compact outboards are in

by Bill McKeown

OUTDOORS EDITOR



## They're in the same-size packages, but you'll get more performance next year.

Next year is already here for outboard boatmen. This season saw kickers get bigger than ever before. Now for '77, our preview survey shows the spaces between top and bottom being filled for all those hulls that don't need an extra herd of horsepower but can use added efficiency and performance (without the added price).

Evinrude and Johnson tell us they will both top out at 200 hp once more. Chrysler is also refining rather than enlarging motor muscle—150 hp on special order for high-performance racing, 135 to push the bigger outboard boats. Mercury does not announce for next year until mid-September, but rumors hint that Black Max is likely to stay at his stalwart 175.

That must be a popular power category. Outboard Marine's big guns, Johnson and Evinrude, are announcing they will have 175 mills in their new 1977 lines, too. Displacement (149.4 cubic inches) will equal their V6 200s, but full horsepower is

available at 5000 rpm rather than 5250. Brand-new as well among the big-muscle machines will be Johnson's Sea-Horse 140, the impressive performer we exclusively previewed on an outboard cruiser last month. Evinrude will also introduce a 140 model suitable for larger hulls that have powered up with twin outboards, stern-drives or inboards until recently.

Once again, racing refinements are benefiting the rest of us with a number of design improvements. Chrysler went to Berlin, Germany, to the world's only computer-controlled water test tunnel to develop its new Power-Flow drive unit, a slicked-up lower unit reported to streamline the water flow as it passes shaft, gear case and prop. More speed from the same amount of power is the result. The new configuration is also said to reduce cavitation on turns and to allow higher mounting of the motor with less underwater drag and the chance to experiment with surfacing props. New stainless-steel propellers will be available this year from Chrysler.

### New skeg slant

Take a look at the Johnson and Evinrude lower units as well. Beneath the bullet-shaped gear case

with its adjustable trim tab on the anticavitation plate, the bottom skeg below will have a new rearward slant claimed to improve steering at both high and low speeds for the big models.

For next year, Chrysler is upping power on its little models, too. This season's 3.6 is becoming a 4-horse, the 6-horse will be available in both regular and long-shaft sailer models, and the 9.5 has gone up to 10 hp in regular and long-shaft sailer configurations. There will be 15, 25, 35, 45 and 55 power categories, the 55 a new one. Top push will come from 65, 75, 90, 105, 120 and 135 motors—take your pick.

### Better fuel economy

If your selection will be from the '77 Sea-Horse stable, Johnson can provide you with its 200-hp speedster, the new 175 and 140, or a 115 if your hull is rated to handle such power. Also 85, 75, 70, 55, 35, 25, 15, 9.9, 6, 4 and 2 hp, plus 12 and 24-volt electrics and C.D. electronic MagFlash ignition now for all the gasoline models except the mini 2-horse motor. New for the large mills will be a starter system that lets you choke the engine simply by pushing in the ignition key as you turn it.

Evinrude offers similar improve-

*(Please turn to page 116)*



Torque to spare for a runabout skiboat, or push-power for an outboard cruiser, the new Evinrude 175 (above) uses less rpm but same displacement as this year's 200 to power performance hulls previously needing 1/0s or twin outboards.



Performance for open seas is offered by Evinrude's 200-horse line-leader powering offshore Mako. With one big engine replacing twin mills, outboarders can head out alongside "gold-plater" inboard machines for gamefish trolling where the big ones are.

Biggest of Chrysler's motors (lower left) tops out at 135 hp (150 for the special-order high-performance racing mill). Line of 17 power sizes, which includes long-shaft sailboat models with new high reverse thrust, ranges down to the new 4-hp on facing page.

Small low-profile power can push a large pontoon or deck-platform boat at respectable speeds when properly propped. New Johnson 15-hp Sea Horse (below) handles party raft easily. 1978 models will boost maneuverability with doubled reverse thrust.





1. Mopeds on the move (left to right): Puch Maxi, Garelli Deluxe, Solex 4600 "Horse," Motobecane 50L Mobylette.

2. Puch Maxi.

3. Garelli Deluxe.

4. Peugeot 103.

5. Solex 4600 "Horse."

6. Motobecane 50L Mobylette.

7. Look for telescopic front fork.

8. Transmissions are automatic.

9. Two-cycle engines are 49 cc.

10. Instruments and controls are simple.

**Below:** Engine is frame-mounted on Garelli (left) and fork-mounted on Solex.

**Opposite page:** Bermuda Bikes' Hampton model.



# Mopeds: Pedal home if you run out of gas!

**PM's buyer's guide to motorized bicycles lists all the makes and models, and tells you how much money you'll need to put a machine on the road.**

**by Bill Hartford** AUTO EDITOR

**T**hey're still rare enough to turn heads, but are expected soon to be as common as 10-speed bicycles. Annual sales are expected to be in the millions in the early 1980s, even though most people have yet to see one on the street.

Mopeds, as most PM readers know from the stories we've run (*How to Stay Alive on a Motorized Bicycle*, page 56, Dec. '75 and *Bicyclists, Start Your Engines!*, page 74, Aug. '74), are bicycles with motors . . . and, conversely, if they don't have pedals, they're not mopeds. One by one, state motor vehicle bureaus are recognizing the moped as a motor-assisted bicycle and allowing it on public roads unfettered by the many rules and regulations that affect motorcycles and motorcyclists.

Mopeds are bikes in California, Hawaii, Michigan, Nevada, New Jersey, North and South Carolina, Ohio, Texas and Virginia. Even in these states, however, regulations differ, and that's why there are 20, 25 and 30-mph versions of most mopeds. Top speeds may differ, but all the machines have 49-cc (plus or minus a cc or two), have automatic transmissions (centrifugal clutch), cost between \$300 and \$500 and get up to 200 mpg.

As it becomes easier to own and operate a moped, more bicycle dealers will start carrying them. At present there are 13 makes available in the United States and a total of 25 models. None are made here—they come from Austria, Belgium, Czechoslovakia, France, Holland and Italy. Here's a rundown of makes, models, prices and sources for each.

■ **Batavus.** Batavus Bikeways, Inc., 1884 Forge St., Tucker, Ga. 30084. The Batavus mopeds are made in Holland by the Batavus Intercycle Corp. and imported by Bikeways.

There are three models: VA Standard, \$429; VA Deluxe, \$459; and HS50, \$475. The Standard has front and rear shocks, speedometer and odometer; the Deluxe adds turn signals and battery. The HS50 is the only moped with motorcycle-style saddle and frame (it's not the step-through type).



All use 48-cc engines, and 20, 25 and 30-mph models are available depending on the state.

■ **Bermuda Bikes, Inc.**, 301 Locust Ave., Oakdale, N.Y. 11769. The Hampton and Hamilton models (\$460 and \$425) are made in Belgium by Flandria, a family company that goes back to 1825. It made its first bicycle in 1886 and its first motorized bike in 1950. Flandria made 25,000 mopeds in 1950 and today has a capacity of 300 machines a day. With the Hampton model you get rear shocks (on the Hamilton the rear is rigid), and the addition of speedo, odo, lock and tire pump make the bike more deluxe.

■ **Cimatti.** Cimatti, Ltd., International Sales Div., 68 Sugar Hollow Rd., Dan-

bury, Conn. 06810 and Motorized Bicycle Imports, Inc., Sgt. Jasper Building, Charleston, S.C. 29401. The City Bike is made in Italy by Cimatti and uses a 49.6-cc engine built by Minarelli. Imported and distributed by the two organizations listed above, the Cimatti City Bike retails for \$425.

■ **Garelli.** American Garelli East, Ltd., 1211 Gadsden St., Columbia, S.C. 29201. The Standard and Deluxe versions of the Italian-made Garelli mopeds are \$399 and \$499, respectively. Additional features of the Deluxe model are chrome fenders, speedo, odo, steering head lock and extended chrome muffler. Both bikes use a telescopic front fork and a swing-arm rear with helical springs.

■ **Intramotor.** F.G.S. Enterprises, Inc., 8000 Cooper Ave., Glendale, N.Y. 11227. Intramotor makes its two models in Italy. The Scout and Blanco are both imported by F.G.S. and both are \$399. Intramotor calls its bikes Autobikes, or Mobikes for short, and refers to them as "the family bikes you don't have to pedal unless you want to." Main differences are tubular steel chassis and telescopic front fork of the Scout versus the stamped steel chassis and front fork of the Blanco.

■ **Jawa.** American Jawa Ltd., 185 Express St., Plainview, L.I., N.Y. 11803. The Jawa Babetta moped retails for \$320 and can be seen at Jawa/CZ motorcycle dealers. Most motorcycle enthusiasts know the Jawa name well, since the Czechoslovakian machines have been available here for many years. The Babetta is a simple machine: It has no rear suspension, but the front fork is telescopic and the seat is sprung.

■ **Motobecane.** Motobecane America, Ltd., 86 Orchard St., Hackensack, N.J. 07601. Five models of the French-made moped are sold here. The 50VL (for 30-mph states) is \$509; 50L is

\$479; 50S is \$459; 40TL is \$429 and 40TS is \$399 (these are West Coast prices. East Coast prices are \$10 to \$20 less). For information on another moped in the Motobecane stable, the Solox 4600 "Horse," see the listing for Velosolex.

■ **Pacer.** Portofino International, Inc., 33 Main St., Bridgewater, Mass. 02324. Two versions of this moped made by Italtelai in Italy are available from Portofino: The Standard is \$288 and the Deluxe is \$315. As is the case with all mopeds, even the simplest, a rear luggage rack is an integral part of the frame construction.

■ **Paloma.** North America Tradimpex Corp., Cycle Div., 1938 New Highway, Farmingdale, N.Y. 11735. The Paloma 50 is a French-made moped listed at \$450. The machine, with its Morini Gyromat engine, uses a battery with its magneto to maintain lighting even when the bike is idling.

■ **Peugeot.** Cycles Peugeot (USA) Inc., 540 East Alondra Blvd., Gardena, Calif. 92407. The French manufacturer is better known here for its 10-speed bikes and cars, but in Europe

**Batavus HS50** is a motorcycle-style moped—others have step-through frames.



the first Peugeot you see will likely be a motorized bicycle. The 103 is \$460 and is fully suspended with telescopic front fork and rear shocks. Color choice: red or blue.

■ **Puch.** Steyr-Daimler-Puch of America Corp., Box 7777, Greenwich, Conn. 06830. The Puch Maxi, \$460, is made in Austria's largest automotive and bicycle plant by a manufacturer that has been in business more than 100 years. It has nice engineering touches like spring-loaded rear carrier and built-in chrome lift handles.

■ **Velosolex.** Velosolex America, Ltd., 86 Orchard St., Hackensack, N.J. 07601. The \$319 Solox "Horse" is the basic motorized bicycle. Engine is mounted on the front fork and drives the front wheel via a friction roller. The 200-mpg French bike is made by the company that introduced the

Solex carburetor back in 1910. You might consider the transmission on this one as manual, since you have to operate an engine-engagement lever to move the roller against the wheel.

■ **Vespa.** Vespa of America Corp., 322 East Grand Ave., South San Francisco, Calif. 94080. The Ciao models, built by Piaggio in Italy, are the Standard, Deluxe and Blinkers models, listed at \$390, \$430 and \$470, respectively. The Vespa name is well known from the motorscooter that was the hot setup here around 1960.

The hot setup these days is any simple machine that'll eat up the miles reliably and economically. Now when you run out of gas, pedal. ★★

*Late item: Due to new legislation, mopeds are now considered as bicycles in eight other states: Ariz., Conn., Ind., Iowa, Kans., Md., N.H. and R.I.*



**Jawa Babetta** gets 130 mpg; fuel tank holds .8 gal.; ignition is transistorized.

**Vespa Ciao Blinkers** has turn signals and battery to power them while idling.



**Cimatti City Bike** weighs 105 pounds, has drum brakes front and rear, 2.5-quart fuel tank and a 1-hp engine.

# IT'S NEW NOW



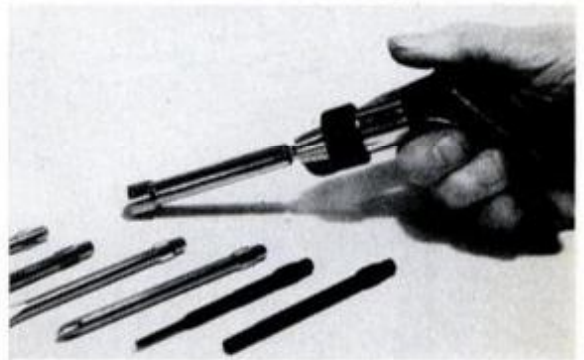
## Super icebreaker

Largest (399 feet overall) and most powerful (60,000 hp) icebreaker to join the U.S. Coast Guard's fleet is the *Polar Star*, scheduled for duty at both poles this winter. Some 90 feet longer and 10 feet wider than *Glacier*, she also boasts three four-bladed controllable-pitch propellers 16 feet in diameter, giving her greater movement through thick ice. She is expected to ride up on ice 21 feet thick and break it down, without backing and ramming, cutting the time in half to carve channels for supply ships.



## Fast cruising cat

She'll exceed 25 mph on reaches in heavy sea, sleeps two in each hull and has 100 cubic feet of foam flotation and self-bailing cockpits. She can be righted if she should capsize and continue sailing. This 36-foot catamaran can be disassembled and towed by a standard car. Assembly takes two men three hours. MacGregor, 1631 Placentia, Costa Mesa, Calif. 92627.



## Quick-change metric tools

The quick-tightening knurled ring on the chuck permits fast switching of four metric hex-nut wrenches, two flat-blade drivers for screws, two Phillips drivers and four Allen wrenches. Pistol-grip handle provides ratchet action, and bits interchange in seconds. \$16.95 ppd. Metrifast, 51 South Denton Ave., New Hyde Park, N. Y. 11040.


## Trick ladder becomes a dolly, too

Fold it, roll it up, climb it or get the optional wheels and fittings and make a dolly out of it. This versatile aluminum ladder can be converted to a stepladder, to odd configurations for tight spaces. Maker is M. Lavrard-Macc, 36 Ave. du President Wilson, 86101 Chatellerault, France.



## Instant fireplace wood

If you've wondered how the pros split all that firewood, it isn't with sledge and wedge. It's done with machines like this "Little Splitter" that drives the log against a wedge by hydraulic ram. LaFont, 1319 Town St., Prentice, Wis. 54556.



Pushing 1000 miles  
in a bumpin', thumpin'  
18-wheeler gives you  
hard-knocks knowledge  
of a trucker's life.

**Trucking** is a myriad of tasks which begin when the driver hauls himself into the cab. Checking fuel, eating chow (above), are all part of it, as are stops by Smokey, highballing with others (opposite page) plus cleaning the windshield, catching a few hours sack and yacking on the CB (following page).

*C.M. Viker*

It is just before daylight on a clear, 40° morning at the parking lot in front of the Orange Park dog-racing track on Route 17 south of Jacksonville, Fla. And Bill Highhouse, owner/operator of a big Ford 9000 cab-over flat-bed tractor/trailer rig, is feeling pretty good.

He has had a short but restful night's sleep, a bowl of cereal and



a glass of milk, is at peace with his God, and has loaded aboard his trailer over 20 tons of 4 by 8-foot and 4 by 6-foot plywood sheets—all tightly strapped down and neatly tarped—for delivery some time

the following morning to Coachman Industries in Middlebury, Ind.

Waiting for him at the other end of the line is a partial load for the return trip to Jacksonville, meaning Bill Highhouse is going to make a week's pay—a few hundred dollars to help

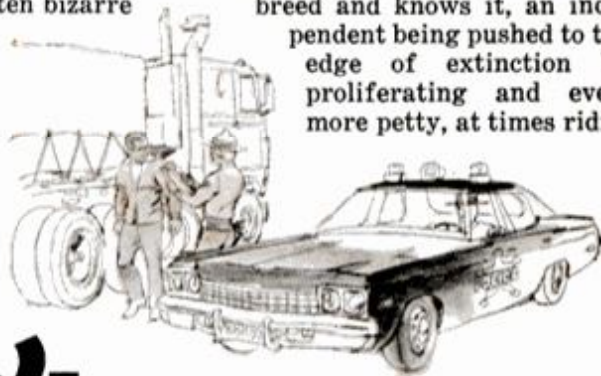
hold at bay for another month the good gray bank that owns damn near everything about him other than his soul, which he quietly and almost convincingly says he has rededicated to Christ, bank or no bank.

If he gets lucky, and the dispatcher at the other end happens to be kindly disposed—and if something turns up—he'll be able to fill out his load for the return run, and the extra few bucks thus earned might enable him to stop by Sears and put a little down on a needed new 10.100 x 20 tire, or at least a recap, maybe even two.

In any event, what he is about to do isn't going to be easy. He'll have to push over 70,000 pounds of gross weight over some 1000 miles in a little more than 24 hours. En route he'll have to stop to eat, take on diesel fuel, service and check his rig, hit the biffy now and then, maybe climb back in his cab bunk to sleep for a couple of hours, shave, and at all times deal with typical, often bizarre interstate highway traffic and with what he and every other trucker on the road is convinced is a small army of state, county and local police whose main reason for being is to nail the Bill Highhouses of this world to the wall.

And there's a lot of piddling paperwork to do, too—the trip log required by the federal Interstate Commerce Commission, the various waybills, shipping orders and so on for the Ranger Div. of Ryder Truck Lines, Inc., to which his rig is leased on a day-to-day basis, and the receipts, notes and other odds and ends his wife Charlotte, who oversees his bookkeeping, needs to keep the Internal Revenue Service off his back.

It's a routine, an exercise he has gone through many times, and yet, somewhat remarkably, he looks to be still of a piece. At 43, a four-time father, even a grandfather, a man knowingly flogging a waning dream of freedom and independence, his stocky, powerful, just under-six-foot presence nevertheless manages to convey affability. He smiles easily and often, and while he wasn't issued rose-colored glasses, he appreciates that for him and for guys like him a certain optimism is—has to be—standard equipment. He is of a dying breed and knows it, an independent being pushed to the edge of extinction by proliferating and ever-more petty, at times ridic-



# Truckin': It's Smokeys, white lines and Roloids

by Bill Kilpatrick



ulous, regulations, rising costs and shrinking profits, and by plain bone-weariness.

His affability aside, however, he is anxious to be off; he has a long day and what will seem like an even longer night ahead of him. He also has a companion—I've wangled my way on board to see what the ride will be like. At least on this trip he'll have someone to talk to. Usually, the only thing he has to accompany the solitude of his "white line fever" is the constant, often inane chatter pouring out of the citizens band radio speaker mounted near the cab's windshield . . . and as entertainment over the long haul, CB chaff is far from socko.

"Sorry about that missing lower step," he says, raising his voice over the idling engine, a Cummins 350 supercharged diesel. "Some guy in a Cadillac knocked it off, and I haven't gotten around to replacing it."

He heaves himself up into the cab and sets the big, 53-foot-long rig in motion, running through the first few

of the 10 or so gear changes he has to make to get to cruising speed.

"Look, one thing I've got to say here, and that is, please don't smoke. I've got an allergy." (He hasn't got an allergy at all, as the blue haze hanging over several subsequent truck stops will prove, but he is too polite to say flat out that he can't stand the close proximity of cigarettes.)

He eases out onto Route 17 and heads north toward Interstate 10, where he'll run west to Winfield and pick up Interstate 75 for Atlanta. Except for starting and stopping the rig's motion, Highhouse ignores the clutch, instead shifting gears by a personally tuned and experienced process of sound and feel. He has both a high and low range of 10 gears each, giving him 20 forward speeds in all. There are four reverse gears, three of which are rarely used.

### 'A lot of nonsense'

"Now you take that thing on TV, that show about truckers," he says, referring to ABC's *Movin' On*, "that's a lot of nonsense. Pure fiction. A trucker'd starve to death trying to make a living the way that guy does. Hell, you can't just wander around picking up a load here and a load there. Ain't no way. The only chance an independent has got is to have a fairly regular run and a few dispatchers who don't mind the way he parts his hair."

He swings around onto Interstate 10 and settles back, committed to the job at hand, which is to drive long and hard until a day when he simply won't do it anymore.

"I'm thinking of getting out of it," he says. "I'm really a cabinetmaker, and a few people are after me to do some work for 'em. I think I could get by. Sometimes I think I'd like to park this thing by the bank and tell 'em it's *really* theirs. But I wouldn't want to work in a factory, or anything like that. Like I said, I think I could get by."

His eyes take in everything in front and to either side of him. He reaches for the CB microphone.

"This is Speedboat. I've got a city kitty pulling onto Ten at the One Eleven intersection. He's heading west. Ten-four."

Off to the right, a Jacksonville city police car is merging into the westbound traffic on Interstate 10.

"Copy that, good buddy. Thank

you. Ten-four," says an anonymous voice from the speaker. Highhouse replaces the mike and sits back.

"We keep each other posted on where the Smokeys are. It's not foolproof, but it helps. So does this." He points to a small black box mounted at the base of the windshield in front of the steering wheel. "We call it a fuzz-buster. Some out-fit makes 'em under that name. Anyway, it's a radar detector. If some Smokey nearby is taking pictures, this little light goes on. The range isn't much, but it helps.

Lots of times I can back off and go by him legal. It's a real help at night, when the Bears are hard to see. They'll sit up off the road, you know, usually behind something, and if you're not careful, they're on you like a cat. We also call this thing our seeing-eye dog."

Highhouse claims it's just about impossible for a big rig trucker to stay within the nationwide 55-mph speed limit. What's more, he feels it's unreasonable for the authorities to expect them to.

"Take your average upgrade. Hell, I've got to make a run at it so as to not wind up barely crawling. You can't hold a steady speed in these things. It's just about impossible. Besides, these rigs aren't efficient at the slower speeds we'd have to hold to average out to 55, and with the price of fuel being what it is, this old baby has got to run as efficiently as possible."

He goes on to imply—but not say so directly—that the nature of the business precludes staying within the speed limit.

### Fines are out-of-pocket

A trucking company, competing for its slice of the pie, agrees to deliver a given cargo at a certain point at a certain time, often knowing a trucker will have to go like a bat to make the schedule. But should the driver get nailed for speeding, he's on his own. For an independent, fines for speeding and other traffic violations are out-of-pocket, nonreimbursable expenses.

"It's the same thing with our gross weight," Highhouse says. "No way we can run legal and make a living. Just about every independent on the road is running overweight. He has to. The rates are too low, and lots of times the overweight makes the difference between coming off a trip a few bucks ahead, or breaking

even. Sometimes we lose money. That's why lots of times you'll see a truck off on a back road somewhere . . . he's going around the weigh stations." He turns and smiles. "Weigh stations can give a man a lot of crap, so we call 'em chicken coops. But I'm running legal today, 'cause I knew you'd be with me."

### A fact of life

Chicken droppings in one form or another are an obsession with truckers, an irksome fact of life with which they must contend every moment they are on the road. A driver can be cited for being as little as 50 pounds overweight, for example, or for doing as little as 4 or 5 mph over 55. They can be cited on a given day for not having their trip logs up-to-the-minute, an offense that on another day might be ignored.

"No telling what they're going to hit you with," Highhouse says, "and some of the stuff is just plain silly. Suppose a Smokey stops me and wants to see my log, and I tell him I haven't got one, that I forgot it. Well, he can fine me \$15 right on the spot, and that's that. But if my log isn't filled in right, or it isn't just so, I can be fined as much as \$150. Now does that make any sense? Hell, no.

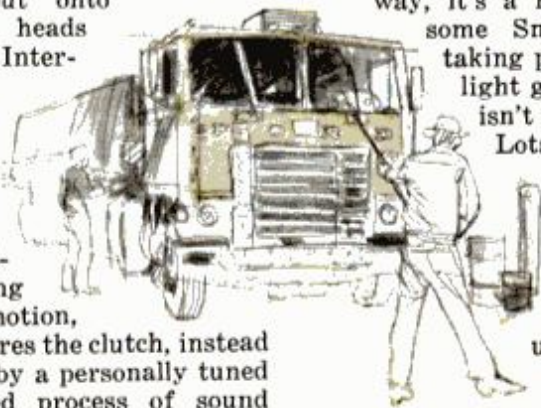
"Funny thing is, the log can be filled out to say just about anything. Now I'm not supposed to drive more than 10 hours, and I'm supposed to sleep at least eight hours. Well, you *know* we're not going to get to Indiana by tomorrow morning if I pull off and sleep eight hours. So I'll fill out the log to say I left earlier than I did. If we get stopped, it'll all look nice and legal. When I hand that log in, it'll be just right, except there won't be much truth on it. I know it, the company knows it, Smokey knows it, the ICC knows it . . . hell, *everybody* knows it. But still, we've got to play the game. It's ridiculous."

He looks off, thinking, his arms stretching forward to grip the top of the slightly-angled steering wheel.

"There's too damn much government," he says suddenly and sharply. "Too many people are making rules and passing laws and they don't know what time of day it is. Get some of 'em out here on the road for a couple of weeks, and I guarantee they'd see things a lot different."

Having said his piece, Highhouse seems relieved, as if he has finally found a sympathetic outside ear into which he can pour his frustrations . . . a few of them, anyway. He goes on, but rambling and on a lower key.

The independent trucker, he says, is being shot down by things over which he has no control. A couple of years ago, before the energy





crunch, a guy could get by nicely, thank you. But when fuel prices doubled and the economy went sour, a lot of truckers found themselves being squeezed out. Many of those who have held on have done so only marginally, their annual net severely reduced.

### Keen competition

Faced with a faltering economy, the trucking companies to which the independents usually lease their rigs to haul commodities lowered their charges to customers to attract what little business there was. This in turn meant lower rates paid to the truckers. At the same time, operating costs shot up. Diesel-fuel prices zoomed out of sight. Truckstop menu prices took bold leaps. A tire change that used to set a guy back a couple of bucks went up to \$6 or more. And so it went. An independent grossing, say \$50,000, suddenly wound up with a net of only \$10,000 or \$11,000, and the disparity was and is often too great—to say nothing of the aggravation involved—to make private ownership and operation of a rig an economically viable proposition.

Still, for a certain kind of man, independent trucking is a not unattractive business. The rewards aren't what they used to be, true, but proportions tend to become somewhat warped when available options are considered. There aren't many Ph.D.s pushing trucks, meaning that for many of the men the alternative is a factory job, or a job in which they'd find themselves under a straw boss of one stripe or another. The self-image of no-strings independence is becoming more and more illusory, but even so, being the kind of men they are, truckers would have it no other way; they are quick and proud to assure you they are indeed their own men.

### Why a flat bed?

"I got into this business about six years ago," Highhouse says. "I was up in Fort Wayne and I saw a bunch of these Ford tractors lined up outside this place and I went in and told the guy I was interested in buying one. I went to a bank and came back and the guy gave me a couple of weeks' instruction and turned me loose. I've been at it ever since.

"I started out with North Ameri-

can Van Lines, but I wanted to go independent as soon as possible. I decided I wanted to haul flat-bed stuff—that it had the best moneymaking potential—so I went back to the bank and took another

hock for almost \$50,000 and my payments kept me awake nights. Almost had it paid off, too, but I had to replace the engine not too long ago, so I'm back in the deep water again. It cost me \$7000. Right now, I've got over 500,000 miles on this rig.

"Whenever I can, I try to do my own maintenance, my own work. Like, when I bought this tractor, it didn't have but one rear axle, the drive axle, so a buddy of mine and me, we put in that tag axle. I've got a little body work to do still, but inside here, I did all this myself, including the carpeting and the airconditioning.

"I run mostly from Jacksonville to the Midwest and back, sometimes down around Miami. We got a depot in Hammond, Ind., and I run a lot out of there. I guess I can damn near drive this road blindfold."

A few miles before coming to Interstate 75, Highhouse slows down and turns off 10.

"Fella over here," he says, pointing to his left, "has some 46-cent fuel. We've still got a little over a hundred gallons, but this is about as cheap as we're going to get for a while."

He says his rig, like most similar rigs, gets about five miles per gallon. "So if I can save a penny a gallon when I fill up, that'll almost buy me a meal."

Despite an "Open" sign, the station is closed. Highhouse makes a sucking noise with his teeth. "Humph. Too early, I guess. Well, no worry. We can get some a little farther up the line."



Pulling back onto Interstate 10, he reports to the CB sets in his orbit that "a county mounty" is heading east near a certain mile-marker. A voice identifying itself as "Hard-rock" acknowledges the message.

### Concrete's rough

At 9:15, just over the Georgia-Florida line on Interstate 75, Highhouse spots a sign calling attention to 45.9-cent diesel fuel just ahead. "Now that sounds about right. We'll stop and maybe get a cup of coffee, too."

Noticeably, the cab begins to bounce up and down. "This is concrete and it's the roughest," he says. "Asphalt's a lot smoother."

A few minutes later he horses the big rig off the highway and into the station. A laconic attendant, his swarthy face partially hidden under the broad brim of a greasy cowboy hat, shuffles out, accompanied by two youths who look to be offshoots of the infamous Jukes family. The attendant starts to pump fuel into the round, twin tanks slung aft on either side of the tractor's frame, while the Jukes boys wash and squeegee the windows and sides of the cab with brushes and rubber blades mounted on the end of long broom handles. The station's head man comes out, smiling, pleased with his munificence in lowering his prices.

"Just set them pumps back this mornin'," he says. "You see our sign? Now I know you boys can't advertise on your radios, but kinda pass the word along, hear? Appreciate it."

Highhouse nods noncommittally, pays for 120 gallons of fuel and climbs back in the cab. There is no coffee.

"Saved a buck twenty there," he says. Maybe that'll buy lunch. We'll stop up the road aways and get breakfast. There's a guy I've got to see about a tire I'm having fixed."

Out on the highway the CB chatter steps up in intensity as traffic becomes heavier. Drawling, twanging voices, some as thick as sorghum molasses, and calling themselves "Kansas City Star," "Miami Kid," "Piccolo Player," "Roadrunner," "Red Baron," "Golden Goose," "Paper Doll," "Georgia Cookie," "Wild Eddy" and so on, fill the air with reports of Smokeys and Bears and destinations and even mild flirting. Highhouse says that when a trucker, from his high vantage point, spots a pair of shapely, fetchingly displayed female legs going by in a "four-wheeler," he'll often get on his CB to advise his fellow truckers that "a nice pair of seatcovers" is

(Please turn to page 140)



# New warning tells pilots: "Collision course!"

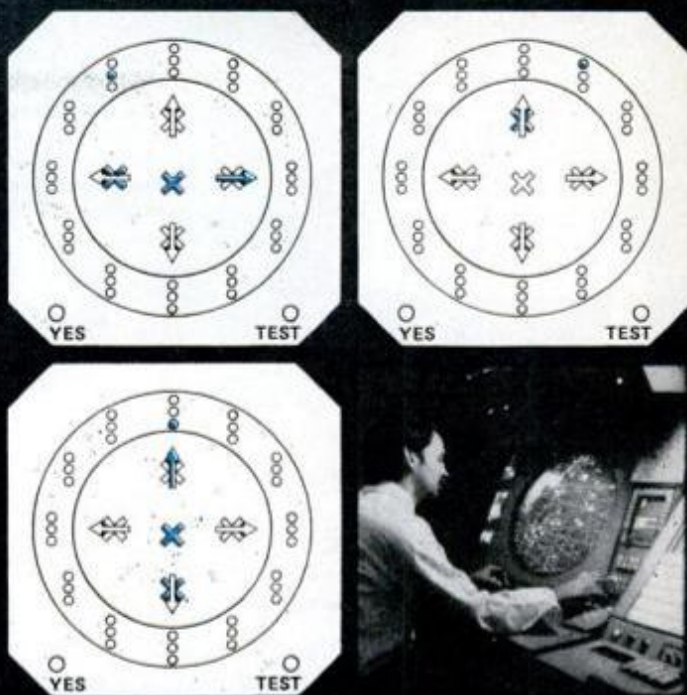
As our skies become more and more crowded, the threat of midair crashes has grown alarmingly. Now ingenious new collision-detection equipment is being developed to end this menace.

Last November 26, on the eve of Thanksgiving, two giant jumbo jets roared toward each other through the night on a direct head-on collision course. Both were flying at 35,000 feet south of Detroit, one an eastbound American Airlines DC-10 carrying 192 passengers and crew, the other a westbound TWA L-1011 with 114 on board. Neither was aware of the other. Just seconds before the almost certain crash would have occurred, the captain of the DC-10 slammed his huge craft into a steep 2000-foot dive, missing the L-1011 by a scant 100 feet. In the sudden, violent plunge, occupants were hurled in all directions, along with food carts, luggage and other objects. As a result, 24 were injured, three seriously, and the cabin interior sustained considerable damage. The plane was forced to make an emergency landing at nearby Detroit Metropolitan Airport.

While the prompt and successful evasive action taken by the DC-10 pilot saved 306 lives, it did not lessen the growing controversy and concern over the dreaded menace of midair collisions resulting from increasingly heavy air traffic. The incident was, in fact, only one in what was to become a nightmare series of near disasters all taking place within the following two weeks. On December 5 near Janesville, Wis., a North Central Convair 580 and a Cessna 421 came within a hairbreadth of collision when the Cessna was inadvertently vectored into the same 7000-foot holding pattern occupied by the airliner. Later the same day, a TWA 727 almost ran up the tail of a United 727 over Lake Michigan. Both were flying the same westbound corridor but at different speeds. Fortunately, the captain of the faster TWA jet spotted the slower craft ahead just in time to dive below it—missing by 100 feet.

Only six days later on December 11, everything that could possibly go wrong did as an Eastern 727 and a Virginia Air National Guard F-101 fighter nearly tangled at 19,000 feet above nearby Richmond. Air

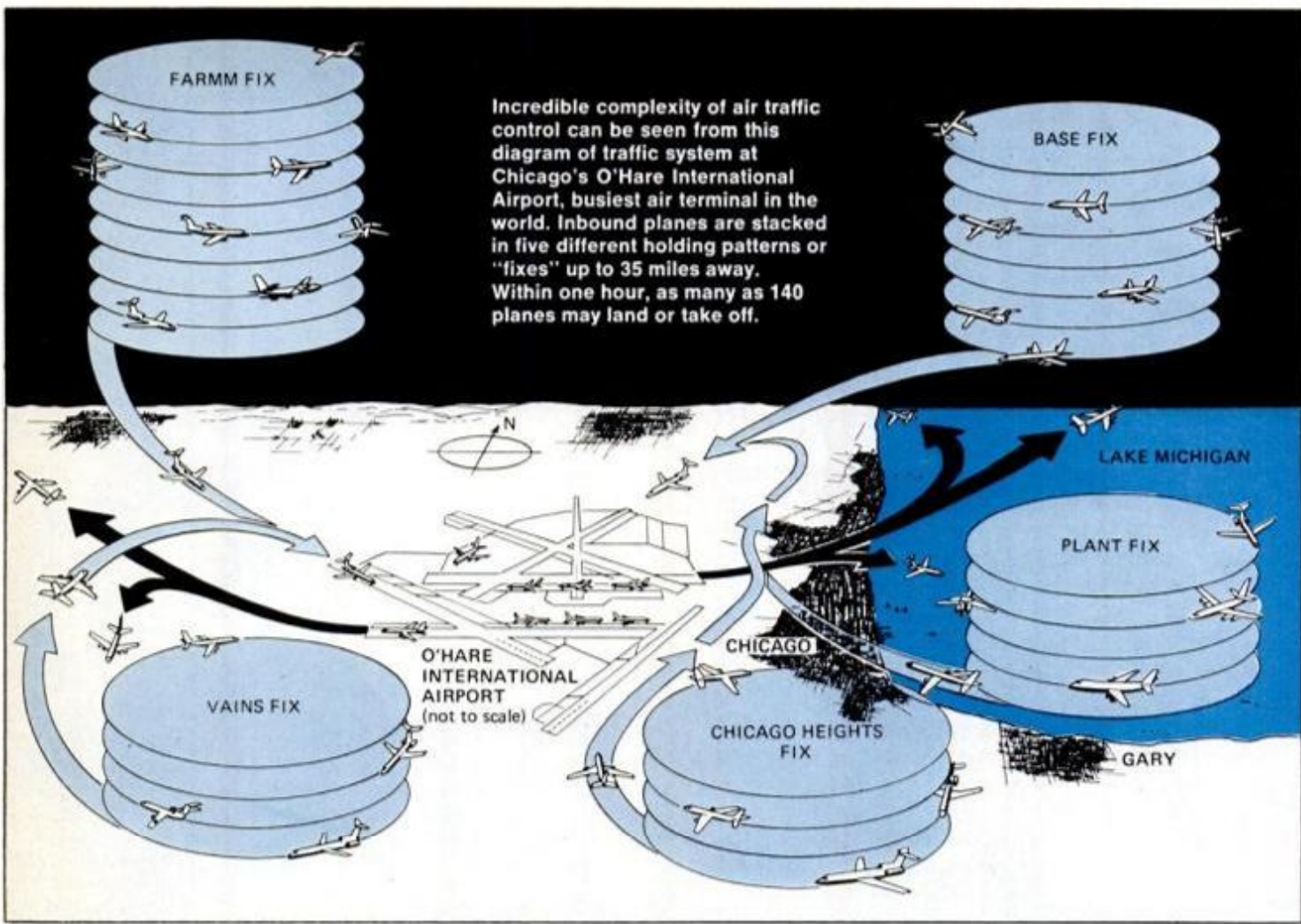
**Sudden dive** by captain of an American Airlines DC-10 averted midair collision with a TWA L-1011 last November near Detroit. Although maneuver was necessary, its violence hurled occupants and loose objects around inside cabin, injuring 24. Incident was just one of four near crashes to occur within two-week period last winter.



The ultimate in safety devices is this ingenious Proximity Warning Indicator (PWI), a part of FAA's advanced collision-avoidance system known as Intermittent Positive Control. In this system, a visual display mounts right in an airliner's instrument panel. Operated automatically by computer signals, it instantly alerts a pilot to any potentially hazardous situation and tells him what to do without relying on verbal instructions from a ground controller. At the center of the display are indicator lights that flash on to show either Xs or arrows. The Xs are "Don't" commands; the arrows are "Do" commands. If an arrow lights up pointing left, it means turn left, another plane approaching on your right. An X at the left would mean don't turn left, another plane coming from your left. Around the rim of the display are additional indicator lights in clusters of three each arranged in the positions of numerals on a clock face. These tell both the direction of an approaching aircraft and its altitude. Top light in each cluster indicates a plane approaching from above; middle one, plane approaching at or near same altitude; bottom one, plane approaching from below. The position of the light around the edge of the display shows the direction the other plane is coming from. In the three samples shown here, the display at upper left would tell a pilot: Turn right, plane approaching at 11 o'clock your altitude. One at upper right would warn pilot: Don't climb, plane approaching from above at 1 o'clock. One at lower left would direct pilot: Climb, plane below at 12 o'clock. Such indicators will be compatible with present anticollision systems, but are not expected to be available for some time. At lower right is a ground controller's console with its radar display and myriad pushbuttons — giving an idea of the complexity of the job.

by Mort Schultz

PM art: Ed Valigursky



traffic controllers got their signals crossed, the computerized radar monitoring system malfunctioned and communications with the military aircraft were lost. Miraculously, the two passed within about 50 feet.

Four near misses in two weeks—a shocking record that pointed up the terrifying possibilities of midair collisions. Nor was that the end. Earlier this year two more close calls occurred within the same month. On April 1, a Northwest Orient DC-10 and a Hughes Air West DC-9 brushed within 20 feet of each other over Washington state.

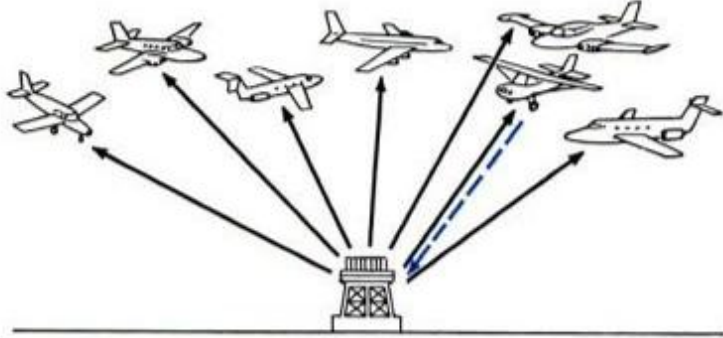
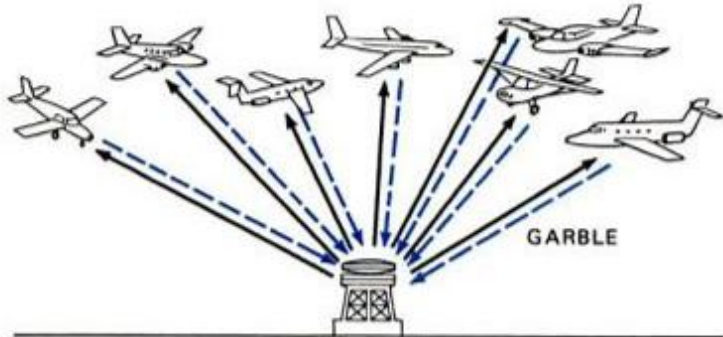
On April 22, an Allegheny BAC-111 jet, making a landing approach at a Long Island, N.Y., airport, had to pull up sharply to avoid hitting a small private plane, injuring one woman passenger. No one knew the small plane was there—it never showed up as a blip on air traffic controllers' radarscopes.

In May, the mighty supersonic Concorde, making its first visit to the United States, narrowly missed another aircraft while landing at Dulles Airport in Washington, D.C.—despite the fact that the area had supposedly been cleared of all other air traffic for 15 miles around as a precaution against just such an occurrence.

**Grim death toll**

Even more horrifying, not all midair mishaps are just close calls. Since 1949, 558 persons have lost their lives in seven major air collisions. One of the grimmest and most memorable is the crash over Grand Canyon in 1956 between a TWA Constellation and a United DC-7 that took 128 lives. In 1960, a United DC-8 and TWA Constellation collided over Staten Island, N.Y., with an even greater death toll—134. The five other air crashes

*(Please turn to page 130)*



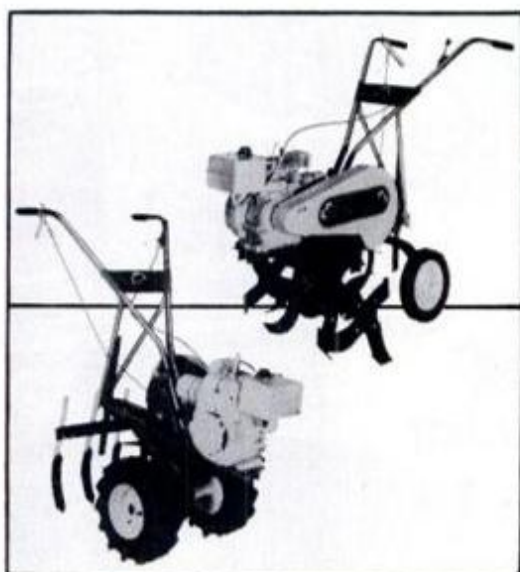
**Why new aircraft monitoring system will be safer and more efficient** is shown above. In present ATCRBS setup (top), all planes responding to ground-based beacons reply on the same frequency—like a crowd shouting back at you when you're trying to call just one person. Results are garbled and lost signals. With improved DABS—for Discrete Address Beacon System (bottom)—each plane replies only to its own specific assigned frequency, thus eliminating the problem of interference.

# IT'S NEW NOW



## Slip-out dashboard tape player

Listening to music tapes as you tool down the road is great, but removing the player for storage when you park can be an exercise in temper control. Now for some Motorola models a bracket lets the unit slip out at the touch of a button. Motorola, 9401 West Grand, Franklin Park, Ill. 60131.



## Garden tiller in a kit

Put it together yourself and cut the cost. Wheels and engine of this tiller-walking tractor come preassembled. Standard 14-inch-diameter tines combine for 26-inch tiller width. Remove outside tines for narrow rows, or add available extras for 36-inch width. It's powered by 5-hp Tecumseh, with chain drive and hand-operated V-belt pulley clutch. It goes together in six hours with screwdriver and wrench. Extras include 13-inch lug tires, draw bar, cultivator, dozer blade. Heald, Box 1148, Benton Harbor, Mich., 49022.

## Pneumatic 'professors'

When a teacher has to impart some of Albert Einstein's or Ben Franklin's wisdom to a class, he can now set up the famous men and let *them* deliver the lecture. John Davis of Los Angeles has developed dummy celebrities with pneumatically animated lips and gestures, plus synchronized tape-recorded lectures. When a life-size Prof. Einstein appears before a class, as shown, and delivers a lecture in a "canned" voice similar to his own, the effect is dramatic. This makes a solid impression on students, says inventor, so message will be remembered.



## Going nowhere in circles

Pedal yourself to exhaustion while hanging around (and around). It's the "Bicycle Bar Stool," with steel and aluminum frame, topped by a leather seat. Pedaling turns a vertical sprocket wheel that meshes with a horizontal one that spins the user forward or backward. For bored imbibers, or keeping kids actively in one spot. \$195 from Hammacher Schlemmer, 147 East 57 St., New York, N.Y. 10022.

# A great car, but a little fussy with fuel

by Michael Lamm  
WEST COAST EDITOR

A nationwide survey based on  
1,023,692 owner-driven miles

**T**his might be the last year for *big* big cars, say a number of Ford LTD owners, and they want to get in on what they consider a good thing while there's still time. Rumor has it that after the 1977 models come out, America's full-sized automobiles will be a foot shorter and 700 to 1000 pounds lighter than for 1976.

Very few buyers ordered LTDs with the large-lunged, 461-c.i.d. V-8 (only 6.5 percent), nor did most go for its 351-c.i.d. cousin. Instead, the majority (52.4 percent) opted for the mid-sized, 400-cu.-in. engine—a choice they probably wouldn't have made during the fuel-conscious years of 1974-75. Even so, the 400 averages only half a mile per gallon less than the 351, according to our survey.

People seem to stick with Fords, because past ownership proved the main reason for buying a new LTD. As a Fort Lauderdale retiree puts it, "I like 'em. I've owned at least 100 Fords over the past 50 years." An Iowa university extension supervisor: "Twelve out of 14 cars I've bought new have been Fords. I drive them 50,000 miles a year, with no downtime. Have kept each two years for 100,000 trouble-free miles. Service and parts are good when needed."

Adds a Louisville newspaper executive, "I'm a Ford fan. I drove a Model T to California and back in 1926. This time I looked at four, five other makes, but came back to Ford. My LTD (black with gold stripes and a gold vinyl roof) was the best-looking car I saw, and I bought it right off the dealer's lot."

A number of LTD owners spontaneously mentioned longevity and durability. An 82-year-old, retired heavy-construction operator from New York volunteered, "I've had four used and nine new Fords since 1918 and never had the heads or pans off any of them. The

Shorter, but with just as much interior space.

In those days, people were shunning big cars and big V8s.

Ford loyalty often goes 'way back.

Photos by the author



Owners like style better than comfort, ride or handling, and this mini B-pillar window is part of it. Owners bought LTDs first because of good past experience, but second reason was, again, smart styling.



**Two-door sedan** is choice of one-third of LTD owners in survey. Half of owners chose four-door; 15 percent the wagon.

**Comfort** was second on list of owners' likes. Individual armrests up front are singled out as a thoughtful feature.



**Wide glovebox** holds a lot. Owners also like trunk's capacity and its layout in the LTD.

**Engine choice** of most owners is the 400-cu.-in. V8. Poor gas mileage is biggest complaint. Average is 11.6 mpg in town and 15.0 on the highway.



1941 and 1955 went over 250,000 miles, and I drove the rest over 100,000. None of them used oil between changes."

The two most-liked LTD qualities are styling and comfort. Croons a Texas truck driver, "It is a beautiful car, with a very quiet, smooth ride, plenty of room front and rear, plus comfortable seats." Seconds a Mississippi engineer: "Love the body style and color combination; ditto the driving comfort, silence and maneuverability."

Handling and performance came in for their share of praise. A Shreveport dentist comments, "Excellent for traveling; superb road-holding and comfort." A Tennessee plumber: "Performs wonderfully; comfortable to ride in, good seats, lots of room, good looks." A Medford, Ore., general manager calls it "driving easability." And a Georgia sales supervisor declares, "It's ready to travel when I am."

What are some of the LTD's least liked attributes? Many owners left this space blank on our questionnaire, and 32.2 percent said specifically that they had no complaints at all. But lower-than-expected gas mileage bothered 20.1 percent of the owners, and much smaller numbers cited exhaust odors, grumbled about having to use more expensive no-lead gasoline, mentioned rattles and groused about engine ping.

On this last, a Wisconsin construction laborer wrote, "If I want to get rid of the engine ping, Ford's local service rep says I can use only a certain brand of superpremium no-lead fuel. All the rest have too low an octane rating in my area. That irks me. This problem should have been corrected before the car got on the assembly line."

Workmanship was praised highly, with 77 percent rating it good to excellent. That's one of the highest figures we've gotten for an American car lately. A South Carolina trucker notes, "Doors, hood, trunk, body moldings, etc., on the LTD are much better aligned than on other new full-sized cars I looked at."

When asked what owners thought of Ford dealers, 74.5 percent gave their service departments marks of good to excellent, and for the sales staff that figure climbed to 82.0 percent. A Louisiana liberal arts college dean, who's not

Explaining what's wrong makes a big difference in service. Silence and smoothness received universal praise.

EPA figures led owners to expect better mileage.

Another gripe involved snow buildup in wiper cavity.

There's a fix on this: see Ford service bulletin 102 (12/5/75).

Here's a refreshing change. We hope it lasts.

too crazy about the workmanship of his particular car, says of his dealership: "If the manufacturer were as dedicated as the agency, I would have no complaint. I receive excellent, careful attention. They always explain problems and make honest, complete repairs."

Ford prides itself on being the nation's leading maker of station wagons. We were curious to find out whether LTD Country Squire (wagon) buyers had a separate set of praises or complaints. Here are some typical comments from Squire owners:

"I like everything about my wagon except the windows whistling and the second seat flapping up when it's let down," avers a Missouri housewife. And a Florida retiree: "I prefer Ford's wagon to the others, but I wish they'd put a more substantial cover over the spare tire." "I like better mileage and a lower price tag," says a Delaware distributor.

What other things would LTD owners like to see changed in their cars? Here are some typical suggestions.

"Redesign the front fenders," opines an Iowa coin-machine owner, "because on rainy days they pick up water and spray the whole automobile from the windshield back." A New York machine-tool demonstrator: "I'd like to see them go back to the old ventilating system of windwings and forced-air vents instead of these awful automatic blowers." A Wisconsin banker: "The inside hood release is so well hidden that I can never find it." A Virginia miner: "The dimmer switch ought to be moved. It's right under the emergency brake pedal."

Some other suggested changes: "I wish they'd fix these cars so they'd run on regular leaded gasoline."—Texas foundry man. "The lower body sides have too much tuck-under, allow rocks to fly up and chip the paint."—Michigan executive. "Move the rear-view mirror—in its present position it creates a blind spot for cars coming in from the right."—Iowa clergyman.

A big 87.6 percent of our respondents said they'd buy another LTD the next time around. No one said, however, that he was looking forward to going to a smaller car in the future. ★ ★ ★

## Summary of 1976 Ford LTD Owners Reports\*

<b>Total miles driven</b> 1,023,692	<b>Dealer service</b> 8.2	<b>Workmanship opinion:</b>	<b>Chevrolet</b> 20.8
<b>Average miles per gallon:</b>	<b>Performance</b> 6.2	<b>Excellent</b> 32.4%	<b>Mercury</b> 6.9
351-c.i.d. V-8		<b>Good</b> 44.6	<b>Plymouth</b> 6.9
In town (EPA, 13 automatic) 12.1	<b>Specific likes:</b>	<b>Average</b> 11.3	
Long trips (EPA, 19 automatic) 15.4	Styling 45.9%	<b>Fair</b> 5.9	<b>Had any mechanical trouble?</b>
400-c.i.d. V-8	Comfort 42.5	<b>Poor</b> 5.9	No 58.3%
In town (EPA, 13 automatic) 11.6	Riding qualities 28.7		Yes 41.7
Long trips (EPA, 17 automatic) 15.0	Handling 28.2	<b>Comfort opinion (front seats):</b>	<b>Type of trouble?</b>
461-c.i.d. V-8	Performance 17.1	<b>Excellent</b> 54.9%	Carburetor 36.5%
In town (EPA, 12 automatic) 10.5		<b>Very good</b> 29.7	Oil leaks 14.1
Long trips (EPA, 14 automatic) 13.5	<b>Specific dislikes:</b>	<b>Good</b> 11.4	Transmission 10.6
Body styles:	Poor gas mileage 20.1%	<b>Fair</b> 2.5	Electrical 5.9
Four-door sedan 52.1%	Emission-related 6.9	<b>Poor</b> 2.0	
Two-door sedan 32.3	Engine ping 5.7	<b>Comfort opinion (rear seat):</b>	<b>Did you repair it yourself?</b>
Four-door wagon 15.6	Rattles 5.7	<b>Excellent</b> 42.5%	No 93.9%
<b>Engines:</b>	<b>What changes would you like?</b>	<b>Very good</b> 28.5	Yes 6.1
351-c.i.d. V-8 41.1%	Better gas mileage 14.4%	<b>Good</b> 22.3	<b>Dealer repairs satisfactory?</b>
400-c.i.d. V-8 52.4	Trouble-free emissions equipment 7.8	<b>Fair</b> 3.4	Yes 68.5%
461-c.i.d. V-8 6.5	Better workmanship 7.2	<b>Poor</b> 3.4	No 31.5
<b>Why did you choose the Ford LTD?</b>	Better materials 7.2	<b>Number of vehicles owned:</b>	<b>Age distribution of owners:</b>
Past experience 54.1%	<b>Dealer service opinion:</b>	Ford LTD only 50.0%	15-29 years 8.5%
Styling 16.0	Excellent 39.1	Two cars 40.1	30-49 years 49.3
Price 10.3	Good 35.4	Three cars 6.9	50-plus 42.3
	Average 9.9	Four cars 2.5	
	Fair 9.9	Five or more cars 0.5	<b>Would you buy another Ford LTD?</b>
	Poor 5.7	<b>Makes of other cars owned:</b>	Yes 87.6%
		Ford 46.5%	No 12.4

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



# IT'S NEW NOW



## The mini-mini calculator

This tiny electronic calculator, billed as the "world's smallest," tucks into a change pocket or purse for quick arithmetic at supermarkets and store counters. About the size of a box of wood matches (2 x 2.8 x .4 inches), it works on two 1.5-volt camera batteries. \$20. Edmund Scientific, 380 Edscorp Bldg., Barrington, N.J. 08007.



## Crossbreed RV combines two good ideas

It's a cross between the rigid-walled "cap" camper for a pickup and the "pop-up" car-towed type. The new Tent Kapper unit applies the fabric pop-up principle to the pickup concept. Advantages, says maker, are: less cost, more space (it expands to 100 square feet), easy installation, compact stowage for lower profile against wind (and consequent fuel savings). Package includes nylon bunks, windows, storm windows, curtains. About \$750 depending on size. Carefree of Colorado, Box 654, 2760 Industrial Lane, Bloomfield, Colo. 80020.



## How to play chess while playing it

Frustrated beginners who have a tough time remembering in which direction, and how many squares, each of the various pieces are allowed to move on a chess board can stop frowning. A manufacturer of the game finally has come up with a foolproof set. On the base of each piece is stamped its name, the different moves it can make—designated by simple arrows pointing directions from the square on which it sits—and the minimum or maximum number of squares the piece can or must travel in a single move. About \$50. From Classic Games Co., Deer Park, N.Y. 11729.

## 'Talking' thermometer

Photographers working in darkness needn't worry about solution temperatures. There's now a thermometer that "talks" when the soup is too hot or cold—high note for too high; low tone for too cool. About \$60. Photo-Therm, 110 Sewell Ave., Trenton, N.J. 08610.

## Pocket-size campstove

It had to come—a stove that'll fit in your pocket, pack or tackle box. It comes in a 5x6-inch vinyl pouch and hooks to replaceable butane fuel cylinder. Takes a good-size pot or skillet. Marketing Networks, 16301 N.E. 8th St., Suite 210, Bellevue, Wash. 98008.





With a fairly compact rig, you can listen in on all bands from long wave through UHF.

# How to eavesdrop on cloak- and-dagger radio

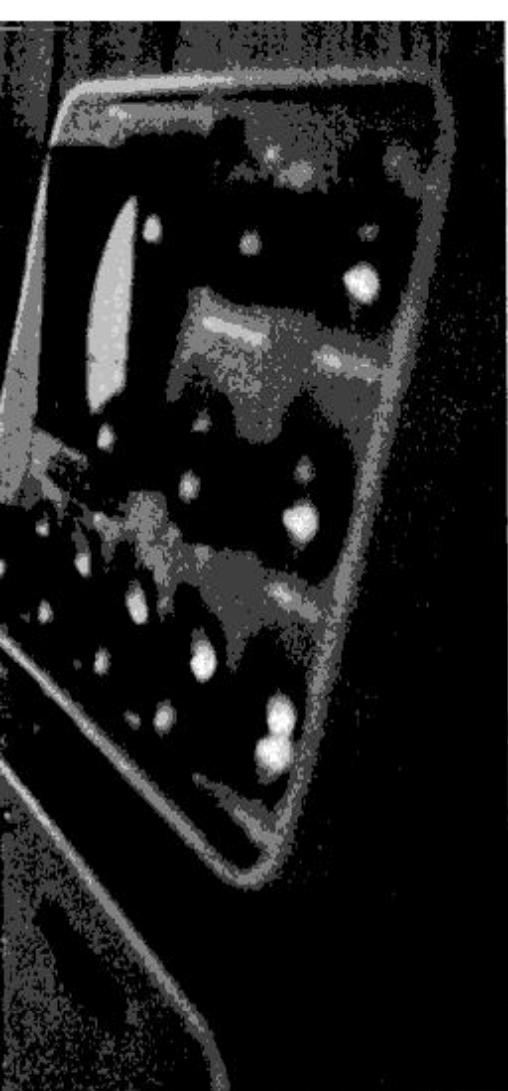
Intrigue isn't the only voice you'll hear along the massive radio spectrum—there's fun and adventure, too.

by Anthony Curtis  
KR3XK

**“A**chtung! Achtung!” followed by a series of five-digit numbers spat from my radio loudspeaker in guttural German. My excitement built as I realized, after months of plowing through static crashes and around the jingle of radioteletype, I finally had lucked into hearing a so-called spy-and-numbers radio station.

Transmitting coded messages to underground political activists, clandestine freedom fighters, Third World travelers and spies around the globe, these shortwave radio stations never identify themselves. And it is next to impossible to decipher their messages. But that doesn't cut the thrill. In fact, it stimulates flights of fancy to think of receivers secreted in false bookcases and transmitters hidden away in dusty attics of the world's exotic hot spots.

Down my radio dial on another day, a woman read a list of four-digit numbers loud and clear in Spanish. Gypsy music and a single word repeated over and over crackled from a different spot on the dial at a different time. These all are part of a stream of cloak-and-dagger radio signals flowing across North America day and night. Such signals are the



## FREQUENCIES FOR SPY-AND-NUMBERS STATIONS

Tuning across the shortwave bands sometimes will turn up strange broadcasts of a man or women reading series of numbers. Occasionally, music is included in these broadcasts. It's hard to tell exactly what these signals may be, but they have come to bear the tag, spy-and-numbers stations. These spy-and-numbers stations don't want to be overheard so they hop around the radio dials, always one step ahead of local authorities and hobby listeners. There's no guarantee of hearing anything but static, but here are frequencies where spy-and-numbers stations have been spotted:

Frequency (MHz)	Language Overheard	Frequency (MHz)	Language Overheard	Frequency (MHz)	Language Overheard
3.060	Spanish	5.810	Spanish, English	8.904	—
3.090	Spanish	5.820	German	9.072	English
3.161	Spanish	5.945	—	9.074	English
3.203	Spanish	6.400	German	9.076	English
3.204	Spanish	6.425	—	9.110	—
3.220	German	6.455	German	9.117	English
3.249	German	6.660	Spanish	9.920	Spanish
3.270	Spanish	6.670	—	9.990	Spanish
3.380	Spanish	6.690	Spanish	10.030	—
3.450	Spanish	6.702	—	10.720	Chinese
4.050	German	6.722	English	10.941	Chinese
4.308	English	6.725	English, Spanish	11.250	English
4.556	Spanish	6.731	English	11.300	Chinese
4.665	German	6.734	Spanish	11.400	Spanish, German
4.670	Spanish	6.746	Spanish	11.545	German
4.680	Spanish	7.404	German	12.092	German
5.015	German	7.450	German	12.405	English
5.020	German	7.850	German	13.196	—
5.140	—	7.970	Spanish	14.775	Spanish
5.239	Spanish	8.413	Spanish, English	14.791	German
5.660	Chinese	8.419	English	17.590	German
5.757	Spanish			17.650	German
5.800	Serbo-Croatian			19.460	German

Where these transmissions originate is not known. Nor is it known to whom the signals are beamed. The numbers codes used are unbreakable by amateurs. One can only imagine their purpose.

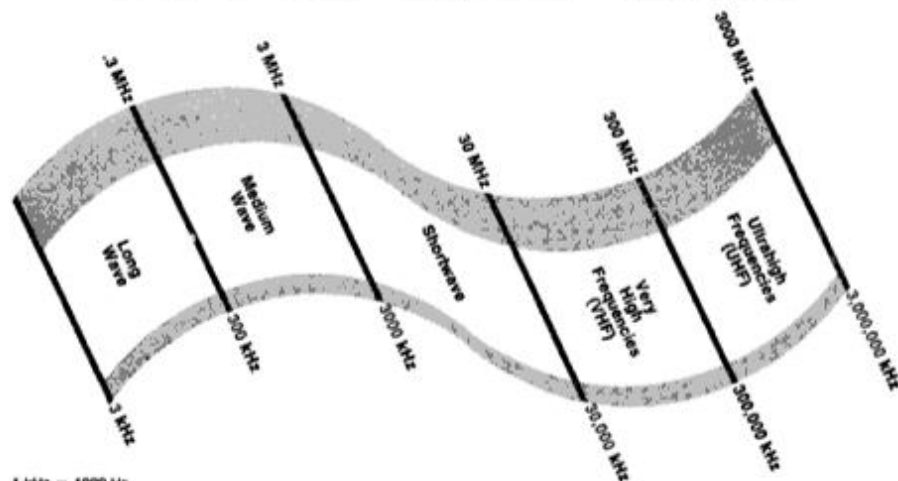
rarest catches of shortwave listeners (SWLs) who often sit up late at night or rise very early in the morning in hopes of pulling an unusual broadcast from the airwaves. The illicit transmissions today make radio listening just as exciting as it was back at the turn of the century when we used a cat's whisker to tickle the sounds of KDKA out of our crystal sets.

Cloak-and-dagger broadcasts include signals known to originate in the Central Intelligence Agency, or U.S. military bases, from foreign embassies in Washington and at Interpol offices around the world. Transmissions are in voice, international code and even radioteletype which can be read off the air with a \$50 secondhand teletypewriter hooked to a shortwave receiver.

The mysterious signals are thrown into the public airwaves just like the rock-'n'-roll music radiating from your home-town disc-jockey station. The cloak-and-dagger broadcasts are far harder to hear, but even the teletype can be copied with readily available equipment.

CIA won't admit it, for instance, but the International Telecommuni-

## HOW TO READ THE RADIO SPECTRUM



1 kHz = 1000 Hz  
1 MHz = 1000 kHz

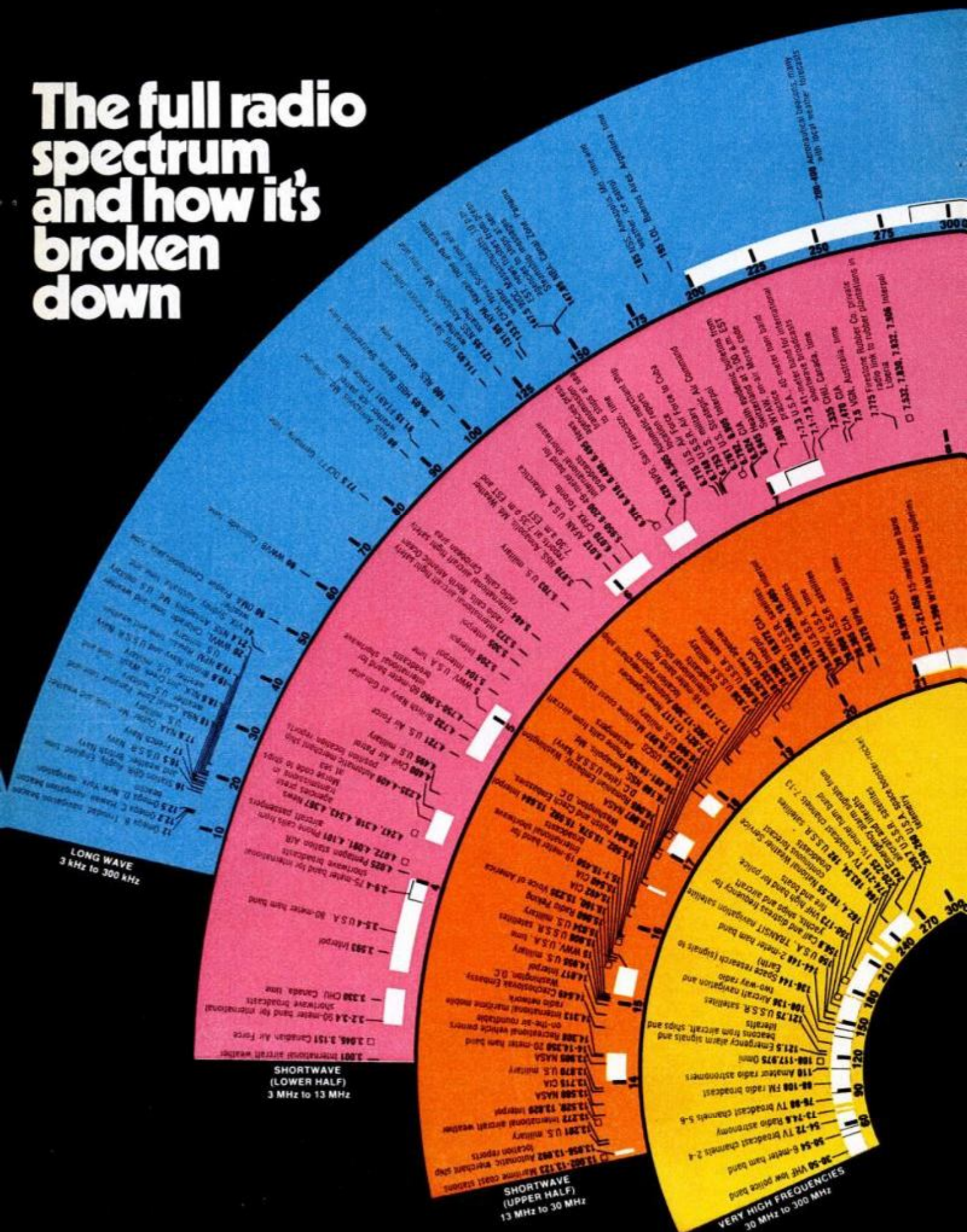
The spectrum can be imagined as a giant radio dial, displaying all frequencies which technology will permit us to use. A frequency is a spot on that radio dial. Frequency is measured in Hertz with the spectrum extending in theory from zero Hertz to infinity. One thousand Hertz equals one kilohertz (kHz). One million Hertz is called one megahertz (MHz) and equals 1000 kHz. The U.S. Federal Communications Commission has set aside all frequencies from 10 kHz to 300,000 MHz for specific radio uses.

Any radio signal can be snagged if your receiver will tune to the spot on the dial where the signal is transmitted and you are in range of the transmitter. For instance, America's oldest broadcaster, KDKA, Pittsburgh, is on the dial at 1020 kHz or 1.020 MHz.

### Long waves

The frequencies from 3 to 300 kHz are known as long waves. Signals sent from high-power transmitters here will [\(Please turn to page 123\)](#)

# The full radio spectrum and how it's broken down

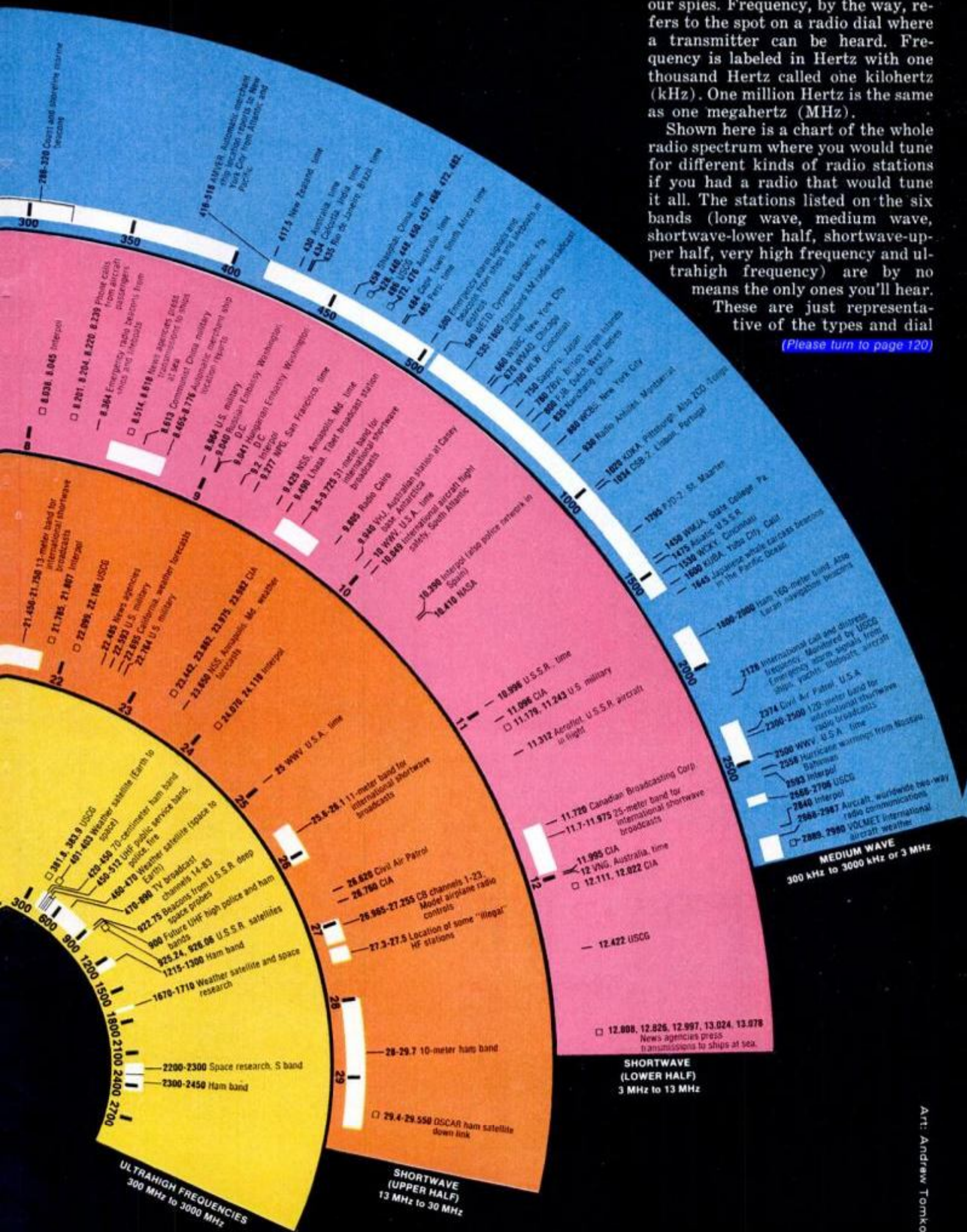


cations Union logs two dozen call signs and frequencies assigned to our spies. Frequency, by the way, refers to the spot on a radio dial where a transmitter can be heard. Frequency is labeled in Hertz with one thousand Hertz called one kilohertz (kHz). One million Hertz is the same as one megahertz (MHz).

Shown here is a chart of the whole radio spectrum where you would tune for different kinds of radio stations if you had a radio that would tune it all. The stations listed on the six bands (long wave, medium wave, shortwave-lower half, shortwave-upper half, very high frequency and ultrahigh frequency) are by no means the only ones you'll hear.

These are just representative of the types and dial

(Please turn to page 120)



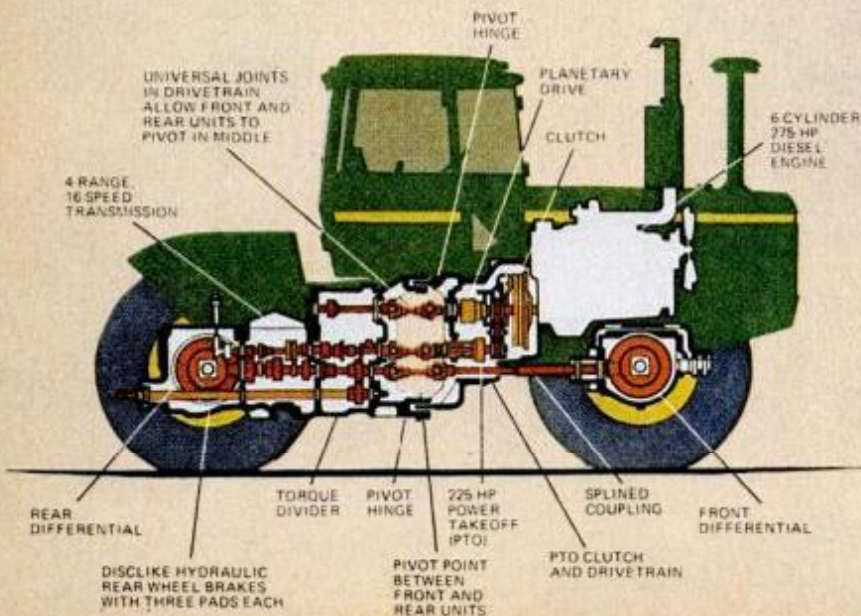
Art: Andrew Tomko

# Down on the farm with four-wheel drive

by Bill Kilpatrick



"Big Red": 300 horses, four-wheel drive and incredibly push appointments make this huge 10-ton International Harvester tractor typical of what's happening down on the farm these days. Elaborate drivetrain in John Deere model (below) carries power from engine to both front and rear axles. Universal couplings allow front and rear units to pivot. A differential at each end lets opposing wheels turn at different speeds when steered.



**\$50,000 for a tractor? Yup, but just see what you get for the money. Here's a look.**

It didn't look like a tractor, but the man kept calling it one. "I'll tell you how it is with that tractor," he said, waving in the direction of a huge red hulk parked in a field nearby. "That disc harrow on the back of it there, that's a 28-footer, and in a 10-hour day, one man, working all

by himself, can do 150 acres." He paused, then smiled. "Now that's moving right along."

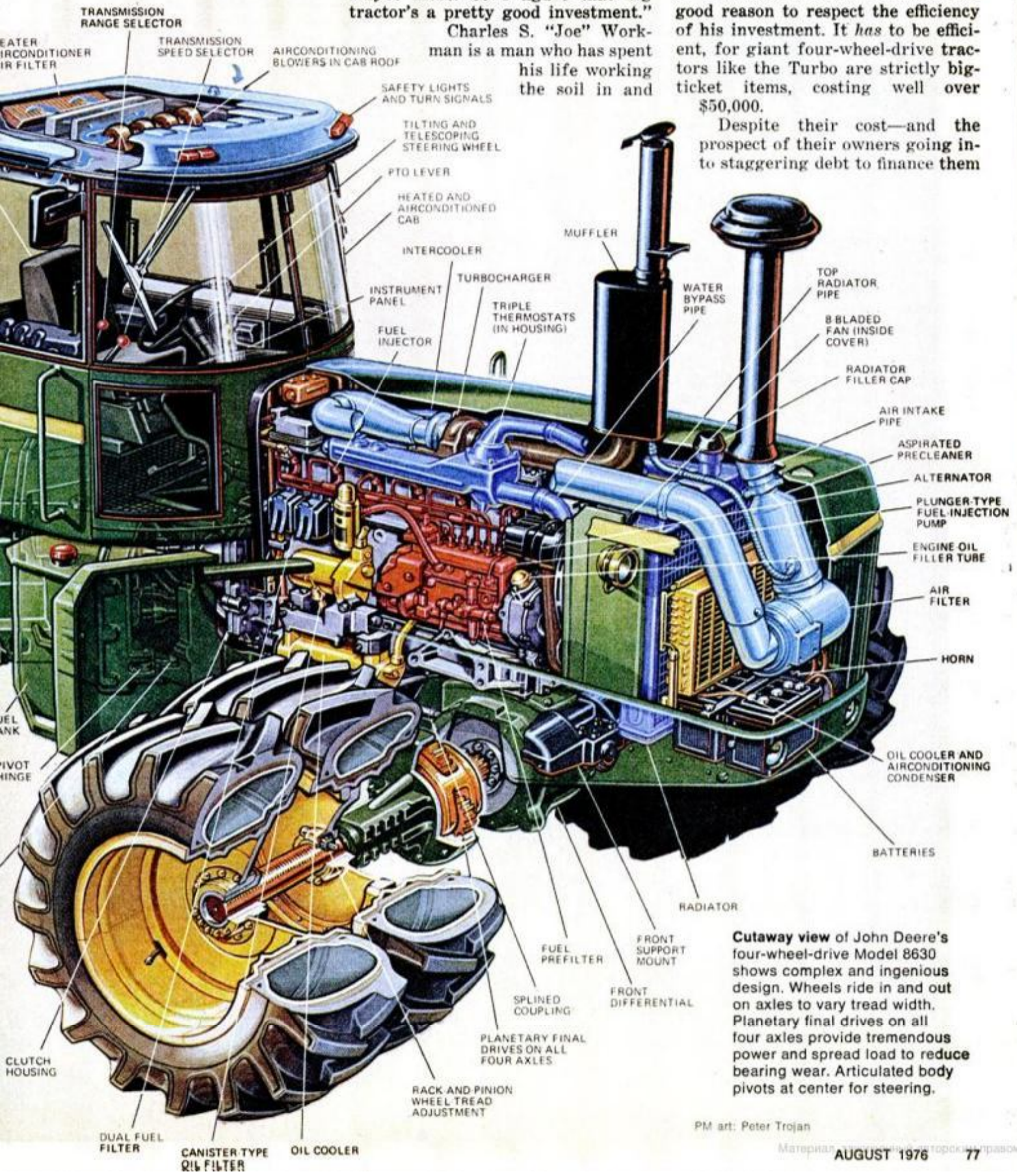
**The big gain: efficiency**

"Normally," he went on, "it would take two men on two tractors pulling two 15-foot harrows twice as long, maybe more. So I figure that big tractor's a pretty good investment."

Charles S. "Joe" Workman is a man who has spent his life working the soil in and

around the Delmarva (Delaware-Maryland-Virginia) Peninsula communities of Georgetown and nearby Bridgeville. He was describing a mammoth 300-hp, diesel-powered, eight-tired, four-wheel-drive, cab-enclosed, articulated International Harvester 4568 Turbo—a 10-ton mass of incredible muscle. Workman has good reason to respect the efficiency of his investment. It has to be efficient, for giant four-wheel-drive tractors like the Turbo are strictly big-ticket items, costing well over \$50,000.

Despite their cost—and the prospect of their owners going into staggering debt to finance them



**Cutaway view of John Deere's four-wheel-drive Model 8630 shows complex and ingenious design. Wheels ride in and out on axles to vary tread width. Planetary final drives on all four axles provide tremendous power and spread load to reduce bearing wear. Articulated body pivots at center for steering.**

PM art: Peter Trojan



Author in cab of big International (top right) tries out the controls. He found performance phenomenal and handling easy except for articulated steering, which "takes a little getting used to." Control console looks more like airplane cockpit.

—more and more farmers are becoming convinced that the big rigs make sense because they can do more work at less overall cost. In addition to awesome power and other advantages, their key feature is four-wheel drive—the name of the game. It goes easily where conventional two-wheel-drive tractors would either struggle or not go at all—up steep grades, in sticky mire, through heavy snow.

#### Getting an earlier start

A typical 4WD tractor may have up to 16 speeds, adjustable tread width to suit different ground conditions and as many as six tire choices depending on load, terrain and type of job. Many have dual tires on each axle, making them mighty eight-wheelers with tremendous traction.



Because they can operate on soft, slippery ground, these high-traction machines enable a farmer to start work earlier in the season when the earth is still wet and muddy from spring rains. Joe Workman reports his big International not only cut his fuel costs, but its greater work capacity enabled him to reduce his payroll. "There's another thing," he added. "I figure I'm about three



weeks ahead of where I would have been without it. I've got more seed in the ground earlier this year than I've ever had before." And for Workman, some of whose 800-plus acres are given over to two crops a year, the savings in time translate directly into money in the bank due to increased productivity and lower operating costs, both critical in today's comparatively specialized farming.

#### Bigger farms, bigger machines

The fact is, farms throughout America are becoming smaller in number and bigger in size. A study by the White Farm Equipment Co., a subsidiary of White Motor Corp., indicates that since 1959, the number of farms decreased by over 17 percent. During the same span, however, farm size increased by more than 15 percent. The White study projects that by 1980 the size of the average farm will be 550 acres.

To work such large lands requires increasingly higher-capacity farm machinery, both tractors and allied

*(Please turn to page 146)*

Mammoth 4WD made by White is one of 13,500 such units expected to be sold annually, as predicted by its maker.





# Kayak surfing:

# 30-mph sensation



Hanging in the curl like a bobsledder, Danny Broadhurst pilots his Extra Sport at speeds that can reach 30 mph. For less than \$500 for boat, paddle, wet suit and helmet, you can join the action.

You'll get all the action you can handle in this new sit-down sport!

by Peter Barmonde

**T**ake almost any stretch of open wave-splashed beach. It's all you need to launch you and your surf kayak on a new water adventure.

These new craft, specially designed to handle the combers, are flat-bottomed, snub-nosed surfers that deliver more thrills per dollar than almost any other boat afloat. Speeds over 30 mph in the curl are not uncommon. Acceleration is phenomenal, any wave over three feet tall looms above your head, and the hull doesn't burn any gas to get going.

First advantage of this kayak over a regular surfboard is that it can be paddled swiftly into position. Riding sitting down is a second plus and, third, you can slide along on surf that would be impossible on a board. Size and design of some surf kayaks let a skilled rider do 360° spins while shooting down the face of a wave.

"It's like riding a floating bobsledder!" reports Danny Broadhurst, former designer of kayaks in Great Britain and now with Extra Sport USA, surf kayak importer at 90 Washington Dr., Centerport, N.Y. Kayak surfing has been around since the first Eskimo took to water, but regular kayaks are difficult to turn in surf and tend to loop or plow in



headfirst. Special boats like the California Surf Shoe appeared about 1970, Broadhurst notes, and became a hit in England which now has over 500 surfers.

The sport is not difficult or dangerous, but you must be able to swim, always wear a life jacket and helmet, and never surf alone. It is important to learn the Eskimo roll—bailing out can be dangerous. Wipe-outs, though spectacular, rarely cause injury and collision is the greatest risk. If it appears imminent, capsize at once, the experts advise; your body will act as a drogue to slow you down.

About \$500 can get you started. Extra Sport USA offers five models (average \$325) including the Surf Ski without deck for beginners. Old Town Canoe's Surfer, from Old Town, Me., is \$385. Add a paddle, life jacket, spray deck, helmet and, if necessary, a wet suit and you're all set for watery action. ★★



**Speedy surfing designs** like Extra Sport's Ripper (above) and Surf Ski (at left) are a long advance over standard kayaks and surfboards. Beginners learn by watching and imitating experts. The Surf Ski, without a deck, allows action without need to learn Eskimo roll.

Photos by the author

# PM's greenhouse: an elegant addition

by Mike McClintock

ASSOCIATE HOME AND  
SHOP EDITOR

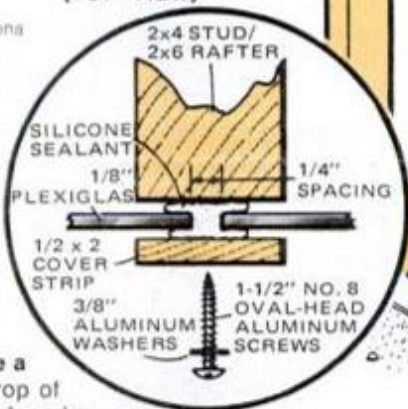


The sun is shining, snow is on the ground, icicles are hanging from the roof, and the roses are blooming. This combination seems impossible, but there's one place it can happen—in a greenhouse, a beautiful addition to your home that will work for you all year round.

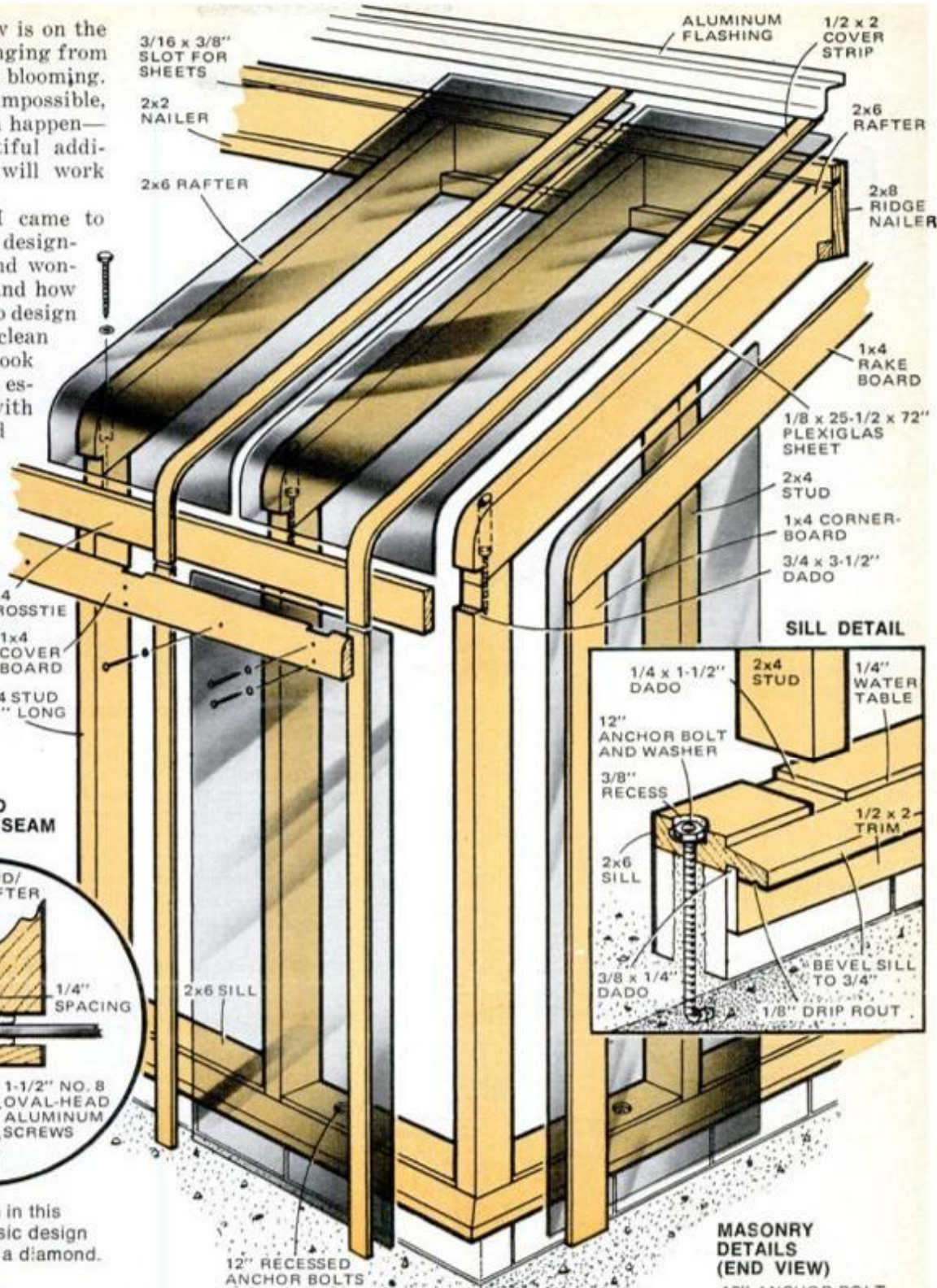
That's the conclusion I came to after several attempts at designing a freestanding unit and wondering where to locate it and how to heat it. The strong lean-to design of PM's greenhouse is so clean and simple that it will look good with any style home, especially when you fill it with your favorite plants and flowers. You'll get the most use out of it in the winter when it captures enough of the sun's energy to keep your garden growing through the sleet and the snow. I'm looking forward to winter this year because I have a fantasy of sitting "outside" in the greenhouse on a bright, 35° F. Sun-

PM photo: George Ancona

#### TYPICAL STUD AND RAFTER SEAM (TOP VIEW)



You'll have a bumper crop of flowers blooming all year long when you put them in this beautiful greenhouse. The classic design will make your house shine like a diamond.



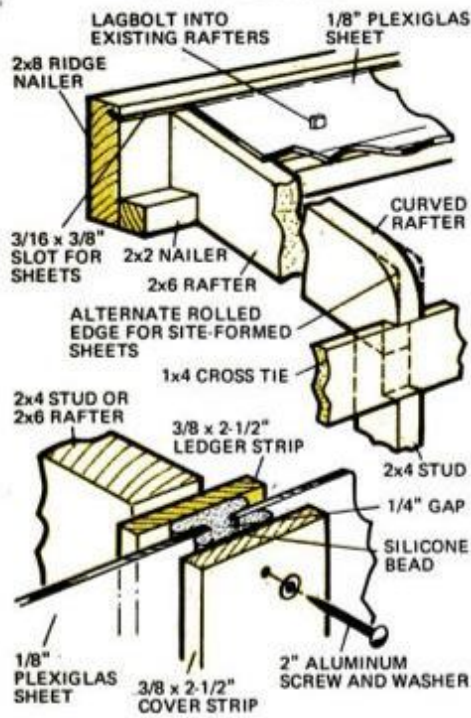
#### MASONRY DETAILS (END VIEW)

Careful layout and a solid foundation are the keys to a good job. Small details like the custom-milled sill make this greenhouse a top-quality addition. Framing is California heart redwood.

PM art: Walken Graphics

Материал, защищенный авторским правом

### RAFTER DETAILS



**HURRICANE DETAIL (EXPLODED VIEW)**

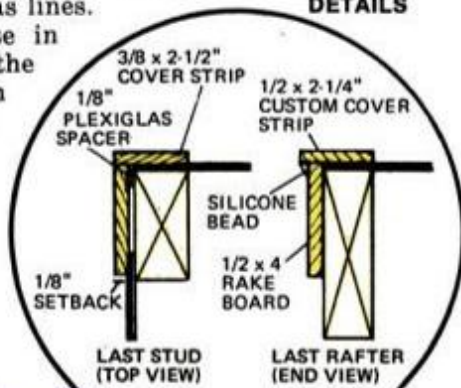


Layout lines should be checked for accuracy before you build the 2x6 forms (1). Run a flat 2x4 across the edges of the forms to level the slab. You can finish with a rough or smooth troweling, depending on the floor surface you want (2). Set up the block while the concrete is still wet, checking the level carefully (3). All studs should be plumbed and braced (4). Inset shows how to set up the rafters for bolting to the studs. Sliding glass doors (from Sears) give access and a good view from the house (5).

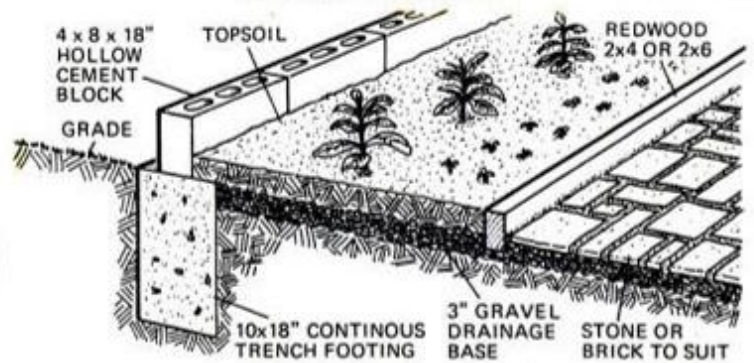
day morning, and reading the papers in 75° F. comfort with the smell of roses mixed in with the aroma of morning coffee.

Making the greenhouse a part of your home gives you a lot of advantages. You'll need less material, and the adjacent house wall will protect the plants from winter winds. You'll be able to enter without going outside. You won't have to install lengthy electric or gas lines. But a great increase in heating efficiency is the best reason to go with a lean-to design. When there's no sun, you can let house heat spill into the greenhouse and take the load off its heater. When the sun is out, you

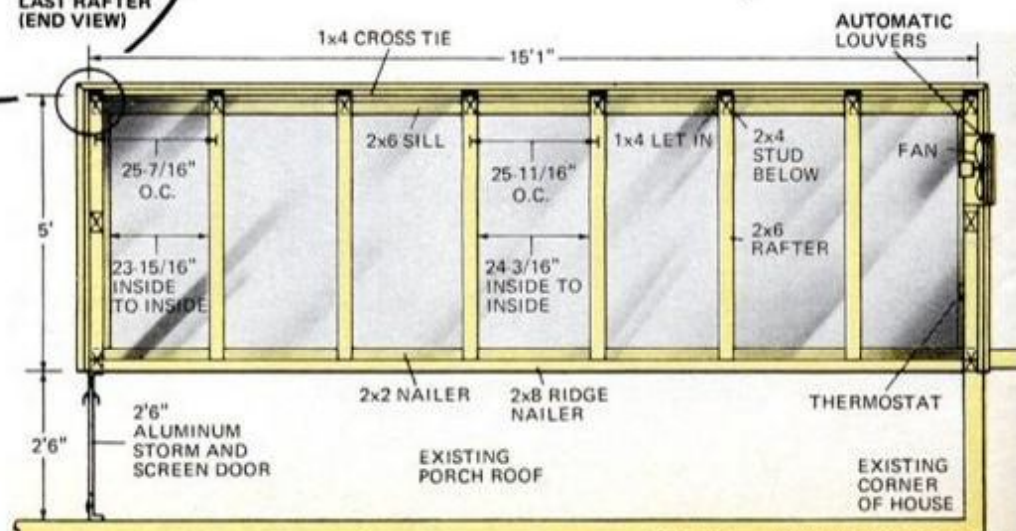
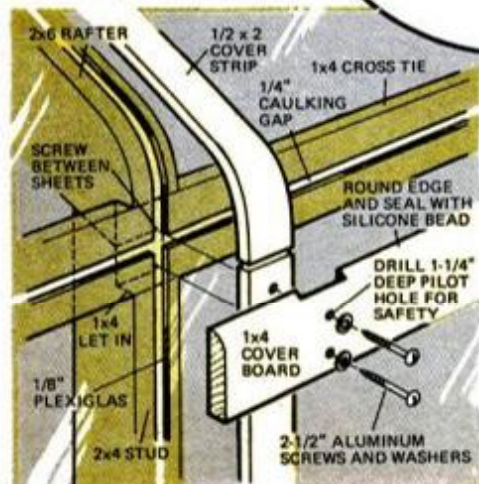
### CORNER DETAILS



### ALTERNATE FOOTING



### COVER BOARD DETAIL





can reverse this process and let that sweet hot-house air spill into the room and save on your fuel bill. It's the simplest form of solar heating.

The structural design is simple, solid and flexible. Each bay is modular so you can add as many as you want to get just the right length. The height of the eaves is figured for a 6-ft. sheet of Plexiglas. This gives you comfortable headroom with the added height of the 8-in. cement block and sill. The run of the rafter also conforms to a 6-ft. sheet. We got extra space by attaching the ridge to an existing overhang. The design will also work against the flat wall of a house where you extend rafters and use 8-ft. sheets, another stock length.

You can use PM's plans and details for any rafter angle that looks best against your house. Here's a rundown on the materials. The footings are concrete. We put down a full slab (a center drain is nice but unessential). You can also use a simpler and less costly perimeter footing (see alternate detail). The cement-block edging was laid while the concrete was still wet to get the best possible bond. This detail raises the wood sill off the ground and gives you more headroom. Many greenhouse designs call for a 3-ft. masonry wall; our design eliminates this expensive, time-consuming job and increases the growing area by letting in more light.

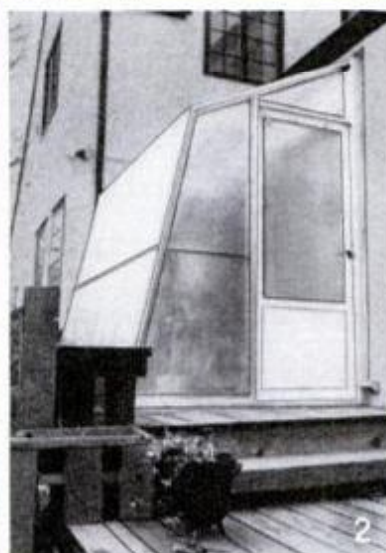
All timber is construction grade, heart redwood. It is milled from the center of the tree, contains virtually no sap, can be left untreated and still

*(Please turn to page 138)*

## Kits you can assemble

1. This fiberglass-glazed, precut redwood freestanding unit is 6 ft. 10 in. x 8 ft., costs \$242.95. Heat kit runs \$65.60. From McGregor Greenhouses, 1195 Thompson Ave., Santa Cruz, Calif. 95063.
2. Vegetable Factory, 100 Court St., Copiague, N.Y. 11726, builds insulated units with two layers of clear, acrylic fiberglass. Its 5-ft. 6-in. x 8-ft. 8-in. aluminum-framed lean-to is \$579. Fan, thermostat and vent package is \$125. Total weight is 2401 lbs.
3. W. Atlee Burpee, Warminster, Pa. 18974, makes this 8x12-ft. freestander with unique sliding entry for \$785 (safety glass, \$85 extra. Add \$171 for 16,360-B.T.U. heater, fan, thermostat, vent.
4. For your estate, here's a 14-ft. 6-in. x 19-ft. 2-in. classic glass and aluminum house for \$1523, with room for three 3-ft.-wide benches. It has fully automatic roof vents and a 44,000-B.T.U. heater. From Janco, 10788 Tucker St., Beltsville, Md. 20705.

**A big range in size and features** is available from all these companies. Aluminum-glass type is most durable and expensive. The price decreases as you go to wood frames and acrylic glazing, even more if you use fiberglass panels. Automatic vents are luxury extras. Fans, controlled by a thermostat that activate gravity louvers, can do the job. See page 138 for more kits you can build.





# Vacation driving tips from a 24-hour racer

Long hours behind the wheel are part of vacationing—and endurance racing. So lend an ear to how Peter Gregg, winner of the rugged 24-hour Daytona race, gets ready for his long drives.

by Glenn Howell

**V**acation time is here. For many, that means stuffing the kiddies and a few weeks' clothing into the family car and setting off for a change of scene.

Such a journey is eagerly anticipated by everyone but, in what seems like no time at all, the miles get longer, the car gets smaller, tempers grow shorter and home never seemed dearer.

There's got to be a better way, right? Well, for many families a vacation trip by car is the only affordable means of travel. And for others it allows a flexibility not offered by bus, train or airplane trips. So for millions, it's everybody into the car!

There are, however, several ways to make such a journey more pleasant and even downright enjoyable.

Since long hours of driving are a necessary part of a vacation by car, who should know more about long-distance driving than a professional racer who drives—and wins—endurance events?

Peter Holden Gregg is such a man. A former Naval officer, Gregg has refined his natural driving abilities to the point that this year he is spearheading the factory BMW effort

in the U.S.A. He's racing in both International Motor Sports Assn. (IMSA) and Sports Car Club of America (SCCA) events and is on tap for some European races.

## Impressive victories

Gregg's credentials are most impressive: He's a four-time IMSA Camel GT champion, two-time SCCA Trans-Am champion, victor in the Sebring 12-hour race twice, and has won the 24-Hours of Daytona an incredible three times, including this year when he shared the winning BMW coupe with Brian Redman.

"The key to endurance is mental, not physical," says the curly haired Gregg. "I don't get as tired as other drivers I've noticed. I don't perspire as much and I don't let the tension get me."

Mental attitude plays a large part in driving, especially when covering many miles in a single day. If you look upon the day's driving as a grueling chore, then it will be just that. But decide before the first mile is logged that it will be the "Great Adventure," taking you to new and exciting places, and the miles will be far less tiring.

"One thing is what I do when I'm not driving. I totally turn off to the race. I don't stand in the pits to make sure he (the co-driver) goes around properly. I trust him completely to do his job and I try to put the race completely out of my mind."

## Switch drivers

If your family has more than one licensed driver, it's best to share the driving with one or two others. When you aren't behind the wheel, try to relax as much as possible.

If your vehicle is a camper and state law allows traveling inside while the truck is moving, sleeping in the back is a fine idea to restore you *and* your concentration.

"I try to totally rest during the period when I'm not racing to relieve the tension," says Gregg. "And I stroll slowly back to the pits when it's my turn to drive, and never more than about four or five minutes before my turn."

How long should you drive in a single sitting? Unless your vehicle has a gas tank providing a range of 500 miles or so, changing drivers at each fuel stop is a sensible idea. Or, if you do have sleeping provisions,

you might change every other gas stop at night so as to let the other driver have a longer rest period.

Stopping frequently results in less fatigue and fewer sore muscles. Even just pulling into a gas station or food-stop parking lot for a minute or two, stretching the legs and taking a couple of deep breaths can be a great boost and restore circulation to those tired limbs.

One of Gregg's methods of keeping himself from becoming fatigued is to freshen up frequently. "I try to give a light-hearted, easygoing impression. I shave frequently, I wear cologne. I like to shave a lot in long races because it keeps my mental attitude sharp. I like to wear clean clothes," says the 36-year-old racer.

Gregg finds that this not only has a positive effect on him but keeps his team in a much better state of mind.

In much the same manner; the driver who freshens up in the wash-room at each stop not only rejuvenates himself but can serve to make the trip more pleasant for everyone.

### Important preparation

While much of the preparation for a vacation is mental, there are some important physical considerations. About six weeks before a long-distance race, Gregg begins thinking about minor things that could serve as major irritants in a 24-hour grind.

"When I'm preparing for a long race I notice that I'm conscious of avoiding injuries. I also don't want to be injured in a minor way that'll aggravate me during the race.

"For example, I don't want to have a cut on the palm of my hand or a sore hip or something, so I try and do whatever I'm doing carefully. If

I'm lifting a crate or something, I wear gloves. When I motorcycle, I try and do it more carefully. If you're sore or have a bad neck or something or other, those long races get quite grueling they aggravate the soreness."

Even driving a couple of hours with a blister on the palm of your hand or a sore ankle can be discomfoting. "If you're not in good physical shape, if you're recovering from some injury or you have a painful sore somewhere, it robs you of concentration. You have to feel good to drive your best," says a man who even forgoes his favorite sport of skiing prior to the first race of the year, traditionally the 24-hour event at Daytona in February.

"I don't eat a special diet or anything. I try not to get too fat. I feel physically stronger when I'm about 145 pounds, so I cut down on french fries and dessert. And I love dessert."

### Car should be in good shape

The third part of successful long-distance traveling is material preparation. Just as Gregg wouldn't think of showing up for a race with a car in anything but perfect racing order, you shouldn't attempt a long drive with anything less than a mechanically reliable car.


When Gregg sets out for a drive of several hours in his personal car (a custom BMW sedan—what else?) he is a stickler for organization. The

*(Please turn to page 150)*



**Peter Gregg** (above) is a safe, skillful, long-distance driver. He confirms that concentration is the all-important ingredient when you're out in traffic, and to concentrate exclusively on your driving you should make sure you prepare and know your car well. That's part of his formula for winning races, like this year's 24-Hours of Daytona with co-driver Brian Redman, shown at right in their BMW. As Gregg says, you shouldn't have to fiddle with things like the ventilation system when you're in heavy traffic: You should know how it works beforehand. Clear visibility is a must and his windshield is cleaned during every pit stop (top right). Tires, too, get close attention (above right). Check your tread, sidewalls and air pressure often. Develop an easy habit: Eyeball your tires before you leave the motel or campground in the morning (just as you should glance back at your car when you leave it for the night—to make sure all lights are off, windows are up and so on).





Realistic  
Rover-1500  
3 channels,  
1.5 watts, \$50.

E.F. Johnson  
Messenger 92  
5 channels,  
5 watts, \$160.


Pace CB-155  
6 channels,  
5 watts, \$100.

Lafayette  
Dyna-Com 12a  
12 channels,  
5 watts, \$110.

Archer Space  
Patrol Standard  
1 channel,  
under 100 mW,  
\$15 per pair.

# CB PORTABLES PUT EARS





Zodiac  
P-5024  
23 channels,  
5 watts,  
\$210.

Realistic  
TRC-100B  
6 channels,  
5 watts, \$90.

Handic 65C  
6 channels,  
5 watts, \$110.

Mega  
PocketCom  
2 channels,  
100 mW,  
\$40.

Citizens Band radio is a good way to keep in touch while on the go. That's why the great majority of CB sets sold are mobile units. But once you step out of your car, you've lost touch with the CB world.

That's not always a bad thing. But for the times it is, there are a host of hand-held CB sets you can take with you, from toys like the little one-channel Archer Space Patrol set shown, to full-featured, full-power, 23-channel sets like the Zodiac, as well as other partial or full-power sets with 1, 1.5, 2, 3, 6 or 12 channels.

Functionally, the major differences between hand-held and mobile CB sets are shape and transmitter power. The size differences aren't as significant as you might think at first—several mobile CBs are smaller than most hand-held sets. But the power differences are notable.

Virtually all mobile sets deliver the maximum legal power of 5 watts at the input of the transmitter stage, or an equivalent 4-watt output. Since hand-helds carry their own batteries, about half the licensed models have lower power outputs, for longer battery life, and many of the 5-watt sets have battery-saver switches which cut down the output and the battery drain when maximum range isn't needed. The Pace shown here, for instance, can cut its power back to 1 watt, cutting battery drain during transmission by about 75 percent.

But there are also units putting out 100 milliwatts (1/10 watt) of power, or less. These cost little and require no license. Toy "walkie-talkies" like the Archer Space Patrol set, sold for kids, fall in this category as

*(Please turn to  
page 112)*

FM photos: Cosimo

# IN YOUR HANDS

by Ivan Berger  
ELECTRONICS EDITOR

**F**iat's five-passenger 131 series arrived on these shores in 1975 to replace the venerable Fiat 124 sedan. The new 131 uses the double-overhead-cam Four from the 124 Sport models and comes with either the 124's automatic transmission or an all-new manual five-speed.

Traditional in powerplant, drivetrain and brake layout (discs and drums), the 131 raises no engineering eyebrows. Its unitized body makes for strength plus lightness (2375 pounds at the curb), and McPherson-strut front suspension complements the coil-spring-hung solid rear axle to give a practical combination of ride and **handling**.

Handling came in as the Fiat's best-liked feature

Fiat body engineers have managed to squeeze an amazing amount of space into so compact an automobile. Remember that the 131's 98-inch wheelbase and 171.7-inch overall length put it very much into the Pinto/Vega range.

In this owners report, instead of grouping responses into specific categories, we'd like to let a number of owners have fuller say. We've tried to pick a sampling that represents an accurate reflection of all owners.

First, a real-estate manager in New York: "We are golfers and need a car that will give good mileage, accept golf clubs easily, be sturdy and cost around \$5000—a car to seat four. I've found Fiat service to be excellent, but you have

## PM OWNERS REPORT: FIAT 131

# Handling, economy and comfort fine, but dealer service could be better

A nationwide survey based on 1,349,698 owner-driven miles

by Michael Lamm WEST COAST EDITOR

Photos by the author





Fiat's roomy interior and well-laid-out controls earn owner praise. Automatic transmission is optional, reclining seats standard. Awkward gas filler dribbles fuel down body side, invites scratches and nicks by hasty attendants. The 131's dohc Four redlines at 6500 rpm, gives good flexibility with five-speed manual gearbox. Overall, owners are very pleased with their cars.



to be patient, because they take care of one thing at a time. For the first few weeks, the car was at the dealer's every other week. But the Fiat mechanic is good—very Italian and concerned.

"The car is tight, but the seats should be a little softer, and there's too much plastic inside. It's squeaky and noisy. Ought to be more like leather. Yet it's a well-constructed car—good-looking, with lots of unexpected standard features: tachometer, quartz clock, Michelin radials, tinted glass, reclining seats. The Fiat has excellent vision and feels safe—like a much heavier car."

Next, a California school health and safety officer, 29: "Sales people used no pressure tac-

By and large, tall people have plenty of head and legroom.

tics. I bought the 131 because it had four doors, a large rear seat and trunk, plenty of headroom; because it handles well on the road and rides very comfortably.

"The car's interior is excellent—no rough edges, and it doesn't look like stick-on paper and cardboard. However, I would like gauges to show oil pressure and engine temperature. Spaciousness in the back seat became a selling point, because we have very tall friends and family. I feel it's an all-around terrific small car for the price."

A San Francisco architect, 33: "I found the dealer here high-pressure and devious, even though I was clearly a willing buyer and didn't

(Please turn to page 133)

## Summary of 1976 Fiat 131 Owners Reports\*

Total miles driven	1,349,698	Performance	22.4	Comfort opinion (front seats):		Had any mechanical trouble?	
Average miles per gallon		Specific dislikes:		Excellent	54.5%	Yes	72.9%
In town (EPA, 18 manual)	19.5	Dealer service	18.3%	Very good	36.1	No	27.1
Long trips (EPA, 29 manual)	25.2	Rattles	12.7	Good	7.8	What type of trouble?	
Body styles:		Mileage below expectations	10.8	Fair	0.8	Carburetor	16.9%
Two-door sedan	44.2%	Emission-related	8.8	Poor	0.8	Speedometer cable	16.9
Four-door sedan	47.8	What changes would you like?		Comfort opinion (rear seats):		Electrical	12.0
Four-door wagon	8.0	Ventilation system	7.8%	Excellent	23.4%	Emissions equipment	10.4
Transmissions:		Remove smog equipment	7.3	Very good	42.7	Transmission	8.7
Five-speed manual	76.2%	More legroom	6.0	Good	25.0	Brakes	8.7
Automatic	23.8	Better gas mileage	5.6	Fair	7.3	Did you repair it yourself?	
Why did you choose the Fiat 131?		Dealer service opinion:		Poor	1.6	No	96.7%
Economy	26.8%	Excellent	19.4%	Number of vehicles owned:		Yes	3.3
Styling	26.8	Good	25.3	Fiat 131 only	44.7%	Dealer repairs satisfactory?	
Price	16.4	Average	19.4	Two cars	44.0	No	53.7%
Handling	15.2	Fair	11.5	Three cars	9.7	Yes	46.3
Comfort	14.8	Poor	24.5	Four cars	1.2	Age distribution of owners	
Size	12.8	Workmanship opinion:		Five or more cars	0.4	15-29 years	50.8%
Specific likes:		Excellent	26.8%	Makes of other cars owned:		30-49 years	36.9
Handling	48.4%	Good	47.6	Chevrolet	16.3%	50-plus years	12.2
Comfort	46.8	Average	16.5	Fiat	15.4	Would you buy another Fiat 131?	
Economy	32.4	Fair	4.3	Volkswagen	12.1	Yes	62.7%
Styling	30.4	Poor	4.7	Ford	10.6	No	37.3
				Pontiac	5.7		
				Mercury	5.7		

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

# How to overhaul drum brake systems

by Mort Schultz

There's a big saving in doing your own brake work. Overhauling disc brakes yourself saves a lot of money right away (*How to Replace Disc Brake Pads*, page 86, Jan. '76). Savings aren't as significant the first time you overhaul drum brakes, however—you need several special tools you may not have, including:

■ Drum-to-brake shoe clearance gauge	\$9.80
■ Brake-cylinder clamps (four)	6.25
■ Brake spring tools	11.95
■ Brake bleeder wrench	3.70
■ Adjusting tool	4.10

(Retail prices quoted above have been provided by a well-known tool company. You can probably purchase the tools for less.)

Another essential tool is a brake-drum micrometer that sells for about \$75. You can avoid buying it by getting a brake shop to do your drum work. Shops charge about \$3 per drum for miking and turning. More about this in a minute. You may also want to have a brake shop grind new brake linings to make full contact with drums, but this isn't always necessary since most high-quality linings are preground by the maker. More on this later, too. Major tasks involved in brake overhaul are (1) servicing brake drums; (2) replacing shoes and linings; (3) servicing wheel cylinders. The master cylinder will also require overhaul or replacing if it's leaking. We'll assume it's not.

Next is a step-by-step guide to overhauling drum brakes. It is concluded next month. Our purpose is to provide instructions that will help you do this job. If you don't want to tackle it, you can use the guide to determine if a mechanic is doing the proper kind of work.

We don't have space, obviously, to discuss every detail for every type of brake system made. However, we stress steps relative to all systems, and give some specific recommenda-

tions relative to the most popular makes. For obvious reasons, don't start your brake overhaul before receiving the final installment—you don't want your car up on blocks for a month.

## Removing brake drums

■ To remove rear brake drums, release the parking brake and relieve tension on the parking-brake cable. On most cars this is done by loosening or removing the adjusting nut at the equalizer (Drawing 1).

It might also be necessary to back off the brake-shoe adjusting mechanism before drums, front and rear, can be removed. On some cars, there is a slot in the backing plate through which this is done.

■ Remove the cover over the slot, insert a brake-adjusting tool and engage the teeth of the adjusting wheel (called a star wheel). Back off the star wheel until drag disappears. Be sure to reinstall the access hole cover (Drawing 2).

On other cars, access to the star wheel is gained through a lanced area in the brake drum. Knock out the plug in the lanced area. Insert the tool and proceed to disengage star wheel tension as just described.

*Remember:* Before you finish the job, make sure you get new covers for lanced areas. Holes must be sealed to keep dirt and water from getting into the brake.

■ If you are working on front wheel drum brakes, in most cars you have to disassemble outer wheel bearings to remove drums. Take off the grease cap, cotter pin, castellated nut (or plain nut and locknut), thrust washer and outer wheel bearings (Drawing 3). Lay these parts on a clean surface.

■ If you are overhauling rear wheel drum brakes, take off the rear wheel and tire assembly. Metal clips (speed nuts) are probably holding the drum

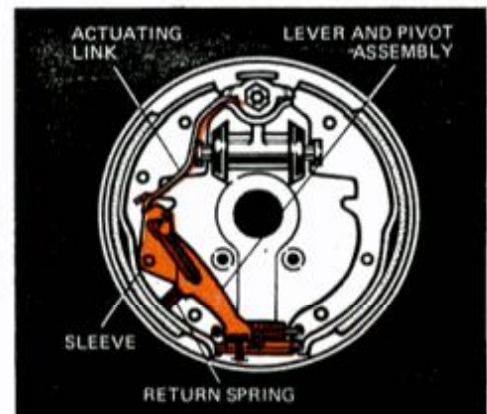
(Please turn to page 134)



1. Parking brake cable tension is released by loosening adjusting nut.



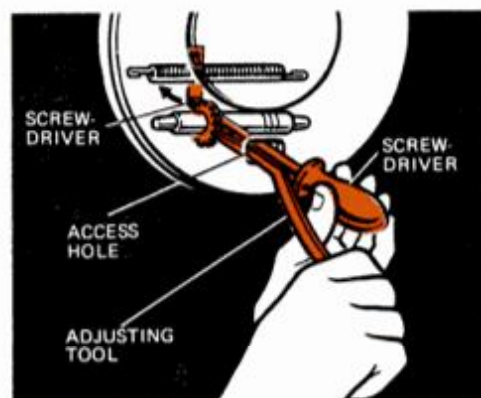
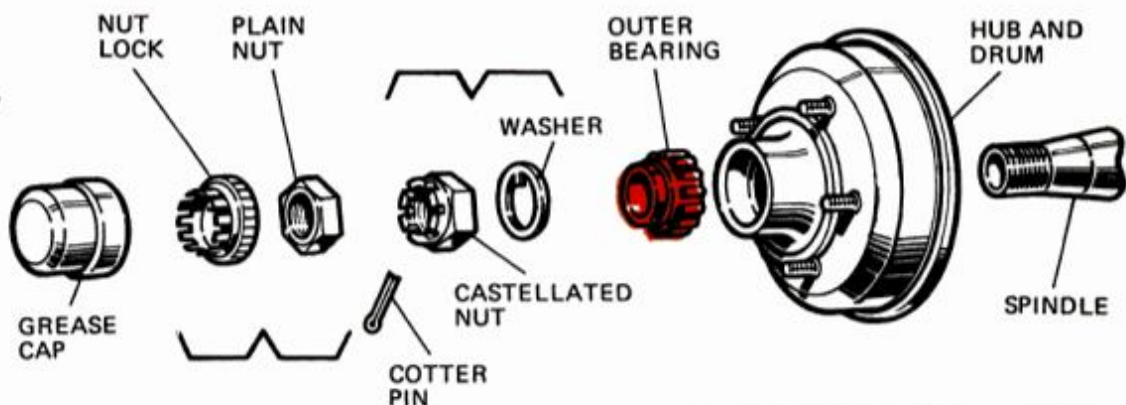
2. Lightly buff drums that are in good condition with emery cloth.



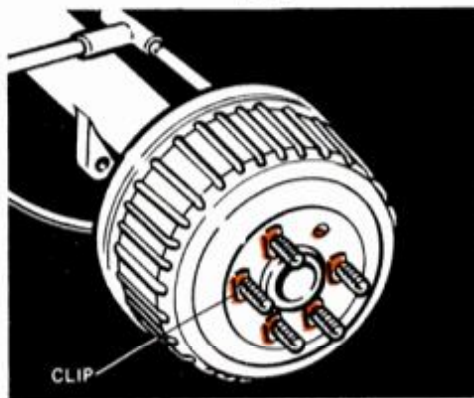
3. Self-adjusting mechanism for Delco Moraine brakes is shown here.

To do a safe, thorough job, start here with Part 1. Next month we'll conclude with Part 2.

**3. Typical front wheel bearing assembly is shown here.** You'll have to disassemble outer wheel bearing to remove drum. Take off grease cap, cotter pin, castellated nut (or plain nut and locknut), thrust washer and then the outer wheel bearing.



**2. Adjusting tool is necessary to back off star wheel (except Wagner).**



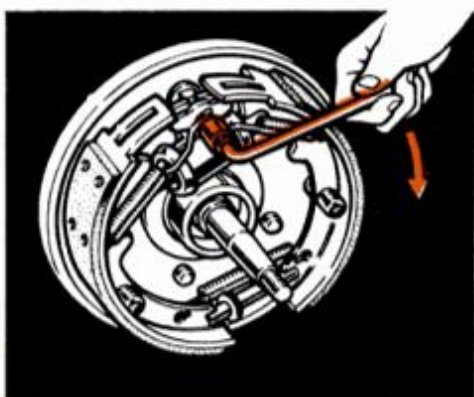
**4. Rear-wheel drum clips (speed nuts) must be removed to remove drum.**



**5. Brake drum is checked with micrometer for wear, out-of-roundness, taper.**



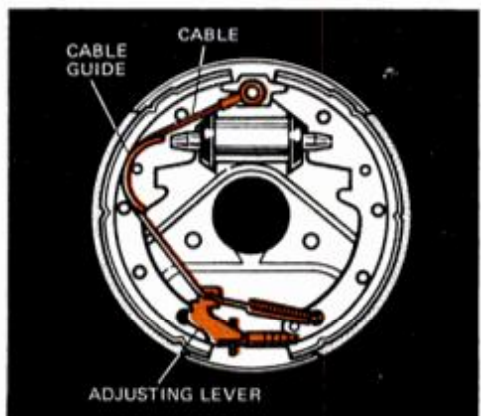
**7. Use clamp to hold wheel cylinder boots in place to prevent fluid leakage.**



**8. Remove anchor pins and take off the brake shoe return springs.**



**9. Hold-down springs are compressed and cups rotated to line up with pins.**



**11. Self-adjusting mechanism for Bendix brakes is shown here.**



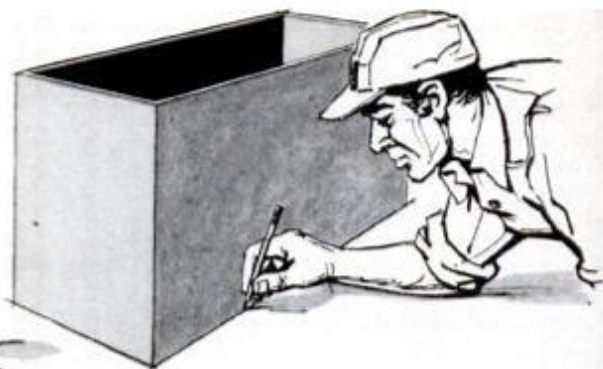
**12. Assembly of brake shoes, adjusting screw and spring is removed.**



**13. Separate shoes by relieving tension on the adjusting spring.**

# Fiberglass: the boatman's quicker fixer

Customizing your boat with an added fish box or bait well is among the bonus projects that fiberglass makes possible. First mark outline of new installation.



The mystery is gone, but the magic of this material remains.

by Bob Whittier

It's been called the miracle material, and fiberglass-reinforced-plastic pleasure boats now crowd the waters of the world. Though most hulls today are made of the material, many owners have only a general idea of how to make repairs and even fewer know the necessary techniques for successful customizing. Yet one of the pleasures of owning a boat is the chance to install special cabinets and cuddies, tackle lockers and rod holders, docking lights and fender cleats—important extras that can make a craft safer and more comfortable. Here's how to use fiberglass to make your boat special; the same procedures will work for projects ashore.

The glass cloth you see most often in your marine supply store is a shiny coarse weave resembling burlap. It is meant for repair and installation work, and for covering wooden boats. Mat and roving were probably the materials used in the construction of your boat, since they are less expensive than the glass cloth.

## Mat and roving: the good guys

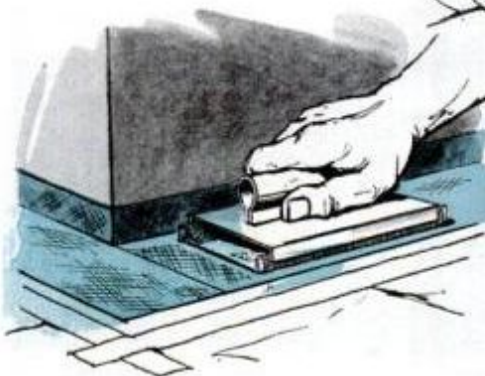
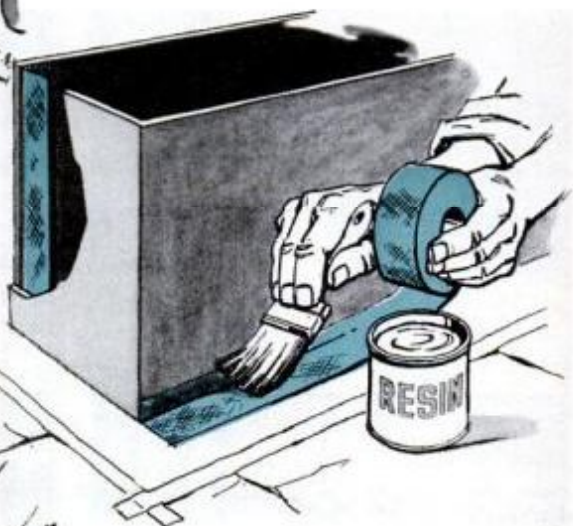
Mat looks like a coarse white felt and is made of many short lengths of chopped strand held together with a binder. You may use it to build up thickness when fixing a large puncture hole in your hull. Inexpensive, it's a quick way to achieve laminate thickness and rigidity, though its resistance to cracking is low.

Roving, a cloth with very thick strands made up of many individual glass filaments, has a high resistance to cracking and puncturing. One layer incorporated in the laminate



Mark area outside of scribing where addition will be positioned. Use disc sander to remove paint and scuff shiny surface so that resin can grip the base surface.

Fiberglass tape, available from marine and auto repair suppliers, is laid into resin-wetted surface. Tape may also be used to help waterproof inner bait well corners.



Finishing installation includes added coats of resin to fill mesh of cloth tape, plus layers to give a smooth finish. Surface is then sanded down for smooth finish and masking removed. An epoxy paint can be used to blend addition into deck or bulkhead.

provides those qualities. For boat construction, some mass-production builders also use a spray gun that blows a mixture of chopped strand filaments and resin into the hull mold, but this is only a professional technique.

Whether made by spray gun or hand lay-up methods, the result is the laminate "planking" of your hull to which you will be installing equipment. It may seem so smooth and hard you'll doubt if you can make holes in it. Actually, it can be worked with ordinary tools. It is drilled and sawed like other plastics encountered by the home craftsman with one ex-

ception: The glass filaments embedded in the resin produce a rather abrasive dust that dulls cutting tools more rapidly. Thicknesses you'll work with may run from laminate less than 1/8-inch in a light canoe, 3/16 to 1/4-inch for an outboard runabout, to 1/2 inch and more in larger cruiser hulls. The smooth finishing gel coat and layers of fabric are fused into a hard solid, and delamination is very rare.

## Drilling is easy

Small holes for screws and bolts used when you install typical accessories can be made easily with ordi-

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nary twist drills. As hole size reaches the 1/2-inch range, lips of a large drill may tend to grab and tear. If so, switch to a flat spade bit. Its pilot point and horizontal cutting edges will go through with less trouble. Making a few holes won't significantly dull it, but if you must drill many holes between about 3/8 and 3/4-inch diameter, buy a bit for the job and then throw it away afterward.

If your twist drill tends to "walk" when being started, make a small pilot hole first to give it bite. Center-punching on fiberglass often does not work well; thin laminate may bounce when it is struck, and with thick laminate the hammer blow is apt to make the punch point shatter the surrounding gel coat. A carefully made pilot hole is preferable.

Round holes between 3/4 inch and 4 or 5 inches—when you are installing dashboard switches and instruments, for instance—are easily made with electric-drill hole saws. Cheap ones dull quickly, but are all right when only a few holes are to be made. Large round holes may also be made with the adjustable so-called "hole cutters" or "fly cutters." Use a slow-turning or variable-speed electric drill to prevent wobbling from centrifugal force. Hold it firmly and watch progress of the cutter carefully.

### Start outside

It is best to start holes from the outer shiny-gel-coat side. If done the other way, the gel coat is likely to chip as the drill or cutter breaks through. It is usual to encounter wood cores inside such areas as outboard motor-boat transoms, and to hit foam plastic cores inside deck laminates and bulkheads. Such material is incorporated to make stressed areas thicker and more rigid. Don't be alarmed if your drill starts throwing up wood chips or suddenly strikes a soft spot. But if you en-

counter wood, squirt in some clear wood preservative liquid and use bedding compound on bolt shanks as a precaution against wood rot.

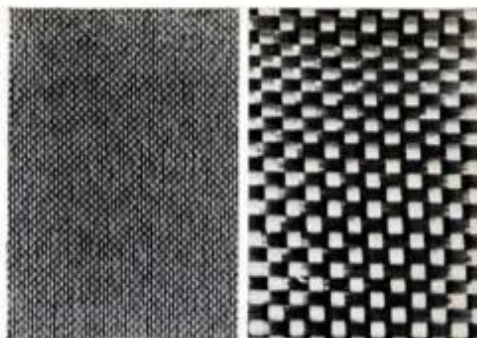
Rectangular or irregular-shaped holes, such as those you will make when you are adding a locker or stowage compartment, can be made with a sabre saw. Use a fine-toothed metal-cutting blade to minimize chipping. It's also helpful to put masking tape on the surface. Pencil guide lines show up well on it, and it keeps the saw's shoe from scratching the gel coat. Make a starter hole with a drill, insert the blade and maintain moderate but steady pressure as the cut progresses.

Regular fine-tooth metalworking files do a good job of smoothing up sawn edges. It is best to file from the gel coat side toward the back to minimize gel coat chipping. For final smoothing, use aluminum oxide or silicon carbide abrasive paper. Flint and garnet grits are too soft for fiberglass and will dull quickly.

### Attaching light accessories

Lightweight accessories not subject to much strain, such as drinking-glass holders along the gunnels, can be attached with stainless-steel self-tapping screws available at marine stores. Drill a pilot hole smaller than the thread diameter. Turn the screw in as a trial. If it can't be started at all, or if appreciable chips of the gel coat threaten to lift around the edges of the hole, try the next larger drill size. The screw should go in firmly yet without raising large gel coat chips. With the right-size hole, the screw will cut its own thread in the fiberglass.

I've found a product called fiber-grip helpful. Made by Marine Development & Research Corp., 116 Church St., Freeport, N.Y., it is a nylon device available in assorted sizes and resembles the common ex-



**Fiberglass materials** suitable for amateur use include cloth (above), woven roving (upper right), and mat made up of glass strands (at right). For customizing and covering areas to strengthen and waterproof, properly treated cloth is best.



pansion shields used to secure lag-bolts in holes drilled in concrete. These items can quickly secure screws in fiberglass or in holes that have worn oversize.

Use caution when you drill holes in the floor of a fiberglass boat. There may be a flotation chamber or reinforcing stringer under it. Tap the surface with a tool to judge by sound what might be underneath. Gas-tank securing brackets and battery-box hold-down hardware can be installed on fiberglass floors by fastening wooden strips to the fiberglass with epoxy adhesive, then driving screws into the wood.

### Installing through-bolts

It is best to use through-bolts to attach parts like hand rails and mooring cleats subject to strain or vital to safety. But when nuts are drawn down very tight and subject to vibration, there is a tendency to

*(Please turn to page 124)*

**Repair of puncture** starts with cutting out of damaged material with hand or power sabre saw, and feathering down of edges of hole both on outside and inside. Wear respirator when sanding fiberglass.



**New laminate** is built up on piece of wood or cardboard that has been covered with cellophane. Latter material does not stick to the resin and gives surface of patch a smooth finish.

**Final polish** of patched area comes after repair has been taped from inside into place and allowed to harden against an outside layer of resined cloth and sheet of cellophane. Color pigment helps blend.



# 10 clever shop tips

by Wayne C. Leckey HOME AND SHOP EDITOR

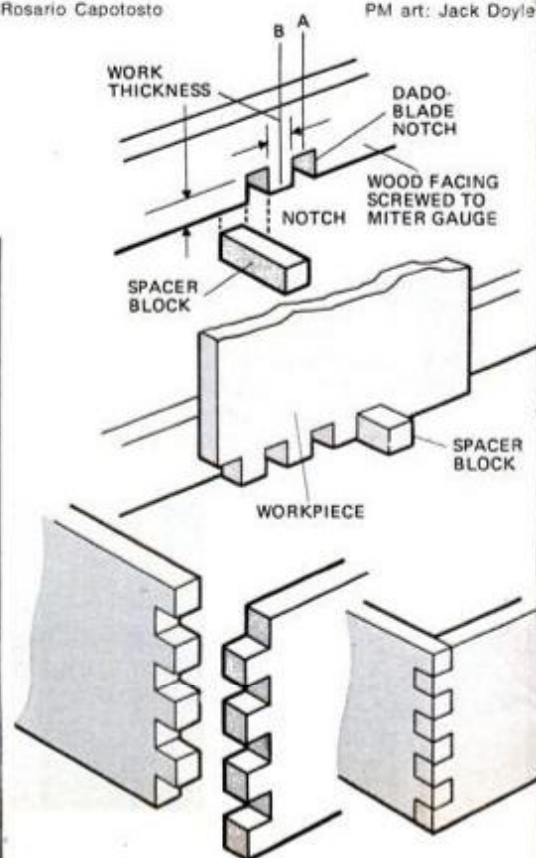
**1** With a spacing jig attached to the miter gauge, it's a simple trick to cut a perfect-fitting box or finger joint on your own table saw. The jig is little more than a wood fence screw-fastened to the gauge and fitted with a small projecting block which uniformly spaces a series of notches across the width of the work. The notches are made with a dado cutter, and their width and depth are generally equal to or slightly less than the thickness of the stock. With  $\frac{1}{2}$ -in.-thick stock, the notches would be  $\frac{1}{2}$  in. wide,  $\frac{1}{2}$  in. deep and  $\frac{1}{2}$  in. apart.

To make the joint, stand the two pieces to be joined against the fence so the edge of one piece is even with line A and the edge of the other is even with B. Push the work across the cutter, then shift it so the notch just cut sits over the spacing block and make a second notch. Place the second notch over the block and make a third notch and so on. Repeat the step until notches are made the full width of the work.

It is important that the two pieces of stock are held in the same position throughout the notching. This is assured when the spacer block projects far enough to catch both pieces. If desired, the two pieces can be clamped together with a small C-clamp. Adjustments can be made by moving either the spacer block or the fence itself.

PM photos: Rosario Capotosto

PM art: Jack Doyle



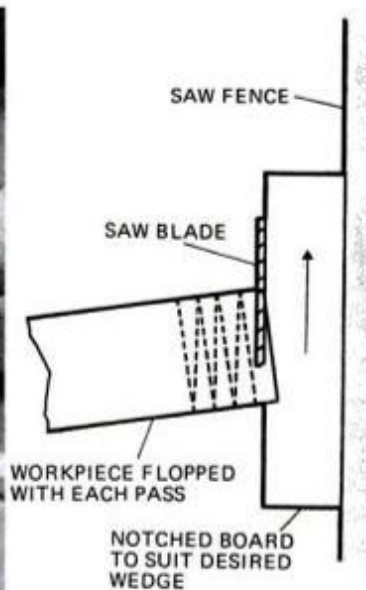
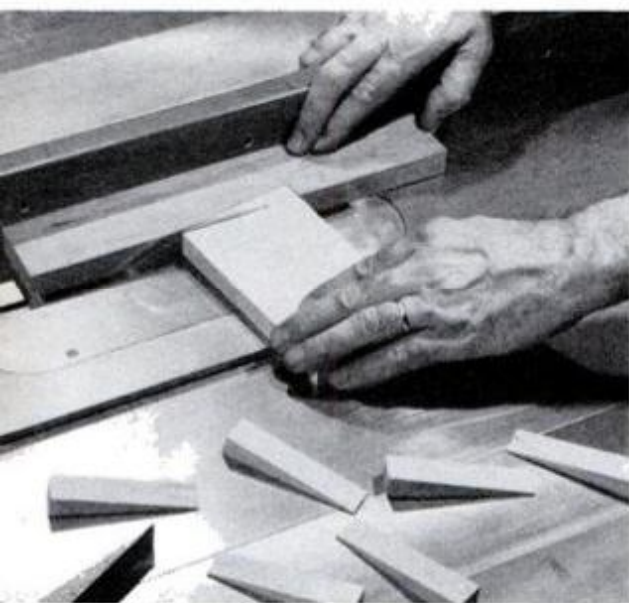


**2** If you want to dish a disc, but don't have a lathe, there's another way to form a saucer-like cavity—with your table saw. All you need is a V-notched board clamped to the saw and positioned so it centers the blank directly over the vertical axis of the blade. With blade running below the table and disc face down in the V-notch, crank up the blade  $\frac{1}{8}$  in. into the work and slowly rotate the disc  $360^\circ$ . Raise the blade another  $\frac{1}{8}$  in. and repeat.

By taking a number of light cuts and slowly rotating the work each time, you'll produce a perfectly concave dish requiring very little sanding. The smaller the blade, the smaller the diameter of cut and the greater the depth.



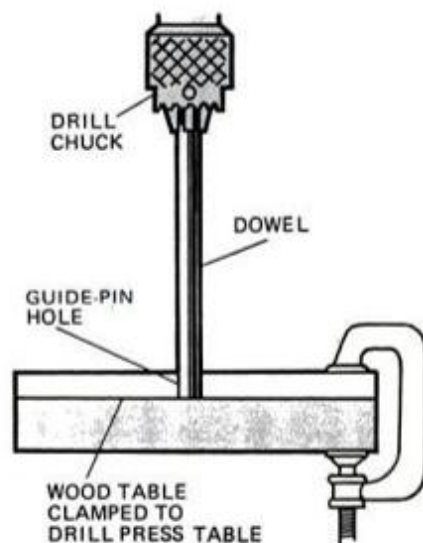
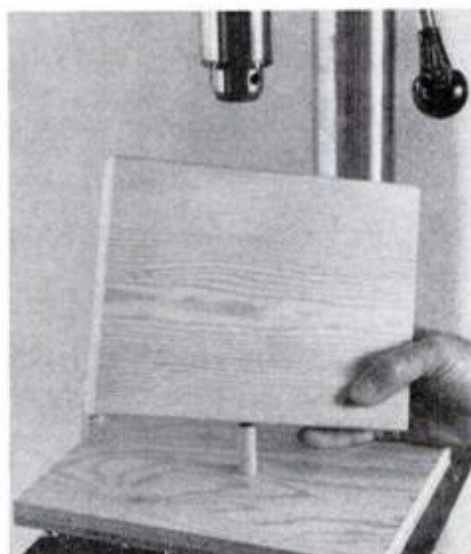
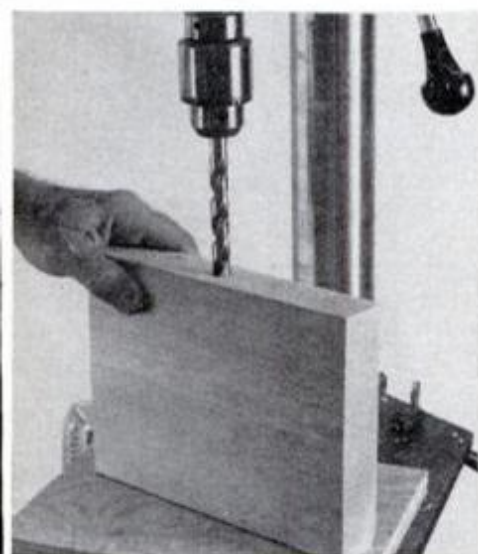
Saucer-like cut in the underside of a wood disc is made by rotating work over saw blade. V-notched board is clamped to table so it positions disc directly over blade.



Notched jig pushed along a fence provides a fast way to mass-produce wedges on a bench saw. Work held at an angle in the jig is flopped over after each cut.

**3** If you must cut a lot of wedges, you can mass-cut them in jig time by using a notched board. The board is notched as shown to suit the desired taper, and the saw fence is set so the blade just clears the jig as it's passed along the fence. Sawing is done with the grain after the stock is first crosscut from wide material.

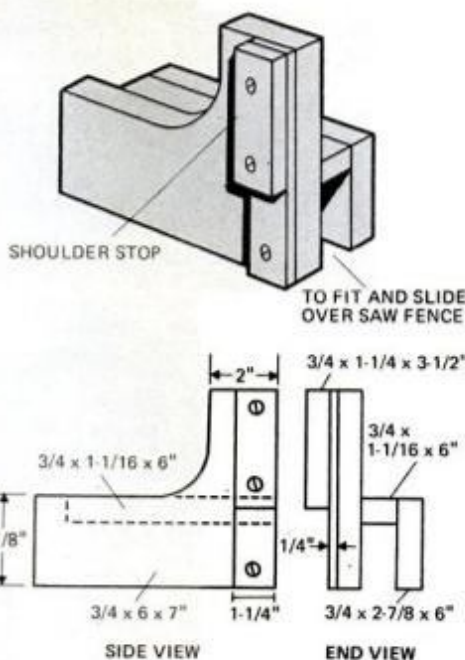
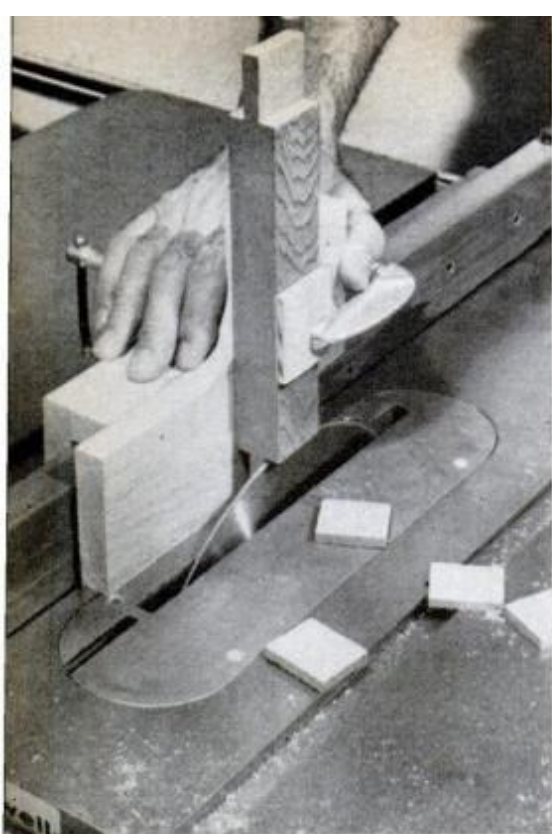
As each wedge is cut, the stock is flopped in the notch. Like slicing cheese, the jig is pushed forward, then withdrawn with the wedge in the notch. Select stock free of knots and with straight grain. If you use a hollow-ground combination blade, there will be no need to sand the wedges. Width of the stock from which the wedges are cut must equal the length of the notch so the wedges will have chisel points. If blunt points are wanted, make the notch in the board deeper.



**4** How do you bore a hole completely through a board edgewise that's 2 in. or so wider than the bit is long? You bore from opposite edges. In doing so, there's a trick to keeping the two holes aligned and here's how: Clamp a scrap board to the drill-

press table and bore a hole in it  $\frac{1}{2}$  in. deep. Then lower the table and bore a hole 3 in. deep in the edge of the work. Replace the bit with a long dowel of the same size. Align the dowel with the hole in the wood table by lowering the chuck, then lock the ta-

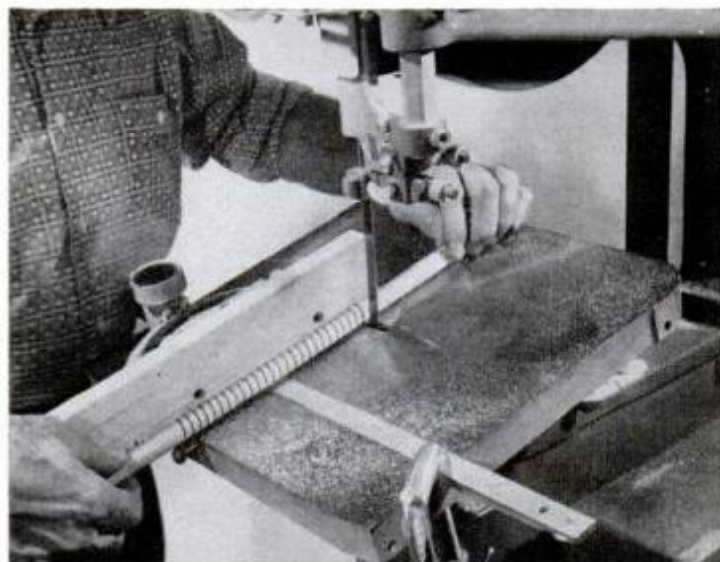
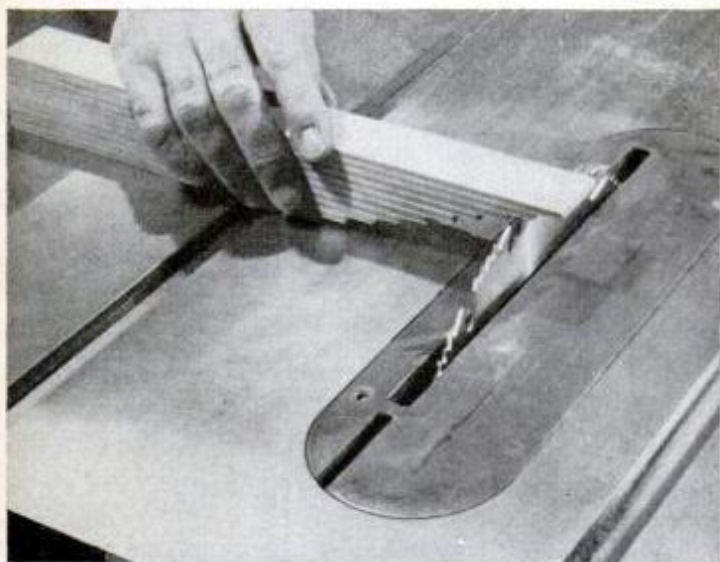
ble. Put the original bit back in the chuck, insert a short dowel pin in the hole in the wood table, place the work over the pin and bore down from the top edge to meet the first hole. Both holes will be on target and align perfectly.



**5** You can buy a tenoner that slides in the groove of your saw table and has a special clamping fixture to hold the work, or you can make one that rides the fence and uses a common C-clamp. Both are used to make the cheek cuts on a tenon after the shoulder cuts.

When one blade is used, the work is simply turned edge for edge to make the second cheek cut. If you use two blades with a spacer between, one pass and you're done. If your saw's fence is a simple box channel like the one shown, the tenoner is made to fit it like a saddle with scant clearance to ride without binding and without play. Waxing will help. In following the dimensions, note that the tunnel is dimensioned for a 1-in.-thick fence and will vary in size with the particular fence. Note too that the vertical stop against which the work is placed, then clamped, must be at a right angle to the base.

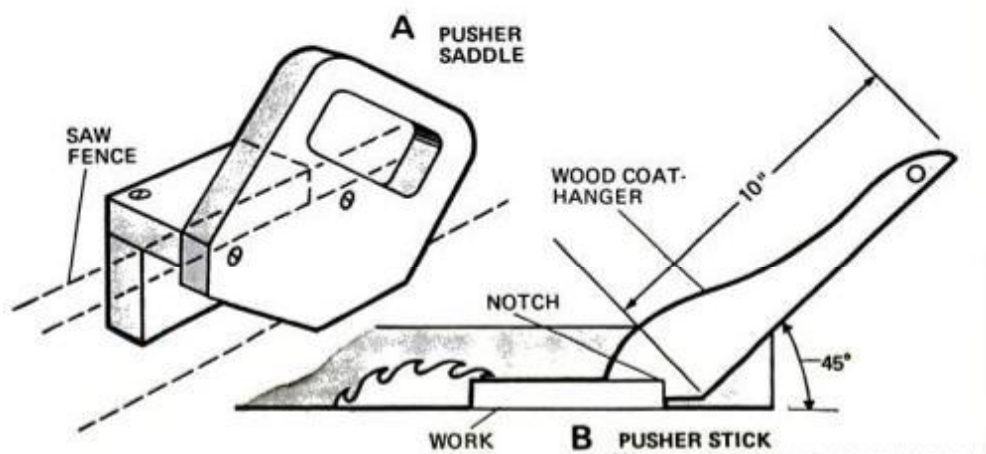
**6** While you can set blade height by the saw's built-in scale, it's often quicker to do it with a stepped gauge block comprising a number of  $\frac{1}{8}$ -in.-thick plywood strips glued together in a stack. Each strip is  $\frac{1}{2}$  or  $\frac{3}{4}$ -in. shorter than the next. To use the block, you place it over the blade and crank the blade down (or up) until the block rests flat on the table. For example, if you want to set the blade  $\frac{3}{4}$  in. high, you pick the sixth step.



**7** The best-holding glue dowels are dowels which have a spiral kerf. Not only does the kerf help line the hole with glue from top to bottom, but it affords an escape for glue trapped in the bottom of the hole when clamps are applied. To kerf a glue dowel on a bandsaw, tilt table  $15^\circ$ , clamp the miter gauge to it and slowly rotate the dowel as the blade cuts a  $\frac{1}{16}$ -in.-deep kerf. Don't attempt this with a short length of dowel.

**8** The first thing to make after you buy your first table saw is a push stick to have handy when you're ripping work narrower than 4 in. A wooden coat hanger will provide you with two ready-made push sticks which require only notching, although it's simple enough to make a push stick from scratch with scrap wood. The fence-straddling pusher is another type for use when the shape of the rip fence permits. Its D-grip handle keeps the hand safe from the blade. Make it to ride the fence freely and not bind anywhere.

(Please turn to page 128)



Материал, защищенный авторским правом

# PM's plans for back-yard summer fun

by Mike McClintock

ASSOCIATE HOME AND  
SHOP EDITOR

**K**ids like all kinds of presents from the most complicated and expensive to the simplest and cheapest. But they're happiest when they know that you made the present yourself. The four games on these pages are easy to build, and one of them will suit your boy or girl (and some grownups if they get a chance to play), no matter what their age. You won't need any special tools to construct the stilts, swing, tetherball or basketball hoop.

Since these games are used outdoors, you have to build them to withstand the weather. I made the swing out of solid oak stock and protected the pieces with two coats of spar varnish.

All wood joints should be assembled with a waterproof glue or construction adhesive and all nails should be hot-

Look, Ma, no feet! Your kids will get a kick out of walking around a foot off the ground on these beautiful stilts that you can make for them. The swing (above) is another easy-to-build project designed to put smiles on their faces.



dipped galvanized to prevent rust. For screws, use brass or aluminum.

The most complicated project, the basketball hoop, is worth the effort because the backstop adjusts to any height. The detail drawing (right) shows how the heavy plywood backstop weights down the upper frame to get a clamping action between cross ties and 4x4 support posts. The cam action is so tight that 2x4 chocks under the cross ties on opposite sides of the posts will support the whole assembly. This system lets you raise the hoop as your kids get taller.

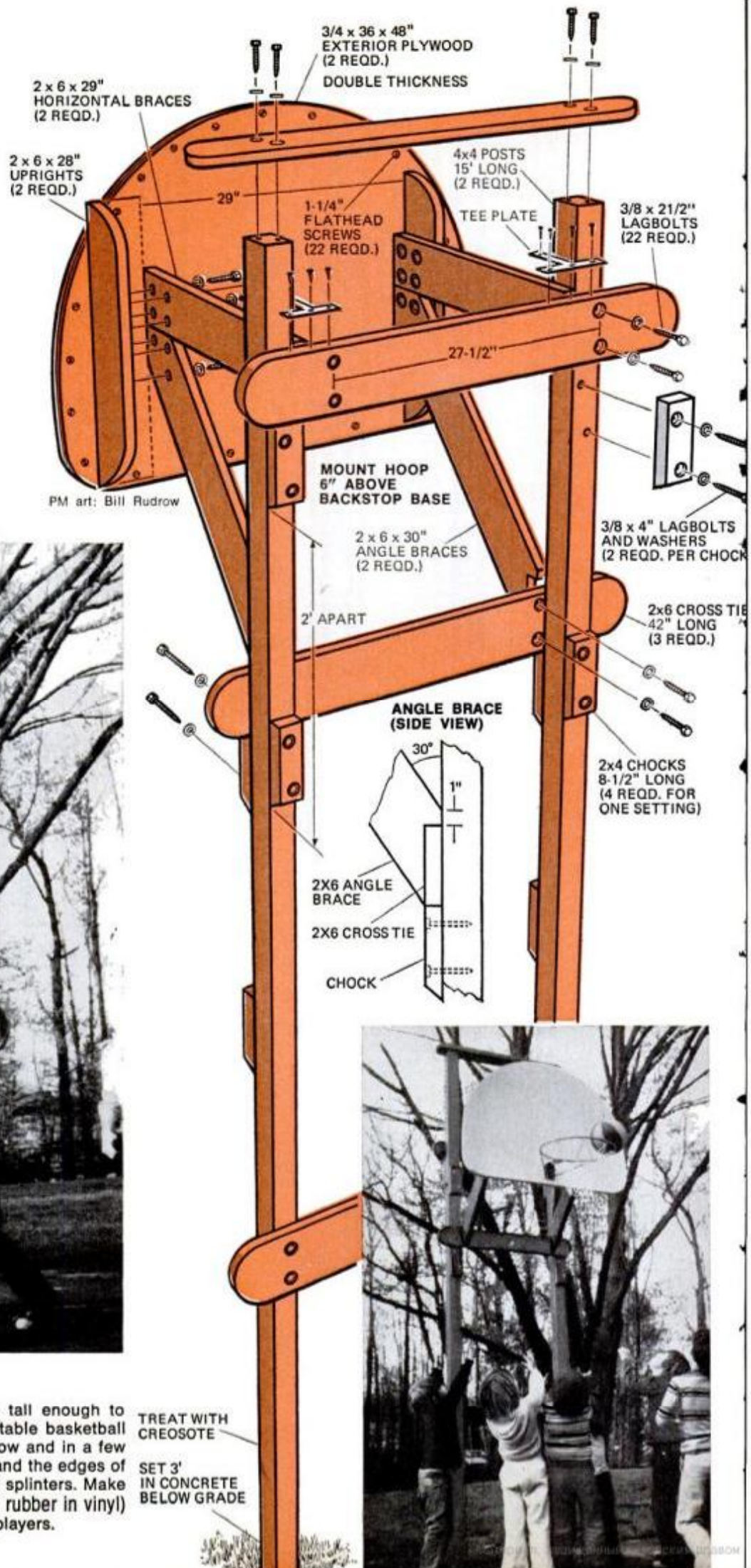
A pair of stilts is a great toy to develop balance and coordination. Use a hardwood like oak or maple for the stock and base pad. I used exterior-grade plywood for the foot platform that will easily support a 75-lb. child. For larger kids, add the alter-

Photos: George Ancona



## Basketball hoop

"Come back in a few years when you're tall enough to play." Why wait? You can build this adjustable basketball hoop that'll be perfect for your kids right now and in a few years when they lengthen out. Be sure to sand the edges of the fir posts and apply a sealer to eliminate splinters. Make the game safe by attaching bumpers (foam rubber in vinyl) around the posts to protect preoccupied players.



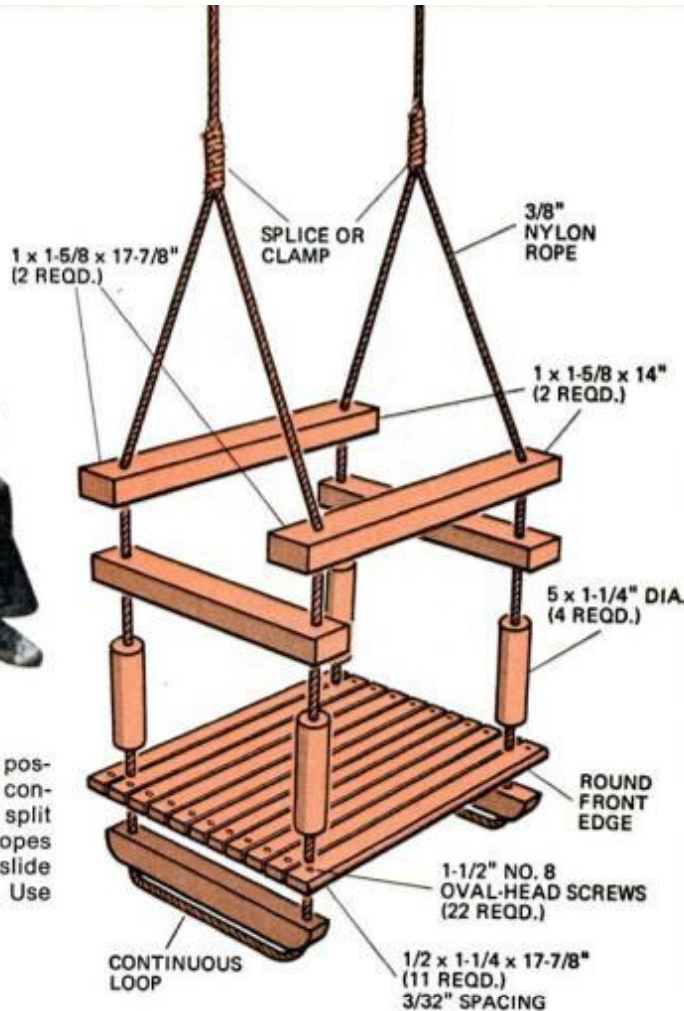
nate brace detailed in the drawings. To preserve the stilts and keep scrapes and bruises to a minimum, stay off hard surfaces.

Tetherball (lower right) is normally for two players. Each takes half of an imaginary circle around the center post for his court and tries to hit the ball past his opponent until the cord is completely wrapped around the pole. It's not easy because the other player is trying to do the same thing in the opposite direction. A metal sleeve, slightly larger than the pole, can be set in concrete at grade level so you can remove the pole to mow the grass or for winter storage. Your yard will be a special place for the kids after you've built one of these toys. ★★★



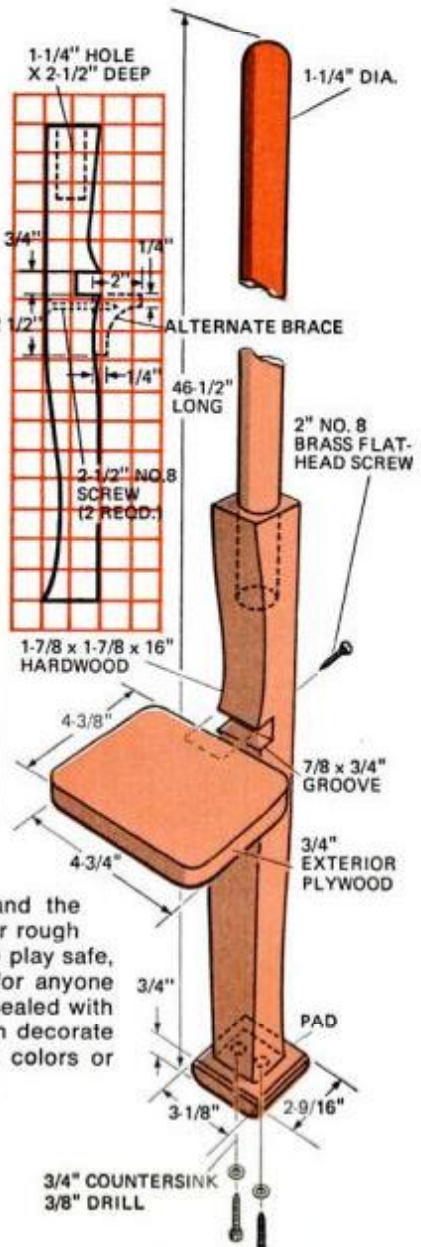
### Child's swing

Whatever the object, kids will try to swing from it if it's possible. This good-looking design, assembled around a continuous rope loop, eliminates screwed joints that may split open under stress. The guard rails lift up along the ropes for easy access (you can face in either direction) and slide down to make an accidental fall next to impossible. Use nylon rope for a safer ride.



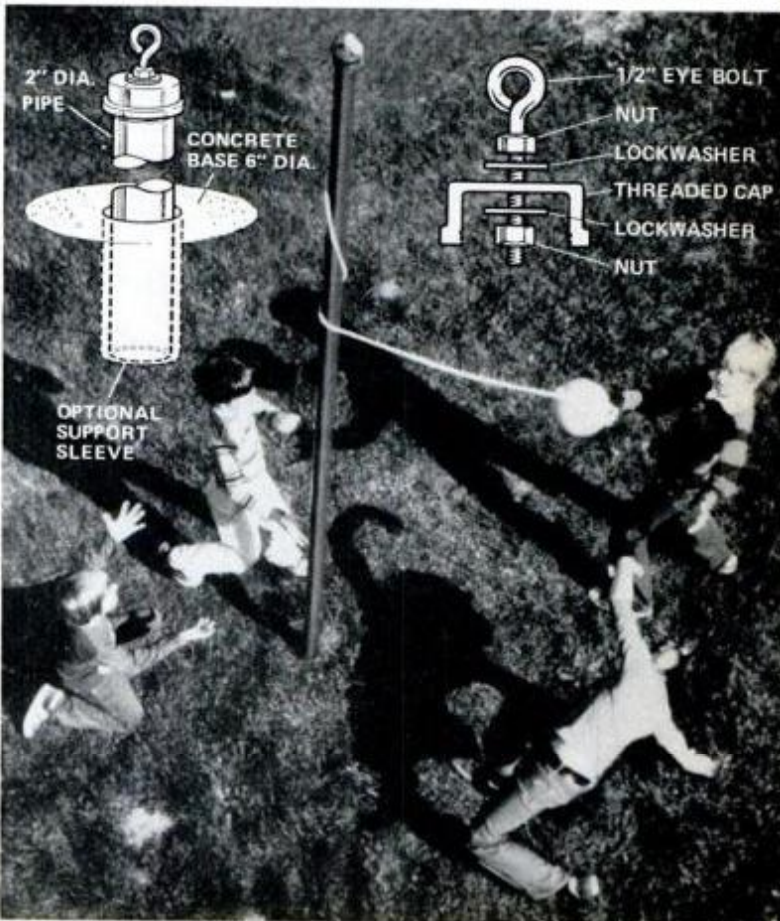
### Stilts

We tested this design and the foot platform held up after rough use by a 150-pounder. To play safe, use the alternate brace for anyone over 75 lbs. This pair is sealed with clear varnish, but you can decorate yours with bright enamel colors or contrasting wood stains.



### Tetherball

The toughest part of this project is locating a ball with a moulded loop on it. A 6-in.-diameter, concrete filled hole makes a strong, permanent base. Setting an oversize sleeve in the concrete will make the pole demountable.



# Two stowaway tables for your next outdoor party

Imagine having a Christmas display on your lawn 12 months of the year simply because it is too big and bulky to put away! You can liken this to a bulky picnic table that sits around from one summer to the next, too large to stow away come winter, a headache to move each time you must mow around it.

Not so with these two unique tables. You can take them apart, close them up, move them indoors if you wish, or park them in the garage in a minimum space.

The 3x6-ft. table below breaks down into four parts—two benchtops, stretcher and a table that folds flat. To set it up, you place the table face down and open the wood turn-

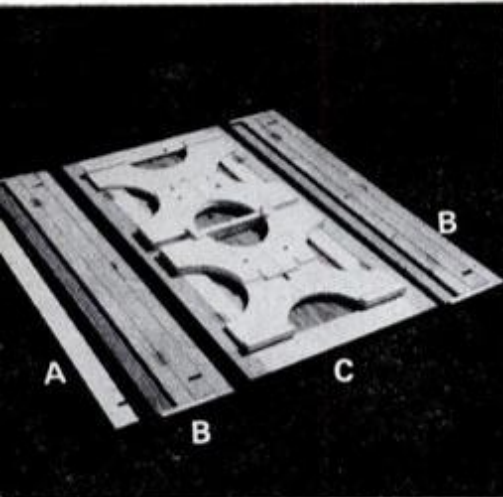


Open both sides of this portable for an outdoor buffet, or just one side for serving. Closed, it's only 7 inches wide.

Photos: George Ancoff

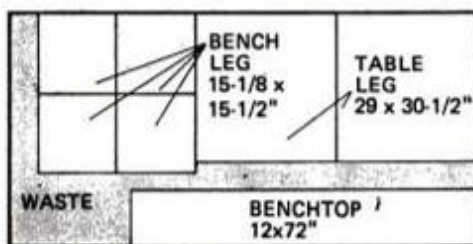
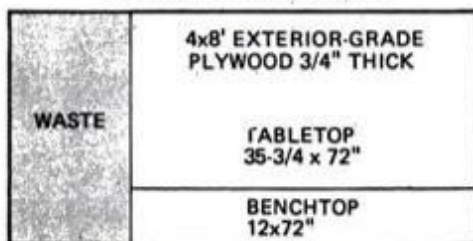


What's more fun than a family picnic? Well, putting the table away when it's one like this that breaks down into four separate parts for easy storage in your garage.



Four parts of table are stretcher (A), benchtops (B), and table legs hinge to tabletop.

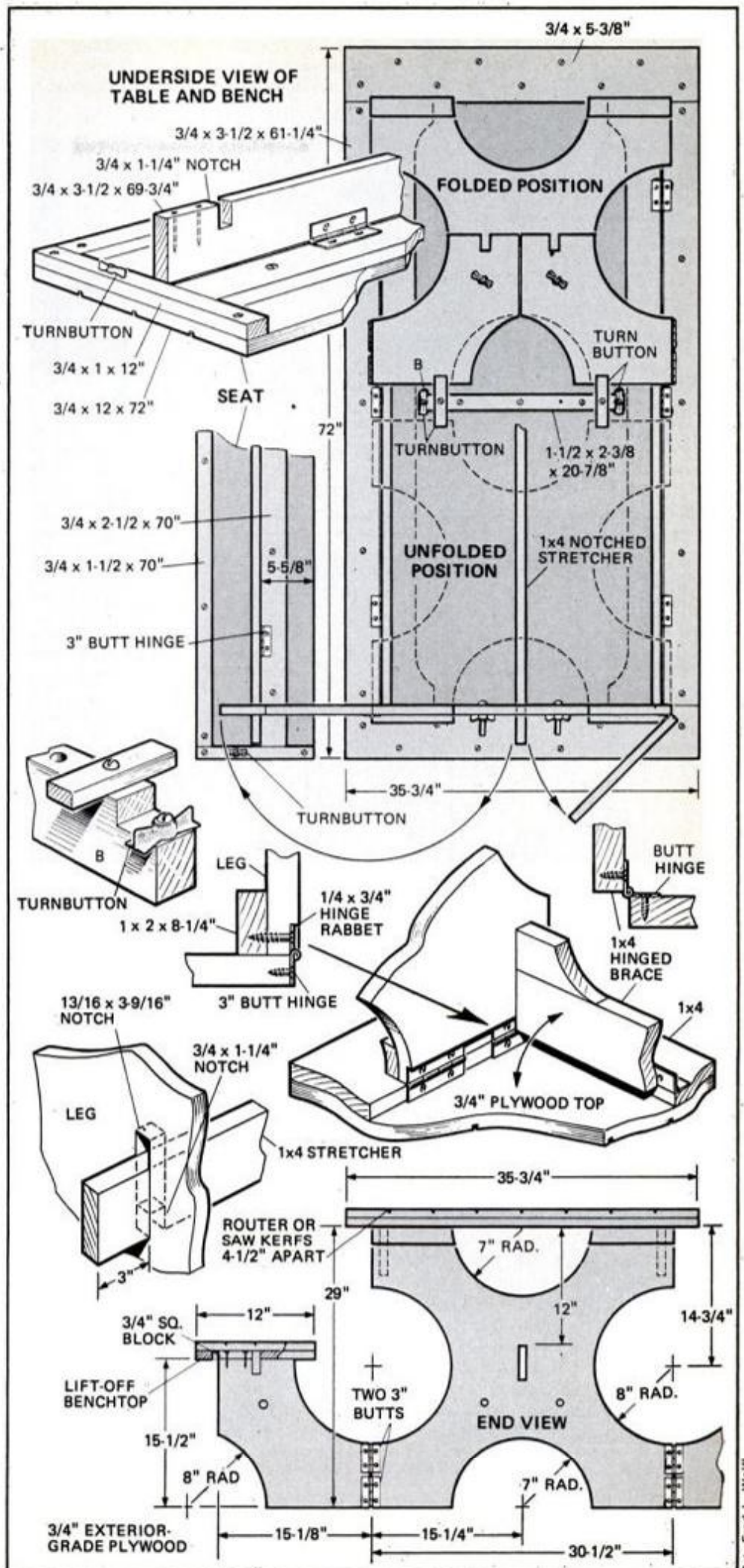
### CUTTING DIAGRAMS



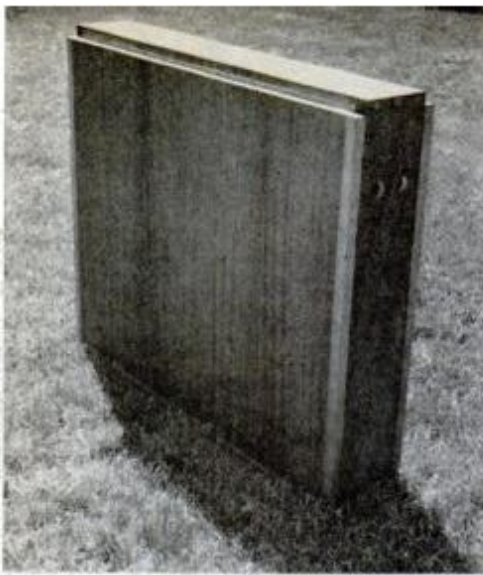
buttons which hold the legs in tow and the metal ones which anchor the leg braces. Lift one leg, back off the wingnuts, swing open the twin bench legs and insert the stretcher part way in its slot. Then lift the opposite leg, swing out the bench legs, raise both side braces, shove the notched stretcher in place and pull up on it to lock it. Turn the table right side up, open the notched rails on the underside of the benchtops and fit them into the notches in the legs. Your table is ready to have a picnic.

### Two sheets of plywood

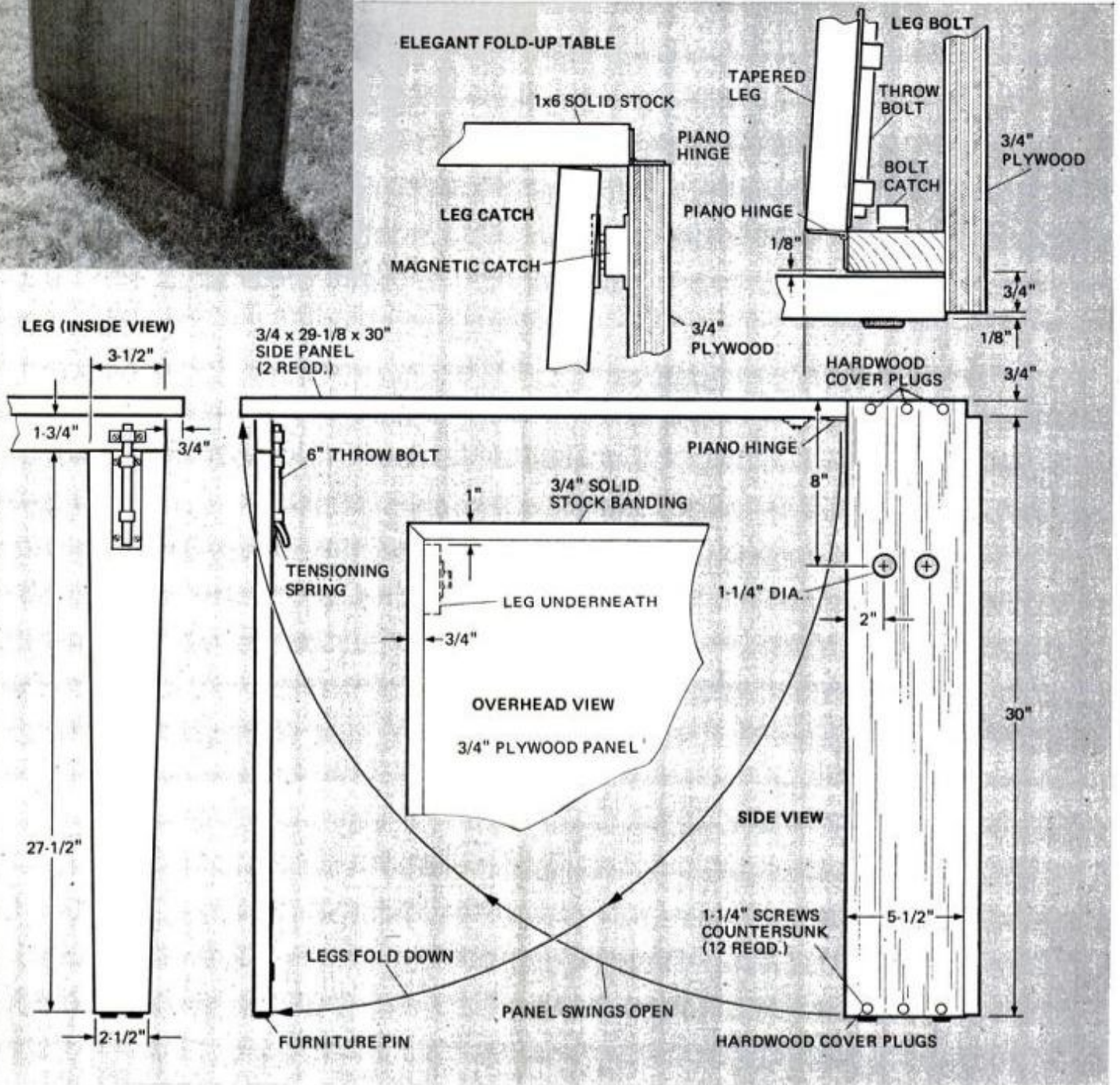
It takes two 4x8-ft. sheets of plywood (with some waste) for the legs, table and benchtops, and 1x2, 1x3, 1x4 and 2x4 lumber for the rest. You'll need 20 3-in. plain butt hinges, four wingnuts and bolts, six metal turnbuttons and about six dozen 1 1/4-in. No. 8 flathead screws, along with some water-resistant glue. A couple coats of a marine-type spar varnish inside and out give good protection for the plywood table and benchtops. We used Zip-Guard by Star Bronze Co., Box 568, Alliance, Ohio 44601. Two coats of acrylic latex house paint



Art: Fred L. Wolff



Clean lines and efficient construction make this table both practical and versatile. Its spacious 5½-ft.-long top folds down to 7-in. width for storage.



will keep the legs in good condition.

You'll need a saber saw to cut the legs, but it's worth the small extra charge to have the lumberyard saw your plywood into the nine individual pieces required. This way, there won't be much cutting to be done and a handsaw will handle what's left. Kerfing of the table and benchtops adds to the looks, but is optional. The kerfs are easy to cut if you have a router or portable circular saw.

It's important that the leg hinges at the top fit flush in their rabbets so the side braces will pass over the barrels when moved up or down. Note too that the end-view drawing shows

a ¾-in.-sq. block added to the tops of the bench legs to bear against the underside of the benchtops.

### The second table

The fold-down table above is light enough to carry to a deck or yard and elegant enough to use inside, too. It doesn't look like a plywood table (even though the panels are) because the edges are banded with ¾-in. solid stock. You can use any hardwood from mahogany (which we used to get a rich, dark tone) to a light birch. You'll need a sharp blade (carbide tipped is ideal) to cut the panels without damaging the edges.

Assemble the center frame first. For good, tight construction, cut a ¼ x ¾-in. rabbet along the edges of the vertical center boards and lock in the horizontal members with glue and screws. Contrasting wood plugs are inserted into the countersunk holes. Let them extend ¼ in. to assure a smooth, flush finish when you do the sanding. We used teak oil for a lustrous finish. It's made by Watco and is available from Woodcraft Supply Corp., 313 Montvale Ave., Woburn, Mass. 01801. Whichever table you build, it will be there when you need it and fold out of the way when you don't. ★ ★ ★





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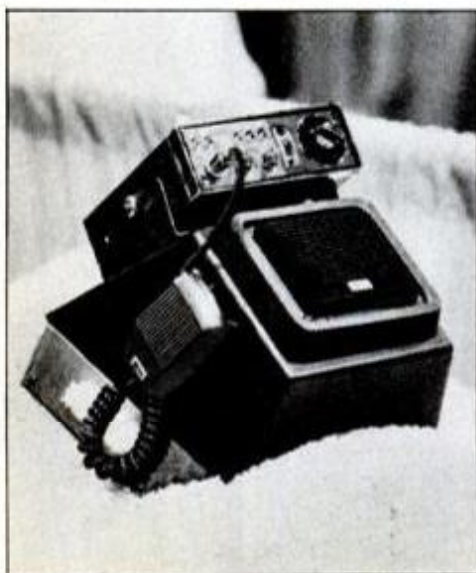
# There's plenty new in CB gear

by Ivan Berger  
ELECTRONICS EDITOR



**Digital channel displays**—easier to read, especially while you're driving—are coming from Motorola (above, left) as well as Boman/Astrosonix, Sharp, Hy-Gain, Royce, Robyn, Cobra, E.F. Johnson, SBE and others. For even easier channel identification, digital readouts are being built into the microphones of some models from SBE (above, right) and Hy-Gain; sets from Radio Shack and Royce have nondigital channel dials on their mikes. Digital keyboards will probably come in when extra channels do; this prototype from SBE (right) lets you key your way directly from channel to channel.

**"Camel" mount** from afs/Kriket (below) holds CB set and mike, has built-in speaker, lifts off quickly for storage in trunk.



**A**t first glance, this year's CB sets look like last year's—except for those with digital readouts, and they look a lot like one another. But behind the uniform facades are many interesting, useful novelties.

Some of these are internal: Royce's "wireless" modular construction, for

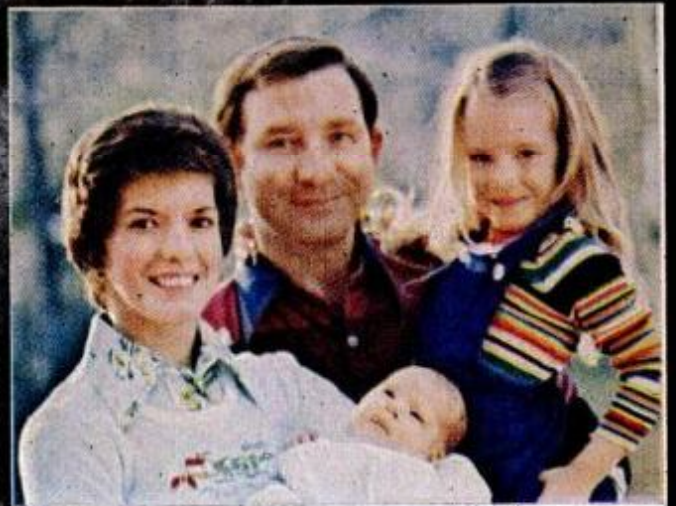
instance, with circuit boards that plug into a bigger, "mother" board, eliminating hand soldering, hand wiring—and human error. Integrated circuit chips are coming, too; look for a lot of them next year, when the FCC finally opens new channels

*(Please turn to page 149)*



**The ideal way** to show what channel a mobile set's tuned to would be a digital display on top of the dash, right in the driver's line of vision. Well, here it is—not on a CB set, but on a scanner, a prototype from Boman/Astrosonix.

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**JOHNSON CB. THE GREAT AMERICAN ADVENTURE.**

## LIGHTNING WARNING

(Continued from page 52)

ing onlookers something to talk about for the rest of their lives.

As for the old notion that lightning never strikes twice in the same place, you need only to look at such prominent structures as New York's Empire State Building, which gets struck an average of 30 times each year. The average risk in the United States (as calculated by insurance companies) is one strike every 100 years.

Globally considered, lightning is continuous. At any given moment, about 100 lightning bolts streak down toward the earth in a constant "rain of electricity." Some 44,000 thunderstorms occur on our planet each day with a total of 8 million lightning flashes. Of course, the number of storms in any given place depends on the local climate.

In some areas of Oregon and northern California, for example, thunderstorms are so rare that when one occurred during World War II, the local population thought it was a Japanese bombing attack. By contrast, parts of the Southeast—especially Florida and Georgia—suffer more than 100 storms a year (see map on page 52), and the weather bureau of Kampala, Uganda, reported 243 days of thunder in 1975.

### Preventive measures

High-risk regions have a special interest in the latest wrinkle of lightning research—practical prevention. Hoping to reduce the number of forest fires kindled by lightning, Dr. Heinz W. Kasemir of the National Oceanic and Atmospheric Administration developed "chaff seeding" as a preventive measure. Planes flying over thunderclouds drop millions of four-inch, hair-thin, aluminum-coated nylon fibers. Each fiber attracts a positive charge at one end and a

(Please turn to page 108)



A method of seeding thunderclouds with millions of aluminum-coated fibers was developed by physicist Heinz Kasemir. Fibers neutralize electric charge in cloud.



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
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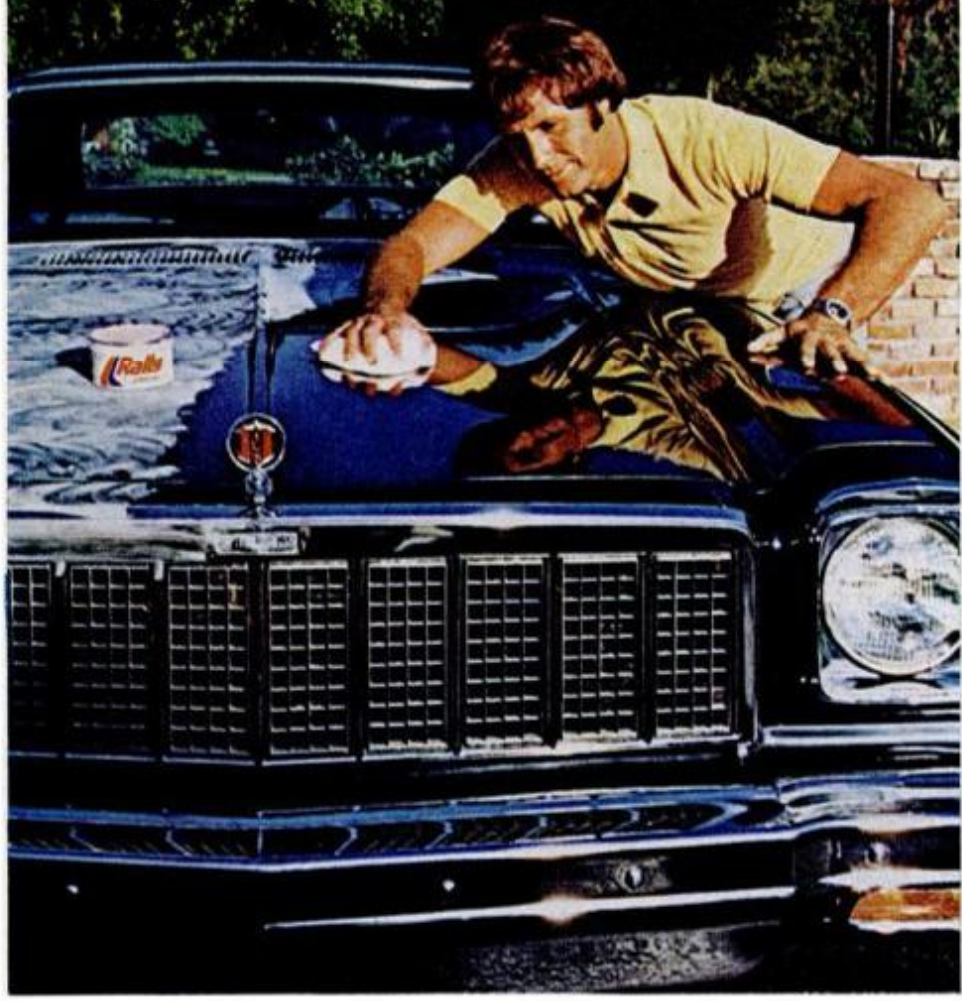
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### LIGHTNING WARNING

(Continued from page 107)

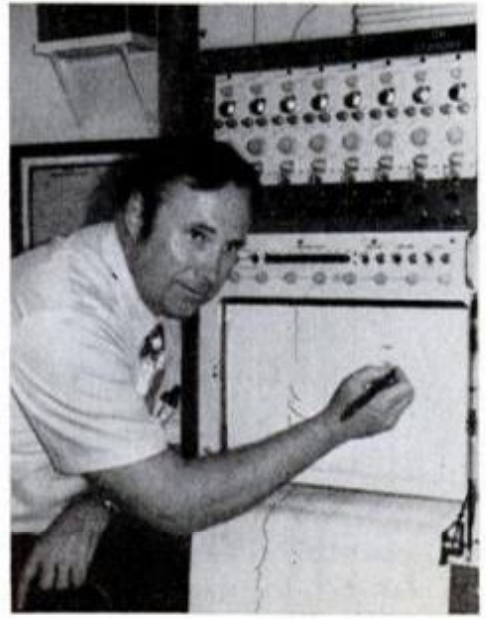
negative charge at the other, thereby neutralizing the overall charge of the cloud. Reportedly, this reduces the number of lightning strikes by as much as 75 percent.

### Rockets trigger strikes

The same technique has been used to protect rockets in the launch stage of their flight. By propelling their own ground potential into a charged cloud, rockets can actually trigger a lightning strike. Dr. Kasemir has used this effect itself for protective purposes. In an experiment near Socorro, N.M., he fired small rockets into clouds, drawing lightning from them. Presumably, this method could be used to "neutralize" the sky before launching a major space vehicle.

A less dramatic approach to lightning prevention is taken by Lightning Elimination Associates of Downey, Calif., a company specializing in protecting broadcast towers, power transmission lines, refineries and other vulnerable industrial installations. They build tall towers with multiple-point discharge arrays, which work like a lightning rod in reverse: Rather than draw the lightning, they dissipate electric charges in nearby clouds.

While we usually think of lightning as a destructive element, we shouldn't forget that we may owe our existence to a lightning bolt. It probably was a stroke of lightning back in the young days of our planet that melded simple chemical elements into the complex amino-acid molecules that form the basis of all life. So, in a sense, lightning is the common ancestor of us all. ★ ★ ★



Graphic computer readout permits analysis of electrical shifts in the atmosphere.

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The *Homeowner's Guide to Successful Remodeling* (with tips on roofing and siding) is a 26-page booklet prepared by A. M. Watkins.

Mr. Watkins is an engineer, consumer building consultant and author of such bestsellers as—*The Homeowner's Survival Kit*, and *The Complete Book of Home Remodeling, Improvement and Repair*.

And what Mr. Watkins has learned in his 25 years in the business he's capsulized in 26 pages of this booklet. Here are some of the categories covered:

1. Should you remodel or move?
2. How much do improvements increase the value of your home?
3. Eight fundamental tips for efficiency and economy.
4. What makes a good plan?
5. When should an architect be used?
6. How to conserve energy and cut future energy bills.
7. A new exterior for your home with prefinished wall siding.
8. How to buy a new roof.
9. Kitchen and bathroom remodeling.
10. Adding a new room.
11. Dealing with home improvement contractors.
12. How to finance home improvements.

Everything is covered in down-to-earth non-technical language with the essential goal being to improve your home.



## Should you be remodeling or moving?

This is the first question you should ask yourself before you start tearing down walls or ripping out ceilings. As Mr. Watkins explains it, your present home may have serious defects that make the kind of remodeling you're thinking of unfeasible. Yet in today's housing market, remodeling may be a more economically sound move than moving.

## Beware of overimproving your house.

One of the biggest mistakes you can make is putting more money into your house than you'll ever get out. For example, a \$15,000 kitchen is really inappropriate for a \$30,000 house. And here's something you might not know—a backyard swimming pool could be the chanciest investment of all. But if you're thinking of putting in air conditioning you're thinking right. Air conditioning almost always returns top-dollar value.

## What are the latest building materials?

If you're thinking about redoing the outside of your house in, say, quaint cedar shakes or Early American "clapboard", what's the best wood to buy? Well according to Mr. Watkins, wood shouldn't be used at all. There are vinyl sidings that not only look better than wood, but are better. Vinyl siding never needs painting. It won't show scratches. And termites hate it.

## Where's the best place to get the money for remodeling?

Maybe it's not the bank. Maybe you belong to a credit union that makes home improvement loans for its members. Or maybe you can get your loan financed against your passbook savings (this is the cheapest of all).

Or you might refinance your mortgage at the same interest rate as before and pay the higher current rate only on the remodeling money.

## There's more to remodeling than meets the eye.

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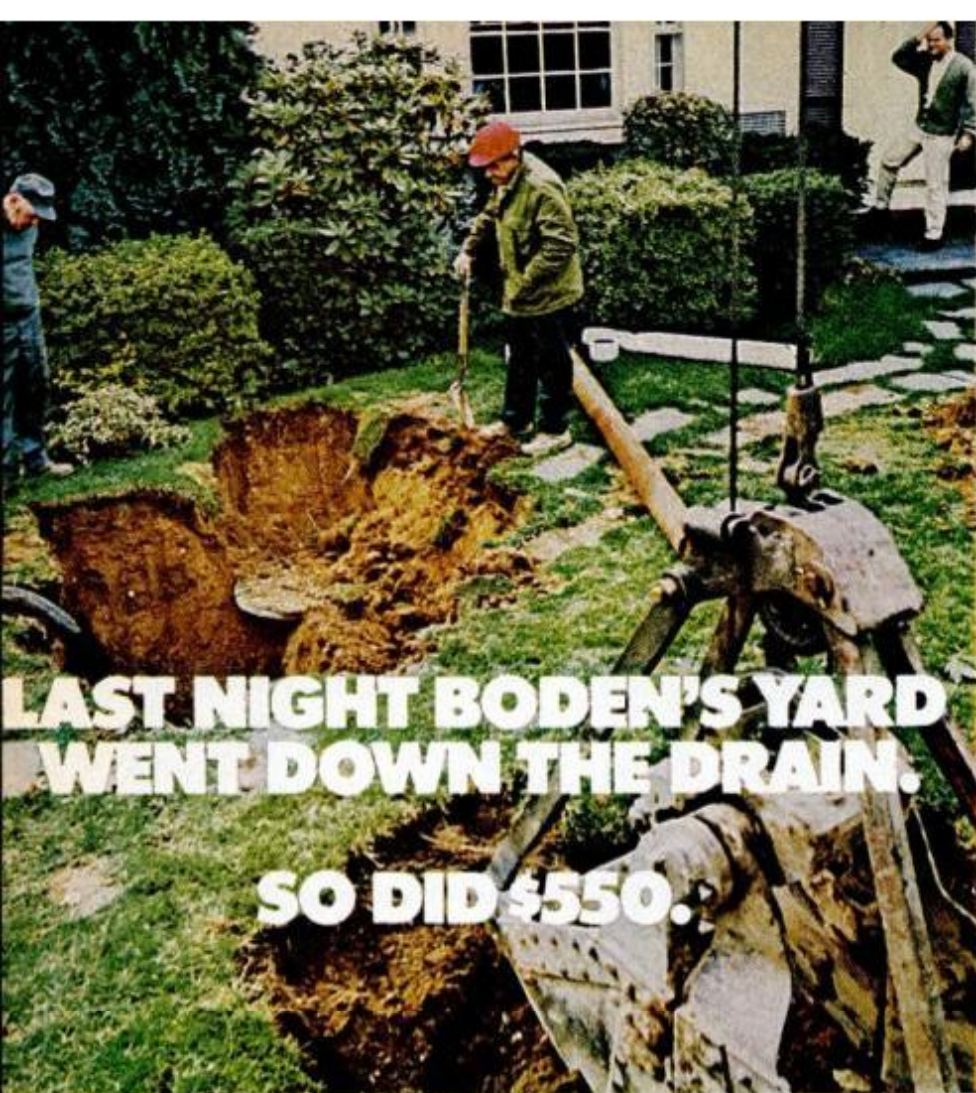
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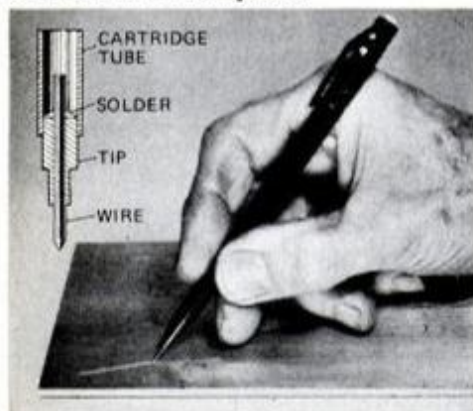
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## HINTS

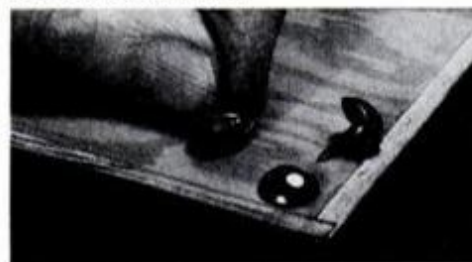
### FROM READERS

#### Scriber from ballpoint



You can make a handy pocket scriber from a retractable ballpoint pen by cutting  $\frac{3}{16}$  in. off the ball end, washing out the ink residue and drilling the tip to receive a 1-in. length of 0.040-in. hardened music wire ground to a needle point. Wire is soldered to tip, tip replaced in cartridge and cartridge returned to pen.

#### Nailheads for feet

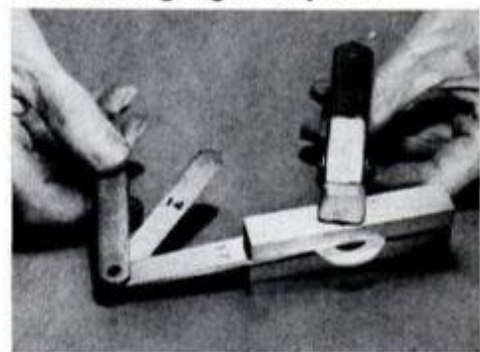


Smooth dome-shaped upholstery nails make perfect little glides for the bottoms of trinket chests. If long, cut nail a bit and file a new point.

#### A better brush keeper

A tall tennis-ball can with its plastic cover makes a dandy overnight brush keeper. Slit the cover with an X to fit over the brush handle, and drill the handle for a crosswire. The wire holds the brush off the bottom of the can; the cover prevents evaporation of turps.—Robert Brightman

#### Thickness gauge in a pinch



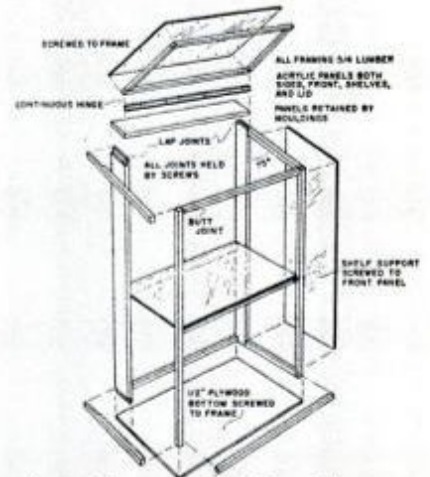
When you want to check the thickness of a washer-like part and lack a micrometer, use your thickness gauge.

Just clamp the part between two flat-ground pieces of metal and insert the blades until a set combination will slide snugly between the two surfaces. Totaling the individual blades will give the thickness of the part.

—Walter E. Burton



# Stanley drives screws easier, faster. Free plans prove it.



acrylic-and-wood Window Greenhouse. (You can enjoy it, by the way, without ever removing a double-hung window.)

To order the plans set, send name and address and 25¢ to cover postage to Stanley Tools, Dept. MW, New Britain, Conn. 06050



Is a screwdriver just a screwdriver?

The moment you use a Stanley screwdriver — and you'll use one often while building this beautiful Window Greenhouse — you'll feel the difference, the quality.

There's quality in those Stanley handles. They're designed to give you more effortless driving power, help do the job easier. The big grip handle on the Stanley Handyman® screwdriver, shown here, puts

You'll find all kinds of good, strong, Stanley screwdrivers, for all kinds of different screw sizes and types, wherever better tools are sold. Try them out when making this

extra thrust into your palm. (Note the handy hole for pegboard hanging.)

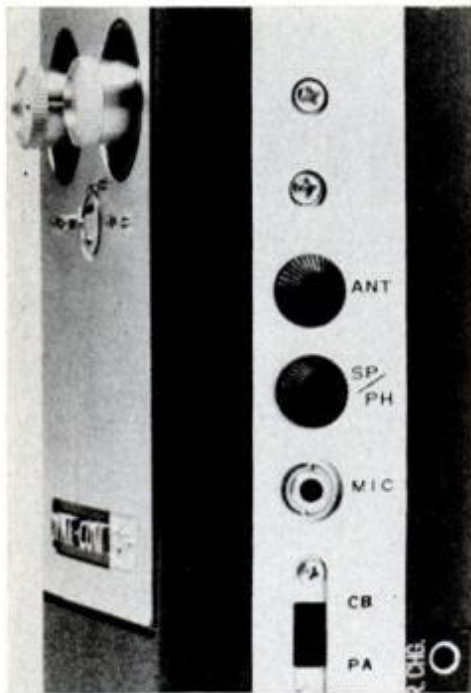
There's quality in those steel blades. Bars are more firmly anchored. Tips are ground to size to keep them from slipping in the screw slot.



**STANLEY** helps you do things right.

## CB PORTABLES

(Continued from page 87)



**Accessory jacks** on this Lafayette Dyna-Com take external antennas, earphone, external speaker, external mike. Switch allows public-address use, extra speaker.

do more sophisticated models like the PocketCom.

The toy units can often be primitive: The Archer shown, for example, has no volume control, no squelch to keep the receiver quiet when it's not picking up a signal, and it only transmits on one channel. It receives all 23 channels, though it's not selective enough to tell one CB channel from another. Toys like this aren't sensitive enough to pick up many signals, either.

Not all 100-milliwatt sets are toys, though. The PocketCom was quite a bit more selective than the toy sets, and had a squelch control to cut out noise and weak signals. Its tiny speaker didn't put out as much volume as the toy, but it did have a volume control, as well as such deluxe extra touches as a battery-test light and sockets for extra crystals to allow operation on a second channel (the set comes with crystals for Channel 14). Out in the country, where there's very little on the CB air, 100 mw of power carried about 200 feet.

But a 100-mw set can carry even farther, if it's teamed up with a full-power set at the other end. Big sets have sensitive enough receivers to pick up a little set's little signals, and their own signals naturally are easier to pick up at a distance.

But there's a legal restriction to beware of: Unlicensed sets can't legally communicate with licensed ones. If you have a license now, it will

cover any sets you have, including 100-mw ones. But if you only have a 100-mw set and plan to communicate with larger sets, get a license.

With bigger sets, you can get bigger power, of course—1 watt (10 times the power of unlicensed sets), 1.5 watts, 3 watts, or the legal maximum of 5 watts. Don't expect quite as much range from a hand-held as you'd get from a mobile or base station of the same number of watts. For one thing, though mobile and base sets are now rated according to how many watts of *output* they deliver, hand-helds are rated according to the number of watts of power *input* to their final stages; so a "5-watt" walkie-talkie is equivalent to a "4-watt" base or mobile.

Walkie-talkies are also limited by their antennas. Nobody's going to carry around a 10-inch walkie-talkie with a 108-inch whip antenna, so hand-helds have shorter antennas—compact, but less efficient. Telescoping whips of about 4 feet in length are common, as are base-loaded whips about 16 inches long, and "rubber ducks" of about 8 inches.

But you can get around this limitation, with many hand-helds, by plugging in a better antenna. The Handic and Zodiac sets shown both use the standard PL-259 plug as their antenna connection, though this doesn't allow their antennas to telescope. Other sets have separate jacks for

external antennas, which require adapters to fit most standard CB antennas. (If you can't find an adapter, Lafayette's No. 99F46054 fits miniature phone-plug inputs, and Radio Shack's No. 278-208 fits RCA or auto-radio-antenna-type "Motorola" jacks.)

### Switching antennas

Antenna input jacks are especially useful if you're trying to operate a walkie-talkie in your car. The car's steel skin cuts down your signal, and opening a four-foot whip inside the car would be awkward. But a magnet-mount antenna on the roof and a cable snaked down to your walkie-talkie solves both problems handily.

About the most important feature to seek in a walkie-talkie is a positive indication that the set is off. Otherwise, your batteries will drain to nothing before you know it. At the very least you want a switch that goes off with a solid "click." If there's a visual indicator, so much the better. Battery life can also be extended, on full-power sets, by switches that reduce the transmitter power. But don't expect too much more life from that—most sets are in a receive mode far more often than they transmit, so the battery-saver switch won't be doing anything most of the time. Battery-check meters are also handy, especially if they measure output modulation, too.

If you'll use your set a lot, rechargeable nickel-cadmium batteries will save you a small fortune. But if you use your set infrequently, you may spend more time recharging the set than you do running it. In that case, look for one which can operate while recharging—not all sets can.

### Adding new crystals

The number of channels is important, too. The most expensive sets cover all 23 CB channels, but most hand-helds cover only about 3 to 12 of them. The partial-channel sets usually come with just one set of crystals, to get you started. Once you decide what other channels you want to cover, you must buy your own crystals for them (usually about \$5 per receive/transmit pair), and install them. Installation doesn't require any technical knowledge you can't get from the instruction book, but you will need nimble fingers.

Microphone input jacks, another common feature, let you talk with the set clipped to your belt or lying on your car seat. But unless there are connections for a microphone with a push-to-talk switch (as on the Handic or Zodiac sets), you'll still need two hands, one for the mike and one for the set's transmit switch. ★★



**Visual "off" indicator** on this Realistic set can help to prevent battery waste.

**RICHARD PETTY SAYS:**

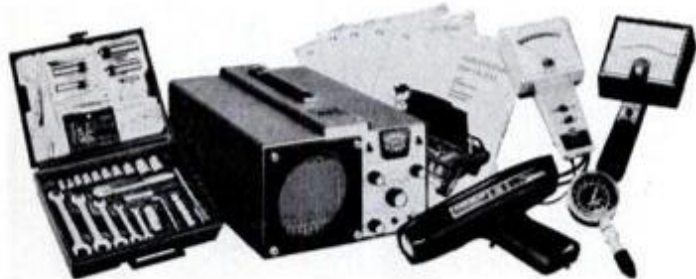
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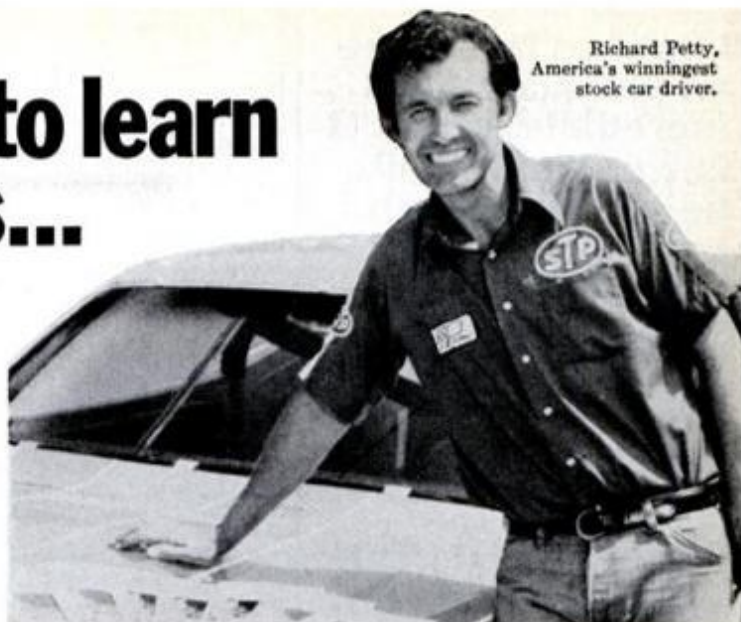
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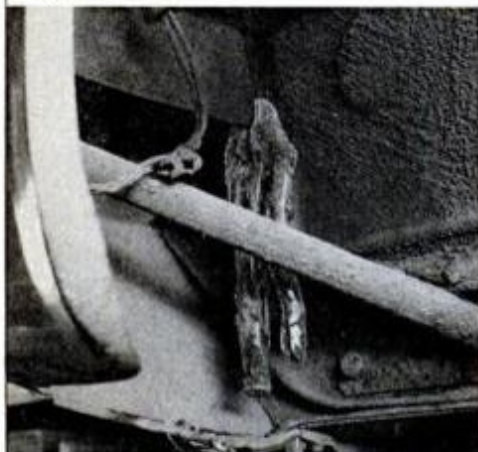
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## '77 COMPACT OUTBOARDS

*(Continued from page 55)*

ments. The large 90° V6 motors of 200 and 175 hp are reported to offer substantial fuel economy at midrange rpm, using cross-flow, pulse-tuned charging, dual overlapped porting, dual tuned exhaust, and three dual carbs and dual fuel pumps. Firepower Breakerless C.D. ignition is used. Additional refinements include mechanical power-assisted shift, through-tilt-pin steering and newly slanted skeg. For the V6 models, six aluminum and six stainless-steel Teflon (SST) propeller options are available. The alternator supplies 15 amps.

The new 140 from Evinrude, plus the 115 and 85 V4s, also incorporate developments pioneered by the V6s. The 140 has redesigned midsection and gear case, with more power developed by additional megaphone tuning. More acceleration and low-end pulling power, plus higher top speed, are boasts of the new Evinrude 25. Pick a high-styled 75, like those used in the Bill Muncy Invitational, for runabout flash and competition, or a 70, 55 or 35 for midrange power.

### Outboards for sailboats

Johnson and Evinrude, which match in power categories offered, also have added features and options for boatmen who own sailboats and heavier craft that don't need added speed but can certainly benefit from the "power brakes" of strong reverse torque. Like Chrysler, these have accessory top-mount controls and long shafts for the sailor who must lean over his transom to reach down and start the engine or adjust the throttle. The OMC 15 and 9.9 claim up to three times more reverse thrust than this year's models. Smaller Johnsons and Evinrudes of 6 to 35 hp also have added a cooling water spray that drains out of the rear of the engine as a visual check that the water pump is functioning properly.

Volvo outboards are now increasing their part of the clamp-on kicker market, and this coming year they are scheduled to offer horsepowers of 3.9, 6, improved 9 and 14-hp models, 20, 45, a unit in the 50 to 60-hp range, and a 70-hp unit. More developments from this famous Swedish name are also reported in the works.

And some good '77 outboard news hasn't yet been even hinted at. A number of motor manufacturers make their announcements in late fall and early spring. Some lesser-known makes sold by sporting goods, department and mail-order stores give away their responsible parent-

hood by their distinctive shapes and styling. A motor with an unknown name may have a well-known maker behind it. Which to choose? Most of today's models are no longer knucklebusters. I'd pick one from a well-established dependable dealer with a reputation for top service. ★★★

### Where XS equals 'extra special'

Around the racing circuits you'll see them, these sleek machines with Merc 402XS, 650-X, 1750XS T-3, or sometimes only the builder's name on the side. That "XS" means a labeled horsepower of 175 is actually "in excess" of possibly 250 hp. Manufacturers use these exotic racing rigs to test specs that will assure dependability of smaller production motors.



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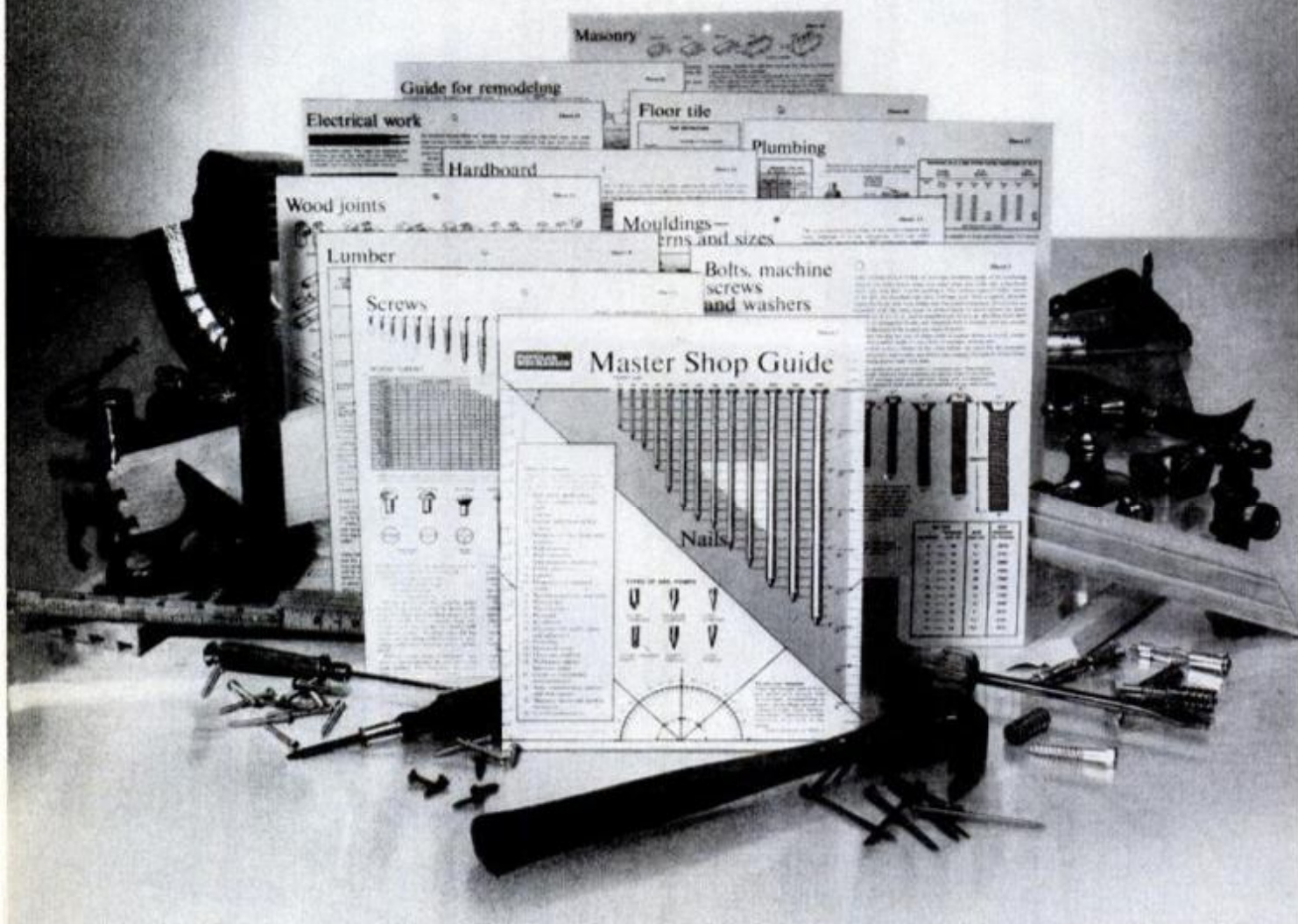
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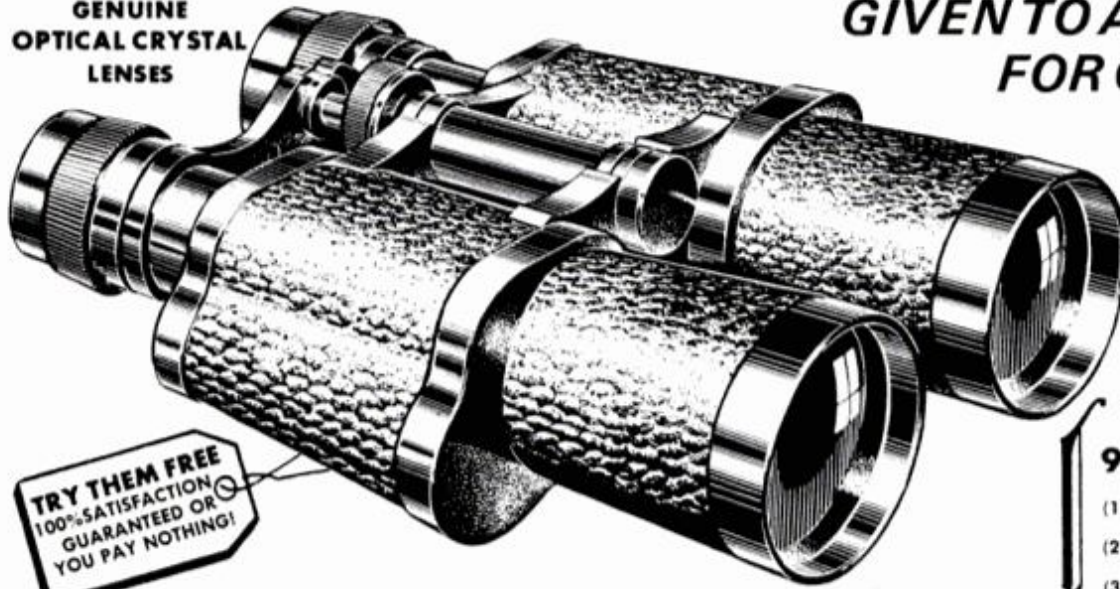
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### CLOAK-AND-DAGGER RADIO (Continued from page 75)

locations of transmissions filling our airwaves. For instance, the familiar radio broadcast band—535-1605 kHz—obviously accommodates many, many more stations across the country than the 17 listed on this chart in the medium-wave band.

The known CIA radio operations, only the tip of an iceberg in the ocean of supersecret transmissions, include station KKN50 which has been spotted on shortwave dials at 6.924, 7.470, 10.470, 11.095, 12.111, 13.646, 17.390, 18.252 and 26.760 MHz. Sources report many of the CIA signals are in international code from high-powered transmitters.

The United States is like other host governments in permitting foreign ambassadors in Washington to radio messages back home from transmitters in their embassies. For instance, the Czechoslovakian Embassy transmits to Warsaw on 15.804 MHz. These signals are from low-power transmitters and are in "CW" (Continuous Wave) as radiomen refer to the international code.

At times spy-and-number stations transmit plain-voice broadcasts which can be heard with careful, patient

tuning of the right frequencies. The "Achtung!" broadcasts have been heard on 3.249 and 5.820 MHz, Tyrolean music, maybe from France, has been heard with other spy broadcasts on 6.425 MHz.

People transmitting clandestine numbers don't want us to overhear their signals. Many times they are not authorized by governments of countries from which they transmit. So they frequently move around the radio dial, trying to stay one jump ahead of local cops and eavesdropping shortwave listeners. To find such stations, keep in touch with other hobby listeners for information, and tune across the whole dial on a shotwave set, stopping to listen to anything sounding unusual.

#### Some equipment you can use

I tuned the signals described here on a medium-priced shortwave receiver, Model QR-666 from Trio-Kenwood Communications, Inc. (116 East Alondra, Gardena, Calif. 90248), which lists at \$289. VHF police signals are tuned easily on a Panasonic Model RF-888, which can be found in many stores at \$99. Publications listing many of these se-

cretive stations include *Confidential Frequency List* by Robert B. Grove, published by Gilfer Associates, Inc., Box 239, Park Ridge, N.J. 07656. *Police Call Directory* for your area is available at a nearby Radio Shack store.

The International Criminal Police Organization (Interpol) is a supersecret "cloak" group. From its Paris headquarters, Interpol exchanges and routes information on drugs, counterfeiting and smuggling around the world to interested authorities. Most known Interpol transmitters are outside the United States and operating at low power levels. But some can be heard here. Most are CW, but there was one voice transmitter operating out of Kinshasa, Zaire, on 6.792 MHz using the call letters 9TK20. Paris HQ has been heard on voice transmissions on 10.390 MHz. Lima, Peru, has been heard on voice on 19.130 MHz. Scores on Interpol offices from Algiers to Copenhagen operate on three dozen different shortwave frequencies.

#### Illegal stations

On the "dagger" side, you can hear thousands of illegal underground stations transmitting within the United States. The latest sophisticated, high-powered, single-sideband (SSB) transmitters, intended for other kinds of legal operations, are used by those who get a kick out of bootlegging frequencies between 27.3 and 27.5 MHz.

Another kind of air cloak-and-dagger work is carried on by those who use radio to solve scientific mysteries. Amateur "star watchers" listen around 110 MHz for extraterrestrial signals from planets and unseen galaxies.

U.S. military transmitters can be heard all across the spectrum. The Strategic Air Command, for instance, named its flying command center "Looking Glass," and can be heard on 6.762, 9.027 and 14.744 MHz.

On the other hand, the Navy uses very-high-powered transmitters in the million-watt range to broadcast to submarines on the long-wave band around 20 kHz.

Even the Defense Civil Preparedness Agency is establishing an emergency network for use in national or natural disasters. You can hear its programming on WGU-20 at 179 kHz.

#### Listening to China

Time signals from WWV in Colorado and CHU in Canada, very familiar to shortwave listeners, are hardly clandestine. A bigger thrill comes in tuning station BPV, Shanghai, China. BPV is the official Peoples Republic of China counterpart of

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WWV with transmissions on 9.368 MHz. Unlike WWV which ticks around-the-clock, BPV is only on the air for five minutes each hour, starting at 55 minutes past the hour.

WWV, by the way, is heard on 2.5, 5, 10, 15, 20 and 25 MHz. CHU is on 3.330 and 7.335 MHz.

One part of the radio spectrum to tune during a natural disaster is what amateur radio operators call the 20-meter band, 14-14.350 MHz. While the government's WGU-20 would switch to emergency programming in a superdisaster, hams always turn out in force on their radio bands to lend a hand with communications when a hurricane strikes or an earthquake hits.

The Guatemalan earthquake disaster on a Wednesday morning last February brought an immediate response from hams. Many collected themselves into an organized network of stations in North America, Central America and the Caribbean on a frequency of 14.325 MHz shortly after dawn. Stations TG9LW and TG9GF in Guatemala, KZ5ZK in the Canal Zone, W4AD/T12 in Costa Rica and other Central American amateurs joined a host of U.S. stations on the air. They brought the first comprehensive communications out of the stricken area.

### Spies on ham band

The ham bands sometimes provide camouflage for spy stations. There is a radioteletype signal beaming out of Mainland China on a number of frequencies inside the 20-meter ham band. The station pops up with very loud signals on ham radio sets in North America. It begins transmissions with a meaningless series of letters and numbers in CW and then switches to radioteletype. The



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Get Afta.**



transmitter is high-powered and jumps around the dial from 14.0-14.200 MHz. Hams, who like to chat with friends around the globe, look for the mysterious Chinese station as an indicator that the 20-meter ham band is open all the way to the Far East, according to station W3BTX, Altoona, Pa.

Meanwhile, neighboring station W3TEF's operator tunes the lower end of the 80-meter ham band around 3.550 MHz for signals from the Russian fishing fleet on the high seas. The ship-to-ship voice transmissions, usually in Russian, sometimes in Czech, are best heard early in the morning along the coasts, according to W3TEF, who finds signals strongest when the fleet is closest to shore.

## SWL AND HAM-BAND FREQUENCIES

Here are frequencies in the radio spectrum where international short-wave radio broadcasts and amateur radio two-way communications can be heard:

### International broadcasting to SWLs

120-meter band	2.300-2.500 MHz
90-meter band	3.200-3.400 MHz
75-meter band	3.900-4.000 MHz
60-meter band	4.750-5.060 MHz
49-meter band	5.950-6.200 MHz
41-meter band	7.100-7.300 MHz
31-meter band	9.500-9.725 MHz
25-meter band	11.700-11.975 MHz
19-meter band	15.100-15.450 MHz
16-meter band	17.700-17.900 MHz
13-meter band	21.450-21.750 MHz
11-meter band	25.600-26.100 MHz

The *World Radio TV Handbook*, published in Denmark, is a popular

guide to the international broadcasting stations and their frequencies. It is available for \$10.95 from Gilfer Associates, Box 239, Park Ridge, N.J. 07656.

### U.S. amateur radio 'ham' bands

160-meter band	1.8-2.0 MHz
80-meter band	3.5-4.0 MHz
40-meter band	7.0-7.3 MHz
20-meter band	14.0-14.350 MHz
15-meter band	21.0-21.450 MHz
10-meter band	28.0-29.7 MHz
6-meter band	50.0-54.0 MHz
2-meter band	144.0-148.0 MHz
1¼-meter band	220.0-225.0 MHz
70-cm band	420.0-450.0 MHz
UHF	1215.0-1300.0 MHz
UHF	2300.0-2450.0 MHz

### Citizens band (CB)

Channels 1 to 23 26.965-27.255 MHz

### Police and fire calls

Ferretting out secrets of the radio waves and eavesdropping on the snoops is very popular today. Hundreds of thousands, if not millions, of Americans are listening to police and fire calls on scanners and other police radio monitors. Scanners are receivers pretuned to several police frequencies. The sets listen to each preset spot on the police dial in sequence and stop on one when a signal appears. Scanners let you listen to only those frequencies where radio action will take place in your town. Silence is all you hear between police and fire transmissions.

These public-service police bands are called "VHF Low" for frequencies of 30-50 MHz; "VHF High" for

(Please turn to page 122)

## CLOAK-AND-DAGGER RADIO

(Continued from page 121)

150-173 MHz; and UHF for 450-512 MHz. VHF and UHF signals travel only line-of-sight distances so you will be able to hear police, fire, ambulances, foresters, highway crews, garbage trucks, press crews and remote radio station broadcast pickups only 10 to 30 miles away.

That compares with shortwave transmissions which skip around the globe, beyond line of sight. Short-wave signals bounce between the ionosphere in our upper atmosphere and the Earth itself, hopping from point-to-point around the world. VHF and UHF signals do not skip so you must be within line of sight of the transmitter to get the signals.

Other two-way radio stations transmitting on the VHF and UHF public-service bands are operated by businessmen, motion-picture film crews, oil-pipeline workers, heavy-construction workers, farmers, home-fuel deliverymen, water companies, power linemen, tow trucks, railroad trains, buses, taxis, shipyards, yacht clubs, marinas, hospitals, doctors, Civil Air Patrol airplane searchers, rescue squads, school buses and mobile telephones.

## WHERE TO WRITE FOR MORE INFORMATION

There's strength in numbers, including strength to hear weak and rare radio stations. For more on when, where, how and why to eavesdrop on the radio spectrum, write to these hobby organizations:

### Medium waves

International Radio Club of America, Box 21462, Seattle, Wash. 98111. Tracks the 5000 standard broadcast AM radio stations in the United States and around the world.

National Radio Club, Box 127, Boonton, N.J. 07005. Oldest medium-wave-only club.

### Shortwave

American SWL Club, 16182 Ballard Lane, Huntington Beach, Calif. 92649. An all-wave club with members interested in receiving signals anywhere on the spectrum.

American Radio Relay League, 225 Main St., Newington, Conn. 06111. The national organization of amateur radio operators known as hams.

Languages By Radio Interest Group, Department of French and Italian, University of Illinois, Urbana, Ill. 61801. For teachers and students interested in studying foreign

languages through shortwave listening.

Newark News Radio Club, Box 539, Newark, N.J. 07101. An old listeners' organization which considers all signals of equal interest, including two-way radio.

North American Shortwave Assn., Box 13, Liberty, Ind. 47353. Has members interested only in tuning international short-wave radio programs, such as from Radio Moscow and the BBC.

RC-USA, 1602 West Pierson Ave., No. 229, Phoenix, Ariz. 85015. For medium-wave and shortwave listeners.

SPEEDX, Box E, Elsinore, Calif. 92530. Covers shortwave listening as well as police-band monitoring.

Miami Valley DX Club, 170 Notre Dame Ave., Dayton, Ohio 45404; Minnesota DX Club, 16920 17th Ave. North, Wayzata, Minn. 55391, and Rocky Mountain DXers Assn., 3071 South Dexter Way, Denver, Col. 80222 (regional clubs).

### VHF and UHF

Worldwide TV-FM DX Assn., Box 163, Deerfield, Ill. 60015. Covers VHF and UHF, especially TV and FM radio stations and public-service two-way radio police bands.

Not all VHF and UHF services will be available in your area but many are on the air for you to hear.

Remember, you can listen legally all you want to any band. But federal law says you can't repeat to anyone

under any conditions the content of signals you hear on the air. And you can't use information you overhear for your own personal gain. But nevertheless, you can surely have fun listening. ★★★

A dirty carburetor can be a real problem.



This can be a real help.

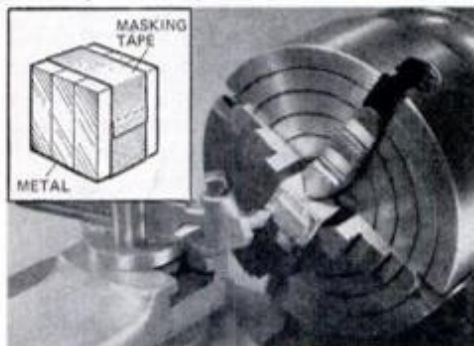
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# HINTS

## FROM READERS

### 'Group turning' in lathe



Keeping two or more small workpieces in alignment when facing and squaring off the ends in a lathe is easy if you bind the metal pieces tightly together with masking tape before chucking.

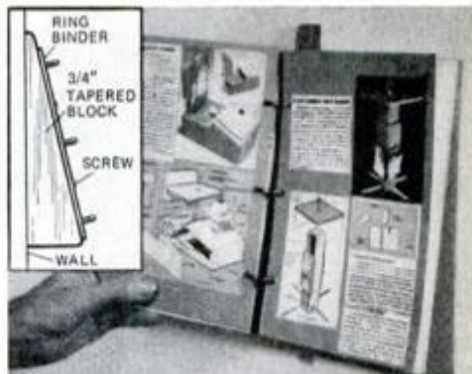
### Screwhead grabber



To keep hex-head screws and nuts from falling out of driver sockets when working in hard-to-reach places, use a bit of cord-type caulking, such as Mortite, to hold them in the socket. Once the nut or screw is started, you should remove the caulking from the driver for final tightening.

—W. E. Burton

### Save and flip



Clipped data is easy to check in this holder mounted over your bench. Attach a three-ring binder section to a tapered block. The slant will keep the pages open.—M. G. McMullen

## READING THE RADIO SPECTRUM

(Continued from page 73)

travel over great distances with little interference from physical obstructions. Antennas for perfect reception of signals on long wave are very long, but shorter antennas will work well for casual listening. Inexpensive radios, readily available, often tune down as far as 150 kHz. Most listeners tune 3-150 kHz with simple home-built receivers.

Signals available at these frequencies include the Omega radio navigation beacons near 12 kHz, world-wide naval shore-to-ship signals between 16 and 150 kHz; time, weather, iceberg patrol and other useful reports between 16-150 kHz; airplane beacons, many with weather forecasts, 200-400 kHz; and coast and shoreline marine radio beacons, 286-320 kHz.

### Medium waves

Medium-wave frequencies cover 300 to 3000 kHz. Signals from high-power transmitters on medium-wave frequencies cover great distances at night and are not affected greatly by physical obstructions. Many inexpensive radios tune these frequencies, especially the U.S. standard AM broadcast portion of the medium-wave band at 535-1605 kHz.

Other signals available here include airplane beacons, 200-400 kHz; coast and shoreline marine beacons, 286-320 kHz; automatic merchant-ship location reports from the Atlantic and Pacific Oceans to New York City on 416-485 kHz; international emergency frequency for alarms from ships at sea on 500 kHz and 2182 kHz; the amateur radio 160-meter band at 1800-2000 kHz; the shortwave listener (SWL) 120-meter band at 2300-2500 kHz; Civil Air Patrol at 2375 kHz; U.S. Coast Guard at 2666-2706 kHz; Volmet international airplane weather at 2889 and 2980

kHz; and airliners' two-way radio worldwide on 2868-2987 kHz.

### Shortwave

Shortwave frequencies extend from 3 to 30 MHz. Lower shortwave frequencies travel farther at night, while higher shortwave signals go farther during the day. Communications between any two places on Earth are possible via shortwaves. Many receivers are available for tuning shortwaves, including used sets at \$25 and professional new gear at \$2500. Many signals mentioned here can be tuned on the least expensive receivers. Even World War II surplus radios still work well for shortwave.

Shortwave signals available include 11 international broadcasting bands with hundreds of stations such as Radio Moscow and BBC sending countless hours of signals in all languages. There also are five amateur radio bands where hams chat across town and around the world. The citizens band (CB) is in the shortwave region of the spectrum.

Clandestine spy-and-numbers stations, military radios around the world, time signals, telephone calls from airplanes and ships, press-agency transmissions of news to ships at sea, weather forecasts and endless other transmissions are to be found in the shortwave frequencies. Russian and Chinese space satellites, the Oscar ham-radio satellites, Civil Air Patrol searches for downed aircraft, model-airplane control and even airliner pilots talking over the world's oceans can be heard on shortwave.

### Very high frequencies

The spectrum from 30 to 300 MHz is called VHF for very high frequencies. Here are three ham radio bands, the FM radio broadcasting band and television channels 2-13. The VHF-Low and the

VHF-High public-service police bands are there along with the National Weather Service's continuous weather forecasts. The main frequencies for two-way air-to-ground communications over the United States are VHF signals.

Short antennas 10 to 100 inches long work well for two-way communications on VHF. Receivers to tune in these frequencies are available from \$25 and up.

### Ultrahigh frequencies

UHF ranges from 300 MHz up to at least 3000 MHz. The spectrum, as allocated by the FCC, extends to 300,000 MHz. Present technology makes frequencies above 3000 MHz of little interest to hobby listeners. In the UHF range from 300-3000 MHz are three amateur radio bands, a police public-service band and TV broadcast channels 14-83.

Antennas become very small at UHF with lengths of less than 10 inches suitable for two-way communications. At least one major manufacturer sells a radio which tunes the UHF police band. Most TV sets can be adjusted to bring in those broadcast channels. Listeners wanting to hear other UHF frequencies usually build small converters to move UHF signals down to frequencies that can be heard by shortwave sets.

It's impossible to list here all signals in the airwaves. Hundreds of thousands of stations transmit at the same time, each on its own frequency, each with its own purpose.

Some of these signals are very boring—good for the challenge of locating and identifying but not much fun to monitor. But most are stimulating. Weird sounds and strange broadcasts that can be heard almost anywhere from 3 KHz to 3000 MHz tickle the imagination and can provide a great escape from a humdrum life. ★★

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### FIBERGLASS REPAIRS

(Continued from page 93)

crush and pulverize the fiberglass under the nut, resulting in elongated holes and loose fastenings. Then, it's wise to use large washers under nuts to spread the pressure. The back surface of fiberglass laminate is apt to be rough and nuts may not lie against it uniformly. Use rubber washers under the metal ones to assure uniform contact. Also use lock washers to prevent loosening from vibration.

Your small deck hardware such as horns, searchlights, rod holders and similar items can be installed by using wood screws passing through the fiberglass into wooden backing blocks. It's good practice to use marine bedding compound under hardware to keep water from being drawn under by capillary action and corroding the screws. Deck leaks can also start around carelessly installed fittings. Much use is made of Pop rivets to install hinges and trim strips. Hardware stores sell hand-operated Pop rivet guns adequate for personal use. But be sure to use aluminum Pop rivets; the similar plated-steel ones will rust.

Check your marine store for additional items useful when attaching accessories to fiberglass. A self-adhesive shock-absorbing pad, also made by Marine Development & Research, can be helpful when installing electronic equipment. Try Velcro, with its remarkable little surface hooks, for securing curtains, screening, and gear such as rope and lines out of the way. Velcro is now available in strip and dot form.

### Paste-in procedures

When customizing your fiberglass boat by adding live bait wells, shelves, lockers and the rest, don't overlook the advantages of combining fiberglass and plywood. A control console or fish box, for example, can first be constructed of exterior-grade plywood, then covered with fiberglass cloth for additional stiffening and waterproofing, and be both bolted or screwed and/or pasted into place with resin and fiberglass cloth tape. This paste-in procedure can be used to repair loosened hull stiffeners and to install extra ones or added bulkheads. Reinforcing blocks can also be positioned by adapting this procedure, and you may find you employ it more often than the frequently described system of making fiberglass repairs for a puncture hole.

First, lay the item in place and mark around it with a soft pencil or felt-tip marker. Depending on its weight, there should be 1 to 3 inches of width in the meeting surface of

old and new fiberglass. If the interior of the boat is painted, remove paint for 2 to 3 inches outside the line you have just drawn. A 3-inch sanding disc run by a small electric drill, of the type often used for auto body work, will do this and also roughen the fiberglass adequately. If the inside of the boat has a gel-coat finish, roughen this surface in the same manner. Put masking paper and tape along the outside of the area.

Fiberglass tape is good for holding down a boxlike accessory. Cloth or mat covering for the entire object would be better for a wooden mounting block to which an accessory will be screwed. Add hardener to resin, mix well, brush resin on the masked-off area, lay the tape or fabric in place, and soak it amply with more resin. Let cure. When it's hard enough, sand off slivers and fuzz. Then apply a second coat of resin to fill in the weave and add smoothness. When cured, sand smooth; a third coat of resin can be used if a very smooth job is wanted.

Finish with an epoxy or urethane paint suitable for fiberglass. It is hard to duplicate the assorted kinds of spatter paints used inside production boats as they are applied with special spray guns. A tour of auto supply stores might turn up spatter paint in spray-can form; it is normally used to refinish the insides of car trunks.

#### Polyester resin

Repair procedures for damaged fiberglass boats use the same materials and techniques. Polyester resin, used almost exclusively for boat building, is on sale at most marine stores. Epoxy resin, with much better adhesive properties, is more expensive, and used chiefly for special situations such as fiberglassing teak wood, which is oily.

Polyester resin is safe to use and few people are allergic to it, but fiberglassing is very messy work. Wear old clothes that can be discarded and use long sleeves and gloves. Glass fragments from cutting and sanding can cause much itching, especially in warm weather when the skin is moist. A very hot shower or bath may help. The acetone used to clean hands and tools before the resin hardens is highly flammable and must not be used near open flame or even the sparks in the commutator of an electric drill. It will sting when it gets into scratches on the hands and leaves the skin dry; some workers use protective hand cream or disposable plastic gloves. The liquid hardener is dangerous to the eyes and is toxic when taken in-

(Please turn to page 126)



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## FIBERGLASS REPAIRS

(Continued from page 125)

ternally; guard against splashing and keep it away from children.

Resin generates heat when curing. The larger the container of activated resin or the thicker the laminate, the more heat is created. If excessive hardener is used, resin in a pail can overheat and begin to smoke and a thicker laminate can scorch itself. In hotter weather, curing action is more rapid and the amount of hardener used is reduced. Direct sunlight accelerates the curing so it is best to work in the shade. A finished job can be rolled outdoors to encourage curing. Room temperatures should be 60° to 80° F.

### What to do with crazing

The gel coat of your boat may sometimes develop hairline cracks called "crazing," usually as a result of the gel coat originally being sprayed too thickly into the mold. Crazing does not weaken a boat because it does not penetrate from the brittle surface into the laminate below. To repair, go over cracks with the V-shaped burr of a modelmaker's electric grinding tool. Then trowel fiberglass paste into the grooves and when cured, sand and polish. When extensive gel-coat repair work has been done or the finish is badly faded, the best method for uniform restoration is to paint the whole boat with epoxy or urethane marine fiberglass paint. Epoxy can be removed with paint remover or hand sanding with very fine (No. 400 grit) wet-or-dry sandpaper and water.

Never try to burn old paint off as the gel-coat will blister. Do not remove antifouling bottom paint with a sanding machine since the dust contains toxic chemicals. When using a disc sander, wear a respirator (dust mask) as dust contains glass fragments.

### Crack and puncture repairs

To repair large cracks and punctures, use a saber saw to cut out the damaged area. Then feather the edges inside and out with a rotary sander. Cellophane is put on a piece of stiff cardboard, since resin will not adhere to cellophane, and this board is then taped and held against the back of the damaged surface and the hole filled with layers of resin-wetted mat, as shown on page 93. A sheet of cellophane can also be placed over the outer surface of the patch to help give it a smooth finish. When cured, the repair is completed by sanding and buffing.

For boatmen, fiberglass is still a miracle material, but no longer a mystery as well. ★★



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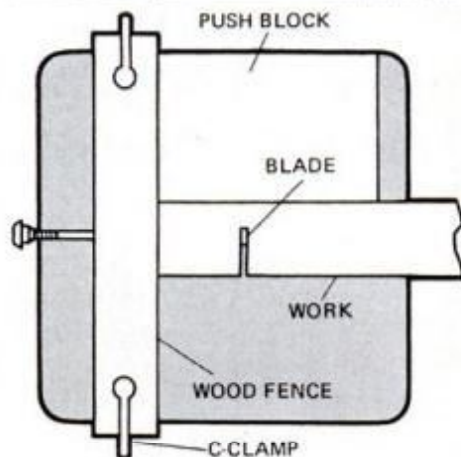
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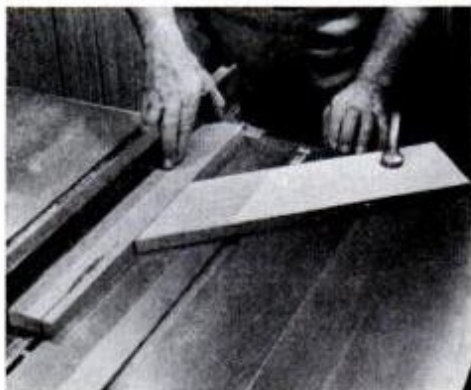
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CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

## 10 CLEVER SHOP TIPS

(Continued from page 96)



**9** While a bandsaw is primarily for cutting irregular shapes, it still can be used for quantity cutoff work even if it has no fence or a groove for a miter gauge. As shown in the setup above, a scrap of wood is clamped to the table to serve as a fence and a wood block pinch-hits for a miter gauge. In use, narrow stock is guided squarely through the blade by the backup block used as a pusher. The block must be perfectly square.



**10** When work must be held in close contact with the fence for the entire length of a cut, the spring action of a spring board is better than the hand. It's made by sawing a 60° angle at the end of a hardwood scrap and then ripping several closely spaced "fingers" two-thirds its length. To use it, clamp it to the saw table to bear lightly against the work. ★★★

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## NEW WARNING TELLS PILOT: 'COLLISION COURSE'

(Continued from page 66)

involved private or military aircraft as well as commercial airliners and accounted for another 296 deaths.

These tragic and near-tragic events have stirred both government and commercial aviation officials to seek improved anticollision systems, especially in view of increasing air traffic density and the greater risks of midair mishaps occurring. Our present radar ATC (Air Traffic Control) network is, of course, a considerably sophisticated collision-avoidance system already. Considering the thousands of flights made safely every day, the system has worked well and the men who man it do a remarkable job.

Still, there is alarming evidence that the system is by no means fool-proof. A slight mechanical malfunction or human error in judgment can in an instant destroy the effectiveness of millions of dollars' worth of complex equipment. Often it's the little things that cause big trouble. The events leading up to the near collision between the DC-10 and L-1011 last Thanksgiving Eve, for instance, were so bizarre as to be unbelievable had they not been thoroughly documented by government investigators.

### Incredible coincidences

According to the National Transportation Safety Board, the DC-10 had been cleared to climb to its assigned altitude of 37,000 feet, requiring it to pass through the 35,000-foot corridor occupied by the approaching L-1011. The radar controller monitoring the two aircraft noted their positions on his scope, but had reason to believe they would clear each other by well over the mandatory minimum separation—1000 feet vertically and five miles horizontally.

At this point, the controller became momentarily distracted by other duties—ironically, duties usually performed by another operator known as the "manual controller." Still more ironically, a third operator—the "handoff controller" who would normally be present to assist and back up the radar controller—was away eating dinner.

To top it off, the radar controller was then relieved of duty by a replacement who took over his post. In the exchange or "briefing" that takes place whenever one controller relieves another, the possibility of a conflict between the two jumbo jets was apparently not discussed. The new controller scanned the scope, suddenly spotted the rapidly closing

blips and radioed the DC-10 for an altitude report. When he learned the plane was approaching the same 35,000-foot level as the L-1011, he immediately ordered it to descend. He watched in horror as the two blips merged briefly, then was relieved to see them separate and continue on. Two seconds later and it would have all been over for the big jets and the 306 on board them.

Such incidents seem incredible, but do happen. The Aircraft Owners and Pilots Assn., in a statement strongly critical of weaknesses in the present air traffic control system, declared that recent reports of near collisions between airliners represent "just the tip of the iceberg" of a bigger problem. Many more accidents and near accidents actually occur, the organization claims, but don't receive public attention because they involve small private or business aircraft. The group cited several examples of radar mixups resulting in fatal mishaps. In one, radar controllers thought they were instructing one aircraft when they were in fact talking to another, causing it to crash. In another case of mistaken identity, an aircraft was ordered to descend—right into a mountainside.

### Which system?

The technology for preventing midair collisions—or at least drastically reducing their chances—is already here. The question has been which of several systems to adopt. So-called ACAS (Airborne Collision-Avoidance System) is an air-to-air approach not involving ground controllers. Essentially, it works by sending out signals that are received and returned by other aircraft in the vicinity. A computer working in conjunction with a radio direction finder decides whether the strength and direction of the returned signals indicate the approach of a dangerous situation. If they do, a warning indicator in the cockpit flashes on and tells the pilot what evasive action to take to avoid a collision.

The Air Line Pilots Assn. (ALPA) has long advocated an airborne system over a ground-based one, believing that in-cockpit equipment gives pilots more flexibility and authority in dealing with potential hazards. Until recently, both the National Transportation Safety Board and the Air Transport Assn., which represents the airlines, have also favored the airborne approach.

Now the picture is changing. The FAA (Federal Aviation Administra-

tion) is strongly advocating a ground-based anticollision system and, in fact, has already installed one form at some major traffic control facilities. The FAA points out that an airborne system requires the installation of costly equipment in each plane and is only effective if all planes are similarly equipped. While commercial airlines could afford the devices, it is not likely that many small private and business aircraft would have them. Thus, argues the FAA, any airborne system would be seriously weakened. To stress this point, it cites the fact that, of the seven recent major midair disasters, five involved aircraft other than commercial airliners.

"As far as we're concerned," assert Administration officials, "ACAS is dead." Now there is indication that the National Transportation Safety Board and the Air Transport Assn. are reassessing their positions and may go along with the FAA's insistence on a ground-based system.

### The universal system

The one piece of equipment that makes a ground-based system feasible for all aircraft—commercial, military, private and business—is the FAA-approved transponder. This is an automatic transmitter that, upon receiving a designated signal, emits a signal of its own that can be tracked. All aircraft operating in commercial airliner airspace are required to have a transponder, a readily available, relatively inexpensive piece of gear. Thus a collision-avoidance system based on the use of transponders would automatically cover all aircraft in commercial airspace from the smallest Piper Cub to the largest 747. This is exactly what the FAA has in mind. But it will be a long-range, step-by-step program and will take time. Current plans are for a virtually foolproof anticollision network to be in operation by the mid to late 1980s—or in about 10 years.

Meanwhile, progress is already being made. The basic collision-avoidance equipment now in use is the Air Traffic Control Radar Beacon System (ATCRBS), which controllers call "at-crabs." It's a surveillance system consisting of a network of radio beacon interrogators interconnected with radars at airport and regional en route control centers.

The rotating antenna of the radar picks up aircraft targets within the zone of coverage and provides information about each target's direction and distance from the ground station. The ground-based interrogator (beacon) elicits additional information from the target plane's transponder,

such as altitude and identity. These findings are automatically checked against previously filed flight plans programmed into computers.

### Human factor still a problem

The problem is that, as sophisticated as at-crabs is, it still ultimately depends on the human factor for proper interpretation of flight data and prompt action—and no human is infallible. The National Transportation Safety Board left no doubt about this when, in a strongly worded statement to the FAA, it said: "The National Transportation Safety Board has reviewed several recent air traffic control related accidents and incidents and has determined that deficiencies in human performance were critical causal factors. The individual controller's susceptibility to error, despite sophisticated electronic equipment available to him, detracts from the overall benefits achievable through advanced automation. . . ."

A recent addition to ATCRBS—so-called "Conflict Alert" warning—will hopefully make the system less vulnerable to human error. This is a computerized setup tied in with the basic control computers. It projects the flight paths of aircraft for two minutes ahead of where they are at any given moment. If the flight paths of any two planes are predicted to be getting closer than the required minimum separation, the words "Conflict Alert" begin flashing next to the display identifying the two planes. The controller is alerted by the flashing warning and advises one of the planes to take a new heading and/or altitude.

### A partial solution

The system has been installed at all 20 en route traffic control centers in the continental United States. These are the regional centers that keep watch over aircraft flying *between* airports. Airport control centers—which handle the really heavy inbound and outbound traffic—are still without the protection of Conflict Alert, but are expected to have it by early next year. It doesn't remove the human element completely, but it should go a long way toward eliminating incidents caused by lack of attention—it's hard to ignore a flashing warning that practically taps you on the shoulder and tells you you have a problem.

### The next step

Conflict Alert is only one of several new technological advances that will gradually be put into effect over the coming years. As the present

(Please turn to page 132)

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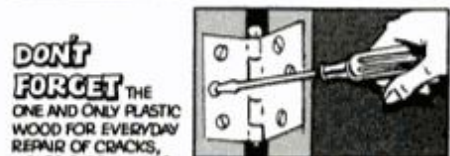
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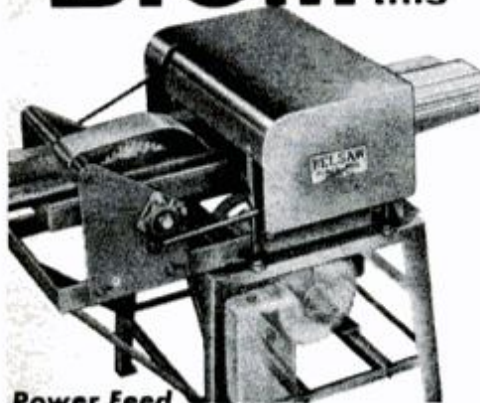


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## NEW WARNING TELLS PILOT: 'COLLISION COURSE'

(Continued from page 131)

ATCRBS system becomes obsolete, it will be replaced by a more efficient and accurate version that will add significantly to increased air safety. There are two reasons a new system is needed. One, ATCRBS has limited capacity in the number of aircraft it can monitor. It can handle 4096 codes—ample for now but not for the future with air traffic growing at a phenomenal rate.

Self-interference is another major shortcoming of ATCRBS. All interrogator beacons operate on a frequency of 1030 MHz, and all transponders reply on a frequency of 1090 MHz. As a result, all transponders in a given reception area, which may be hundreds of miles in diameter, respond to all interrogations picked up by their receivers.

What happens is described by an air controller this way: "It's like using a bullhorn to ask the identity of a single individual in a crowd by shouting 'who are you?' or 'where are you?' Everyone who hears replies."

In high-density terminal areas, where the danger of collisions is most acute, there may be as many as 60 interrogators each querying a specific airplane but getting answers from every transponder within range. Garbled and lost replies result.

### An end to garbled messages

The new monitoring system, now being tested to replace ATCRBS, is called DABS for Discrete Address Beacon System. DABS first of all has an astounding code capacity of 17 million, enough to meet the growth of aviation well into the 21st century. But its greatest asset lies in the key word "discrete"—the ability to positively identify individual aircraft and eliminate the problem of lost and garbled messages.

DABS will work basically the same way as ATCRBS, using a network of interrogator beacons to monitor replying signals from airborne transponders. The important difference is that each transponder will be programmed to reply only to a specially assigned (discrete) signal. It will ignore all interrogations aimed at other aircraft. The result will be a vastly improved monitoring system. The new modified transponders, will, of course, be different from those now in use, but this is not expected to be a problem. Since the average life of a transponder is only about 10 years, most aircraft owners will have had to purchase new units anyway when the DABS system goes into effect some time in the 1980s.

A little farther down the road is

another refinement called Intermittent Positive Control (IPC). According to the FAA, it is considered the "optimum long-term solution" to the problem of collision avoidance.

### Coming: A cockpit display

IPC dovetails with DABS. It is a computerized system that issues corrective commands automatically to a display right in the cockpit of each aircraft. Using altitude, flight path and other data gathered by DABS, the IPC computer can make an early determination that two aircraft are on a collision course. It then sends signals to the cockpit displays in both planes telling the pilots to "climb," "turn left," "turn right," "descend"—whatever evasive action is needed to avoid collision—all without the aid of a ground controller. This "ultimate" in safety systems is expected to be available some time in the 1990s.

### Airborne backup

There is still another system on the horizon that will probably please airline pilots for it is, curiously enough, an airborne system, though different in concept from the earlier ACAS proposal. It is called B-CAS for Beacon Collision Avoidance System and is, in effect, a miniaturized cockpit version of the present ground-based ATCRBS. With B-CAS, each pilot could personally and directly monitor the transponders of other aircraft in his area to see if any were heading his way on a collision course.

B-CAS could come along sooner than either IPC or DABS—probably before the end of this decade—and is not particularly expensive considering what it does. It would cost roughly \$20,000 per plane for airliners but only about \$1000 per plane for general aviation aircraft. However, while the FAA is expected to approve it if it tests out successfully, the government agency makes it clear that it views B-CAS only as a secondary or backup aid, not a substitute for ground-based equipment. It would be most useful in situations where ATCRBS breaks down for some reason—and could literally be a lifesaver in the case of human failure.

B-CAS is not likely to be made mandatory, but it's comforting to know it will be available. Commercial airline pilots will probably want and demand it. The combination of all the coming new systems should eventually make everyone happy—and a lot safer. ★★★

## FIAT 131 OWNERS REPORT

(Continued from page 89)

need to be convinced or persuaded. I bought the Fiat because, in its price range, it had the best performance, comfort, styling and mileage. It's very nicely designed—classy as compared to Dasher and some other imports.

"Workmanship is solid. It's a well-built auto—nice detailing, upholstery, seats, instruments. The one problem I've had was carb icing at highway speeds. The San Francisco dealer didn't know what to do, but the dealer in Stockton corrected it (a simple adjustment of warm-air intake.)

"Under normal driving conditions, the 'slow down' light often appears. The catalytic converter heats up and causes this, especially in hilly or mountainous areas. It's damned annoying. But what I especially like about this car is its great comfort, performance, roadability, lots of glass for good visibility, good handling on curves and okay braking."

From an Iowa railroad conductor: "Of the three Fiats I've owned, and especially in this 131, quality has always been high. The 131 is well-constructed and obviously had a lot of thought put into it.

### 'Very quick performer'

"I particularly like the car's handling, both in town and on the highway. It's a very quick performer with an exceptional ride. It has comfort plus styling and yet isn't super expensive. Windows are big all around, and you don't feel packed into it.

"I've had no problem at all with this car, and in the past the Fiat dealer has always done his best to see work done correctly. I have no major complaints, yet I'm aware that Fiat doesn't have as good a paint job as American cars in its price range."

A San Diego warehouseman, 45: "Front seats are very comfortable, but taller people need more room in back. I'd rate the dealer so-so. There's a new salesman every time we go back. It took two months to get an owners manual.

"When we got the car, the speedometer and odometer were broken, there were oil leaks, the car died in the morning, and the smog pump belt was broken. Little things, yes, but the speedometer is broken again, the engine still leaks oil, the carburetor doesn't take gas properly, and the smog belt is still under repair.

"Everything shouldn't be made of plastic. We wanted to try a foreign car, and this one had everything we wanted—four doors, good gas mileage and room. But it took almost a month to fix the speedometer the first

time, and the dealer never has the parts. We wouldn't consider buying another foreign car."

A San Anselmo, Calif., sales vice president, 49: "This car comes close. It has size, comfort, performance and price. However, it falls short when the smog system has to be added. Fiat seems to have compromised by lowering the compression ratio, adding dual points, etc., but this still retards the basic good design of the dohc engine.

### 'Seats not for all Americans'

"Seats are very comfortable but not designed for all Americans—it would help if Fiat lowered them. I can't judge the dealer or his service department because I do all my own servicing after the warranty period. I'd probably be hard to satisfy. I've driven the Italian 131 in Europe and find it twice the car the U.S. version is, and the California version is worse yet."

A 26-year-old North Carolina CPA, 26: "Extremely smooth, quiet ride for a compact car; good performance and handling; neat appearance; good quality of workmanship; reasonable price for quality of car; comfortably seats four adults; adequate trunk.

"Clutch is a bit firm; gearshift a little tight. My major complaints are there aren't enough dealers in the area, and gas mileage isn't as good as expected. I've been pleased with my dealer's sales policies and service department. The overall car is much more impressive in quality than comparably priced imports."

A Florida salesman, 27: "The 131 is a balance between the small, economical sports car and the mid-sized sedans that feature roominess, comfort, and style. The 131 handles very well, gives good gas mileage, provides comfort and space.

"The salesman was courteous and helpful, but the service department is something else. Small repairs require long waits. They're apparently understaffed, and they have inadequate communications procedures with customers. Not that much really went wrong with the car—a broken speedometer cable, a knob off the ashtray, and the tach bounces at about 2000 rpm. Basically, it's a very solid car, with comfortable seating, good style inside and out and the recessed sunvisors are a nice touch."

An Austin, Tex., teacher, 26: Two minor problems. Speedometer cable broke at 400 miles. Dealer ordered part; has been four months. Also emission-control light kept coming on. Service foreman couldn't locate cause. Replaced all fuses, wiring, etc. Finally ended up just removing bulb. Service is not too swift. ★★

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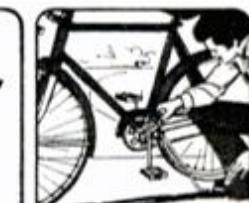
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## DRUM BRAKE SYSTEMS

(Continued from page 90)

to the axle. Take off speed nuts and remove the drum (Drawing 4).

In removing brake drums from the car, watch that you don't bang the drum and don't drop it. You could send a good drum to the junk pile.

With drums off the vehicle, examine brake linings. Their condition can often tip you off to defective brake drums. Look for:

- Linings serving one wheel that are worn down more than linings serving other wheels. The drum on that wheel is probably roughed up.
- Uneven wear from side to side on any one set of linings. The drum is probably tapered.
- Linings badly worn at toe or heel, indicating a drum out-of-round.

### Cleaning and inspecting drums

If compressed air is available, blow loose dirt from drums. If there is no compressed air, use a stiff bristle brush to remove dirt.

If drum has oil, grease or hardened dirt on it, wash it thoroughly with a nonoil-base cleaning solvent, such as carburetor cleaner or lacquer thinner. Check to see where oil or grease is coming from and make repairs before

reinstalling drums. The leak likely is from a defective brake cylinder or front-wheel-hub grease seal.

Closely inspect each drum for cracks. A cracked brake drum should be replaced. Never attempt to weld it closed. This won't work and may lead to a serious accident.

Inspect also for other damage, such as score marks, rough spots and polished areas. You might be able to eliminate these defects by turning, so the drum can be used again.

■ Even if drums look good, with no indication of taper, out-of-roundness or damage, I suggest you still have them checked with a micrometer for excessive wear (Drawing 5). If you have an inside micrometer to which you can fit an extension rod, you don't need a professional brake-drum micrometer. If not, let a brake shop make the measurements.

Take measurements at open and closed edges of the friction surface, and at right angles to each other. If taper or out-of-roundness exceeds .006 inch (.004 inch for Chrysler Total Contact brakes), the drum is not fit for use and should be turned.

Note: Chrysler Total Contact brakes haven't been used since 1962, but are mentioned here just in case you have an oldie. If the maximum

diameter reading exceeds the diameter of the drum by more than .060 inch when the drum was new, the drum cannot be turned and should be replaced. (This limit specification for a Chrysler Total Contact brake is .030 inch.) For example, if the diameter of new brake drums for your car is 11.00 inches, and the micrometer shows that wear has reached .070 inch, giving you a total reading of 11.07 inches, discard the drum.

If drums have to be turned to get them even and smooth, remove only enough metal to obtain a true surface. But keep in mind that if one drum has to be machined, the other drum on the same axle should be turned to the same diameter—even if it does not need machining—to assure braking equalization. For the same reason, if one brake drum has to be discarded, replace the other one on the same axle.

Every brake drum made since Dec. 31, 1970, has been stamped with a discard dimension. This is the permissible wear dimension, not the allowable turning dimension. If the drum cannot be turned so .030 inch is left for wear, replace the drum.

For example, suppose your brake drums are marked: Max. Dia. 9.090";

(Please turn to page 136)

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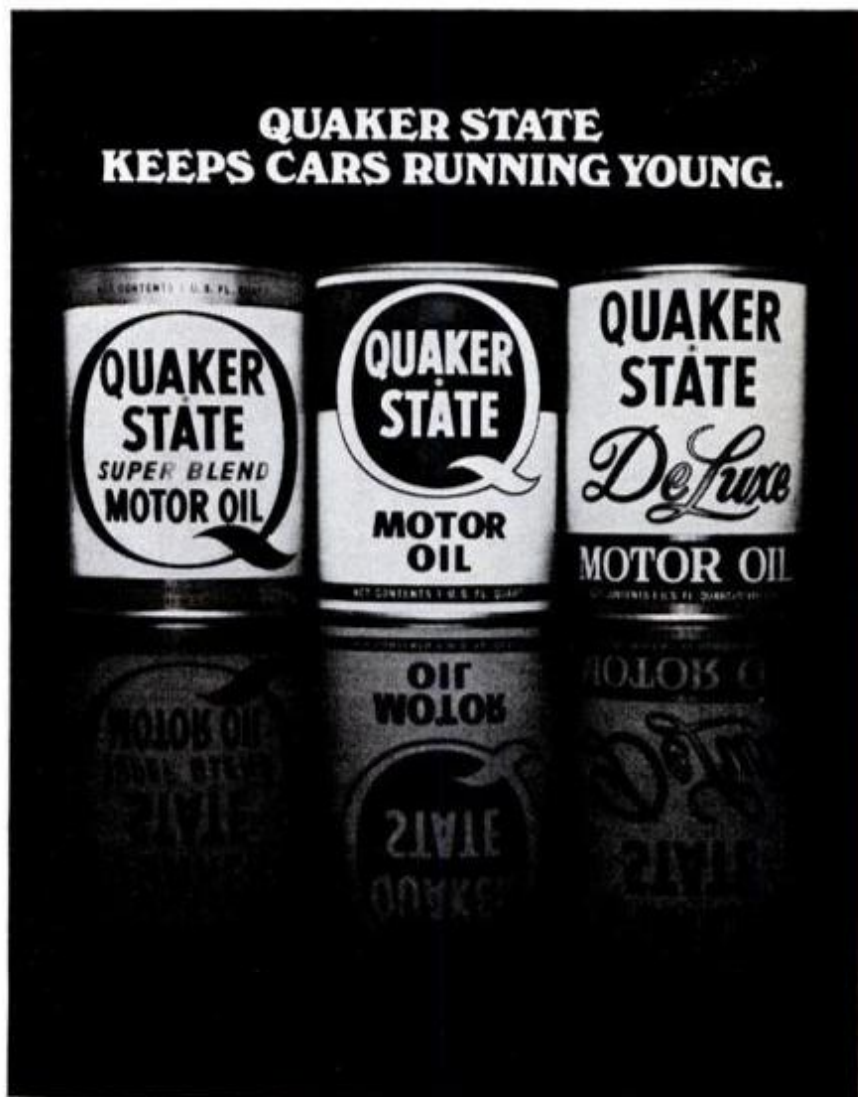
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Now do you really believe that all motor oils are the same?



## DRUM BRAKE SYSTEMS

(Continued from page 134)

once the drum reaches this diameter, replace it. It should be refaced no more than .060 inch beyond 9.00 inches, allowing .030 inch for additional wear.

■ If drums are true and smooth, needing no turning, use some fine emery cloth to polish out slight score marks (Drawing 6). If this won't remove them, the drum should be turned.

### Removing shoes and linings

The following step-by-step guide applies to drum brakes on most late-model cars. If your setup differs, the changes will be minor and you should be able to compensate using this outline:

**1. Install brake-cylinder clamps** to keep fluid from leaking (Drawing 7). Some brakes have brake-cylinder stops built into the backing plate, and need no clamps. In any event, don't press the brake pedal after shoe-return springs are removed.

**2. Loosen the brake-spring anchor pin** and remove the brake-shoe return springs (Drawing 8). Your setup may not have springs attached directly to the anchor pin. They may

be hooked to a plate that, in turn, is held by an anchor pin. Whatever, examine the arrangement closely before proceeding. Be sure the layout is firmly in mind (make notes and a sketch, if necessary) so springs may be reinstalled properly.

**3. Remove shoe-retaining parts.** There are differences from brake to brake. Some use a coil spring-cup-pin arrangement (Drawing 9). Others have pins with the outside end retained by a spring clip. Still others use tension hold-down springs, enlarged on one end and with a hook on the other that engages a retainer through the backing plate.

You may not be able to remove shoe-retaining parts without a special tool. To get the right one, tell your auto-parts supplier your car's make and model. Better, bring him a Polaroid picture of the brake.

**4. Remove self-adjusting parts.** On Delco Moraine brakes, you must lift off actuating link, lever and pivot assembly, sleeve and return spring (Drawing 10). Discard damaged parts.

On Bendix brakes (Drawing 11.), slip the adjusting cable off the anchor pin and unhook bottom end of the adjusting lever. Remove cable guide, but don't remove the adjusting lever

yet. It's easier to get it off after shoes are removed.

On Wagner brakes, remove screw holding the adjusting crank, lift off crank and unhook adjusting links from the anchor pin and adjusting lever. Wait until you have taken off brake shoes to remove adjusting lever.

**5. On rear brakes,** remove the parking brake strut by spreading shoes apart slightly. Disconnect the parking brake lever, which may be held either by a retaining clip or bolt, or may be hooked in place.

**6. If anchor plate is used,** slip it off anchor pin; if plate is bolted on, leave it be.

**7. Spread brake-shoe anchor ends** and take shoes off brake-cylinder links. Remove shoes, and adjusting screw and spring as an assembly (Drawing 12). Some brakes don't have brake cylinder links. Shoes ride directly on brake cylinder pistons.

**8. To separate shoes,** relieve adjusting spring tension by overlapping anchor ends of shoes (Drawing 13). Unhook spring; remove adjusting screw. Parts are now separated.

Next month we'll explain how to clean and inspect disassembled parts, examine and overhaul brake cylinders, and install new shoes and other essential parts. ★★★

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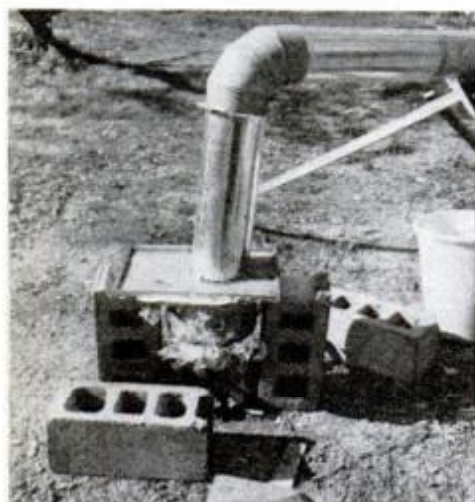
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**PM'S GREENHOUSE: AN ELEGANT TRADITION** *(Continued from page 83)*

withstand high moisture. This is crucial since all sealers contain a mildicide agent with vapors that are harmful to plants months after application. Cypress is the only other choice, but locating it (and paying for it) is next to impossible.

We chose 1/8-in. Plexiglas from Rohm and Haas (even though it's

**Yankee ingenuity strikes again!** Boiling water sends steam into the 8-in. ducts. We fed the 1/2 x 2-in. wood cover strips into the other end and plugged it with a towel. In 30 minutes, the strips bent like rubber.

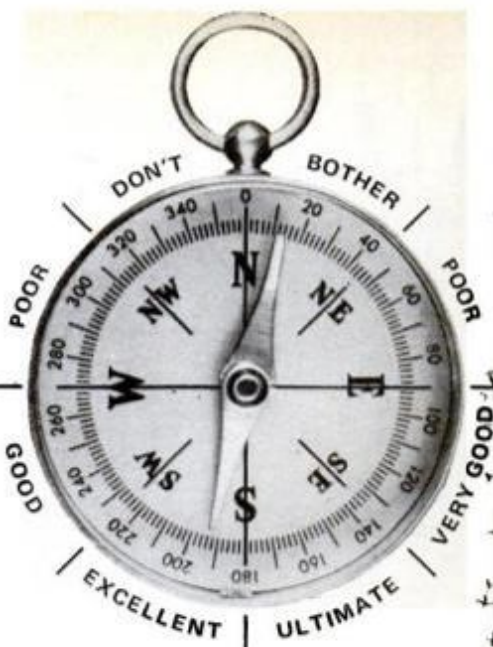


softer than glass and more expensive than fiberglass) because it transmits light well, can be cut or trimmed easily (a sharp plywood blade will do it) and has an elegant appearance. The biggest consideration was our two young boys who like to play baseball in the yard. Materials including an 8-ft. bench, heater, fan and thermostat, cost \$700.

This is a large undertaking, but it's an addition with unusually high payoffs: good looks, a major jump in equity on your home, extra solar heat and, if you're an enterprising gardener, high-vitamin, unprocessed and nearly free vegetables.

Plexiglas comes slightly oversized, so we widened the framing centers and cut sheets down the middle. Be sure you comply with your local building codes. To maintain 60° F. on a cold day, your heater should produce 5000 B.T.U. for every 10 square feet of greenhouse.

One last note: Curving the Plexiglas to a wide arc is tricky with heat tape. Your supplier can bend the sheets to your design or you can use our alternate method for a single, tight bend at the eaves. At right are more sources of greenhouse information. ★ ★ ★



**LOCATING YOUR GREENHOUSE**

**More information**

- The American Horticultural Society, Mount Vernon, Va. 22121.
- Greenhouse Specialties Co., 9849 Kimker Lane, St. Louis, Mo. 63127.
- Walt Nicke Co., 19 Columbia Tpke., Hudson, N.Y. 12534.
- Hydroponic Specialties, Box 1013, Carlsbad, Calif. 92008.
- Aluminum Greenhouses, Inc., 14615 Lorain Ave., Cleveland, Ohio 44111.
- Peter Reimuller Greenhouses, 980 17th Ave., Santa Cruz, Calif. 95062.
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## TRUCKIN': IT'S SMOKEYS, WHITE LINES AND ROLAIDS

(Continued from page 63)

going by in a certain make and color of car.

"It's kinda foolish," he says, "but it helps break up the monotony."

Over the speaker, a driver—having picked up a "seatcover" message—says, "Ever' time I hear one of them reports, I'm either too early, too late, or on the wrong side."

### Ladies of the road

Later, another driver reports that ladies of joy, their cars equipped with CB radios, will pull up by a truck and try to arrange a transaction at a nearby hot-sheet motel.

Highhouse says he has to stop to see about the tire and suggests breakfast. "That'll see us through till this afternoon, when we can stop for lunch."

At the truck stop, featuring motel rooms, showers, a large restaurant and a lounge complete with a pool table and a color TV set projecting the inevitable morning game show, Highhouse notes that one of the tires on the trailer show signs of being about to throw its tread.

"Recaps aren't worth a damn," he mutters, but adds that buying new tires for the trailer is out of the question. He checks with the fellow about the one being repaired, learns that it isn't ready, and goes in to have breakfast. "I'll pick it up on the way back," he says over a plate of fried eggs and Polish sausage. "We'll run with that other one till it goes. Maybe it'll hold out."

### Tire goes—but 'don't worry'

It doesn't. Shortly after rolling by Macon, he sees in his rear-view mirror chunks of rubber being thrown onto the highway. "There it goes," he says. "Don't worry. We're okay."

At a big truck stop in McDonough, Highhouse loses an hour while the chunked tire is removed, a spare put on. It costs him \$6.

Up in the cab, he reaches past the steering wheel and drops a few pennies into the slot of an empty soda pop can wedged in between the windshield and instrument panel.

"That's Linda's penny can," he says. I've got a daughter in grammar school, and whenever I get back from a trip, she climbs up in here and empties that can."

Highhouse says most independents pull either one of three types of trailers—a flat bed, a plain cargo box or a refrigerator box (called a "reefer," a term once applied to marijuana cigarets). He says that from a trucker's point of view, hauling fruit and

vegetables is the most critical job. Refrigerator unit temperatures must be held within a certain, often narrow range, meaning the thermometer in the cab must be monitored constantly.

"I don't know why, exactly, but the guys tell me strawberries are the toughest thing to haul," he says. "I guess they can get spoiled real easy. There's a saying in this business that the only difference between hauling produce and hauling garbage is one degree."

### Not running right

He glances at his watch and says that maybe it's time to stop for lunch. Besides, he wants to take a look at the fuel filter. "We're not running right. Might be I got a little dirt in there."

He rolls off into a large truck stop, its parking lot full of idling rigs, the drivers of which are inside grabbing a bite to eat and a few minutes of relief.

"A diesel engine'll cool down a lot quicker if you let it idle instead of shutting it off," Highhouse says.

He climbs down, checks the filter, decides he might rig his fuel lines to bypass it—perhaps when he stops for dinner—then reaches up behind his cab seat and takes out a two-foot-long stick like a broom handle, one end of which is weighted. He walks around from one axle to another, thumping each of the rig's 18 tires with the weighted end of the stick and listening for a certain *thunk* that will tell him a tire is flat or might be going flat. He says that his youngest son, Bill Jr., a loader checker for North Florida Freight Forwarders in Jacksonville, made the stick for him in shop class in school. "They sell 'em in the truck stops," he says, "but I like this one. Makes a pretty good billy, too."

Over a barbecue sandwich and a glass of ice tea, Highhouse confirms that truckers usually carry with them a fair amount of cash, and that a lot of them keep guns handy for protection. He says that's one reason truckers tend to stick together in well-lighted areas—for protection. He recalls the robbery and murder some years ago of several truck drivers along what he thinks was the Pennsylvania Turnpike, and the consequent feeling among many drivers that the wisest course is often to shoot first and ask questions later. "Lot of nuts wandering around out there," he says in a flat voice. "You can't be too careful."

Back out on the road, Highhouse

rolls on to Chattanooga, where he swings around onto Interstate 24 and makes a long, laborious climb up a mountain to a refueling stop at Monteagle, Tenn. He takes on \$36 worth of 47.9-cent fuel, enough, he says, to last until he reaches a favored station in Elkhart, Ind.

### Back on the road

The hours slide by, and the soft light of an early spring day down South fades into a gentle twilight, then a shadowy darkness. The steady beat of the big diesel sounds a monotonous accompaniment to the miles and miles of monotonous asphalt. Highhouse is quiet, the novelty of having a guy aboard with him just about exhausted. He seems settled into a state of suspended consciousness, as if he has somehow checked out of the human machine behind the wheel. He sighs now and then, belches and blames the Polish sausage he had for breakfast, clears his throat, reaches in his pocket for a stick of chewing gum. With the exceptions of brief stops here and there, he has driven steadily for more than 12 hours, and as a result appears to have turned his physiological rheostat down to idle. There is still a long way to go.

As he approaches Nashville, the CB blurs out that the police are out in force, apparently sweeping the highway by radar and collecting on-the-spot fines. "Smokey's got his Kodak on and he's takin' green stamps," the voice on the speaker says. Highhouse adds his two cents to the jam of acknowledgements and, without looking, hangs his mike back on its hook.

"We can have supper up here a little ways," he says. "There's a place over in Kentucky where the food's usually pretty good."

At 8:15 p.m., he pulls off Interstate 65 and into a big, well-lighted truck stop, parks his rig alongside an idling "reefer," and goes in to have his third meal in 14 hours.

### She's heard it all

Highhouse orders the evening's special from a young, bored, somewhat overweight waitress whose reasonably pretty face reflects immunity to the occasionally coarse japes and suggestions proffered by the men she serves. She has seen and heard it all, fella, and her knowing brown eyes show it. Not quite listlessly, she deals out an order of chopped beef, brussels sprouts, boiled carrots, a glass of milk and a dish of indetermi-

(Please turn to page 142)

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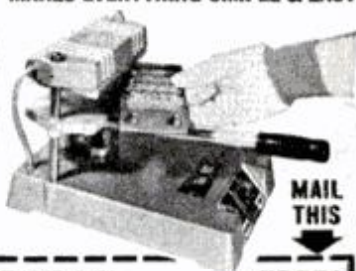


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## TRUCKIN'

(Continued from page 141)

nate red Jello. Highhouse takes it in, apologizing for its so-so quality.

"Can't imagine what they did to this chopped steak," he says, looking at it as if perhaps it might bite him.

If for no other reason, America's truckers deserve a tip o' the hat for their genial and cast-iron tolerance of depressingly bad food. They are a captive clientele to whom the advertised slogan "Home Cooking" too often signals gastric distress. To a man, they pack antacid tablets, palliative evidence of their courage and endurance. In general, truck-stop food—served round the clock seven days a week—is not exactly memorable cuisine.

Back in the rig's cab, Highhouse fires off a splendid volley of belches while flourishing a toothpick with practiced precision. "We'll push on up over the Indiana border," he says between burps, "then maybe we'll grab a little nap. Might rig up that fuel line, too."

The miles roll by in comparative silence; the traffic is light, the CB chatter a now-and-then thing, and Highhouse is almost robot-like as he pushes his rig through the chilly night. Much of what he does, he seems to do automatically, as if no thought is required to flick his headlight beams up and down, flash his courtesy lights to passing truckers, or cope with the few and indifferently regarded "four-wheelers" nervy or foolish enough to play dodge'em with the rumbling behemoths that seemingly own the night roads. His conversation is sporadic, his words spare. He is every inch the old pro, gloried in the songs of country-western music, very much a part of the "white line fever" that each night delivers the nation's goods.

About 1:30 a.m., he seems to drag himself up out of the abeyance into which he has folded his being for the past few hours.

"We've been doing pretty good," he announces brightly. "Been averaging about sixty-five, and we're almost to Crothersville. We'll stop there, get a bite to eat and sleep for a bit."

## Hits the spring

A few minutes later he pulls off U.S. 31 and into an island of fluorescent lights and parks in a nest of idling rigs. Inside, he hits the spring, washes up, and goes out into a surprisingly crowded coffee shop to sit down at a small table and order from a thin, harried and foot-sore blonde

Marquesan (Please turn to page 143)

## TRUCKIN'

(Continued from page 142)

a hamburger and iced tea. His eyes are red and watering, and in between bites he fights back an occasional yawn. Someone cranks a coin into the jukebox, and the country-rock result strikes an oddly discordant note in the clamorous, yet strangely subdued room. "Let's take a nap," he says, pushing himself away from the table.

Outside, he gives his rig a final walk-around, climbs up in the cab and stretches out in its single bunk.

"It's kinda cold out there," he says, "so we'll leave the engine running to give us a little heat. Hit the door locks, will you? You okay?"

### Sleep a brief interlude

I assure him I am—I'm draped over the seats and the padded engine housing. Highhouse says "Good night" and drops off immediately, his even breathing synchronized with the offbeats of the idling engine. It is just past 2 a.m.

Three hours later, Highhouse stirs, prods me and says we've got to get going. He sits up, fishes around for his toiletries kit, and crawls down and out into the cold morning air. He yawns, stretches, then shuffles into the truck stop to wash up, shave, brush his teeth and have breakfast. He says he has slept an hour longer than he intended to and has to make up time. Repair of the balky fuel line is postponed.

A little after 9 o'clock, Highhouse turns off 31 and heads east on U.S. 6. He wants to get to Middlebury as soon as possible so he can offload and get to the Ranger Div. depot at Hammond, where he hopes to pick up enough to fill out his load for the return run to Jacksonville. He says he'll call Hammond as soon as he gets to Middlebury.

At 9:50, he drives through the gates of Coachman Industries, stops to find out at just what building or area the plywood is to be offloaded, then carefully and skillfully threads his way through piles of lumber and rows of finished Coachman RVs and trailers.

Pulling up parallel to some lumber and axle assemblies stacked outside a long, low, cement-block factory building, he goes inside to notify a forklift operator of his presence, then sets about unfastening the straps and tarps and plastic sheets that have secured and protected his cargo. He is responsible for any damage incurred en route, and he checks the uncovered stacks carefully; a couple of sheets on the bottom of one of the stacks are damaged

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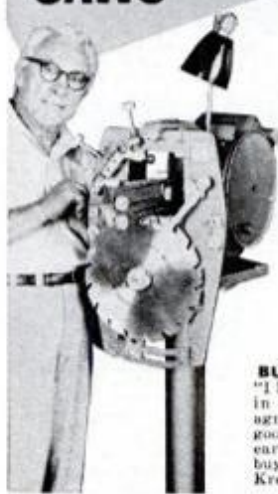


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slightly, not enough to cause any flap. He goes about his chores with an easy familiarity, then stands by as the fork-lift comes and goes. He smiles as the last stack is lifted off, waves to the forklift operator, then goes inside to find a telephone and make his call to Hammond.

**Okay to ride**

"If we make time," he says minutes later, "I can pick up some stuff for delivery down around Miami. They want me in Hammond as soon as possible. Incidentally, I got an okay for you to ride to New England with a friend of mine, a guy named Mike Webber. He'll be leaving later on this afternoon."

Nearing noontime, he is back on the road, heading for a favored fuel stop in nearby Elkhart. At 12:30 he pays \$51.50 for 121 gallons of 42.9-cent diesel fuel, four cents cheaper per gallon than any he has purchased thus far on the trip. He figures his savings at \$4.84, enough, he says again, "to buy me a meal."

Out on what Highhouse calls "the Toll Road" (Interstate 80/90), I surrender and reluctantly but gratefully heed his urging to crawl back up in the bunk and sack out. The sleep is brief but blissful.

At 2:30 in the afternoon, Highhouse noses into a dreary, fenced-in lot on the outskirts of a bleak, ravaged bit of landscape typical of America's industrial fringes. Parked in the oil-soaked dirt lot are a few other partially loaded rigs, their drivers presumably inside a nearby office shack awaiting word on possible cargo that might fill them out for runs to Texas, New England and points south. Highhouse parks, goes inside, is told by the dispatcher that if he gets it in gear, he still has time to drive over and pick up that partial load for Miami.

**Ready to roll again**

Highhouse is all quick motion now, completing the necessary paper work and anxious to be off again. His luck seems to be holding, and maybe he can make the first stop and then the other one and maybe by midnight be on the road back to Jacksonville. Maybe when he gets there he'll be able to stop by Sears and put something down on that needed new tire. Maybe.

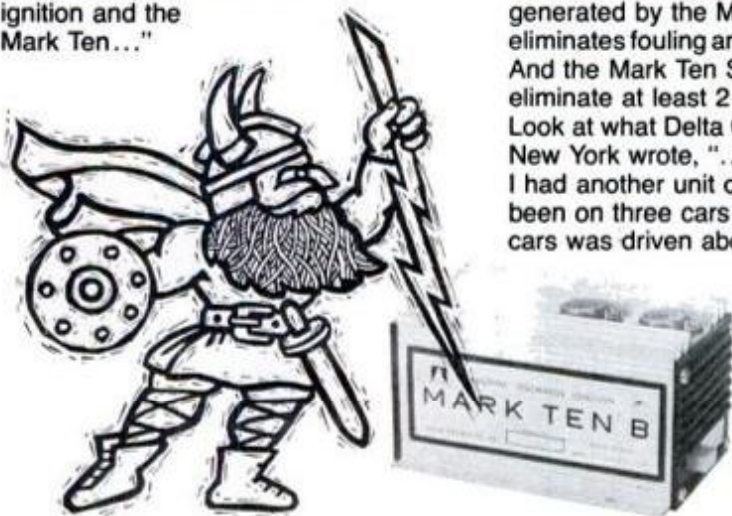
"Nice to meet you," he says, heading for the door. "Hope you get home okay. Mike here'll take good care of you. Be sure and let me know when that story comes out."

He waves and is gone. ★★★



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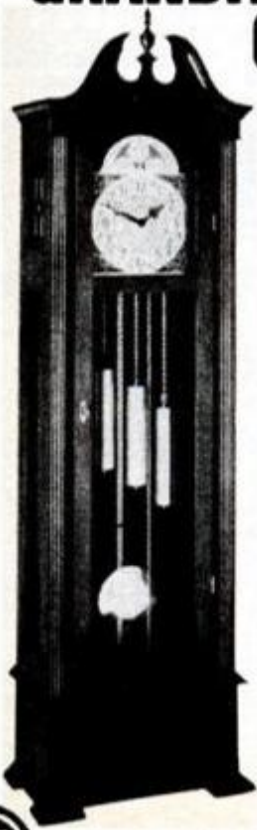


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**GIANT TRACTORS**

*(Continued from page 78)*

Two of the many new farm giants are those of Allis-Chalmers (right) and Massey-Ferguson (below), both 4WDs.



a farm tractor. Usually, the big units have as standard equipment roomy, rigid, tightly sealed, soundproof all-weather cabs and deeply cushioned, bus-driver-type bucket seats. Common are such creature comforts as AM/FM radios, stereo tape decks and—ready?—airconditioning.

You can also get such things as heaters, tinted safety glass, simulated burled-walnut instrument panels, tilt and telescoping steering columns and dual rear-view mirrors—some standard, some options. What is probably the most Spartan four-wheel-drive unit on the market now is Ford's County, made in England. It comes with no cab and few, if any, luxury touches offered by others.

**CB on the farm**

Some owners of the big tractors have installed CB radios, thus making... *(Please turn to page 148)*



equipment. Helping to meet this need are the big, high-horsepower, four-wheel-drive diesel tractors. And farmers, brandishing time payment booklets like ears of prize corn, are lining up to get on board.

Over the past five years, industry-wide sales of the big units have increased from 2547 in 1971 to over 10,600 in 1975. In the first three months of this year, overall farm tractor sales of 39,175 included 2187 four-wheel-drive units. The White study projects annual big-tractor sales of more than 13,500 by 1980.

**Power plus luxury**

In addition to brute strength, the new giants offer amenities not normally associated with something as purposeful and lacking in subtlety as



**Unusual design** of J.I. Case's Traction King (left) has a single, rigid body but with optional steering on front or rear wheels, or on both. With four-wheel steering, tractor can "crab" sideways. Above is Steiger's articulated four-wheel-drive rig.

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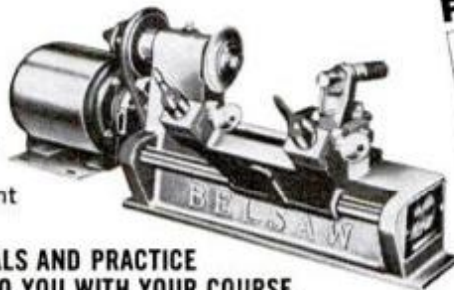
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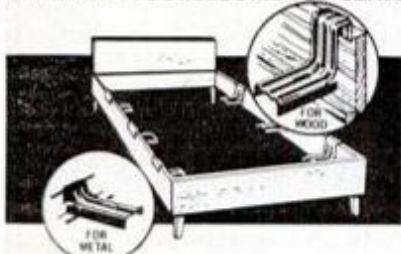
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## GIANT TRACTORS

(Continued from page 146)

ing their sound-deadened cabs mobile command posts from which all operations of a farm can be directed. A few have even installed mobile telephones, enabling them to carry on a good portion of their normal business-day communications right from the tractor's cab.

This sort of on-the-job convenience and luxury in a farmer's fields—particularly on a hot summer's day—is a long way from the time-honored south-end view of a northbound mule, and farmers are lapping it up.

"I can climb up in there," says Brent Workman, Joe's son, "turn the radio and blower on, and work a full 10-hour day without feeling like I've been beat to death, or like I'd spent the day in a dust bowl."

Controls are simple, handy, direct, mostly automatic and easy to operate. Thanks mainly to power steering and flexible transmission ranges, it is not unusual to see the units being driven by farm-wise youngsters, even by farmers' wives. Once you adjust to the idea of horsing 10 or so tons of in-motion weight around, the trick—if any—involves steering.

### Two halves pivot

With the exception of the Traction King unit made by J.I. Case and Ford's considerably smaller County, the big rigs are articulated in design—fore and aft sections are joined by a central swivel linkage so they pivot. The front wheels do the steering, but don't turn as they would on a car. Instead, the entire fore section turns as a single unit. And because the overall length of the tractor "bends in the middle," the directional response of the trailing aft section takes a little getting used to for an inexperienced driver.

Getting power to all four wheels through a central pivot requires classy, complex engineering. The feat is accomplished by an intricate system of universal couplings in the drivetrain that allow the tractor to bend in two while still transmitting power to its wheels. Differentials—one at each end—let opposing wheels turn at different speeds as they go around a corner.

In the unit manufactured by Case, the frame is rigid throughout and features a choice of front-wheel, rear-wheel or all-wheel steering. All-wheel steering can be "coordinated" with the rear wheels turning in the opposite direction from the front ones to produce a tight turn, or the rear wheels can turn in the same direction as the front ones, permitting the tractor to "crab" sideways. The lat-

ter is an utterly startling phenomenon that belies what instinct and experience would have you expect when you turn a steering wheel. The Ford unit is similar to a conventional tractor except for its four-wheel drive.

### Light on their feet

Maneuverability, greater work capacity, multispeed power ranges, lower fuel costs per hour of operation, versatile adaptability to either row-crop or open-field farming, and on-the-job comforts are not the only attributes of the big new tractors.

A word of concern to farmers these days is "compaction." Soil traversed year in and year out by heavy tractors pulling often equally heavy machinery tends to be compacted to ever-increasing depths, eliminating air spaces between the grains of soil necessary for healthy, productive fields. Also, equally vital subsoil faunas, such as earthworms, find themselves literally squeezed out of living quarters.

By no means do four-wheel-drive tractors eliminate the problem, but they ease it to an encouraging degree. In a big, conventional two-wheel-drive tractor, approximately 75 percent of its weight rests on its rear wheels. Under load, this weight becomes even heavier, meaning that most of, say, six or more tons is concentrated on two comparatively short and narrow tread prints.

In a four-wheel-drive tractor, weight is distributed about evenly on all four wheels—with a unit of 10 or more tons, each wheel is exerting less tread-print pressure per square inch than would be the case with a two-wheel-drive tractor. If a four-wheel-drive unit is equipped with dual wide-tread tires—eight tires in all—the per-tire weight pressure on the ground is dispersed even further. The articulated design also helps to reduce compaction because the rear wheels track perfectly behind the front in a turn, producing only two tire prints instead of several.

### Things to come

Nine manufacturers are currently jockeying for a share of the growing four-wheel-drive market—Allis-Chalmers, J.I. Case, John Deere, Ford, International Harvester, Massey-Ferguson, Steiger, Versatile and White. If these companies' predictions are on the money, the day is not too far off when the bulk of America's agricultural bounty will be planted, tilled and harvested by tractors rivaling the finest of luxury cars in comfort, opulence and a virtually indefinable something called "class." \*\*\*

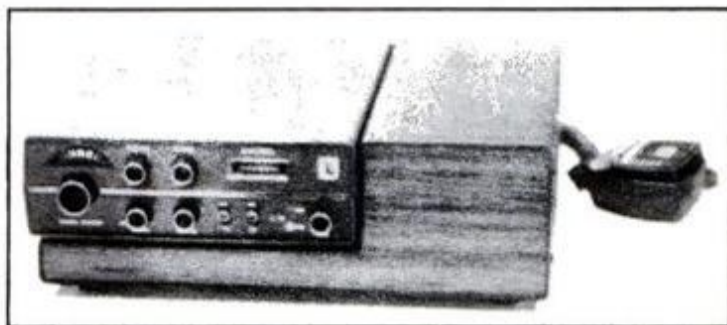
The gibberish of SSB (single-sideband) becomes comprehensible on this 23-channel set from Robyn: It has a BFO (Beat-Frequency Oscillator) to decipher SSB.



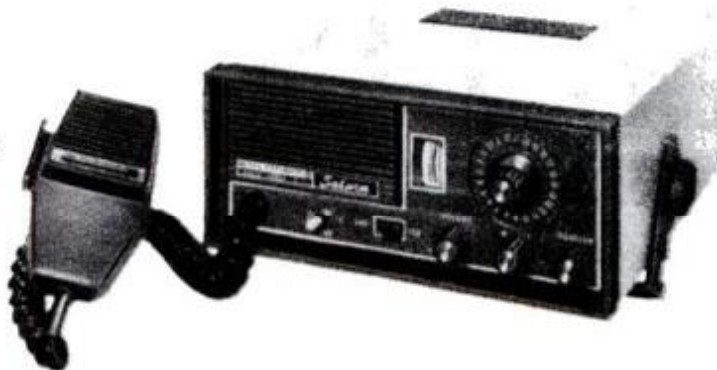
In-dash, AM-FM-CB set made by Boman/Astrosonix has a telephone handset as an optional accessory.



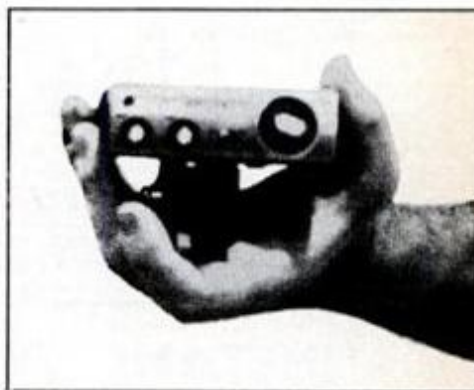
This nicely styled "base station" is actually a mobile unit sitting on a well-designed power-supply/speaker combination. The matched set is from E.F. Johnson.



A CB set for boats, this rig from Ray Jefferson transmits and receives on CB, also receives VHF/FM weather channels. (It doesn't transmit on marine VHF bands, though.) An RF gain control lets you adjust its sensitivity so the boat at the next slip doesn't blast your ears off.



Tiny "Brute" from SBE is really small (a fountain pen is longer than the set is wide), but not quite as tiny as it looks here—that hand belongs to a giant who's a bulky six feet eight or so tall. The set has all the standard features, including squelch and PA, and sells for about \$145.



## NEW CB GEAR

(Continued from page 104)

for CB. (The added channels will call for more complex tuning systems, such as SBE's calculator-type keyboard shown on page 104.)

Another trend, in mobile sets at least, is toward transferring controls from front panel to microphone housing. Some new mikes have volume and squelch, some have channel selectors, still others have all three. Some channel selectors employ the usual dials or knobs; others have

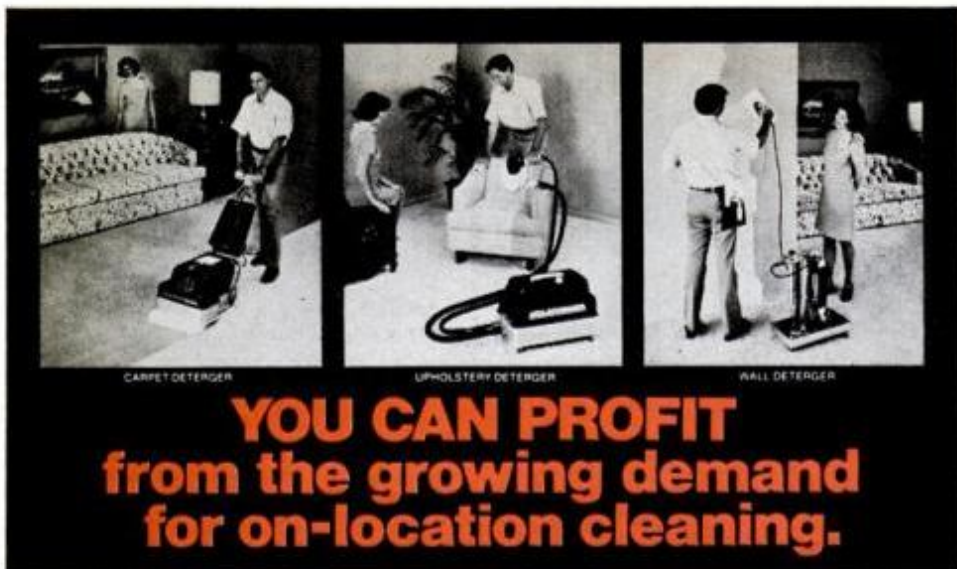
buttons that shift to higher or lower channels. Some of the latter sets have digital channel readouts in their mike cases, too.

As CB thefts increase, more and more sets are designed to mount in the dashboard, where they're harder to remove. And since dashboard space is at a premium, in-dash sets are often combined with AM and FM-stereo car radios, and sometimes with tape—as exemplified by the Boman/Astrosonix prototype here. ★ ★ ★

Combination CB, AM/FM stereo and tape units are beginning to abound. This one, from Boman/Astrosonix, has digital readout

and 8-track tape. You tune it by pushing the channel-down and channel-up buttons just to the left of the digital display.





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## VACATION DRIVING TIPS

*(Continued from page 85)*

trunk and glove compartment are organized so that things can be located without a hassle. And he likes a few other details attended to also:

"I like the steering wheel to be high-centered (when it's pointing straight ahead, so are the front wheels). And since I drive different cars on occasion I always read the owners manual to see how the ventilation system works most effectively."

Then there's the simple fact that you eventually want to get where you're headed. But, like in racing, things aren't always trouble-free.

### Things to take

"In a long-distance race, sometimes the car will break down and you want to be able to get back to the pits. In the case of the traveler, maybe it's just getting to the next town. So I carry a little spool of wire, a screwdriver, and a pair of pliers wrapped in a little package. With that wire, I can wire open a broken throttle linkage; if the exhaust pipe is falling off, I can wire it up; the wire also conducts electricity if the ground wire comes off the fuel pump."

Vacation-bound drivers might go a step or two farther by adding a couple of yards of rope, a roll of heavy tape, and a spare fan belt.

Now it's time to hit the road. You're feeling great, the car's in good shape, and you've made up your mind you're going to have a good time no matter what. So what's left? How about safety? Gregg has some thoughts on that as well.

"Speed relative to other cars is important. I believe it's safer to travel at a different speed than the surrounding traffic, as far as alertness goes. If everyone is doing 55 to 60 mph, there's no relative sensation of speed compared to the other cars. Overtaking, changing lanes and all keeps it interesting."

### Stay out of 'packs'

Traffic studies show that cars tend to travel multilaned highways in "dog packs," several cars bunched together at the same speed. It's better to avoid these packs and travel by yourself on a clear portion of the road. It's safer and helps avoid the monotony that Gregg talks about.

And the most important thing of all: "The main thing I look for in long-distance driving is to make it enjoyable," says Gregg.

It all works for Gregg and he has a shelf full of trophies to prove it. Why not try it yourself this summer and wind up your vacation feeling as good as when you left. ★★



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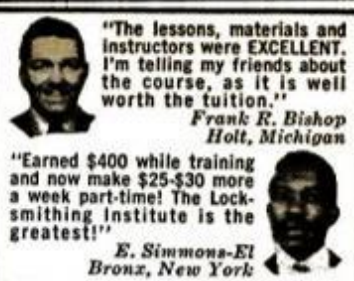
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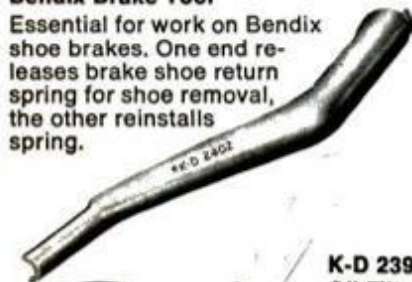
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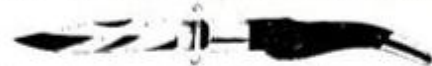
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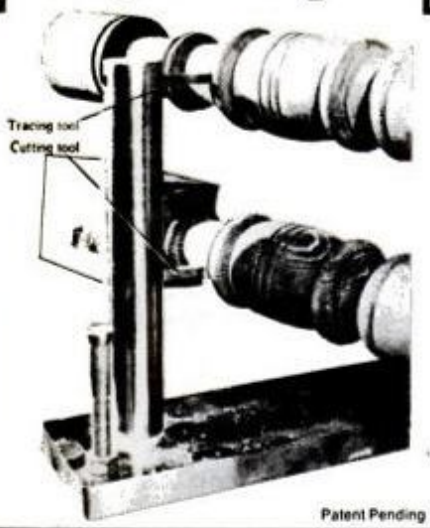
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