

# Popular Mechanics

## 3 CARTS FOR INDOOR/OUTDOOR LIVING

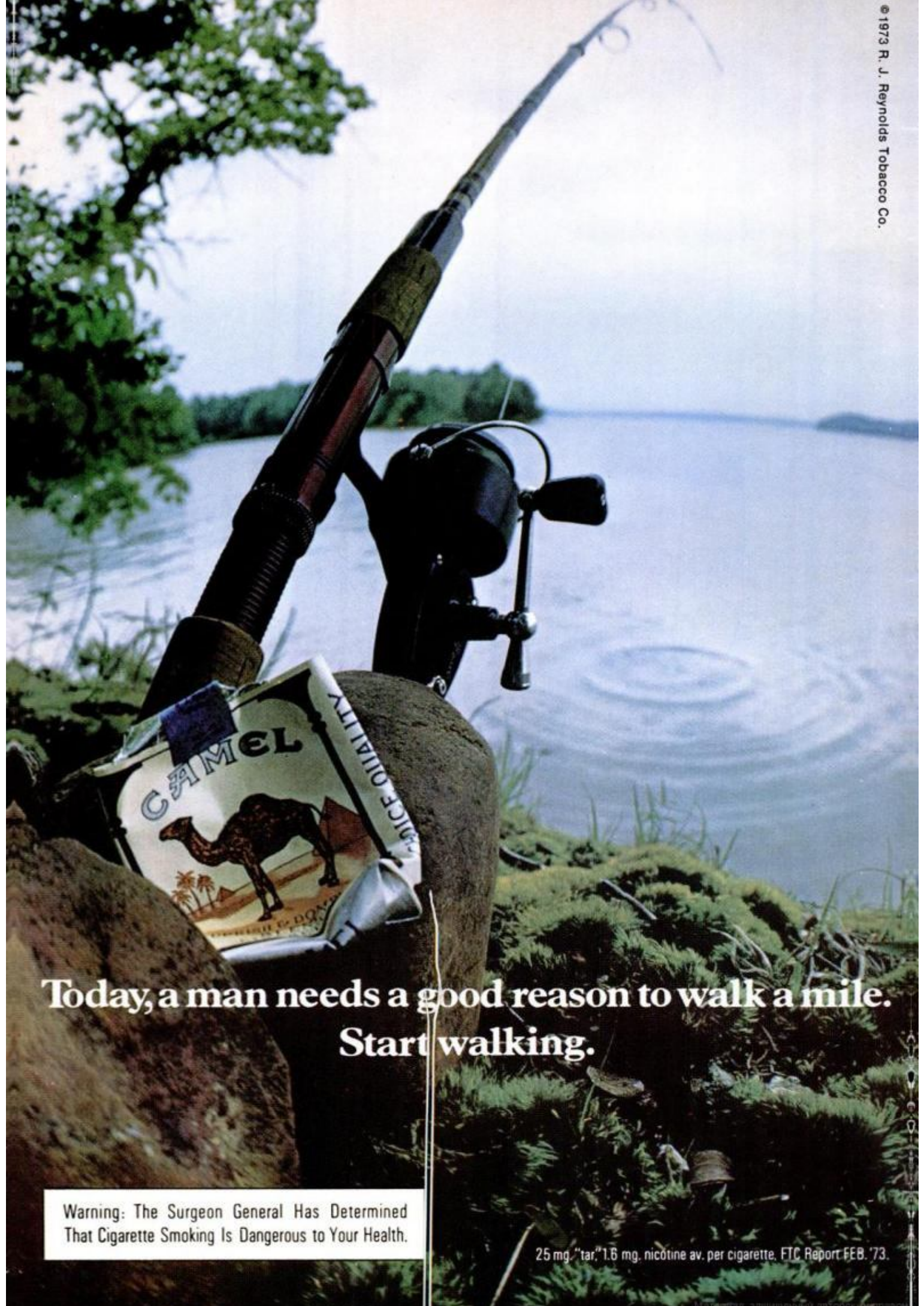
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Bar-sink on wheels  
Roll-about stereo  
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- How to build retaining walls
- How to fix aluminum screens
- How to pour concrete slabs
- How to repair a dishwasher

Combs on Main Street: Deadly rail and truck cargoes Page 132



**Today, a man needs a good reason to walk a mile.  
Start walking.**

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

25 mg. "tar," 1.6 mg. nicotine av. per cigarette. FTC Report FEB. '73.



## When you're talking racing, records and performance, you're talking Monroe Shock Absorbers.

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stabilizing units. The Ride-Leveler<sup>™</sup> air adjustable shock absorber. And a complete line of high performance shocks called Max.

That's performance. That's Monroe. At Monroe, we know more about winning. And more about performance. And more about shock absorbers. Because our only business is making shock absorbers.

**MONROE** Monroe Auto E  
Monroe, Michigan 48161.

This One



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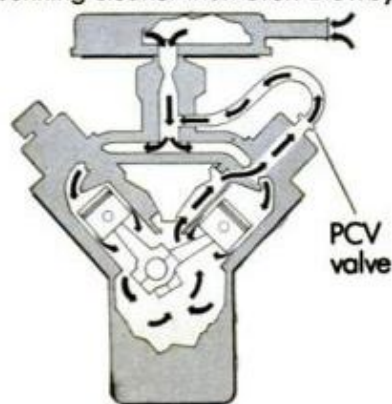
# Monroe The Shock and a Half.

# Clean air: good reason to use a great oil.

Today's anti-pollution systems are making the temperature of your motor oil higher than ever before. And if your system isn't working properly, that makes it even tougher on your oil and your engine. Today you should name your oil. By type. By SAE Grade. By brand.

Briefly, here's what's happening.

When the PCV valve is working properly, your car's engine is running cleaner than ever. Blowby



gasses that once seeped into the crankcase are recycled back to the combustion chamber. This not only keeps the air cleaner; it also keeps your oil cleaner.

**Keep your PCV Valve clean.** On the other hand, if the PCV valve gets clogged, combustion or blowby gasses are trapped in your crankcase and form damaging corrosive acids. What's more, today's engines must operate on a leaner fuel/air mixture than did engines in cars without anti-pollution devices. So today, your engine, and its motor oil, are operating under much higher temperatures.

**Other systems, more heat.** Today's improved combustion systems, supplemental air injection systems, lower compression ratios, air conditioning and power equipment are all "hot items." They put extra stresses on your engine that can send your motor oil's temperature over the 300° level.

**What heat can do to motor oil.** Heat is motor oil's number one enemy. Because, when heated, oil has a tendency to oxidize. Excessive oxidation causes oil to thicken—and not lubricate properly.



The newest service designation—see the chart—is "SE." It meets 1973 requirements and it's vitally important that you use it when recommended.

Then, especially these days, ask for the highest quality brand you can find. By name.

Old designation	New designation	Oil description
ML (Motor Light)	SA	Oil without additive, except that it may contain pour and/or foam depressant
MM (Motor Medium)	SB	Provides some antioxidant and anticuff capabilities
1964 MS (Motor Severe)	SC	Oil meeting the 1964-67 requirements of the automobile manufacturers. Provides low-temperature antisludge and antirust performance
1968 MS (Motor Severe)	SD	Oil meeting the 1968-71 requirements of the automobile manufacturers. Provides greater low-temperature antisludge and antirust performance
1971-73 (none)	SE	Oil meeting the 1972-73 requirements of the automobile manufacturers. Provides high-temperature antioxidation, plus greater low-temperature antisludge and antirust performance.

**Remedy #1. Change oil frequently.** Consider your car manufacturer's oil change recommendations as absolute minimums—under ideal conditions. Take careful note of the warnings against severe operations—such as heavy loads, sustained high-speed driving, constant heavy traffic, dusty roads, and extra cold weather. You might not be changing your oil often enough.

**Remedy #2. Know your motor oils.** First ask for the service designations and viscosity recommended in your owner's manual.

**Why Quaker State offers quality protection:** Quaker State is refined from 100% Pure Pennsylvania Grade Crude Oil, the world's choicest. Then it's put through an elaborate refining process.

Finally, it's fortified with a blend of additives, scientifically selected to retard oxidation, clean and disperse harmful deposits and to neutralize acids.

So ask for it, by name: Quaker State.



**Quaker State your car to keep it running young.**

# Is there a pump action shotgun that actually helps you stay on target? Shot after shot?

**Yes. The Remington Model 870 "Wingmaster" is designed to do just that. Here's how and why.**

Hunters don't always have a chance to get set for a shot. If a covey flushes without warning or the ducks suddenly veer from the decoys, the hunter has to go into action fast. That's when proper shooting techniques pay off.

A good hunter should practice shouldering his shotgun until getting it into position becomes a reflex. Always bring the stock to your cheek rather than your cheek to the stock. Keep it high enough on your shoulder so it isn't necessary to strain your neck muscles getting a good sight picture.

It's a good idea to wear your regular hunting clothes when you practice (especially if your jacket is thick or bulky). Then you'll be sure your shotgun "fits" properly when you're out in the field. And if it's a Model 870, you'll find it's balanced to swing smoothly and point fast.

**So much for the first shot.** But what happens if you have a chance for a double, or the bird you miss is still in range? That's when the 870's pump action comes to your aid.

**Here's a tip from Remington experts.** Recoil tends to force a barrel up and back. The 870's pump action actually lets you make use of this force to help bring the fore-end back to eject the hull. Then the forward motion of your hand, which chambers the next shell, helps you bring the gun back on target—ready to shoot—with no wasted time. Thus, your natural reactions to recoil help keep your

shotgun under constant control...to help you get set for that second shot as quickly as possible.

**What's more, the Model 870 has two separate action bars—one attached to each side of the fore-end—that let you pump it**

much more smoothly, shot after shot, without twisting or binding the action. That's double insurance it will feed and eject properly under all shooting conditions.

**Now there's an 870 that takes a load off your shoulders.** It's the 870 20 gauge "Wingmaster" Light-

weight—an easy-handling partner for easy all-day hunting.

It has a specially designed solid-steel receiver and a mahogany stock and fore-end. Yet it's so lightweight that with a 26" plain barrel it weighs only 5¾ pounds.

And although it's a lightweight, this Model 870 is engineered for heavyweight performance. It's available in standard or magnum models.

**If you have any doubts about the dependability or handling of the 870,** visit any trap field and you'll find it's a favorite with trapshooters everywhere. Remember, a trapshooter can fire four or five thousand shells a year or more—and he wants a gun that can take it. No wonder the Model 870 is the leader in the pump action field.

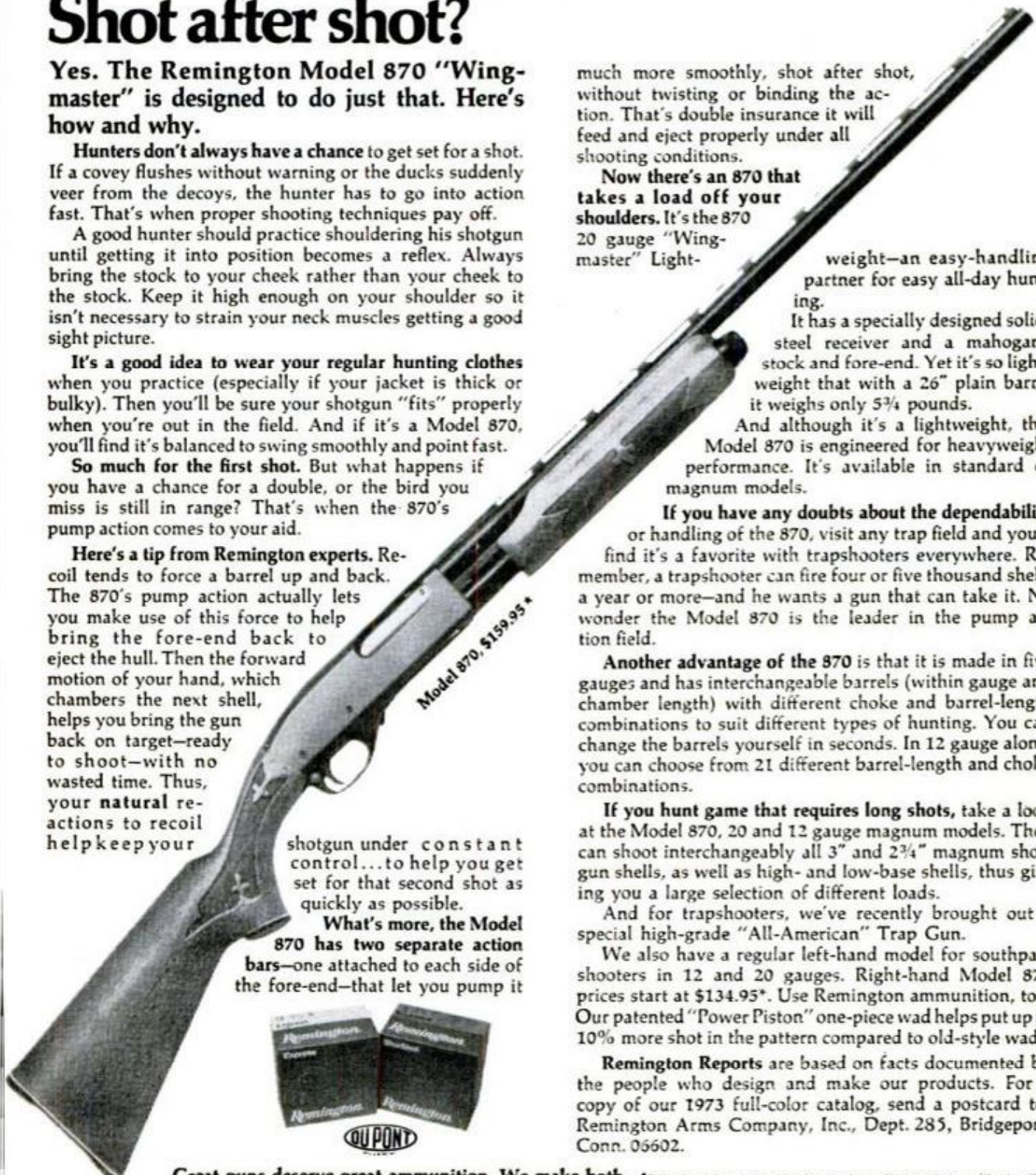
**Another advantage of the 870** is that it is made in five gauges and has interchangeable barrels (within gauge and chamber length) with different choke and barrel-length combinations to suit different types of hunting. You can change the barrels yourself in seconds. In 12 gauge alone, you can choose from 21 different barrel-length and choke combinations.

**If you hunt game that requires long shots,** take a look at the Model 870, 20 and 12 gauge magnum models. They can shoot interchangeably all 3" and 2¾" magnum shotgun shells, as well as high- and low-base shells, thus giving you a large selection of different loads.

And for trapshooters, we've recently brought out a special high-grade "All-American" Trap Gun.

We also have a regular left-hand model for southpaw shooters in 12 and 20 gauges. Right-hand Model 870 prices start at \$134.95\*. Use Remington ammunition, too. Our patented "Power Piston" one-piece wad helps put up to 10% more shot in the pattern compared to old-style wads.

**Remington Reports** are based on facts documented by the people who design and make our products. For a copy of our 1973 full-color catalog, send a postcard to: Remington Arms Company, Inc., Dept. 285, Bridgeport, Conn. 06602.



**Great guns deserve great ammunition. We make both.** \*Price shown is suggested minimum price, subject to change without notice. "Remington", "Wingmaster", and "Power Piston" are trademarks registered in the U. S. Pat. Off. "All-American" is a trademark of Remington Arms Company, Inc.

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ON THE COVER: Three PM-designed carts for indoor/outdoor living: mobile cooking center, bar-sink on wheels, roll-about stereo. *Illustration by Van Kaufman*

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—William C. Warner  
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—Mrs. Mary Nyberg  
Los Angeles, Calif.

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—Charles Dunin  
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## LETTERS

### TO THE EDITOR

#### Dutch Mini-Barn in Florida

Just completed the *Dutch Mini-Barn* (page 64, Aug. '72 *PM*). I left off some of the fancy trim as I spent roughly \$500 as far as I have gone.



I painted it bright barn red with white trim. It sure makes a great workshop for me—lots of headroom, too, as I am 6 feet 7. I look forward to every issue.

LAKE PARK, FLA.

G. J. BROCKLEBANK

*Complete construction plans for the Dutch Mini-Barn are still available for \$3.95 from Popular Mechanics, Dept. DM-L, Box 1014, Radio City, N.Y. 10019.*

#### More, not less

On page S28 of the *Car Care Guide* (May *PM*), you make the statement, "If you find the level is less than 1/4 inch below the top of the cylinder, add a high-quality brake fluid." It should say *more* than 1/4 inch.

HOWARD BEACH, N.Y.

GEORGE SCHMAHL

*Our mistake; you're right.*

#### Better bike price any day

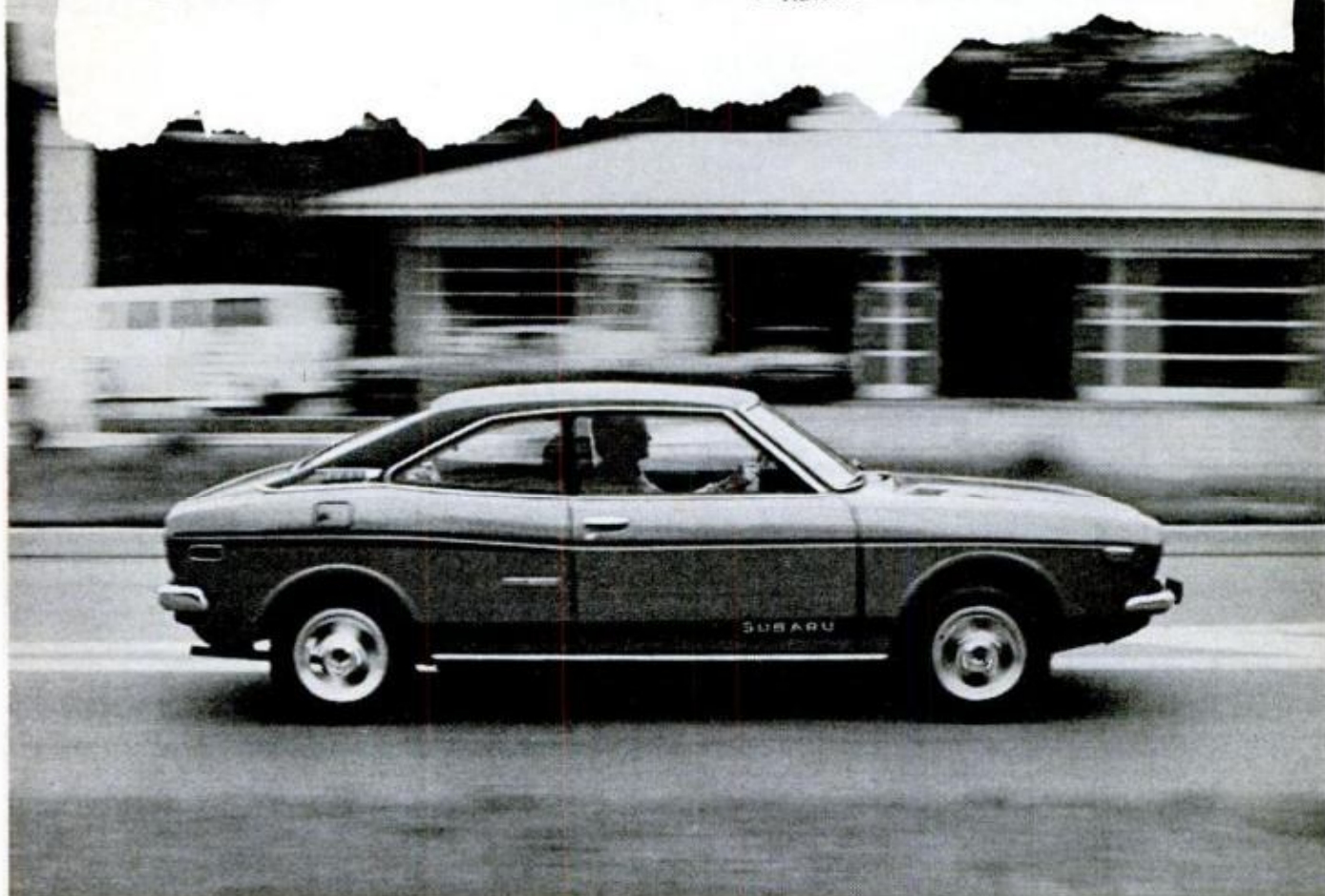
*Eugene Sloane Picks the Best Bikes for Your Family* (page 98, June *PM*) fails to be of good service to readers.

We have five 10-speed, lightweight bicycles in our family (three different makes) with not one of them priced over \$69.95. One was priced at \$55. These bicycles have all the attributes of high-priced racing bi-

*(Please turn to page 10)*

# Smaller engines, front drive seen as fuel gets shorter

—Automotive News, April 23, 1973 (pg. 18)



It's pretty obvious that the days of the big gas-gulpers are numbered. From now on, you're going to have to make every gallon count.

And that's where Subaru comes in.

Our unique, 4-cylinder Quadrozontal engine gets around 25 miles per gallon. On regular. And because of its horizontally-opposed design, vibration and wear are cut way down. Subaru is the only car to use this advanced, liquid cooled engine

design (but a number of airplanes do very well with it).

As for front wheel drive, we're right on target again. Automotive engineers agree that front drive is the best way to build superior handling and roadability into a car. And Subaru shows how right they are.

Subaru corners securely. It maintains straight-arrow control even in crosswinds. And with the weight of the engine directly over the driving wheels, it has more than enough traction to

climb snow-covered hills like a jackrabbit.

So for a good look at the shape of cars to come, call your nearest Subaru dealer. He'll be glad to arrange a test drive.

**Why wait for the others to catch up?  
Subaru's got it now.**



## The front wheel drive Subaru.

For your nearest dealer call 800-447-4700. In Illinois 800-322-4400.

Subaru automobiles priced from \$2397. Plus dealer prep., freight, state and local taxes if any. Subaru automobiles manufactured by Fuji Heavy Industries, Ltd., Tokyo, Japan. Imported by Subaru of America, Inc., Pennsauken, New Jersey.

## LETTERS

(Continued from page 8)

cycles: 27-inch wheels, circular chain guards, reflectors, wrapped handlebars, chrome rims. Two models have center-pull brakes, front and rear. Weights vary around 34 pounds.

We have been using these bicycles daily; they give us excellent performance. Yet, your author reports on only one 10-speed under \$100, and it is reported at \$99.50. We here can do very much better any day.  
FRESNO, CALIF.                      A. S. AVAKIAN

*If you've found low-priced bikes that are adequate for your needs—fine! However, after thousands of miles of touring and experiencing about every kind of breakdown known to bicyclists, Sloane is also well aware of what kind of components hold up under sustained hard use—and it was on the strength of his experience and actual tests of the bikes that he made his "best bike" selections. (He adds that "high-priced racing bicycles" do not have guards, reflectors or chrome rims—and weigh more like 22 pounds.)*

It was an interesting, enjoyable article—with the exceptions of some bikes you picked.

The Mercier 200 can easily match or better the Schwinn Deluxe Paramount. The Mercier 100 is a much finer and better running bike than the Raleigh Grand Prix. Your choice of the Crystal 220 was excellent for "adult bikes under \$100." The Ross 701 and 702, I think, are much better than the Schwinn Pixie; the Schwinns are much heavier.

CAMBRIDGE, MASS.

BENEDICT PALAIMA

### The last word on Morse

In your May *Letters*, R. T. McCleary criticizes the use of the term "Morse code" for what oceangoing ships employ as a communications medium. Surely he is being rather precious, as to find the original code as devised by Morse it would be necessary to visit a reference library.

What ships use is defined in signals publications as "The International Morse Code," based on the above and referred to in the trade simply as "Morse." If you men-

(Please turn to page 12)

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	1	2	3	3	3	<input type="text"/>
TOTAL INCOME (in thousands)	Under 8	8-10	10-12	12-15	Over 15	
	1	3	4	6	8	<input type="text"/>
YEARS WITH PRESENT EMPLOYER	Under 1	1-3	3-6	6-12	Over 12	
	1	2	3	4	5	<input type="text"/>
DEPENDENTS (including self)	1	2	3	4	Over 4	
	3	4	3	2	1	<input type="text"/>
YEARS AT PRESENT ADDRESS	Under 2	2-4	4-7	7-10	Over 10	
	1	2	3	4	4	<input type="text"/>
PERSONAL DEBT IN THOUSANDS (exclude mortgage)	Over 5	4-5	2½-4	1½-2½	Under 1½	
	0	1	2	4	6	<input type="text"/>

TOTAL

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# IF YOU OWN A PICKUP TRUCK, CAN YOU PASS THIS TEST?

- 1.) Most people who buy pickup trucks end up carrying heavier loads than they think they will.
- 2.) Passenger car tires are designed to perform as well in truck service as they do on cars.
- 3.) All pickup truck tires cost more than comparable size passenger tires.

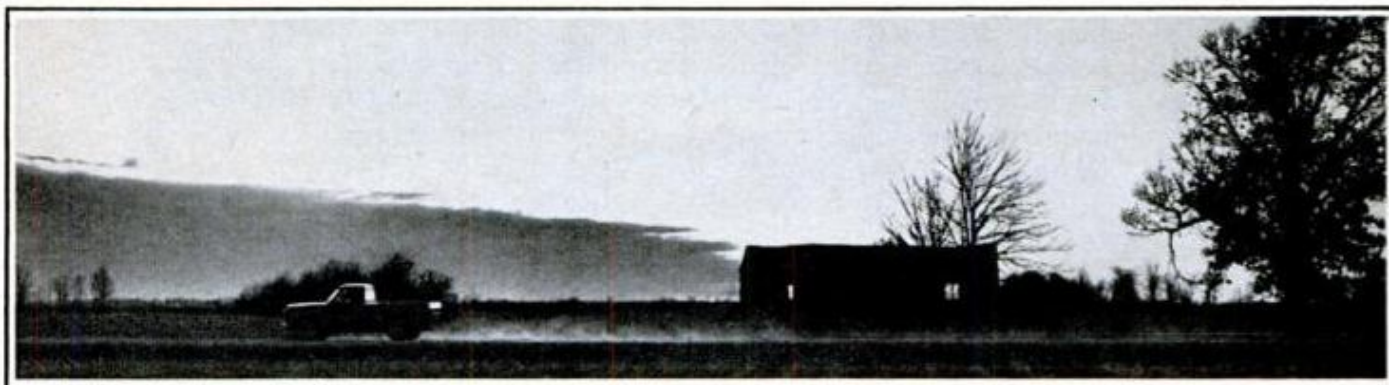
TRUE FALSE

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(Answers below)



- 1.) **True.** Many people who buy a pickup plan on carrying only light loads. But because it has the capacity, and is so readily available to them and their friends, its load limits, particularly its tire load limits, are often exceeded.
- 2.) **False.** Passenger car tires are designed for car use. Truck tires, like the Firestone Transport, with a combination of shock-fortified nylon cord body plies, rugged tread design and rubber compound, reinforced beads and sidewalls, are designed for the tougher requirements of pickup trucks. In addition, the Transport has a 6-ply rating instead of a 4-ply rating of passenger car tires.
- 3.) **False.** Some sizes of Firestone Transport truck tires actually cost less than passenger tires. And you can even get them with whitewalls at your Firestone Dealer or Store.



Transport<sup>®</sup> Truck Tire

# Firestone

## LETTERS

(Continued from page 10)

tion the term "International Code" to a ship's officer, he will assume you mean a book containing groups of letters representing phrases, the latter being available in a choice of several languages. The letters, which are common, can be sent by flags—or in Morse.

S.S. RAJULA  
SINGAPORE

P. A. ARCHER  
RADIO OFFICER

### Student-built 'grandmother clock'



Here's a photo of the "grandmother clock" (*PM's Handsome Hall Clock*, page 124, Oct. '69 *PM*) built by Gordon Player, a 17-year-old graduate of this school. He made it of willow wood, stained it with walnut wiping stain and hand-rubbed it with Danish oil. Cost: \$190.

STRATFORD NORTH-ROSS KELTERBORN  
WESTERN SECONDARY SCHOOL  
STRATFORD, ONT.

### Worth a five-year subscription

Keep your good projects coming—I've been finding them highly useful. You had one quick run-through on repairs a few months ago—fireplaces et al (page 76, Jan. *PM*)—that quickly repaid me the price of a five-year subscription.

NEW YORK W. STEVENSON BACON

### Auto parts for his telescope

As a result of reading *The Sky's the Limit With This 200-Power Telescope* (page 166, Dec. '70 *PM*), I purchased the lens and instruction manual from Edmund Scientific Co. And today I am enjoying the use of my telescope.

I found it necessary to refer to the *PM* article for clarification and a simple explanation of various points. From the diagram printed with the article, I was able to transform some automotive transmission



parts into the equatorial movement. I hope you continue to publish the valuable and informative material.

HICKSVILLE, N.Y.

FELIX TIRANE

### Angle cutter for radial saw

We were pleased to see our Angle Cutting Table Surface for radial-arm saws on page 94 of *It's New Now* in April. Unfortunately, the price shown is incorrect. The price should be \$4.95 plus \$1 mailing, or \$5.95 postpaid. It can be ordered from Comparator Chart Engineering, Box 1250, Huntington Beach, Calif. 92647.

HUNTINGTON BEACH, CALIF. L. D. TAYLOR

### Saucy Shingle is well worth its cost

In building my *Saucy Shingle* (page 144, March '65 *PM*), I used a high-grade marine plywood and mahogany framing. I fiberglassed the seams and resined the rest. I used an epoxy paint which gave a gleam-



ing finish and a smooth surface. My boat weighs 100 pounds. The construction and rigging (less engine) cost about \$150, but it sure is worth it.

VALLEY CITY, N.D.

STEVE RIDEN

### Sap remover

Someone asked in your April issue how to

remove tree sap that drips on cars (*Automobile Clinic*, page 22).

The simplest way is to let your car stay outside for several hours on a rainy day. Then soft water from the rain will soften the sap. While it's still raining, put on a raincoat and hat and wash the car with a good soap and rough towel. I have had that trouble often, but this method never failed me yet. Hope this helps.

RIDLEY PARK, PA.

HAROLD A. MILLER

### Another use for stockings

Good idea—stocking on dryer vent for lint (*Hints From Readers*, page 125, April PM). I keep an old nylon stocking fastened over the end of my washer drain hose to catch lint, and I haven't had to have the floor drain cleaned since. A plumber told me it saves drain-cleaning bills. It does!

PONTIAC, MICH.

MRS. JAMES WILSON

### Credit to art industry

I would like to pay a personal compliment to your technical artist, Fred Wolff. His are truly excellent examples of technical illustration. He is quite a credit to the art industry.

WEST NEWTON, PA.

RICHARD STANCHIK

### Like the real thing

Yes, Dacor Brick-In-A-Can looks and feels like real brick (*Trowel-On 'Brick' Looks Like the Real Thing*, page 168, April PM). I, a woman, did it myself. The only difficulty I did have was in applying the mortar, which was just a little strenuous. But the top coat was simple.

WATERFORD, N.J.

GILDA PASSARRELLA

### Early start

*One (Young) Man's Shop* (page 98, Feb. PM) caught my interest for it was at his age that I started my cellar workshop. Later, in 1932, PM showed a small handmade woodturning lathe; I made it and its turning tools and won confidence. My workshop has expanded well since.

MALDEN, MASS.

PETER LEGON

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AUGUST 1973

13

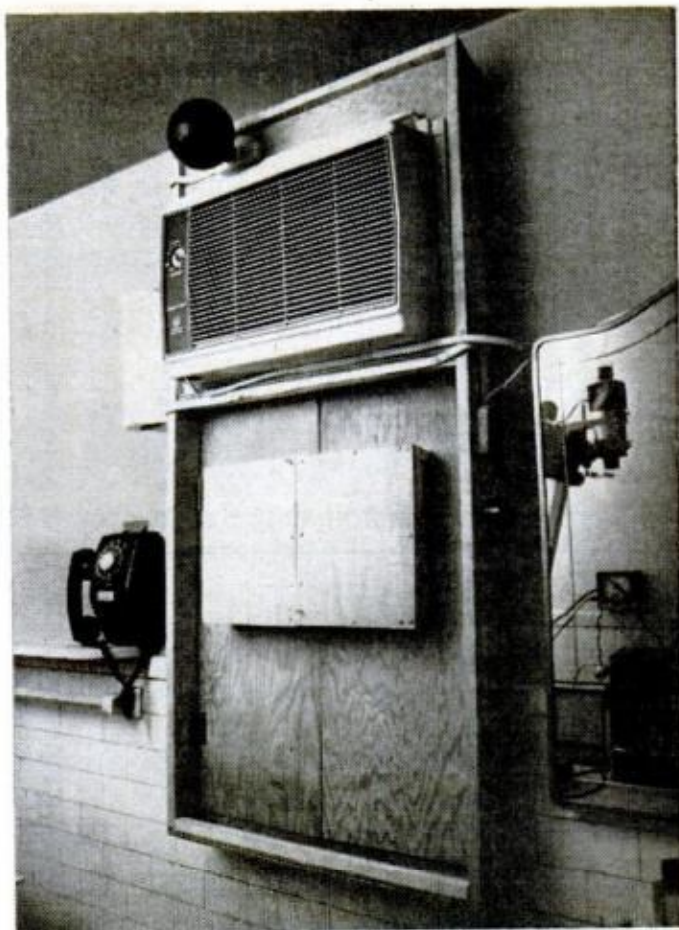
## How to aircondition a bathroom darkroom

If you're going to use your darkroom in summer, airconditioning is a must to keep your sweat off the enlarging easel. But the bathrooms many amateurs use as darkrooms have windows too narrow for most airconditioners. (Casement models will fit, but cost a lot and have too much cooling capacity for small rooms.) When a friend ran into this problem, I built him the frame and duct shown here—which also serve to darken the room for daytime processing.

Basically, it's just a box that butts against the window casing. T-shaped shelves, one resting on the window stool (ledge) and the other just below the airconditioner, keep it from slipping down (and duct the airconditioner's exhaust heat out); a steel strap bolted to the end of the upper T shelf rests against the outside wall to keep the frame from falling into the room (it's too big to fall out), and plywood doors shut out the light when necessary.

The airconditioner is a GE Porta-Cool, the smallest, lowest-capacity (4000 B.T.U.), lightest and about the least expensive (\$100) unit I could find. The frame was custom built to just fit around it. Weather-strip was installed after these photos were shot for a better air and light seal around the airconditioner and the doors.

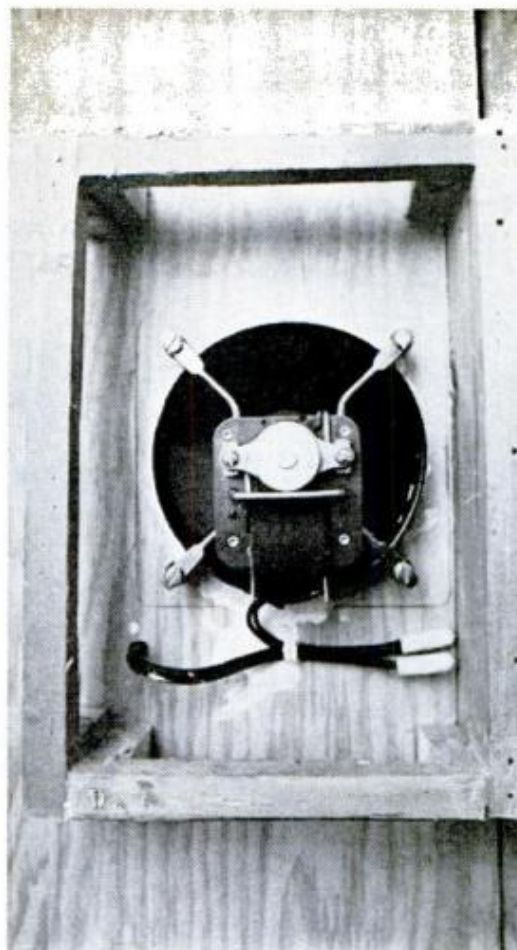
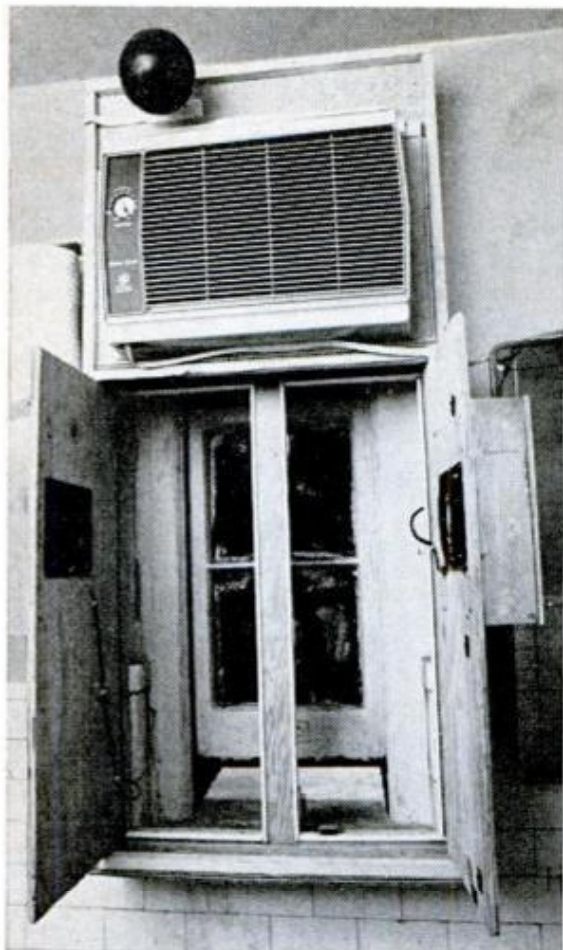
Since the airconditioner just recirculates the air in the room, we mounted small fans (Lafayette No. 24P 39016, \$10.50) in each door, for ventilation. The light-trap boxes around each fan are boxes with tapered slits on three sides (all but the side facing the other fan); the edges of the slits overlap the fan's own ducts, blocking the light path, and the light-traps (shown unpainted here) were painted flat black inside to avoid reflections. Dimensions will vary according to the window the frame is mounted on; the only critical dimension is the airconditioner opening, 22½ in. wide by 14¼ in. high.—*Joyce Aysta, New York.*



The problem was to fit that wide airconditioner (above) into that narrow bathroom window (below). But author added extra touches, including doors to cover the window during darkroom operation, exhaust fans with light-traps (boxes shown projecting from doors in photo above; one light-trap is shown uncovered below and on facing page), safelight socket, a.c. outlets (on side of frame away from camera) and darkroom phone (\$4.95 from Olson Radio). T-shaped shelf (below) ducts airconditioner heat out window; similar shelf holds frame bottom. Steel strap bolted to shelf rests on outside wall, prevents toppling.







**Doors** (at far left) darken room, open to admit light. The weatherstrip shown is light seal. Fans are in doors to exhaust the darkroom fumes. Loop in the fan wire allows for easy flexing when doors are opened. Fans are housed in light-trap boxes, shown in profile.

**Light-trap** (left), shown here with lid removed and before interior was painted black, lets air out but no light in. Fan shroud extends far enough in room to overlap lip of frame, breaks light path. Frame slots have 45° bevel for smooth airflow. Fan opening, wire hole are caulked to gain light-tightness.

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"Naturally, I was nervous at first. So I took my lesson diagrams with me on the job. And I could lick any problem.

"Pretty soon, they asked me to head up the air-conditioning department. I also picked up some repair and installation business of my own on the side. That's what's helping to pay for the new house."

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ICS has trained 8,500,000 people in the past 80 years.

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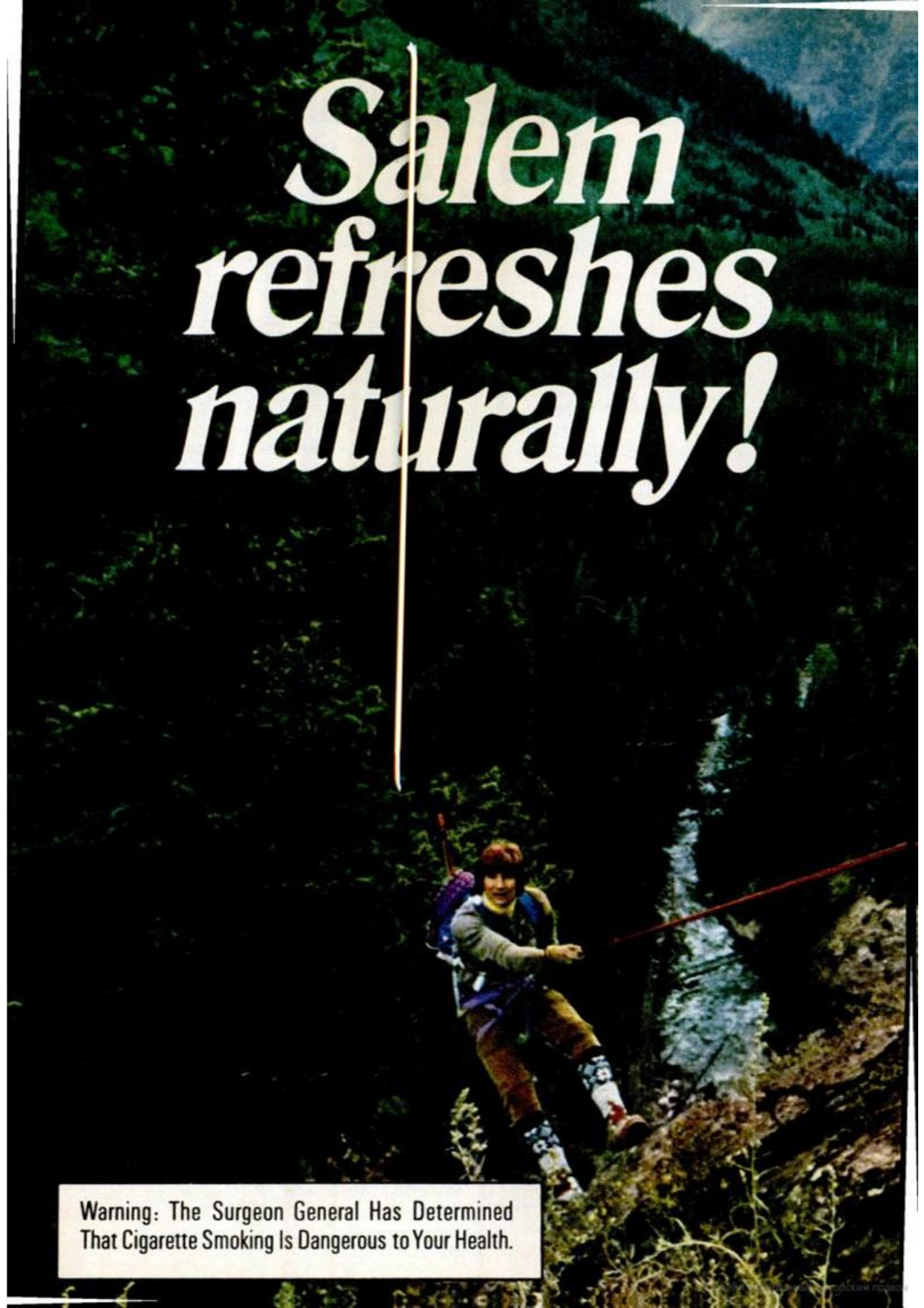
If you want your job to give you more, (more money, more day-to-day satisfaction, and more future) get our career guides and free demonstration lesson.

Remember, it's your life. You might as well make the most of it.

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*We'll show you a better way to earn a living.*

*Soon, a new home built on a wooded lake site will give John and Cheryl Muirhead lots of room for their growing family. (Photo: Frank Cowan)*

A person is rappelling down a rocky cliff face. They are wearing a blue jacket, brown pants, and a backpack. A red rope is attached to their harness. The background shows a lush green forest and a river flowing through a valley. The overall scene is outdoors and adventurous.

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## CAR CLINIC

BY MORT SCHULTZ

### Service by the manual

*I recently bought a 1957 Buick Special and want to get a service manual. Can you tell me how?—G.S. Nemeth, Lethbridge, Alta.*

We've received many letters from readers asking about manufacturers' service manuals. Your dealer might have late-model manuals. Otherwise, write the manufacturer or organization that handles the manual you want. Some are listed here:

**Chevrolet:** Helm, Inc., 2550 East Grand Blvd., Detroit, Mich. 48211.

**Ford and Lincoln-Mercury:** Ford Service Publications, Box 07150, Detroit, Mich. 48207.

**Ford (prior to '49):** Polyprints, Box 31207, San Francisco, Calif. 94131.

**Corvette (prior to '63):** Chevrolet Div., General Motors, Owner Relations Dept., Room A-1077, GM Building, Detroit, Mich. 48202.

**Thunderbird ('56, '57):** Classic T Bird International Club, 2945 62nd Ave., Oakland, Calif. 94605.

**Buick:** Buick Motor Div., General Motors, Service Publications Dept., Flint, Mich. 48550.

**Cadillac:** Cadillac Motor Car Div., Publications Dept., 2860 Clark Ave., Detroit, Mich. 48232.

**Oldsmobile:** Oldsmobile Div., General Motors, Publication Dept., 920 Townsend St., Lansing, Mich. 48921.

**Pontiac:** Drake Printing Co., 2000 West Eight Mile Rd., Ferndale, Mich. 48220.

**Chrysler Corp. products:** Chrysler Corp., Building 410, Highland Park, Mich. 48203.

**American Motors products (including Jeep):** American Motors Corp., Consumer Relations Dept., 14250 Plymouth Rd., Detroit, Mich. 48232.

**GMC:** GMC Truck and Coach Div., General Motors, Publications Dept., 660 South Blvd. E., Pontiac, Mich. 48053.

**International Harvester:** International Harvester Corp., 401 North Michigan Ave., Chicago, Ill. 60611.

**Datsun:** Leo Adler, Parts Dept., 28001 Grand River at Eight Mile Rd., Farmington, Mich. 48024.

**Toyota:** Mid-Southern Toyota Distributors, Inc., Parts Dept., 10750 Grand Ave., Franklin Park, Ill. 60131.

**Volkswagen:** Autobooks, 2800 Magnolia Blvd., Burbank, Calif. 91505.

*and they tell me that new bushings are needed. Is this possible, and is Ford service correct in saying that grease fittings cannot be installed because there isn't enough room?—Harold A. Leach, North Webster, Ind.*

Grease fittings can be installed, but Ford believes them unnecessary, because lubrication at the upper end of the control arms at periodic intervals is not recommended. If an annoying squeak develops, lubricant can be applied with the special tool. According to Ford, a squeak develops so infrequently that installation of grease fittings would not be warranted.

Your problem, however, appears not to be a squeak, but a "clunk." This is another matter. The clunk may result from worn bushings as your dealer says, or from a worn shock absorber, weak spring or broken jounce bumper.

### Frozen airconditioner

*The airconditioner in my 1970 Pontiac Catalina freezes up on a highway after 20 to 30 minutes of fast driving. This cuts off airflow. What's wrong?—Roy M. Inouye, Galveston, Tex.*

Check the suction throttle valve, which controls evaporator air-outlet temperature. A faulty valve would cause the evaporator to freeze.

### Transmission 'burp'?

*I use my car—a 1971 Pontiac Catalina with 400-cu.-in. engine and automatic transmission—to pull a 1700-lb. camping trailer. Recently, while I was towing at about 55 mph, a cloud of smoke developed behind the car. Oil was found to be burning on the exhaust pipe. A repair shop operator said, "Nothing to worry about. The transmission*

*(Please turn to page 24)*

### Clunker

*A clunking noise has developed on the upper end of the A-frame member of my Ford Maverick. Ford service used a special tool to apply grease, but the noise is still there*

*NRI gives you the professional testing equipment and tools you need. Illustrated is the equipment you get with the NRI Master Automotive Technician's Course. Equally complete materials come with the Courses in Air Conditioning, Refrigeration and Heating.*



## Now you can learn these two well-paid skills at home... in your spare time

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Richard Petty, America's winningest stock car racer and NRI Automotive Consultant, says, "NRI training gives you the kind of solid background you need to launch a career as a master mechanic, or to learn what you have to know to take good care of your own car. I especially like the "bite-size" lessons, and how NRI has covered practical service work... so a guy can learn with his hands."



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**APPROVED UNDER GI BILL**—If you have served since January 31, 1955 or are in the service now, check GI line in the coupon.



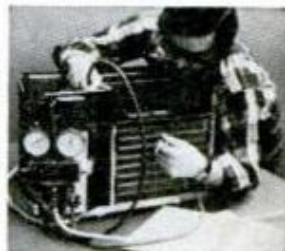
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## CAR CLINIC

(Continued from page 22)

*burped." What is this and is it serious?*  
—M.A. Robinson, Oil City, La.

Some automatic transmission fluid may have been ejected from the transmission overflow because of the strain placed on the unit by the heat of trailering. The opening of the overflow is on line with the exhaust pipe. Be sure that the transmission isn't overfilled with fluid. Check the level as spelled out in your owner's manual, making sure that the transmission is well warmed up.

It would also be wise to consider installing an auxiliary transmission oil cooler. You will extend the life of the fluid and the transmission, and probably eliminate the "burp."

### Salted transmission

*A few months ago I drove my 1971 Volkswagen Beetle through high water. Since then I have had difficulty shifting into first gear and reverse, but only when it is rain-*

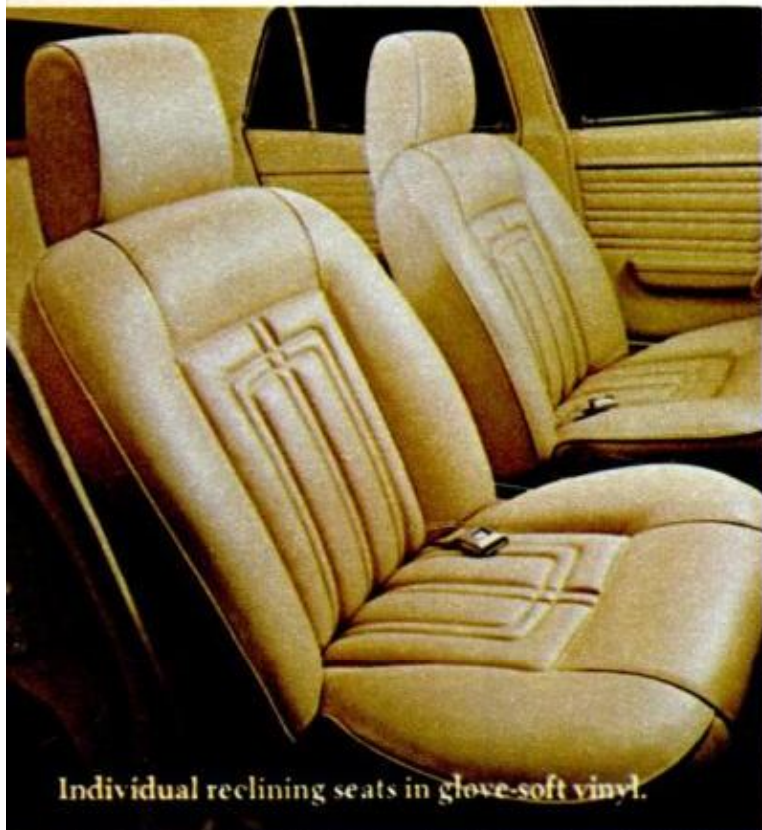
*ing. What do you think is wrong?—Israel Colon, Brooklyn.*

I think salt got into the transmission. The incident may have happened on one of Brooklyn's parkways, which are near bodies of saltwater. But even if you had driven through "fresh" water, road salt clinging to the underside of the car could have been washed into the transmission. Salt is probably restricting the clutch, but why in damp weather? Because in damp weather corrosive material expands. Salt could have also been washed into the bell-housing, where it is affecting the pressure plate and splines of the main shaft. It happens in first and reverse only, because in other gears synchros are in motion, making shifting easier. I think you should have the clutch fork, pressure plate, driven plate and transmission main shaft serviced.

### A cloudy prospect

*My problem is obtaining parts for a 1965 Sunbeam Alpine. Your help in locating a national supplier would be appreciated.—Jim Walery, Northridge, Calif.*

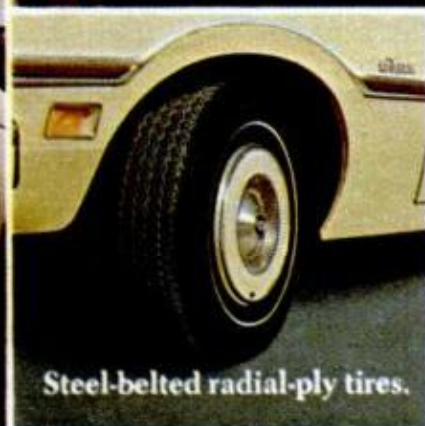
# You'd expect this kind of luxury in \$6,500 European cars.



Individual reclining seats in glove-soft vinyl.



Wood-grain dash, cut-pile carpeting throughout.



Steel-belted radial-ply tires.



Grained vinyl roof.



Sunbeam was made by Rootes Motor Corp. and handled in the United States by Chrysler dealers. I haven't been able to locate a national supplier, Jim, but suggest that you consult the parts department of Chrysler agencies. If the parts guy is helpful, he'll be able to get you what you need although you may have to wait a couple of months and you will also have to leave a deposit.

If the dealer says he can't help, suggest he contact his Chrysler regional office. Also try British Motor Car Distributors near you at 1200 Van Ness Ave., San Francisco, Calif. 94109.

### Spanking the bottom

*I own a '70 Ford Van Econoline (E-200) that bottoms out in the front on mild humps. The I-beam compresses the rubber stop block and is hitting the frame. Heavy-*

*duty shock absorbers haven't helped. Any suggestions?—Richmond Wadden Jr., Los Angeles.*

Try replacing the springs you now have with those used on current eight-cylinder models which have airconditioners.

### SERVICE TIPS

□ **A warning to Chrysler service departments** regarding the electronic ignition control unit in 1973 models can serve as a warning to Saturday mechanics, too. An electronic ignition control unit may not work if a heavy coating of grease is applied to wiring harness electrical terminals.

□ **1973 Oldsmobile owners:** Don't panic if the automatic transmission fluid turns a dark color or you get a strong smell from it that's usually associated with overheating. These conditions are normal, because a new fluid is being used. Oldsmobile recommends that the fluid be changed at 24,000 miles if the car is driven normally—at 12,000 miles if the car is put to a severe use, such as towing. ★★★

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

## But not in an American compact at \$2,695.\*



Maverick with Luxury Decor Option. You get everything here, plus about 30 other luxuries. About those steel-belted radials: tests show that the average driver can expect 40,000 miles of tread life under normal driving conditions.

See your Ford Dealer. And while you're there, check on the other 1973 Mavericks. All have a refined suspension system, thicker seats and carpeting. The ride is quiet.

## FORD MAVERICK

FORD DIVISION 

\*Car shown: \$2,695 sticker price. Dealer preparation, destination charges, title fees and taxes extra.



# I'd like to give this to my fellow men... while I am still able to help!

I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my

summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

## I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to

gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

## A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

## Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and

ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest \$15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

## Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

**VICTOR B. MASON**  
1512 Jarvis Ave., Suite M-2-CJ  
CHICAGO, ILLINOIS 60626

# Are you with it?



In such relevant fields as ecology, medicine, communications, crime control, there are exciting new careers waiting for people with the right skills. **ELECTRONICS TRAINING** can help put you where the action is.

If you'd like to take an active part in solving some of the big problems facing the world—Cleveland Institute of Electronics training can be your key! Today's electronics specialists are working hand in hand with science and industry to perfect tools that will make a better life for all of us. And they're well paid for it, too!

If you are trained in Electronics, you can help develop new electronic equipment to save our lakes and rivers, to clean up the air we breathe. Help design the electronic devices that are revolutionizing medical science. Help build the electronic tools to fight crime. And in other growth fields such as aerospace, computers, communications, agri-business—just about everywhere—the trained electronics technician has a growing role in "what's happening!" With training, you can be one of these "with it" men. And getting the training you need to break into Electronics is easier than you might have

thought. You can learn Electronics at home, in your spare time, with CIE's step-by-step **AUTO-PROGRAMMED® Lessons**. You don't need college . . . or even a high school diploma. CIE removes the roadblocks, makes learning easier. You'll be amazed at your progress!

## Send for 2 FREE BOOKS

Whatever you're doing now, you owe it to yourself to look at the facts. Send for CIE's two **FREE BOOKS** that describe career opportunities in Electronics. Mail reply card or coupon today. For your convenience, we will try to have a representative call. If coupon is missing, write: Cleveland Institute of Electronics, Inc., 1776 E. 17th Street, Cleveland, Ohio 44114.

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2. Your book on "How to Get a Commercial FCC License."

I am especially interested in:

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|---|--|
| <input type="checkbox"/> Electronics Technology                 | <input type="checkbox"/> Industrial Electronics  |
| <input type="checkbox"/> Electronic Communications              | <input type="checkbox"/> First Class FCC License |
| <input type="checkbox"/> Broadcast Engineering                  | <input type="checkbox"/> Electronics Engineering |
| <input type="checkbox"/> Electronics Technology with Laboratory |  |

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**Veterans and Servicemen:**

Check here for G.I. Bill Information.

PM-82

# You look at more than 2 pickup campers.



# Shouldn't you look at more than 2 pickups to haul them?

It never fails to amaze us that people will spend weeks looking at one camper after another and yet when it comes to choosing a pickup to haul it they usually consider only two: Ford and Chevy.

We think they should at least consider a *third*.

Namely, INTERNATIONAL. The Other Pickup.

Now we realize that the fact that we make a pickup is one of America's best kept secrets.

But we just happen to make a great pickup. Especially for hauling your pickup camper.

  
**INTERNATIONAL HARVESTER**



Our ride is smooth. So is the handling. Our heavy duty suspension system is as rugged as they come. And you can choose automatic transmission, power steering and power brakes.

And we have important safety features like a collapsible steering column, a fuel tank located outside the cab and an optional anti-skid system available on two models.

Now, don't you think you should at least see what you've been missing?

The Other Pickup.  
At your International dealer.

 **International.**  
**The Other Pickup.**

## DETROIT LISTENING POST

### Sportiest Valiant ever

Plymouth's working up its sportiest Valiant as a four-door with everything on it. It will be the first car to carry the stamp of Chrysler's new styling chief. As it looks now, it won't be ready when Chrysler brings out its new cars the last week of September, but it should be in the showrooms shortly after the first of the year.

### Vega carbons coming

Vega will not be an exclusive Chevrolet product after 1974, although Chevy will retain exclusive use of the name. GM is ready now with three versions of the new Vega coming in '75, one to be sold by Chevrolet shops, another by Pontiac dealers and a third that Buick and Olds will have to fight over.

Olds is now favored to get the No. 3 version on the basis of the job it has done with its present all-from-the-same-mother car, Omega—a spin-off from Chevrolet's Nova, as are Pontiac's Ventura II and Buick's Apollo. But GM doesn't always reward its divisions with new cars on the basis of past performance. Who gets the new one may be decided on the basis of which division needs

a shot in the arm or the product lineup offered by competitive divisions of Ford and Chrysler. No. 2 and No. 3 versions of the car will have conventional engines, at least until the start of the 1976 model run, giving Vega sole use of GM's rotary through 1975 model production.

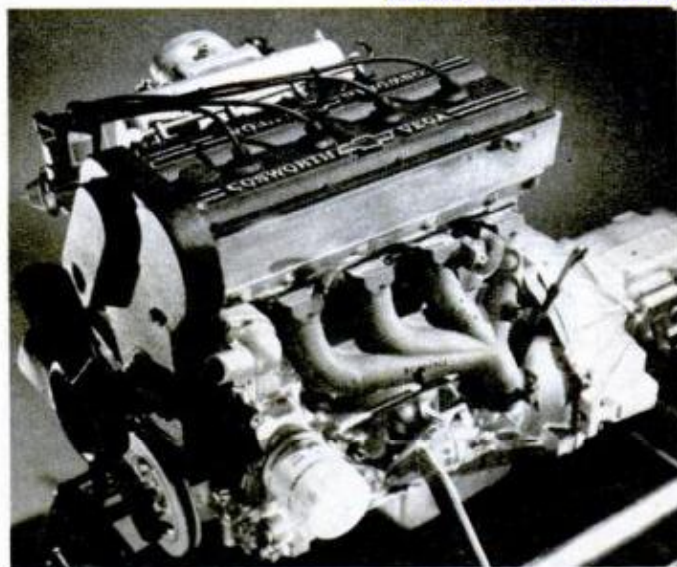
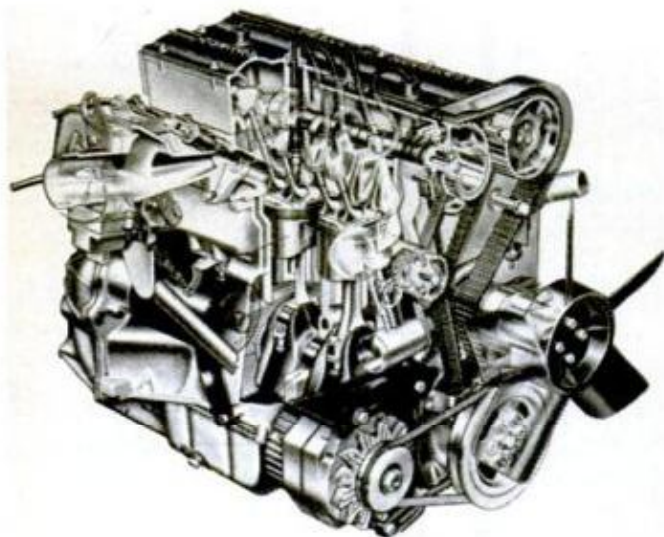
### Limited edition Vega

Coming in '74 will be the Cosworth Vega, a special-engine, special-driveline package with a sporty steering wheel and different exterior trim. Chevy says it will limit Cosworth production to one an hour—about 4000 units for the model year. Price hasn't been disclosed, but it will go for \$1700 to \$1900 over that of a regular Vega. Production will begin 30 to 60 days after the division launches its other '74 cars. GM expects to announce its '74s the third week of September, so the Cosworth will be along late in October or early November.

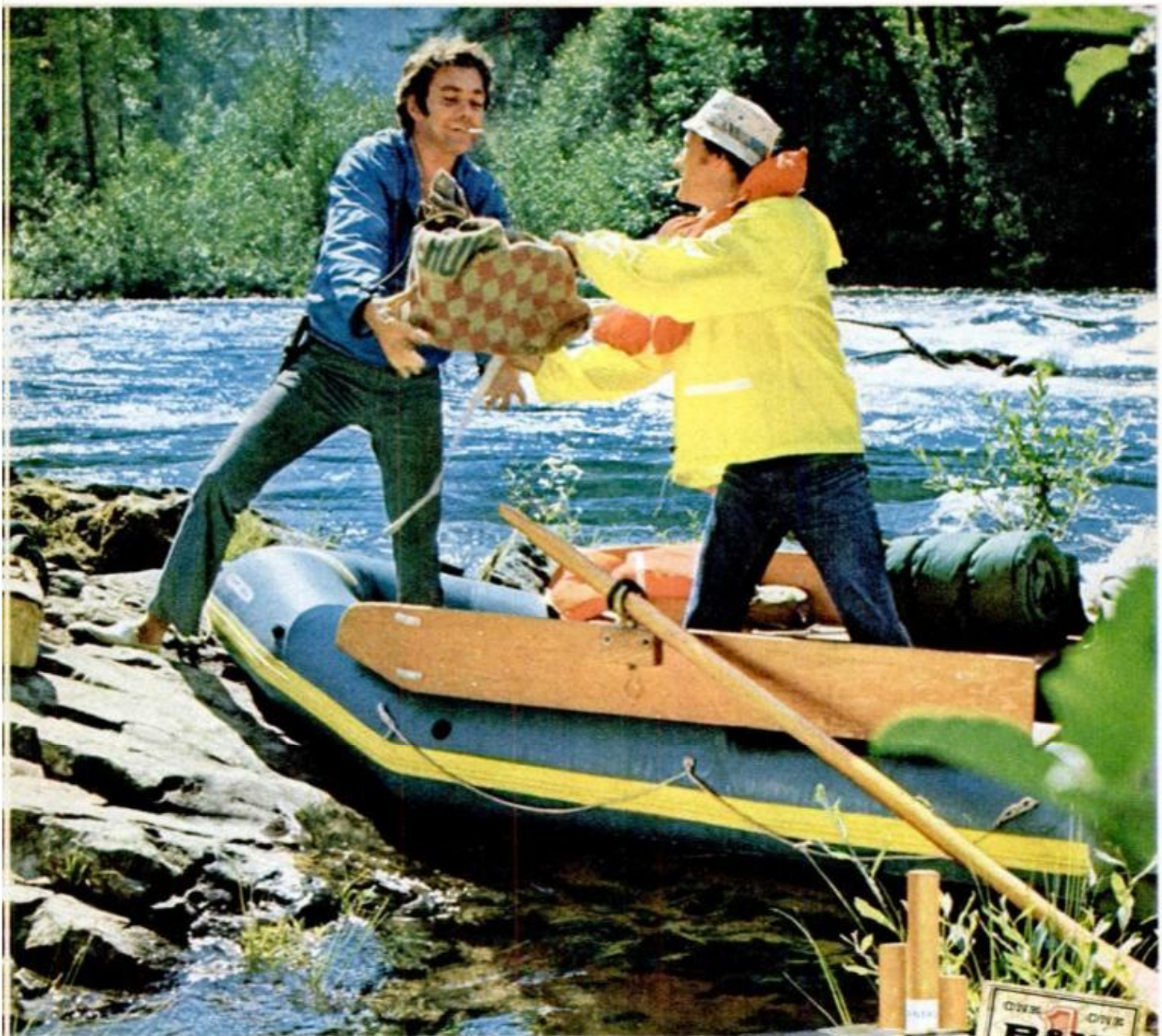
### GM refunding Wankel deposits

If you're not in the movies or an in-law of a member of GM's board of directors, don't-

*(Please turn to page 34)*



Red-hot engine for '74 Cosworth Vegas is twin ohc Four with fuel injection and solid-state ignition. Two-liter high-revver will go into 4000 hatchbacks in '74, more in '75. Details of car won't be released until fall.



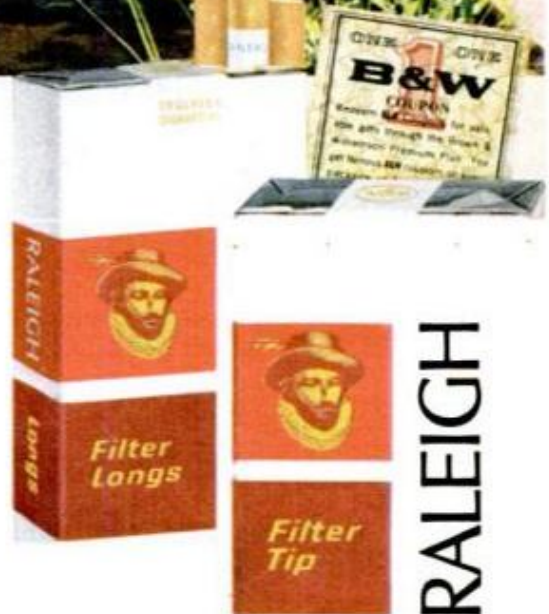
## Spend a milder moment with Raleigh.

A special treatment softens the tobaccos  
for a milder taste.

Rough it in comfort. Get a water-repellent Sportline Sleeping Bag just like the one shown for free B&W Raleigh coupons, the valuable extra on every pack of Raleigh.



To see over 1000 gifts,  
write for your free Gift Catalog:  
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**RALEIGH**

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Filter Kings, 16 mg. "tar," 1.2 mg. nicotine; Longs, 18 mg. "tar,"  
1.3 mg. nicotine, av. per cigarette, FTC Report February 73

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

# Stripper Offer



## Strypeeze SEMI-PASTE paint remover

Clings and softens old finishes from every angle . . . for easy scrape-off or wash-off removal. Available where paint is sold.

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Versatile Maximat combines lathe with vertical & horizontal mill, drill press, and grinder in one rugged, compact unit! Designed for labs, precision workshops and serious hobbyists. Three models available: 7" x 18"

7" x 24", 10" x 26". The Maximat is fun and easy to use. Anyone can machine like a "pro" with our fully illustrated Maximat instruction handbook, **Precision Machining Techniques** — only \$2. Dealers in all major cities.



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**MASON & SULLIVAN COMPANY**  
Dept. PM, Osterville, Mass. 02655

### DETROIT LISTENING POST

(Continued from page 32)

bother sending GM your check to put you on the waiting list for a rotary-engine Vega when it comes out next year. You'll get your check back along a form letter saying you'll have to get in touch with your local dealer when the car goes on sale. There's a little legal nicety of being licensed to sell at retail in the individual states and GM doesn't sell direct to customers. Your best bet for early delivery of a Wankelized Vega would be to butter up the local Chevrolet dealer.

### Update on AMC's Wankel

Here's the straight stuff on American Motors' rotary engine program from the company executive nursemaiding the project: Gerald Meyers, v.p.-product. AMC's pushing development of the Wankel but hasn't reached a point of no return. The go or no-go decision will be made independent of GM's experience in installing a Wankel in Vega. There's no chance of AMC putting a Wankel in production in the next two years, but Meyers doesn't rule out a rotary installed in an American Motors car within that time. He says that the company could put a Wankel in a car short of the two years it would take to get the engine in production by buying one from a supplier.

### New four-wheelers

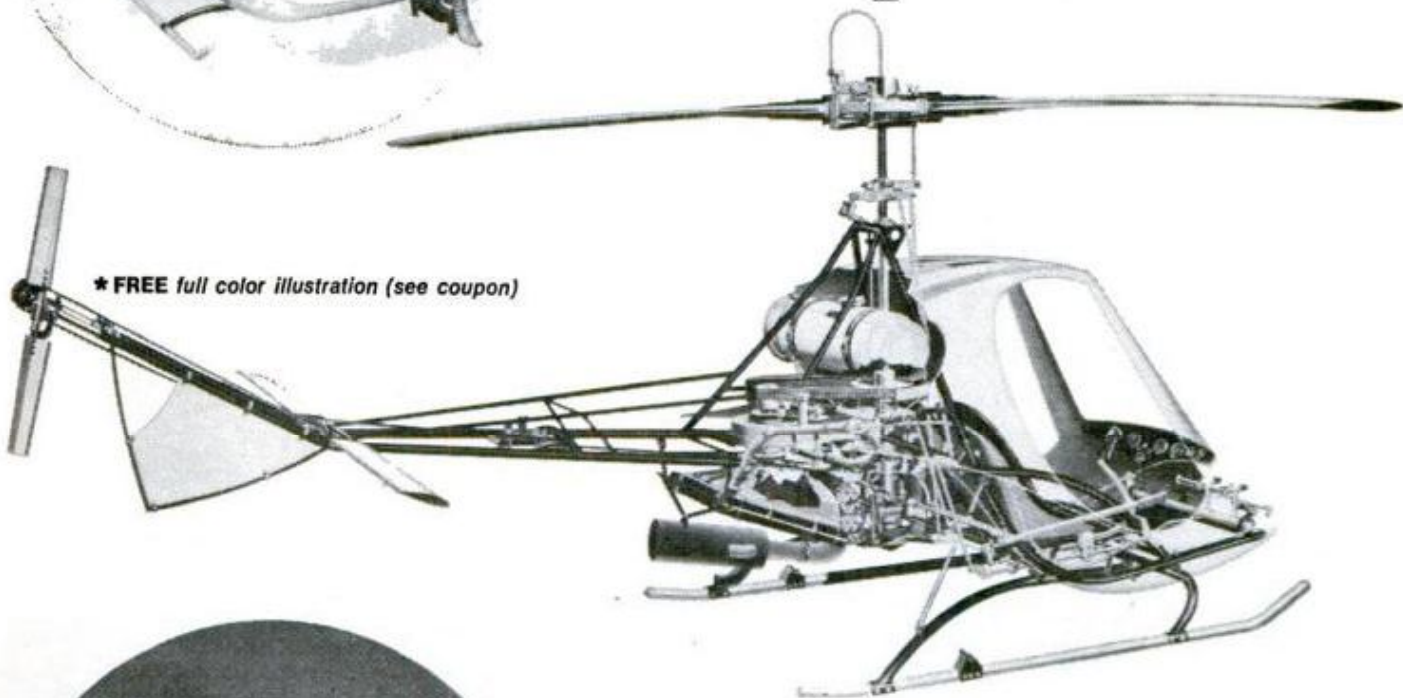
Ford and Chrysler are stepping up pre-production work on new four-wheel-drive vehicles. Ford's not satisfied with its Bronco sales and wants a larger, more versatile, more luxurious vehicle to sell against Chevy's Blazer and AMC's Jeep. Trend in four-wheelers, from Ford, Chrysler or elsewhere, will be to larger, more stylish cars. They'll still be utilitarian, but with more eye appeal.

### Price cut on antiskid

Ford has launched an aggressive program to cut the cost of its antiskid system to attract more buyers. The company is developing a less sophisticated skid-control system, expecting it can shave the \$200 price in the hope that it will be able to pull in more customers—for the '75 cars. ★★★



# a new look at the fabulous *Scorpion Too*



\*FREE full color illustration (see coupon)

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The Scorpion Too is RotorWay's answer to backyard flight.

Remember, the Scorpion is a true vertical take-off helicopter.

**It takes off straight up.**

Using a 140 h.p. engine, it cruises at 75 m.p.h. and can carry over 400 lbs. The most exciting news about the twin-seat Scorpion is its low cost, but then it's about time a helicopter became a recreational vehicle.



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**RotorWay**  
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\* Enclose this coupon with your \$5 and you will receive free, along with your package, a 25"x38" full color reproduction of this beautiful scaled cut-away drawing (as shown above). Rotorway commissioned Dick Aleith, one of the West's leading illustrators, to create this work of art. It's truly a collector's item.

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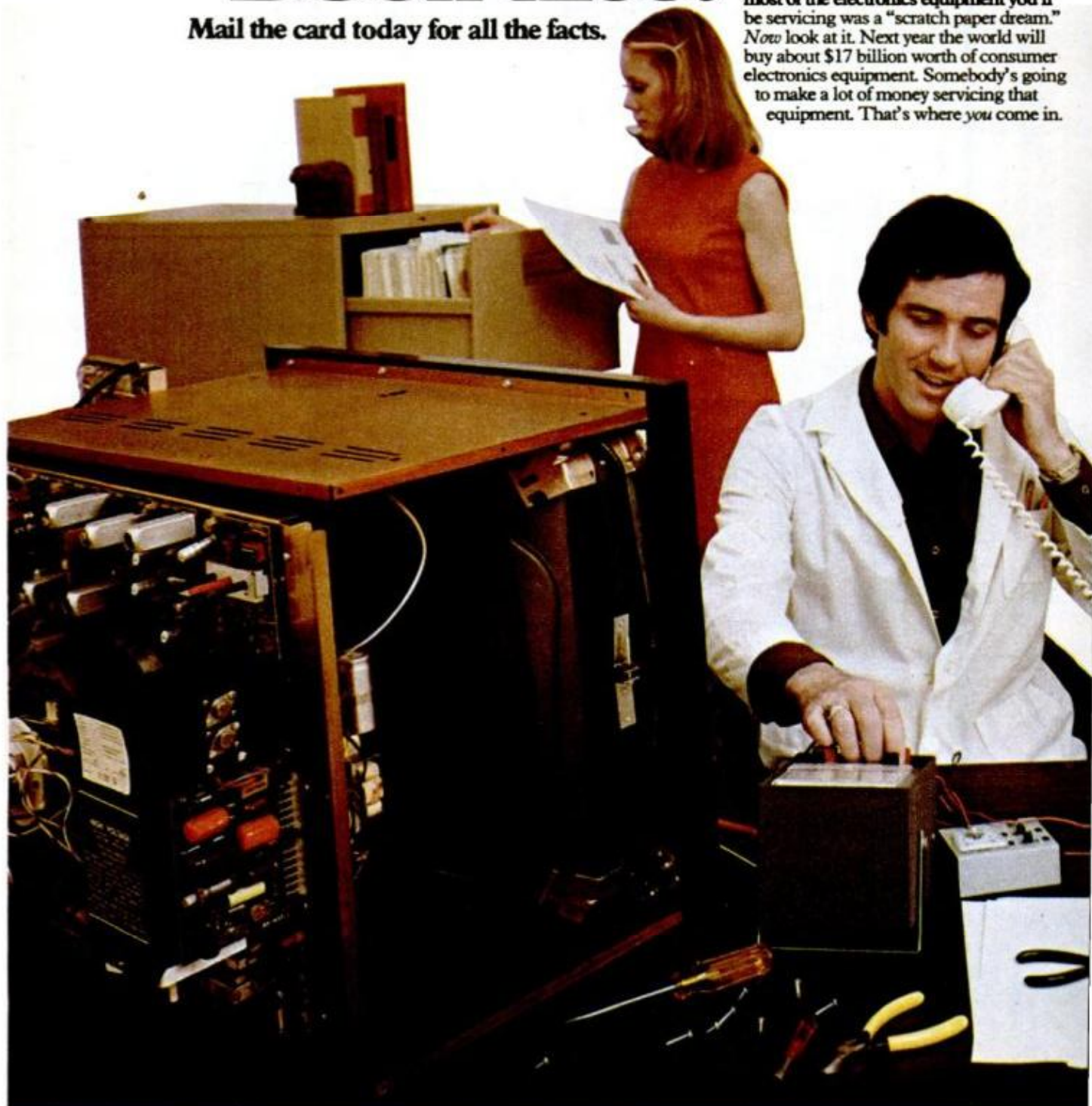
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How many times in the last year have you thought about it . . . doodled it out on scratch paper . . . and left the daily treadmill knowing you could get a lot more done—and probably earn more money—in a business of your own?

Bell & Howell Schools can help you build the technical know-how that could become the foundation of a business of your own in electronics equipment servicing. Consumer electronics is growing like gangbusters. When you've mastered this complex equipment you could find a big demand for your skills. A business of your own in this field stands a pretty good chance of making it into the black when you've got skills that people are looking to buy.

Building a profitable business of your own needn't be just a "scratch paper dream." As a matter of fact, thirty years ago most of the electronics equipment you'll be servicing was a "scratch paper dream." Now look at it. Next year the world will buy about \$17 billion worth of consumer electronics equipment. Somebody's going to make a lot of money servicing that equipment. That's where you come in.



Just a few years ago, many of our graduates — guys just like you — saw the handwriting on the wall. They realized that a business of their own could really happen. Bell & Howell Schools helped them turn the growing field of electronics equipment servicing into a passport to independence and a successful business of their own.

**If you'd like to start your own business ...**

... the skills you learn in this unique Bell & Howell Schools learn-at-home program can give you the right kind of technical foundation — to help you set up your own electronics servicing business full time. You'll have the knowledge and practical skills you need to completely service and troubleshoot just about any kind of consumer electronics equipment a customer could send your way.

Or go it alone part time — in your spare time — for extra cash in addition to your regular income. It's a great way to get your feet wet in your new career ... get a good taste of the independence you'll enjoy ... and start earning extra money.

**Mail the postage-free card for all the facts about ...**

... growing opportunities in electronics for a guy who likes to work with his hands. Bell & Howell Schools offers a complete learn-at-home program that includes building yourself a 25-inch diagonal Bell & Howell solid state color TV!



**Beyond color TV, there's a whole new world ...**

... of home entertainment electronics equipment — from stereo systems to the new home videotape players. By 1985 the world will be spending about \$35 billion a year on consumer electronics equipment! Somebody will have to fix it when it goes haywire. How about you?

**One thing's certain, you're going to need ...**

... something to *sell* if you want to build yourself a successful career. That's what this Bell & Howell Schools program is designed to give you — up-to-date technical skills that electronics equipment owners are looking to buy.

**Getting ready for a business of your own means you have to start with ...**

... a hard look at what's happening in growth industries — like solid state electronics.

Today there's hardly an industry — or a leisure-time activity — that isn't touched by electronics technology. That spells "opportunity" for you — with the right training!

**The Bell & Howell solid state color TV you build is ...**

... an important part of your training because it gives you "firing line" experience with solid state equipment. Here are the technical details:  
 ■ Ultra-rectangular tube ■ 25-inch picture measured diagonally ■ full 315 sq. in. viewing area ■ solid state modular circuitry ■ 4 advanced IC's ■ 100 transistors ■ 72 diodes ■ individual plug-in circuit boards ■ special UHF/VHF tuning features ■ built-in self-service components

**If you'd like some personal advice on your program ...**

... talk over problems with a qualified instructor at one of our special "help sessions" — scheduled at Bell & Howell Schools and in many other cities. And you're only a toll-free call away whenever you'd like to discuss your program with an instructor!

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... the brand-new Laboratory Starter Kit! A volt-ohm-meter (VOM) with design panels, modular connectors, experimental parts, battery power source. Gives you immediate troubleshooting experience with your very first lesson.

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... Bell & Howell Schools Electro Lab®! Gives you "hands on" experience with precision instruments you assemble and use in your new business:

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"Breadboard" circuits without soldering for both solid state and vacuum tube experiments. Patented modular connectors ... transistorized dual-range regulated DC power supply ... 12.6 volt center tapped AC power supply ... sine and square signal generator ... test speaker.

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Professional technician's diagnostic instrument. 5-inch screen ... wide-band ... sharp screen images ... calibrated for peak-to-peak voltage and time measurements ... 3-way jacks for leads and plugs.

**Transistorized Voltmeter**

Measure current, voltage, resistance, on large dial ... combines vacuum-tube voltmeter with multimeter ... sensitive, 4-inch, jewel-bearing d'Arsonval movement.

510

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# HINTS

## FROM READERS

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### Guitar-string shop tool

An old guitar string my daughter gave me has come in handy a number of times. Since the wire is stiff, though small in diameter, it is good for cleaning jets and small orifices. To make it easy to find and use I keep it coiled with a plastic bag twist tie, and I store it near my workbench.—*Harry Wheeler, Toledo, Ohio.*

---

### Dowel locks sliding doors

You have published other methods, but I have found that the best and simplest way to lock a sliding glass patio door is to cut a length of 1-in. dowel or broom handle and lay it in the door's track. To work best, the dowel should be a snug fit in length to jam the door closed.—*Vickie J. Walker, Spring Lake, N.C.*

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### Chain length cleans bottles

When I had to clean a number of bottles, many with residue on the bottom, I found that the best way to do it is to drop in a 5-ft. length of brass chain and swish it around with some detergent. The chain scrapes the insides of the bottles and gets them spanking clean.—*Stephen N. Stresnic, Fort Lauderdale, Fla.*

---

### Tape keeps square from sliding

When using a carpenter's framing square to cut pieces of glass, you may find that the smooth steel tends to slip off the desired line. A length of masking tape applied to the underside of the square will keep it from shifting. The same thing can be done with any metal straightedge used as a guide for glass cutting.—*W. Szenker, Philadelphia.*

### Saving cement forms

To salvage the lumber used for a cement form without the bother of scraping it, I bought a roll of 4-mil plastic and covered the inside of the form with it. I made sure to tuck the bottom of the plastic under the form securely to keep cement from getting between the plastic and the wood.—*Carroll C. Stander Jr., Portage, Mich.*

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### Cool cleanup trick

The cements used for installing plastic floor and wall tiles and decorator bricks are difficult to clean off tools, even when the recommended solvents are used. I tried leaving the tools in my freezer overnight and found that the cement chipped or peeled off most of them with ease.—*John J. O'Neil, Warwick, R.I.*

---

### Ring compressor for small cars

Plenty of auto-supply outlets sell ring compressors for larger cars, but sometimes it is hard to find one the right size for a small import. A good substitute is a large hose clamp, one that will open up to about 3 in. dia. You should be able to get one from any auto parts store.—*Charles Stubbe, Cherry Valley, Ill.*

---

### Nails lock bed slats

Although a way to lock bed slats into place was described in *PM* some time ago, the one I use is easier and costs next to nothing. With slats in position, drill a 1/8-in. hole through both slat and support strip. Drop a 6d common or box nail into the hole and it will keep the slat from shifting.—*John F. Bachmann, Fort Walton Beach, Fla.*

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# SLIM DOWN

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You eat the wrong combination of foods, you do not get enough exercise to thoroughly work your muscular, metabolic and respiratory systems daily. Because of this, fat accumulates around your waistline, heart and other body organs, slowing you down, aging your body and destroying your vitality, virility and youth. There is only one way to firm up and shape up: that is through proper exercise and proper nutrition. Effortless exercisers, reducing pills, sauna shorts, weighted belts, dangerous and painful diets and other gimmicks designed to appeal to your laziness will not work and have been exposed by the medical profession as frauds, ineffective and in some cases dangerous. They can only reduce your pocketbook. Face up to it... If you want to slim down, firm and shape up, you must work off the inches, and there is no safer, faster and more enjoyable way to do it than with our patented, truly miraculous "5" Minute Body Shaper Plan.

### How does this ingenious "5" Minute Plan slim, firm and shape you up?

Its miraculous slimming action is based on doing one simple "5" Minute Continuous Rhythm coordinated exercise! **That's all you do!** That's all your body needs to help make up for the lack of activity it doesn't get most of the day. The action is designed to supply your waistline and hips (where fat accumulates quickest, giving your body a flabby, weak and distorted look) with the activity it needs to slim you and keep you slim. It also burns off excess fat **FAST** by speeding up your metabolism and respiratory system, using up stored calories, carbohydrates and fats and releasing excess water, thereby shaping and firming up your total body!

Patent Pending. © Copyright Joe Weider, 1973

It's safer than strenuous gym workouts, beats the time consumption and dangers of gym workouts... or any other vigorous sport.

The unit weighs about 16 ounces and fits any wallet-size case. You can carry it with you and use it — anytime — wherever there's floor space for your body. Even while watching television.

### What the experts say:

*Medical Doctors, Chiropractors, Osteopaths, Athletic Coaches... agree it's the most successful Waistline-Weight Reducer and Shaping Up Plan ever invented!*

"Doctors have always known, exercise done while lying on the back virtually eliminates strains while slimming and reshaping the body. Yours is the finest Body Shaper Program on the market."

RICHARD TYLER, Chiropractor

"Beats jogging and working out in gyms — and much safer. I lost 4½ inches off my waist in 14 days."

JIM HANLEY, famous athletic coach

"Miraculous! Weighs less than a pound, is simple to use and beats working out in a gym with 30 different exercisers."

TOM MINOCHELLO, famous gym owner

"Based on sound physiological and medical knowledge, it burns fat and shapes the body without strain to the heart or other organs. I lost 32 lbs. of excess weight using it."

PIERRE GRAVEL, DC

## '5' MINUTE BODY SHAPER

**We'll slim your body... while you watch the girls!**

### What comes off in 14 days?

Individual results vary, but during an average 14-day period you can expect to lose up to 4 inches from your waistline and up to 10 pounds from your present weight. It strengthens your heart and lungs, increases stamina and endurance, improves your digestive function and general health. It also shapes you up — from head to toes. For a "5" Minute Exerciser — it sure does a lot.



**Weighs just 16 ounces. Small enough to fit into pouch shown.**

**FREE TRIAL OFFER: Get it off fast... and see measurable results in three days or every penny back!**

Proven results are already verified by the thousands. The guarantee is in writing. Now, can you think of a reason for not ordering your "5" Minute Total Body Shaper and start looking and feeling like a million... in just 3 days?

**DISCOVER A NEW JOY IN YOUR BODY GIVE IT SEX APPEAL! COMPLETE KIT ONLY \$9.95**

**JOE WEIDER, Dept. BR/H  
"5" Minute Body Shaper Plan  
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Woodland Hills, Ca. 91364**

Dear Joe: Rush me your "5" Minute Body Shaper and Slimmers Course in plain wrapper, with your money back guarantee offer!

**I ENCLOSE \$9.95 FOR THE ABOVE.**

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City ..... State ..... Zip .....

IN CANADA: "5" Minute Body Shaper Plan, 2875 Bates Road, Montreal, Quebec

## HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

### Shades stay up

*Several large window shades in my home won't stay down—they won't catch and hold in any position. The shades are not old, torn or discolored. What's wrong?—Mrs. R. M. Lamb, Chicago.*

It is likely that the ratchet ends of the rollers have been filled with lint, or that the springs installed in them have loosened. Take the shades down, brush lint out of the ratchets and use the tines of an old fork to retighten the springs. If no parts are bent or missing, the shades should then work properly.

### Veneer lifting

*I've stripped a chest of drawers which is veneered. With the remover washed off, some of the veneer has come loose and the edges have lifted. What happened, and what do I do next?—R. Dewey, Tulsa, Okla.*

It is quite possible that you dampened the glue under the veneer and, thus, softened it enough to make it let go in places. I'd try lifting the veneer with a sharp chisel, and forcing new glue underneath. Then clamp plywood on top, with wax paper in between, until the glue dries. If blisters result, slit each at its center, force glue through the slits underneath the veneer, and weight until dry.

### Sharpening lawn mower

*Can you tell me how to sharpen a reel-type lawn mower?—Vernon Sheff, Racine, Wis.*

Place the mower on a table or bench. Clamp or tie the handle securely. Remove the wheel, pinion and other parts, making sure that you keep them in order. Hold the reel shaft with lever-jaw pliers. Mix valve-grinding compound (obtainable from an auto-parts supplier) with oil to make a paste; brush this on the blades and bed knife. Adjust these parts for light contact

and turn the reel backward with the pliers. Keep the bed knife and reel blades in contact by repeated adjustment. When properly sharpened, they should contact smoothly along their whole length. Then readjust so that blades just clear the knife. Reassemble the parts in reverse order to that of their removal and lubricate.

### Gilding book edges

*I have several old volumes, bound in leather, which have the top and one edge of the pages gilded. I want to regild these if possible. How is this done?—Manley Post, Pittsburgh.*

By a professional bookbinder, if your books are heirlooms or otherwise valuable. But if the volumes are not so choice, you might try this method: Protect the edges of the book and binding with masking tape, clamp the book between two pieces of plywood and spray the exposed edges with gold paint, the type sold in aerosol cans.

### Determining soil needs

*My garden soil needs fertilizing, but how do I tell what and how much to apply?—Bill Leach, Alliance, Neb.*

By testing the soil. Kits for this purpose are available at most garden-supply stores and include full instructions. You can do the testing yourself or, in some cases, have it done at the store if you bring in some samples of your soil. Your state university extension service will also undertake this chore for you, either free or for a nominal charge. ★★

*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. While letters cannot be answered individually, problems of wide interest will be discussed in this column.*

Your menthol cigarette lost its cool?  
Find the taste of extra coolness.  
Come up to KOOL,  
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Kool Milds 14 mg. "tar," 1.0 mg. nicotine av. per cigarette, by FTC method. Kool Kings 17 mg. "tar," 1.4 mg. nicotine; Kool Longs 17 mg. "tar," 1.3 mg. nicotine av. per cigarette, FTC Report Feb. 73.

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## The thick and easy house paint.

### Glides on in one coat even over black.

Just follow label directions.

There's no oil base house paint on the market anything like Spred Gel-Flo. Glidden made Gel-Flo so that even a "weekend painter" could do a fast professional paint job on his house.

Put it on thick, and Gel-Flo goes on thick with no sagging or running. It fills hairline cracks and gives two-coat protection where you want it — all in **one** easy coat. And that one coat works like two coats over any color —



even over black. Just follow label directions.

Or, put it on thin. You can get a lot of mileage out of Gel-Flo where siding and trim are still in good condition.

But easy, precision

painting isn't all you get from Spred Gel-Flo.

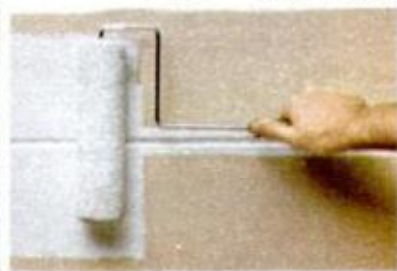
You also get top quality oil paint protection that resists blistering, peeling and any kind of rough weather and burning sun.

You can apply Gel-Flo any way you want! Spray it on, roll it on or brush it on. Any way, Gel-Flo glides on for the easiest paint job ever.

Spred Gel-Flo from Glidden. It's just waiting to turn you and your paint job — professional.

## Five Gel-Flo advantages to turn you into a painter's painter.

1. Gel-Flo "seals" tighter for better protection. Fills hairline cracks and surface imperfections with no running or dripping.
2. Gel-Flo is "settle free" because it's gelled. Stirring is almost unnecessary.
3. Gel-Flo paints on more easily because more of it loads on your brush, stays on the tip and glides on smoothly.
4. Gel-Flo adjusts to thick coats or thin as you paint — no waiting for a second coat.
5. Gel-Flo smooths itself on your house with that bright, clean professional finish that stays that way for 2 years or more.



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# Jock itch (or chafing, rash, itching, sweating) shouldn't be treated lightly.

If your groin, thighs, or buttocks suffer from redness, rash, chafing, soreness, excessive perspiration, or Jock Itch (Tinea cruris), then you need medicated Cruex®.

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## "How I rewired my taillights with a plastic straw and Dow Corning Bathtub Caulk."

We knew our silicone rubber bathtub caulk was good for a lot more things than bathtubs, and when we heard how Larry Oswald of Sewickley, Pa., used it, our opinion was confirmed.

"When my taillights started getting dimmer and dimmer, I took them apart and found that the sockets, wires, everything, were all corroded.

"So I cleaned everything up, bought two new sockets, and decided this time that they weren't going to corrode.

"I had a tube of Dow Corning® Bathtub Caulk lying around the house, so I figured why not, and caulked up the sockets.

"Then I figured that if it'd work on the sockets, it'd work on the splices.

I cut two small pieces off a plastic drinking straw, slid one over each set of wires to keep them from getting stuck together, tied the wires together, and then pumped them full of caulk.

"It's been six months now, and my taillights are still brighter than ever."

Next time you're faced with a plumbing leak, broken gasket, or

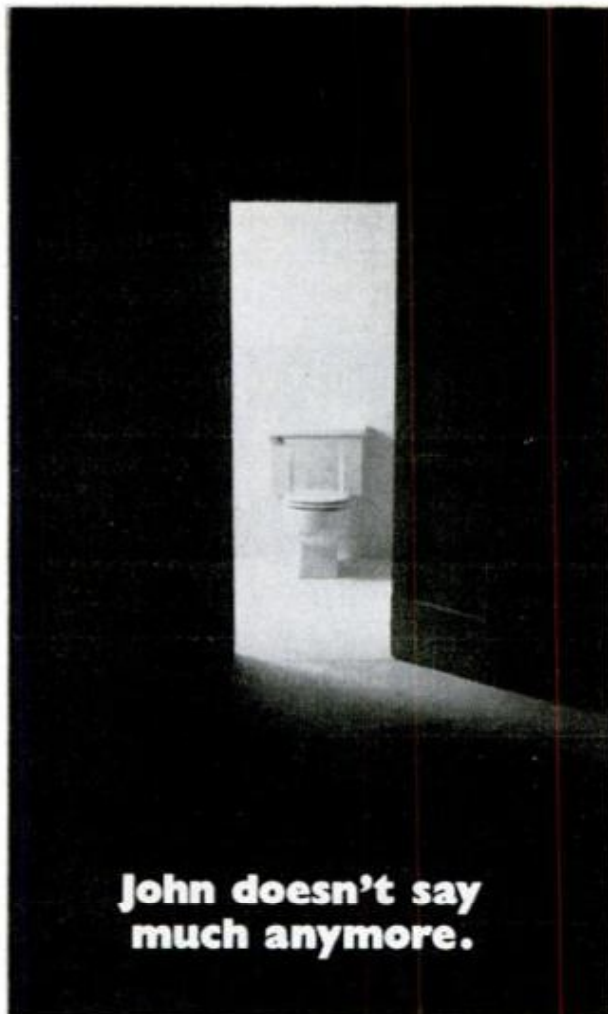
almost any fix-it job around the house, get the Dow Corning Silicone Bathtub Caulk out of the bathroom and put it to work.

You'll find it in white and pastel decorator colors in the hardware or paint department of your favorite store. Look for Dow Corning Silicone Sealer in clear, black, or aluminum in tubes and cartridges, too.

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## SCIENCE WORLDWIDE

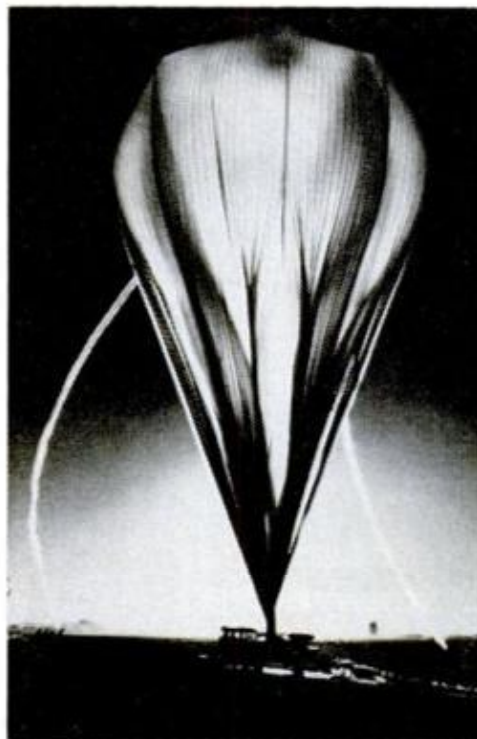
### This is a big year for tornadoes

Tornadoes have struck the United States in record numbers this year, according to the National Weather Service. Some 700 tornadoes occurred from Jan. 1 to May 29, compared with the previous high of 504 for the first five months of 1957. The Weather Service ascribes the increased activity to a stronger than normal jet stream flowing into the United States from the southwest. Fatalities reached 59 by May 29, more than double the total for all of 1972.



### The Inflatobird flies again

Intended as a rescue vehicle for stranded airmen, the Inflatobird failed to interest the military when it was introduced in '55. Now the maker, Goodyear Aerospace Corp., has hopes it might catch on as drone, remotely piloted vehicle or as a minimum aircraft for reconnaissance. The plane stores in a pod that can be dropped by parachute. It can be inflated by compressor or with bottled gas, has a 60-hp engine and a wooden prop. The only controls are a stick and rudder. Inflated, the plane is 19 feet long, has a 28-foot wingspan and carries enough fuel for five hours of flight. Engine compression keeps the plane inflated—even if it has taken a few bullet punctures.



### Balloon-borne astronomy lab

The old-fashioned balloon, created to immense proportions, is an important tool of astronomers. Earlier this year, a team of Australian and MIT scientists sent a huge helium-filled balloon aloft in the interior of Australia. It carried 1800 pounds of instruments to measure X-ray radiation from space. The vehicle reached altitudes well above 100,000 feet, remained airborne for 26 hours and produced scientific results that were "extremely rewarding." The payload was recovered about 500 miles from the launch site. An American design, the giant free-flying balloon was constructed of polyethylene film.

### Cleaning can lead to coughs

The vacuum cleaner can be a serious source of pollution in the home, according to Kansas State University researchers. When the vacuum's exhaust hits an unclean part of a rug it can double the amount of airborne

*(Please turn to page 50)*

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"Balls of fun" for kids, traffic stoppers for stores, terrific for amateur meteorologists. Create a neighborhood sensation. Great backyard fun. An exciting beach attraction. Amateur meteorologists can use these balloons to measure cloud heights, wind speed and temperature. Made of heavy-duty neoprene. Inflate with vacuum cleaner or auto air hose; or locally available helium for high rise.

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Projects illustrations up to 3" x 3½" enlarges them to 35" x 30" if screen is 6½ feet from projector. You get even larger pictures if screen is farther away. No film or negatives needed. Primarily intended for children, this unit projects charts, diagrams in color or black & white. 115v AC. 6 foot cord and plug are included. Size is 12" x 8" x 3½" wide. Weighs just 1 lb. 2 ozs. Comes with a sturdy plastic case.

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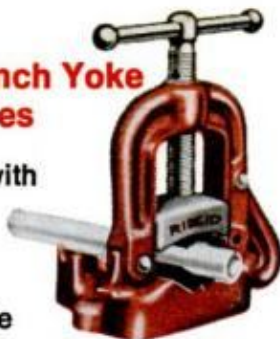
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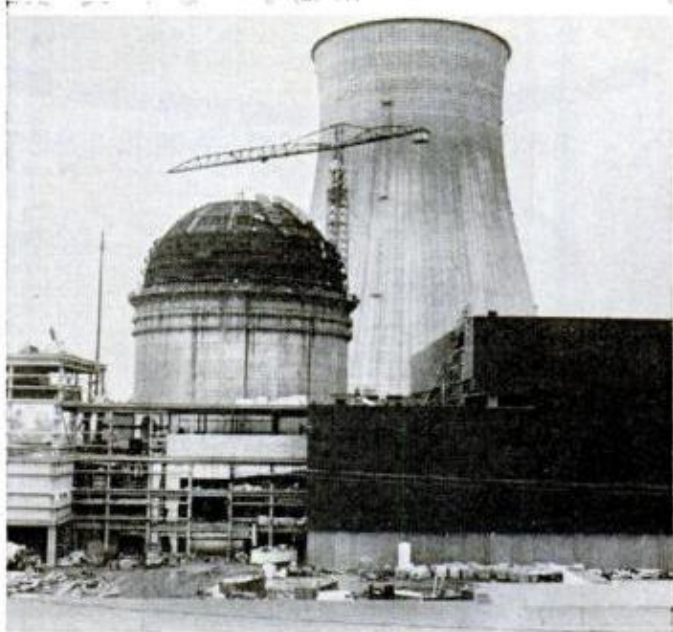
## SCIENCE WORLDWIDE

(Continued from page 48)

dust for a two-hour period. By shielding the exhaust, the researchers reduced contamination by nearly two-thirds. The KSU scientists advise persons with a respiratory problem to clean less frequently.

## Old campfire provides clue

The oldest accurately dated evidence of man in the state of Virginia has been set at 10,000 years ago, according to a U.S. Geological Survey radiocarbon-dating expert and scientists from Catholic University and the University of Maryland. They determined the date from bits of charcoal from campfires used by early Indians at a site near Front Royal, Va. Carbon-14, absorbed by animals and plants, decreases at a known rate after the organism's death.



## Nuclear powerplant for Northwest

Once thought to have an abundance of hydroelectric power, the Northwest now needs other sources of electric energy. One source will be a 1.13-million-kilowatt nuclear plant now under construction about 42 miles from Portland, Ore. To avoid thermal pollution in the nearby Columbia River, water from the plant's condenser will be air-cooled in a 500-foot tower. The \$298-million installation is scheduled for completion in 1975. ★★★

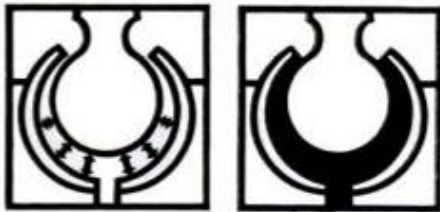
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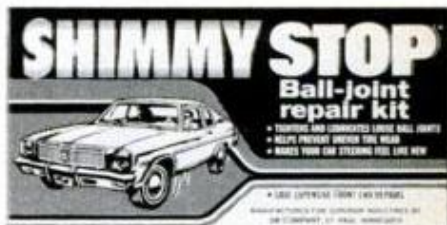
Once Shimmy Stop cures to a self lubricating solid . . . it lasts for thousands and thousands of miles. The 3M Company



Look for this display in your favorite auto supply store . . . it gives you the complete SHIMMY STOP story. And ask for your FREE ball joint wear gauge. The gauge makes it easy to determine your need for SHIMMY STOP. What could be fairer?

developed, tested and proved SHIMMY STOP in all kinds of cars under all kinds of conditions. (in fact 3M spent 7 years developing SHIMMY STOP and tested it for more than a million miles.)

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## IMPORTS AND MOTORSPORTS



### New British beat

The Austin-Morris group of British Leyland Motors is planning to rock the market in Europe with its new Allegro. The all-new car isn't destined for the U.S. market, at least not in the foreseeable future. The Allegro is in the tradition of the legendary Mini with front, transverse engine and front-wheel drive. Among new features are



wax-injected body sections and hydragas suspension—cylinders of compressed nitrogen at each wheel.

### Never misses a beat

There's no beat to miss in a rotary-engined dragster. Among the growing number of Wankel-powered competition cars on the circuits is "Project Rotary," a rail being run by the Dana Corp. Rotary powerplants are capable of spinning out a lot of power for their weight, providing that engine seals and gaskets are doing their job. That's Dana's interest: The company's Perfect Circle Div. and Victor Div. are using Project Rotary as a test bed for engine seals and parts that will be used in production passenger cars. Win or lose, developing race-proven parts is the name of the game.

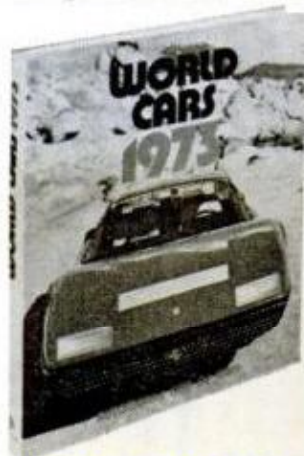
### Up against the wall

Our 142 gains speed and "climbs" the test track at Volvo's all-new proving grounds at Hallerad, Sweden. We drove all of Volvo's cars around the impressive facility when it was officially opened early this summer. All the company's vehicles are tested there and we drove the trucks, too. Volvo Penta is well known here, but less known are the big-rig buses and trucks; forestry and construction equipment; aircraft engines; and specialty vehicles, all of which were at the proving grounds for the inauguration day.



### Unbeatable book

Herald Books has done it again: *World Cars 1973* is the definitive volume on cars in production in the world today. In addition to being a catalog of production cars country by country (some 800 cars in 27 countries), the book includes 80 introductory pages with essays on current trends, motor racing and special car bodies. The indices include a history of carmakers and coachbuilders, names and prices of all models, even top



(Please turn to page 54)



# Why play the oil filter numbers game... when the name of the game is filtering efficiency

When it comes to oil filters, AC is not in the numbers game...we're in the business of filtering oil.

At AC, we work on the premise that the worth of an oil filter is judged on its filtering efficiency...not the number of filters involved. We pride ourselves on our filtering efficiency...and we do it with a single filter! We find it's not the number of filters that counts...it's how well the filter does the job.

We run tests to make sure that AC Oil Filters provide effective filtration. We use engine wear test data to determine how well our filters are doing. After all, our job is to keep harmful contaminants away from vital engine parts...that's what counts in the filter business.

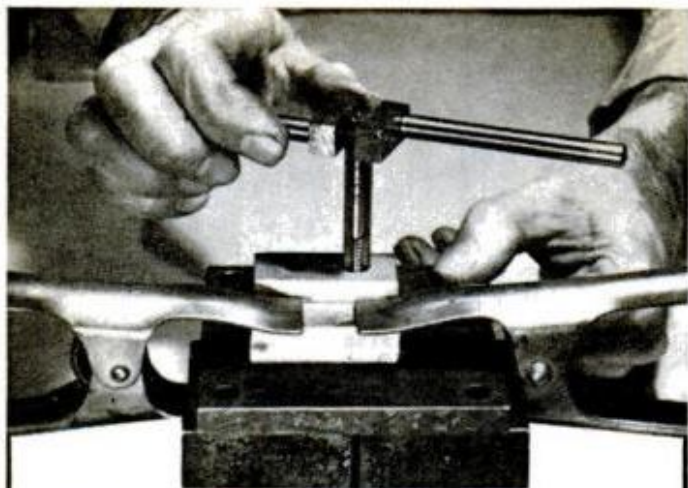
We can build a filter so fine that nothing could get through...not even the oil...and we can build a dozen screens that will let sand, shavings and marbles through. The secret of filtration is getting a filter that will trap harmful contaminants yet pass clean oil to the engine right up to the time of a filter change. That's the ideal filter balance.

In line with our goal of providing the best in filtration, we may never reach perfection...but you can bet we'll never play the numbers game. We contend one filter gets the job done, especially if it's built the way AC builds filters.

If we wanted to play the numbers game, we are capable of building a three-stage filter, but numbers alone wouldn't make it more efficient. AC is in the business of providing you with efficient oil filtration for your car...nothing more, nothing less. Ask for an AC Oil Filter at your next oil change.



AC SPARK PLUG DIVISION



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(Above prices apply in U.S. & Possessions only. Canada add \$2 per year. All other countries add \$4 per year.)

WSF3H1

## IMPORTS AND MOTORSPORTS

(Continued from page 52)

speed of all cars listed. \$19.50 at bookstores. Herald Books, Box 17, Pelham, N.Y. 10803.

### Movin' machines

Race-car repairs are simple—with the right tools like a milling machine, lathe, drill press, metal-cutting bandsaw, grinder, finisher, welding equipment, portable tools and nondestructive test gear. It's all in Rockwell's big bus at the races on USAC's Championship Trail. If you wonder how teams put race cars back together over-



night, fabricating hardware, polishing cranks and routinely working miracles with metal, the answer is partly in this mobile shop used free by competitors. After the season Rockwell makes the shop available to vocational schools for instruction in metalworking and automotive technology.

### Sparking safety

Safety fuel cells are now more available to enthusiasts. If you're running a high-performance street, sports or drag car, off-road vehicle or high-speed pursuit car, chances are you can get a unit from Aero Tec Laboratories. Their cell replaces the conventional gas tank to minimize fuel-tank cracking or rupture and eliminate fuel spillage in an accident or rollover. The container has aluminum valves and fittings and a flexible bladder filled with safety foam. It is approved by FIA, SCCA, NASCAR, USAC and IMSA, used by racing teams and in government limos. For more information write ATL at 1100 Blanch Ave. Norwood, N.J. 07648. ★★★



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a new edition of



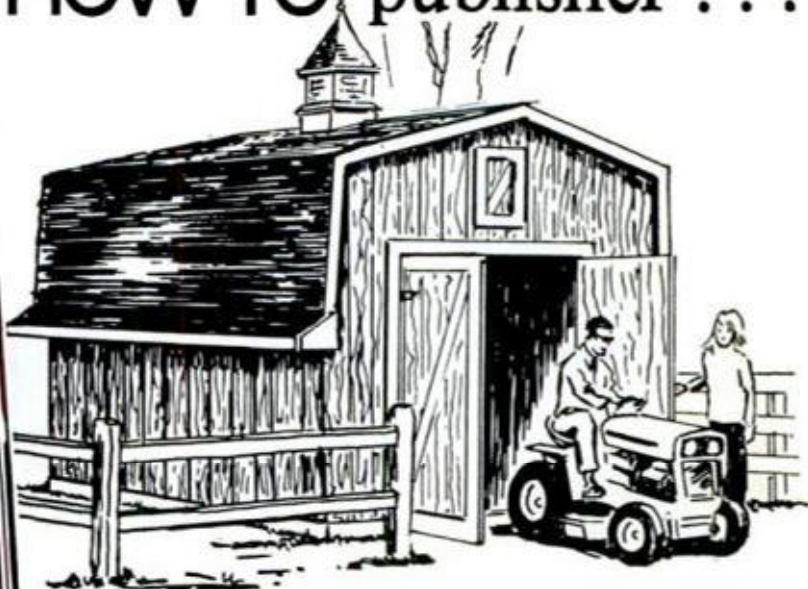
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FOR ORDERING INSTRUCTIONS  
see pages 31 and 32.



Want to impress your relatives, astound your friends—and have a ball doing it? Send for this great *new* edition of the famous *Popular Mechanics Catalog*. You may find yourself building your own airplane, or a beautiful little “Mini-Barn” for storage in your back yard, or any of a thousand other fascinating projects. No matter what your interests, you'll find plans listed in this fully illustrated catalog that will set your mind spinning, from garages to ground-effect machines, from elaborate models to complete houseboats, from house plans to fine little one-evening projects. The *Catalog* also lists the greatest how-to books and shop guides ever published. *Order your copy of this brand new edition today!* Send only 25¢ to cover postage and handling.

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## THE BICYCLE SHOP

BY EUGENE A. SLOANE

### Ten-speed side-play

*The sprocket on my 10-speed moves back and forth, and I'm wondering if that's normal.—Rob Archer, Enaville, Idaho.*

Yes, its normal for a 10-speed rear gear cluster (sprocket) to have a lot of side-play. All of them do.

### No gears 6 through 9?

*I recently bought a 10-speed, and the dealer told me not to use the No. 6, 7, 8 or 9 gears because the derailleur was not made to stretch this far. Is this correct?—Jim Ramsdell, Canastota, N.Y.*

You should be able to use every gear on a 10-speed. The dealer told you wrong. If you have trouble, then the derailleurs are not adjusted correctly. Of course, if you have changed to a wider gear freewheel, you would have to change to a derailleur with capacity to handle the wider gear range. Generally, you should not have to use the smallest rear gear with the smallest front gear or the largest rear gear with the largest (diameter) front gear, but you should be able to use them if you wish to.

### Double a five-speed

*Can I change the front chainwheel on a five-speed to make it into a 10-speed?—John Austin, Greenwich, Conn.*

Yes, you can remove your single-speed chainwheel and put on a double chainwheel. You will need a longer axle to accommodate the extra chainwheel, and of course you will need a front gearshifter (derailleur) and a gearshift lever. I estimate cost for parts to be about \$15 and labor about \$10 or \$12.

### Cable snapper

*I've had a 10-speed bicycle for two years*



**Surfboards, camping gear, skis, groceries**—in fact, almost anything you want to tote somewhere can be carried behind your bicycle on the Bike Packer, a new single-wheel trailer. The low-slung Packer is made of tubular steel and has a baked-enamel finish. It weighs under 12 pounds and disassembles for storage or shipment. Price of the unit, including duffel bag and bike hitch, is \$34.95 postpaid (without the duffel bag, \$29). Coalson Tackle Co., 1241 East Chestnut, Building K, Santa Ana, Calif. 92701.

*and have been doing my own repairs. Now I have a problem. In one month I have snapped four rear derailleur cables. Can you help me?—Matthew Manes, Fayetteville, N.Y.*

Four broken cables in 30 days is indeed unusual. I assume you mean the cable came apart as if cut by a knife. I've seen the leaded ends of cables come off, though this is rare. It would appear that somewhere

*(Please turn to page 58)*

For easier starting, lower emissions, smoother idling, no stalling, faster take-offs and better mileage.



# THE CARBURETOR CLEANER.



**Inside.** Just pour a pint of GUMOUT into your gas tank. It cleans out all the jets and passages, removes the gum and varnish while you drive.



**And out.** It takes less than a minute to clean the outside of your carburetor with Jet Spray GUMOUT. Throat, automatic choke, linkage, throttle plate—all clean like new.

**GUMOUT** Division, Pennsylvania Refining Company, Cleveland, Ohio 44104

## THE BICYCLE SHOP

(Continued from page 56)

along the cable travel there is a sharp edge or burr against which the cable rubs. Check cable tube ends, cable tunnels and where the cable enters the derailleur for sharp edges.

### Tires for a Belgian bike

*I bought a bicycle in Belgium, and when I got back to the States I couldn't find new tires to fit it. Where can I buy 28 x 1<sup>5</sup>/<sub>8</sub>-in. tires?—Bob Brickweg, Melrose, Minn.*

Those tires are, of course, nonstandard. However, Raleigh does supply a bicycle with that size tires; your Raleigh dealer should be able to get them from his supplier.

### Don't tamper with a Manta-Ray

*I would like to convert my five-speed Schwinn Manta-Ray into a 10-speed by adding a dual chainwheel. But I'm afraid the 24-inch wheels and short wheelbase would make it hard to shift in certain gears or cause undue wear. Is this change advisable?—Jeff Miller, Clarks Summit, Pa.*

Generally, I do not recommend going to the time, work and expense of this type of conversion on what is essentially a heavy, cumbersome toy. The Manta-Ray, which is no longer made, weighs upward of 40 pounds. I suggest you sell it and buy a better, more efficient 10-speed that fits you—such as the new Schwinn Varsity Sport with 24-inch wheels, 10 speeds and turned-down bars.

### New paint for a 10-speed

*I wish to spray paint my 10-speed. Should the frame be sanded first? Do I need an undercoat or base? What's the best paint to use?—Jim Schools, Riverside, Calif.*

You'll have to strip all the parts off the bicycle or mask them with masking tape. After removing all oil, grease and road dirt, sand the frame lightly; this will give the new paint "bite" for good adherence. You won't need an undercoat because the frame already has one. Spray two or three coats on, sanding lightly between coats with very fine sandpaper and allowing 24 hours for

each coat to dry. Both Raleigh and Schwinn have small cans of spray paint for bicycles in a wide variety of colors.

### Three-speed instructions

*Recently I bought a bicycle with a Sturmey-Archer three-speed coaster brake. Instructions received with the bike were minimal. I can handle everything but the coaster brake. Do you have an address for Sturmey-Archer?—Irvin Reigner, Port Republic, N.J.*

You can reach Sturmey-Archer through Raleigh Industries, 1168 Commonwealth Ave., Boston, Mass. 02134.

### Can't shift into first

*I have a five-speed bike that won't shift into first gear. The shift lever goes all the way down, but the chain goes only to the second-speed gear and then starts rattling. I tried adjusting the derailleur setscrew, but that doesn't help. What would?—Bill Jones, Stamford, Conn.*

I assume you mean the chain won't shift from the next to the smallest diameter gear to the smallest diameter gear. Most likely you have the cable drawn up too tightly into the derailleur. Push the gear lever all the way forward. Loosen the cable locknut on the derailleur and let the cable go through (or pull it through) until you have just a slight bit of slack in the cable where it parallels the down tube. Then gently pull out this slack by tugging on the loose end of the cable at the derailleur and tighten the cable locknut at the derailleur. It's also possible you have so much grit and gunk in your derailleur that it's stuck in place; try cleaning it in kerosene. It's also possible you're adjusting the wrong derailleur stop bolt (for the big gear instead of the little gear).

### Ambitious 12-year-old

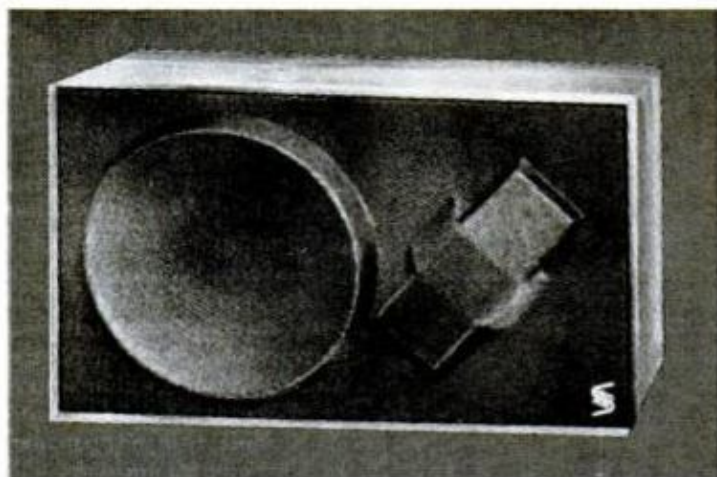
*I like bikes and would like to open my own repair shop. But I'm only 12. What should I do?—Ed Hill, Alliance, Ohio.*

Get a job with a local shop. If necessary, work free just to gain experience. When your employer finds how valuable you are, I'm sure he'll pay what you're worth. ★★ ★

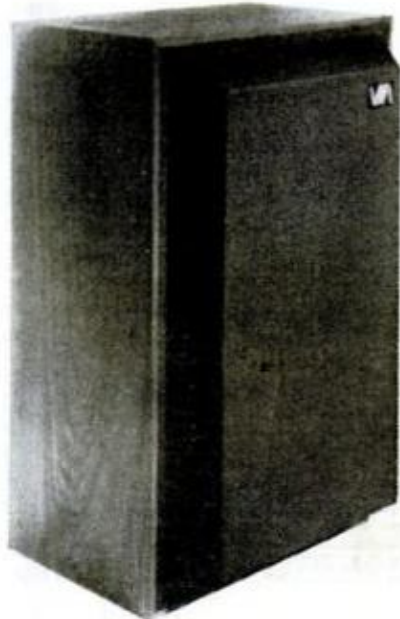


# Five-tweeter speaker gives wide-angle sound

by Ivan Berger  
ELECTRONICS EDITOR



**Cross-shaped tweeter assembly, shown with grille removed (top), spreads highs evenly through room. Optional grille (above) lets speaker positions show through; standard grille (right) doesn't.**



**H**igh frequencies sometimes sound fine directly in front of a speaker, but fade away as the listener moves to one side. Micro/Acoustic's solution to the problem is a bookshelf speaker system with five tweeters, angled so that one will face you no matter where you sit.

The tweeters are in a cross-shaped array, one facing dead ahead and the other four angled outward. The array is then set at an angle, so dispersion will be the same whether the cabinet rests on one side or on its end. There are tweeter-level controls for the front-facing tweeter and for the four angled ones.

The system gives a more open, spacious sound, both because there is no treble falloff at the sides of the sound fields, and because the listener is surrounded by additional highs—reflections of those coming from the other tweeters. Since these reflections come from all angles, the effect is a bit like that of omnidirectional speakers.

Overall, the sound is clean, well-balanced, with a crisp and solid bass. The speakers are \$149.50 each, with a choice of grille styles. For more information, write Micro/Acoustics, 8 Westchester Plaza, Elmsford, N.Y. 10523. ★★★



## OF POPULAR MECHANICS



### Those dangerous grade crossings

Each year 1500 are killed, 7000 injured at 223,000 grade crossings in this country. Electronic warning devices are our best hope for a solution.

### Compost machines

Shredder, grinder, chipper—what's the difference? Which best suits your needs for recycling garden trash and making rich compost? PM describes what each machine does and presents the latest models and prices.



### Desks to suit any need

This desk is a wonderful home office; closed, it's a handsome wood-grained credenza. One of three you-build-it desks designed by PM editors.

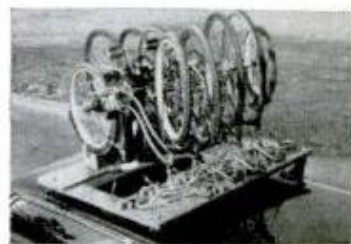


### Cutting board

A good cutting board is a valuable tool for any shop or darkroom. This multipurpose board is a dandy to work with, even if you're a left-hander. It can be scaled to meet your needs and built for less than \$10.

### Bike carrier

This cartop carrier mounts five bikes without disassembly. You can build it in a weekend for \$30 from our plans.



## PLUS

How to fell a tree • How outdoor gear can serve in power failures • Why clean-air '74 cars will cost \$300 more • How to troubleshoot a water heater • How to install stereo speakers in your car • Fiat's new XI/9. • Fitting out for bass • How to add a fairing to your motorcycle • How to build a practice tennis court.

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WPM3H1

## ALL OUTDOORS

### Chris-Craft ends an era

When Chris-Craft announced recently it had just built its last wooden boat and has now converted the famous line entirely to modern metals and plastics, it seemed to mark the end of a boatbuilding era stretching back to the Ark. Boats from many builders will still be formed from wood, of course, and pleasure-craft owners still find it an easy material to work with and maintain.

But today's boat owner also needs to work with aluminum, steel and bronze, fiberglass-reinforced plastics and various new resins, sealants and lubricants, paints and cleaners. Many have exceptional strength and life but are tricky to use. The best book we have seen that updates all these topics for the do-it-yourself skipper has just been published. Called *Modern Marine Maintenance*, it is by John L. Duffett, a prominent yachtsman, marine surveyor and practicing expert in this field. For \$6.95 from book and marine stores or *Motor Boating & Sailing*, 224 West 57th St., New York, N.Y. 10019, it ought to be able to save a boating reader its purchase price quickly.

### Sail—and save gas

Sailboating is a particularly easy answer to the gasoline shortage, and a bargain source of information is available from the American Sailing Council of the National Assn. of Engine & Boat Manufacturers, 537 Steamboat Rd., Greenwich, Conn. 06830. Its 162-page illustrated directory lists 1000 day-sailers, one-design racers, multihulls, offshore racers, cruisers and motorsailers with addresses of manufacturers and class associations; 50 cents while the supply lasts.

### Inspect your rigs before you move on

Camped at a "Hazardous Mobile Home Park or Recreational Site" recently? The northeastern states have a number of them, according to a list from the U.S. Department of Agriculture. Gypsy moth caterpillars and eggs, it seems, are hitching rides to uninfected parts of the country aboard mobile homes and recreational vehicles. The USDA's Animal and Plant Health Inspec-

(Please turn to page 62B)



MIAMI-METRO PHOTO

**Twin hulls and a pickle-fork nose**, plus a horizontal tail stabilizer, may make a new look for unlimiteds. Pay 'N Pak, David Heerensperger's Seattle hydro, was

driven by Mickey Remund to set new qualifying (119 mph), lap, heat and race records while winning the Miami Champion Spark Plug Regatta.



CARPET DETERGER



UPHOLSTERY DETERGER



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# PART TIME or FULL TIME

*have your own  
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**You offer a service everybody needs . . . work part time or full time . . . own your equipment . . . keep all you earn . . . start with just a small investment . . . and we help you every step of the way!**

Have your own money-making business and make the kind of income you probably thought impossible. You can when you clean carpeting or upholstery or walls with Von Schrader professional cleaning equipment. Every home, every building, are potential customers. And every customer represents repeat business.

Moreover, we help you every step of the way . . . just as we have helped thousands of other Von Schrader Associates build money-making businesses for almost 40 years. Here are some comments. Carpet: "You people sure helped me and I'll never forget it. I'm averaging about \$18,000 a year."—*H. Kendall*. "During first 2 months made \$2500 net."—*R. Pilong*. Upholstery: "One day I did a \$135 job. Best week was \$500."—*C. Lambert*. "We passed over the

\$450 mark in five days."—*T. E. Baylor*. Wall: "I work just 2 or 3 days a week. Best month was \$1200."—*J. R. Johnson*.

There are three easy-to-operate Von Schrader Detergers. You need no special skills. Each offers a proven way to a growing income. (1) Von Schrader Carpet Deterger gives deep-level cleaning to carpeting. (2) Von Schrader Upholstery Deterger cleans fabrics and synthetics beautifully. (3) Von Schrader Wall Deterger cleans walls (and ceilings) five times faster than by hand.

You can start with just one Deterger. Then, as your business keeps growing, you may want to add the other two and thus offer a complete cleaning service.

There are no fees, royalties, or contracts. There's no franchise involved to shackle you with giving up part of your income. Instead, you own your equipment, keep all you earn. Cost of the equipment is so small you may find it hard to believe. What's more, we help you get started and continue to help afterwards. For complete information—without any obligation—send for the interesting free booklet.

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—Francis von Schrader, President



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For rough going when it's wet as well, L.L. Bean, Inc., Freeport, Me., has added Vigram lug soles to its famous Maine Hunting Shoes. They are \$28.50 postpaid.



This revolver rotates barrels to fire two .45-cal. shots in two seconds. For black powder shooters, new Hopkins & Allen/High Standard Muzzle Loader is \$140.



Wigly Crawler from Lazy Ike can make like a snake with spoon molded in head. Action and depth control according to rate of retrieve are claimed for new lure.

## ALL OUTDOORS

(Continued from page 62)

tion Service wants units moving from sites on the "hazardous" list to be inspected before they move on. But with the spread of this threat to foliage, it wouldn't hurt for all campers to take a good look at their tents and rigs before packing to move on.

If you don't want to camp out but would rather build an A-frame summer cottage (or a pole-frame hunting cabin, farm cottage, Adirondack shelter, horse barn or trailer, greenhouse or boating landing), the Government Printing Office also has *Recreational Buildings & Facilities*, a 70-cent booklet that tells how.

### Traveler finder

A new along-the-highway aid for travelers uses a television screen at 350 Stuckey's roadside stores across the country. By pushing the buttons for his phone number at any stop, a motorist sees on the TV screen if anyone has tried to contact him by calling Stuckey's headquarters computer in Eastman, Ga. Numbers the driver should call for messages appear on the screen, and the computer stores these numbers for five days. The system should help to contact a traveler in an emergency. And it's free.

### RV assist from carmakers

RV shoppers and owners alike have new aids going for them via local car dealers. Dodge offers *Guidelines to Safe and Care-free Campering*, with information about proper loads for passenger-car towing as well as selecting and outfitting a recreational vehicle. The booklet is also available free from Box 970P, Detroit, Mich. 48231.

Two new offerings from Ford are *Let Ford Take You Camping*, a survey of vehicles available plus coupons for free campground passes, and *Ford Outdoors*, published by the editors of *Ford Times*.

Chevrolet's *Recreational Vehicle Buyer's Guide* provides 82 pages of solid information and suggestions for choosing and using trailers and pickup campers, conversions and motor homes. It can be ordered for 50 cents from Box 7271PM, Detroit, Mich. 48202, or through Chevy dealers. Also available are a *1973 National Parks & Monuments Road Guide*, 140 pages covering 280

(Please turn to page 62D)

# Announcing

## Popular Mechanics Picture-Tools— the handiest shop-organizers ever designed

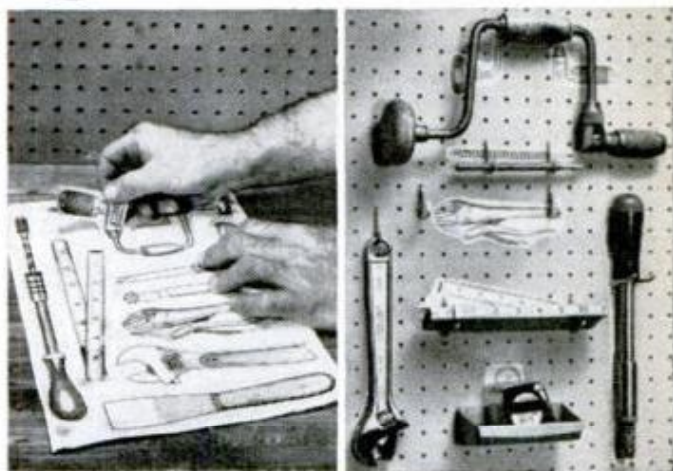
POPULAR MECHANICS PICTURE-TOOLS are a great new idea to take the confusion out of *what goes where* on workshop tool panels.

The complete PM PICTURE-TOOL KIT consists of seven big sheets (9¾ x 11¾ in.) of a special heavyweight paper with a pressure-sensitive adhesive on the back. On each sheet are beautiful drawings of hand tools and portable power tools—all (74 in total) you're likely to have in your shop. Most are full size; the others, only slightly reduced.

Also enclosed in the kit is a blank sheet of the same special paper, printed in an overall color to match the tools. This sheet enables you to design your own drawings or silhouettes of any special tools you have.

Each of the PM PICTURE-TOOLS is carefully die-cut. You simply peel it off the backing paper and apply it to the proper spot on your panel. You can apply PICTURE-TOOLS to any painted or unpainted wood, plywood, hardboard and even perforated-hardboard surface.

Later if you want to move a few tools or rearrange the entire panel, you can peel off



the PM PICTURE-TOOLS and move them to new locations. They are reusable!

Once your PICTURE-TOOLS are in place, you'll know at a glance exactly where each tool in your shop belongs. You'll also know—again at a glance—what tools are missing.

Best of all, you'll be surprised how PM PICTURE-TOOLS will instantly and dramatically enhance the appearance of your shop!

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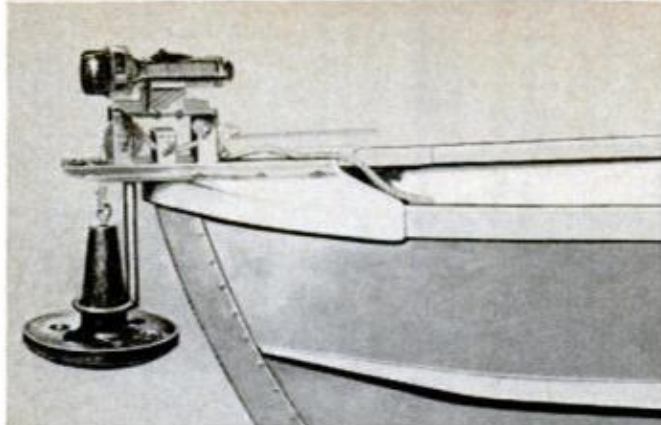
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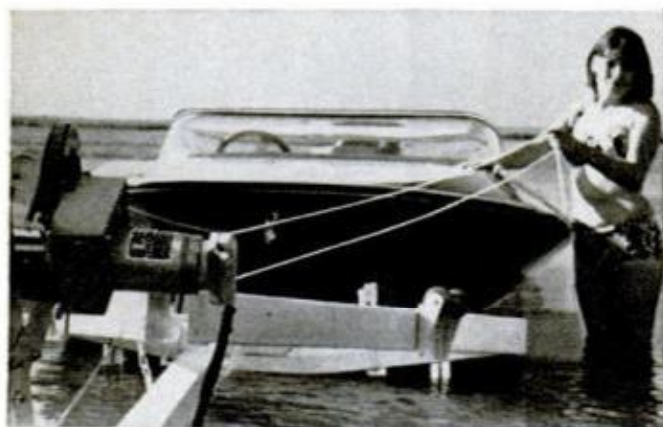
Zip \_\_\_\_\_

## ALL OUTDOORS

(Continued from page 62B)



Anchor handling without falling overboard is among advantages of Anchor Caddy. Bracket holds anchor snug but clear of bow to lower or haul in. \$19.95.



Heavier inboard and stern-drive craft can be hauled out with Dutton-Lainson DLE 7000 using 12-v. power and 25-ft. lanyard control or hand crank. \$165.95.



Designed to keep a trailer's hitch locked whether or not it is hooked up to the tow vehicle, the All-Safe Hitch Lock from Waukegan Outdoor Products is \$10.

parcs, monuments, recreational areas and historical sites of the National Park Service, and the *Chevrolet Trailering Guide for Passenger Cars and Trucks*. Groups and organizations can also borrow three half-hour movies: *The High Roads*, *The Water Roads* and *The Historic Roads of America*.

And from the Recreational Vehicle Institute, the RV industry's trade association, comes a consumer guide called *The Way to Go*, a good introduction to the sport. It's available through many RV outlets or directly, for 50 cents, from the RVI, 2720 Des Plaines Ave., Des Plaines, Ill. 60018.

### New tackle boxes resist plastic worms

Most fishermen now know how effective the new plastic worms are in catching lunkers and damaging tackle boxes. Now a number of manufacturers claim new plastics they use resist the corrosion and paint-softening caused by tray storage of plastic worms. Several makes we have given a preliminary test seem to be holding up well. When tackle-box shopping, check for this quality.

### European air travelers get RV package

Air travelers who want to camp the Grand Tour of Europe have a new bargain RV package available. Swissair will have a Mercedes or VW camper caravan waiting for you at the Zurich airport—fully equipped (even maps and china, linens and champagne). Two weeks of unlimited mileage is less than \$940 for two, including round-trip air fare.

### Coming outdoor events

Aug. 7-10, Heavy Bench Rest Nationals, National Bench Rest Shooters Assn., Springfield, Mo.; Aug. 17-25, Grand American Trapshooting Tournament, Amateur Trapshooting Assn., Vandalia, Ohio; Aug. 18, Hennessy California Offshore Powerboat Race, Marina Del Rey, Calif.; Aug. 18-26, National Fall Championship Shoot, National Muzzle Loading Rifle Assn., Friendship, Ind.; Aug. 31-Sept. 3, Metallic Silhouette Championships, National Rifle Assn., Tucson, Ariz.; Sept. 22, National Hunting & Fishing Day. ★★

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## APPLIANCE CLINIC

BY PAUL MANN

### Capacitor capers

*Your explanation of how a reader may have ruined his new ohmmeter was quite good. However, you stated that an appliance capacitor may be discharged by shorting across its leads to ground. This is true in many cases, but not all. Some capacitors have internal fuses. If they are shorted to ground, the fuse will blow and render the capacitor useless. To be perfectly safe, a man can do as you suggested—disconnect the capacitor leads and bypass the capacitor with a jumper. Or he can safely discharge a capacitor by using a 20,000-ohm, 2-w. resistor, or by setting a voltmeter to a high voltage setting, such as 1000 v.—O. James Rickley, Greeley, Colo.*

Thanks, O.J. You emphasize a point that needed it.

### Nutty knob

*My Westinghouse Filter-Clean portable dishwasher (model SFK5A) is out of synchronization. For example, when I press the double-wash button and then turn the timer knob, the knob moves past the wash cycle to rinse before the dishwasher starts operating. On the rinse-hold cycle, if I press the rinse-hold button and turn the timer knob to rinse-hold, nothing happens, but if I move the timer knob to the off position and then to wash, the appliance comes on. A repairman installed a new timer, but no success. How do I solve this complicated problem?—Alphonse Moore, Philadelphia.*

With a simple solution. Replace the timer knob. It is probably cracked or worn and has slipped so it isn't lining up properly with the timer shaft, and therefore isn't lining up properly with cycle selections.

### Putting it to use

*I received a Facit typewriter, model 1620, as a birthday present, but I never did get an owner's manual. The local dealer has been of*

*no help. Can you suggest something?—Robert Taylor, Lynn Center, Ill.*

Yes. Use your Facit typewriter to write the company and ask for the owner's literature: Facit-Odhner, Inc., 501 Winsor Dr., Secaucus, N.J. 07094.

### Doing a no-burn

*Here's an odd one for you. The left front burner of our 20-year-old, four-burner Frigidaire electric range will not heat up unless the other burners are also switched on. Why?—Joe Holmes, New Castle, Pa.*

The burner has probably developed a bad switch, which would account for its not working by itself. It's possible that the switch for this burner has shorted itself across the switch of one of the other burners, so that when that burner is turned on, the left front burner also gets electricity and heats up. There's one more point that should be mentioned. Some electric ranges have one burner connected in series with another to act as a griddle warmer. If your range is one of these, the left front burner may be connected in series with the left rear burner. For the griddle burner to operate, both burners have to be switched on.

### Odds-on

*I have a Whirlpool automatic washer that's about 10 years old. It has three water-temperature settings: hot, warm, cold. When we switch to hot and turn the machine on, the water barely trickles into the tub. Yet, on the cold-water setting, it flows forcefully. Do I need a new valve or something?—Frank Murray, Greensboro, N.C.*

Your washer needs something, but odds are 99 to 1 in your favor it's not a new part. Close the hot water valve on the line to the washer, unscrew the hose connection from the faucet and clean out that small intake filter screen you'll find in the hose inlet. I

(Please turn to page 62H)



TOM McCAHILL says:

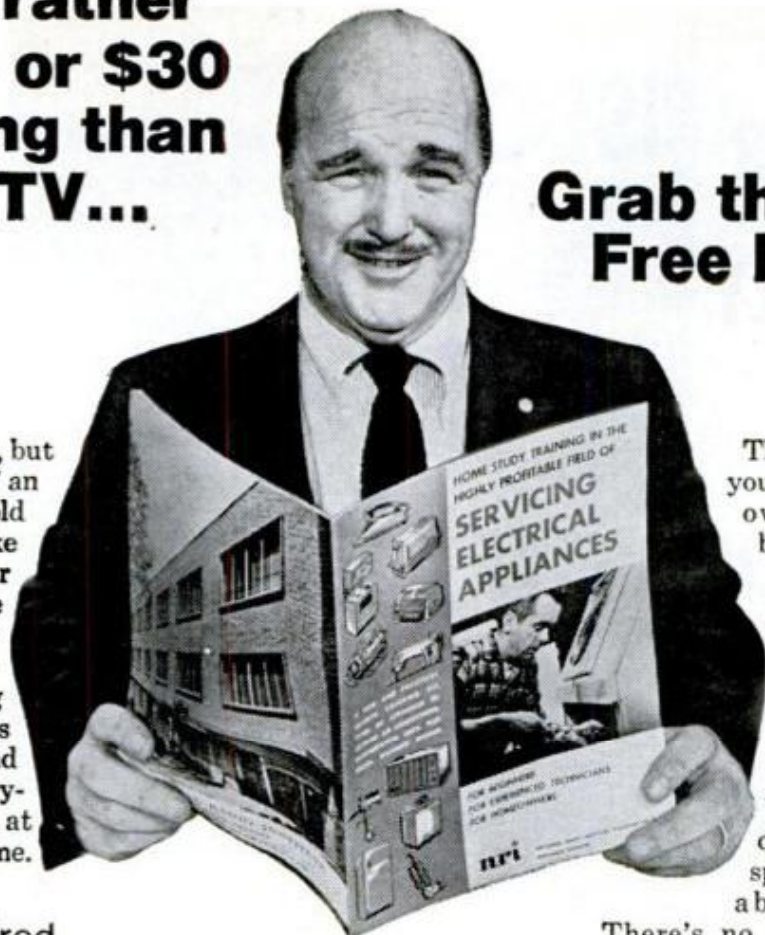
**"If you'd rather  
earn \$25 or \$30  
an evening than  
watch TV..."**

**Grab this  
Free Book!"**

I'm not against the tube, but I'd hate to pass up \$5 to \$7 an hour just to catch those old movie reruns. You can make that kind of money in your spare time by being the man in demand: an Appliance repairman. Guys who can keep appliances going are wanted in more states than the FBI's top ten. And NRI can teach you everything you have to know ... at home ... in your spare time.

So you've never wired a plug ... NRI can show you how.

Even Edison had to do some studying. And there's no easier way to learn than the low-cost, home study course put together by the Appliance Division of NRI Home Training. All the lessons are fully-illustrated and easy to understand. Thousands of guys like yourself have learned basic electricity and how to use test instruments. The course covers the electrical and mechanical operation of every type of appliance from toasters and coffee makers to dishwashers; from vacuum cleaners and automatic laundry equipment to air conditioning and refrigerators. They even show you how to fix farm and commercial appliances and small, one-lung engines. Their staff of experts works with you every step of the way. NRI includes a professional Appliance tester in the low tuition. Almost a million men have studied with this great school,



Think of the money you'll save when your own appliances go bloolie!

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so you know they've got this home study business down pat.

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*Tom McCahill*

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**APPLIANCE CLINIC**

(Continued from page 62F)

bet it's clogged by water deposits built up over the years.

**Out of its element**

*A break has developed in the flat-ribbon wire of my toaster's heating element. What can I use to repair it?—Paul F. McRae, Des Moines, Iowa.*

Resistance-wire cements are sold by appliance dealers and at hardware stores. However, such repairs are temporary. The permanent solution for your problem is to buy a replacement element.

**At long range**

*Our home is equipped with a Republic ThermoGlas water heater. We get hot water okay, but not very much. Can you make a long-range diagnosis of what the problem may be?—Ronnie Maron, Duarte, Calif.*

You don't give me much to go on—but let's set down a few thoughts. First, if the hot water lasts a very short time (about a minute) and then turns cold, the dip tube may be leaking. This tube directs incoming cold water from the top to bottom of the tank. Hot water comes out from the top. If the dip tube has broken off or is leaking at the top, cold water will be delivered.

If water is turning cold at one faucet only, such as the shower or bathtub, the mixing valve there may be bad, diverting cold water to the hot-water side. If so, nothing may be wrong with the water heater.

Possibly your burner flame or thermostat is set too low. Ask your local gas company to have a serviceman check gas-operating functions of the appliance; there is usually no charge for this.

Finally, when you say you don't get "very much" hot water, you're not being too specific about the problem. *How to Troubleshoot a Water Heater*, in next month's *PM*, should be good reading for you. ★★★

*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 answered in this column.*

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# Dodge takes the mystery out of buying your first

## (or your second or your third...)

As an adventurer that's considering a recreational vehicle, you've probably found it's difficult to decide which unit is best for you. Take price. You can spend as little as \$150 for a pickup cap cover. Or go first class and spend as much for your home on wheels as you would for a house. To get you started, we've listed here most of the major types of recreational vehicles. After you have a general idea of what you want, stop in and see your Dodge Dealer. He may have what you're looking for right on display. And he'll do his best to answer any questions you may have.



### First, Slide-on Campers.

This is a popular way to start for several reasons. First, if you already own a pickup, you're halfway there. But before you buy a camper, check the carrying capacity of your pickup and make sure the center of gravity of the camper matches up with the recommended load location of the pickup. Second, you can move into more deluxe campers easily. Just keep the pickup and trade in the top. Finally, for those who like to get far off the beaten path, the four-wheel-drive pickup is probably the most surefooted RV you can have. Obviously great for hunters, fishermen, and the like.



Only Dodge offers you the new Club Cab pickup. It has room inside for the things you don't want to leave outside.

Dodge has developed one of the most interesting pickup innovations in recent years. The Club Cab. It has 34 cubic feet of extra storage space behind the seat. Room for the camping equipment you don't want inside the camper. Optional jump seats are available if you prefer. Like the other Dodge pickups, the Club Cab can be equipped with a special camper package. It provides the basic equipment you need to carry today's larger slide-on campers.



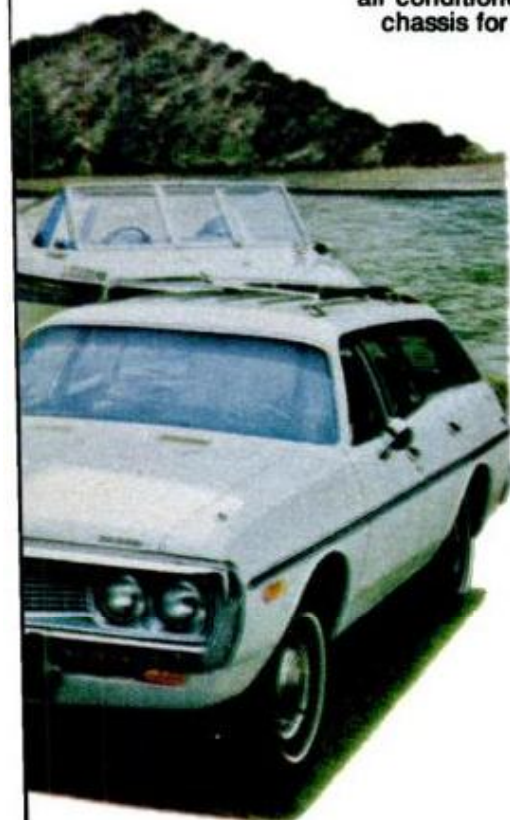
# recreational vehicle.

## Second, Motor Homes.

Motor homes are much more than vacation units. They're ideal for traveling with large families or taking friends to outdoor events such as football games. Or serving as a year-round hospitality suite. Motor homes are built by various manufacturers in a variety of sizes and interior luxury levels. But no matter which one you choose, you'll find Dodge builds the chassis for 80 percent of all motor homes.

### Van Conversions and Mini Motor Homes.

Van conversions are basically compact vans which offer added conveniences such as a stove or fold-down beds. Mini motor homes, on the other hand, offer expanded bodies and many of the conveniences of larger motor homes. Such as a shower, generator, and air conditioner. Again in this area, Dodge supplies more chassis for mini motor homes than any other manufacturer.

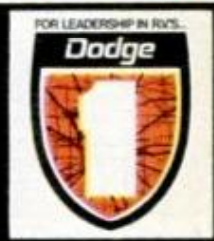


## Third, Trailer Towing.

This is the easiest way to start because you already own half the equipment. Your car. However, here again to handle the extra load, all cars require some special equipment. To make it easy for trailer towers, Dodge offers Chrysler-engineered, factory-installed towing packages. Depending on the car you select, you can get the basic equipment you need to handle a trailer weighing up to 7,000 pounds.



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Marlboro Red  
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8 mg. tar, 1.3 mg. nicotine  
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Warning: The Surgeon General Has Determined  
That Cigarette Smoking Is Dangerous to Your Health.

# Mobile entertaining indoors and out

Three novel roll-abouts—  
a cooking center, wet bar  
and hi-fi on wheels—give  
you a mobile rec room for  
year-round use anywhere.

**R**oll these three mobile carts out on a deck or patio and you have, in effect, an "instant" outdoor playroom all set up and ready to go for family fun and party entertaining. A brand-new concept in flexible, go-anywhere furniture developed by PM editors, the carts include a complete cooking unit with electric barbecue and built-in refrigerator (see below), a wet bar with sink and running water, and a self-contained stereo music center on wheels.

What's best about these versatile roll-abouts is that they're not limited just to outdoor use, either. There's no having to store them away between seasons while



**Mobile cook center** is designed for use with electric barbecue from Char-B-Que and a Sears mini refrigerator. Compartment on right side is for storing supplies.

PHOTOS BY  
ROBERT D. BORST



waiting for another summer to come around. Companion-styled with the smart good looks of fine furniture, they're as handsome and functional indoors as out. The cooking center, in addition to its barbecue and mini fridge, features swing-up extension wings that make it ideal for doubling as a buffet server inside. The rolling





wet bar and music center shown on these pages are match mates with hinged tops that swing down to conceal their contents when not in use. Closed, they look like sleek, modern credenzas ready for service in a living or dining area. On the next 14 pages, PM shows you how to build these unusual pieces you can't buy anywhere.



# 1. Mobile cook-center

by Harry Wicks

DESIGNED BY THE AUTHOR



**At indoor buffet (above) cart becomes the center of attraction. For buffet use, a three-well food warmer replaces the barbecue setup shown on page 69.**

**Compact refrigerator from Sears holds food and drink for typical get-together. Storage area is a bonus: Cooking and serving equipment is always at hand.**



This cook-center has a lot going for it if you enjoy year-round entertaining. During the warm months it's sure to draw raves from your neighbors when they spot it on your patio. At season's end, you simply roll it indoors for use in the family room. And, when not in service (photo above) it's a handsome piece of furniture that will suit any room decor.

The concept started with the electric barbecue cooker manufactured by the Char-B-Que Co., New Shrewsbury, N.J. The cooker can be used outside (indoors in a fireplace) for barbecues and, with its lid closed, for delicate, Chinese smoke cooking. Of die-cast aluminum the Char-B-Que is offered in four colors—orange, yellow, avocado and black. It sells for about \$60.

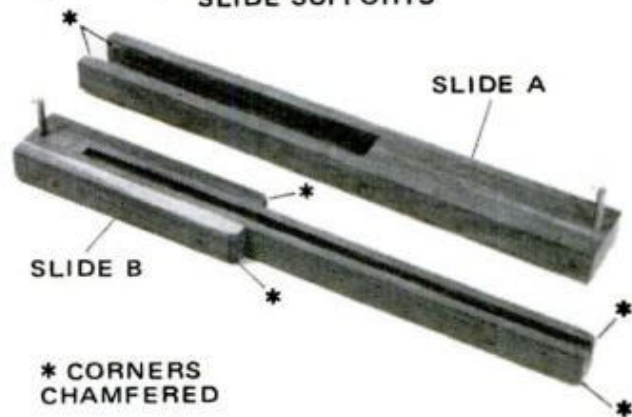
The other piece of equipment that played a major part in the cart's design is the coppertone Mini-Fridge which we selected from Sears, Roebuck's fall/winter 1972 catalog.

And the plastic-laminated countertop is an exciting new product too. The latest pattern from Formica Corp., it's called Butcherblock Maple. It looks like the real thing; in all probability, only experienced workshoppers will be able to spot the difference. The drop leaves, on which you cut and prepare vegetables, are the real thing, of course, made up of laminated strips of maple.

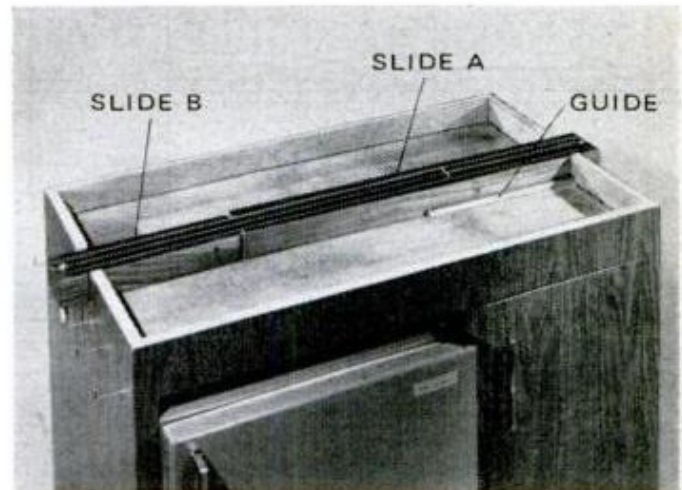
At the end of this article, you'll find a list of manufacturers of all major components used—including hardware.

To build your cart, it's a must to have your mini-refrigerator on hand. It will determine the final size of the cart (except for height). The top on the cart shown is at a comfortable, and recommended, cooking

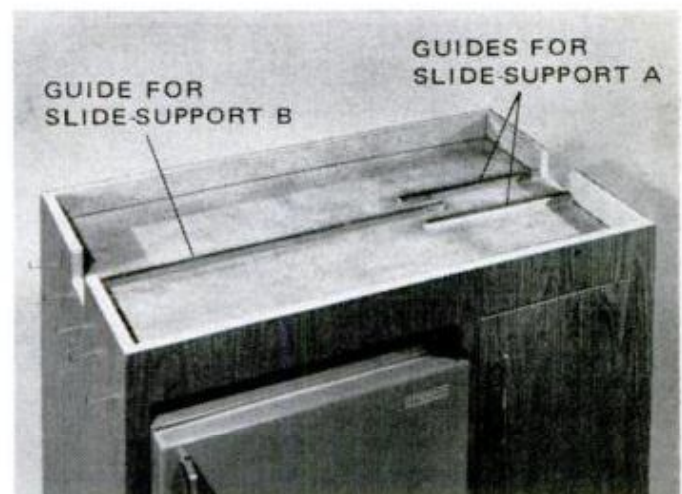
BOTTOM VIEW OF SLIDE SUPPORTS



Drop-leaf supports are of walnut, slide B inserts into slide A when the slides are fully retracted.



Slide B travels on a single 25-in.-long guide. Slide A is sandwiched between pair of 12-in. guides.



Guides should also be of hardwood. When satisfied with location, secure them with glue and 1-in. screws.

# 'Butcherblock' top looks like the real thing

height when used with the electric barbecue. If possible, do not alter this dimension.

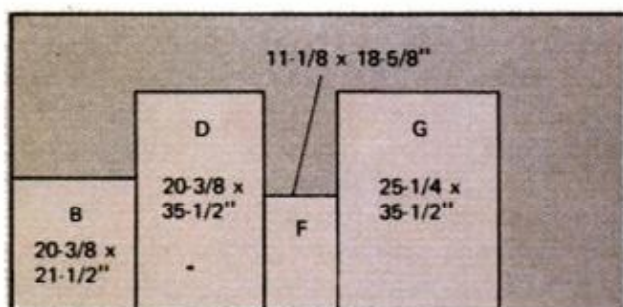
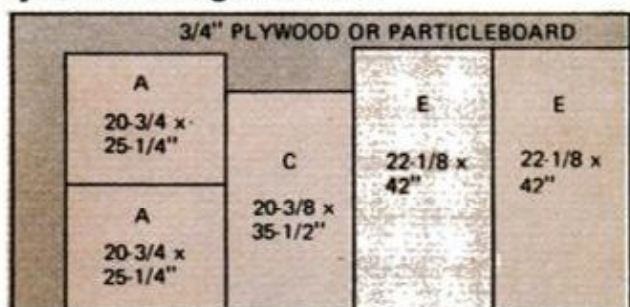
Start building by laying out the cart parts on two sheets of plywood. Before cutting, take time to double check those critical dimensions concerning the refrigerator. Assemble the cabinet using waterproof glue and screws and then apply the Gunstock Walnut laminate using contact cement. (See *How to Work With Plastic Laminates*, page 154, Mar. '70 PM, for laminating know-how.) You can flop the box about

so you can trim laminate overhang using your router and a carbide cutter, but you will have to do some hand-filing to square the four corners in each of the two openings at front.

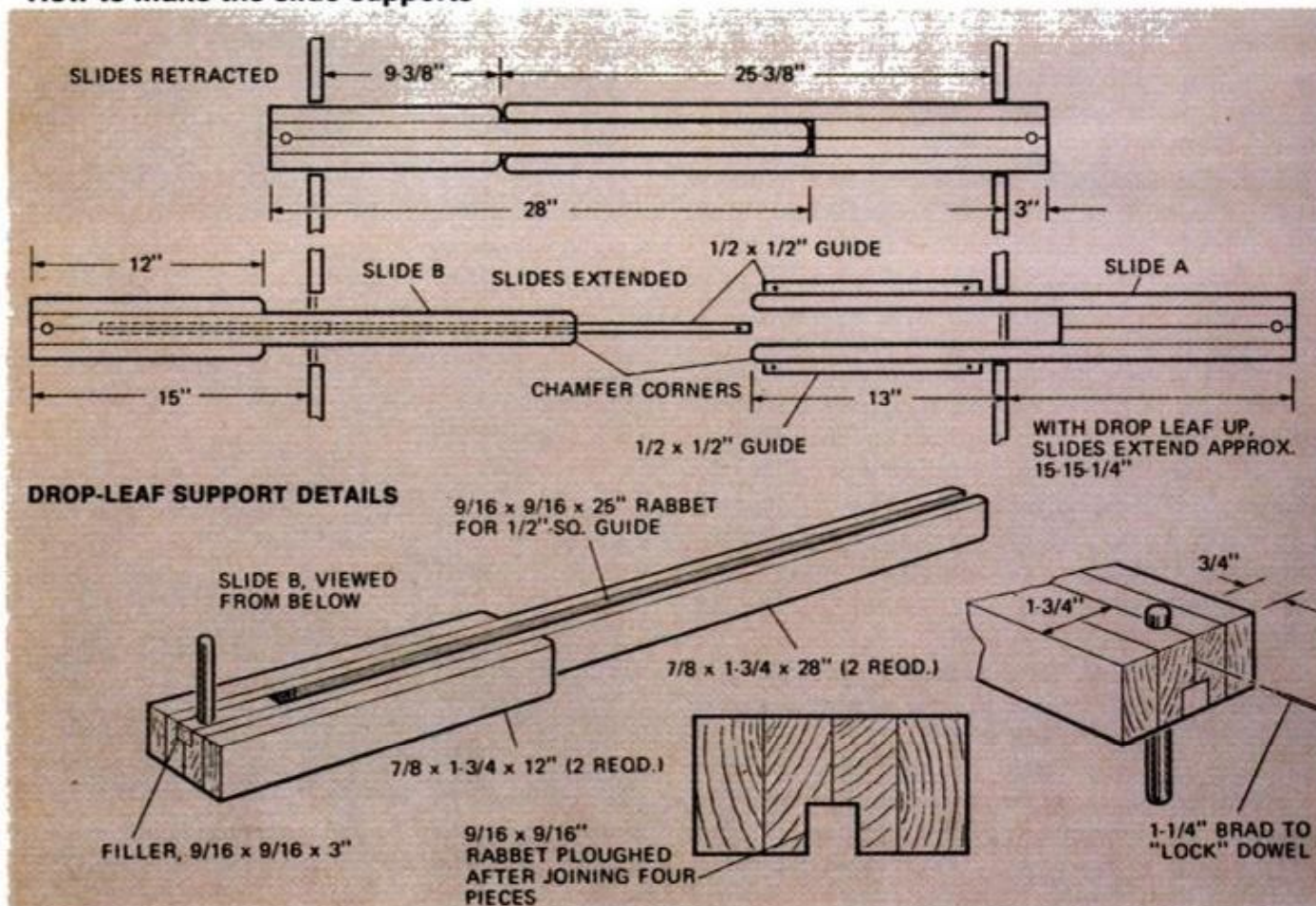
Next, make the cabinet top. After cutting the two pieces, use waterproof glue and 1 1/4-in. No. 8 screws to join the pieces. The top can now be covered with plastic laminate. Do the edges first and finish by applying the top.

Glue-up the maple chopping blocks (or

## Plywood cutting schedule



## How to make the slide supports



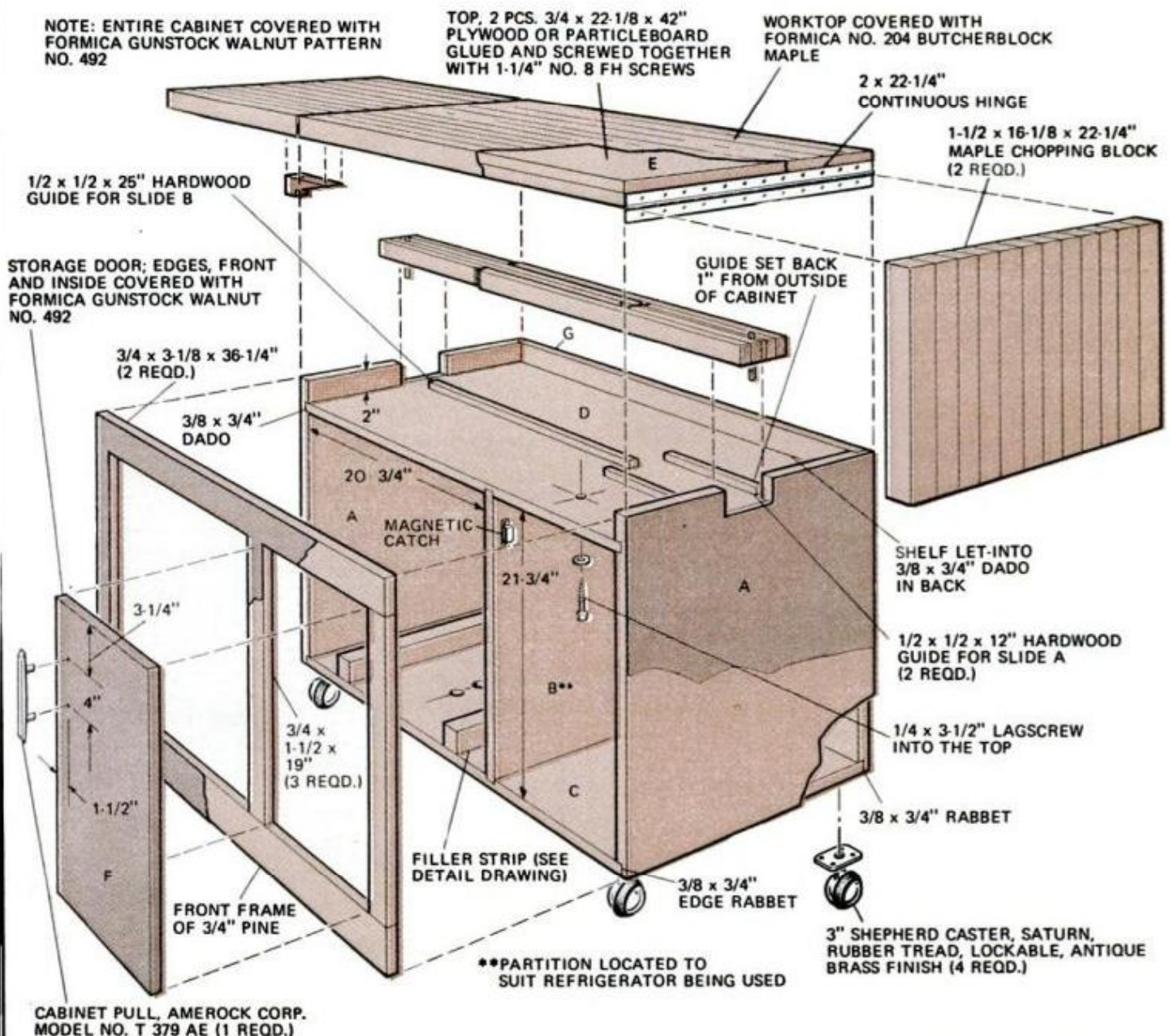
consider having this step done at your local lumberyard mill) and fasten these to the countertop using 2-in. brass-plated continuous hinge. Make absolutely certain that you drill adequate-size pilot holes in the maple chopping blocks for the hinge screws or you are almost sure to pop the heads off a number of screws.

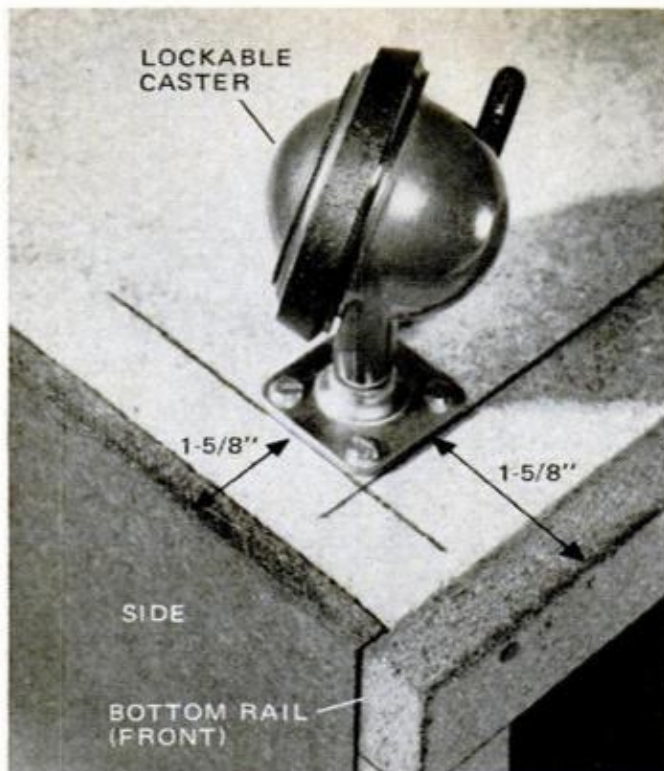
Although the weight of the top itself holds it in place, you are well advised to anchor it using one lagscrew as shown in the drawing below. The four corner blocks

prevent lateral movement of the top but at any social gathering there is a chance that a guest will lean on one of the upraised drop leaves. With the cooker going full blast, that could cause a tragedy. The single anchor, we found, absolutely prevents any chance of tilting the top.

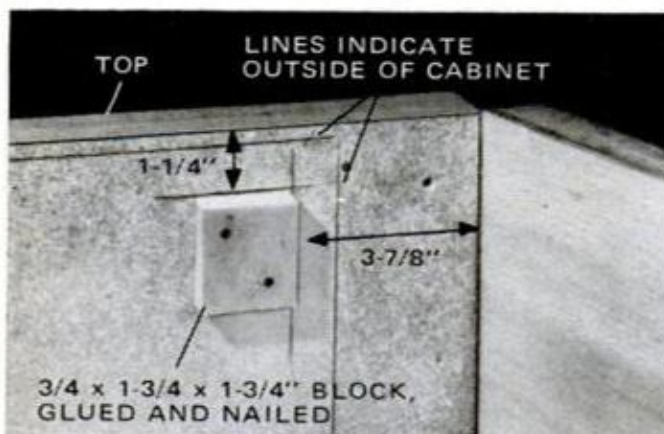
When you're satisfied with the installation, remove lagscrew and top so that you will have less weight to handle while you work on the remaining details. For example, the cart can now be rested on its back

### Exploded view of the mobile cook-center

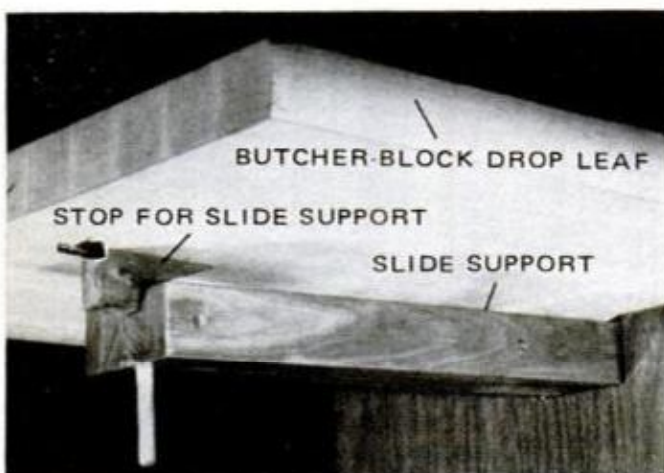




**Lockable casters**, by Shepherd Casters, permit cart to roll easily on patio surface despite unit's weight. The casters used are mobility-rated at 100 lbs. each.



To locate top on its base, place the top on unit and measure overhang on all four sides. Then, using a pencil, draw the cabinet outline on the top. Flop the top and locate one block at each corner as shown.

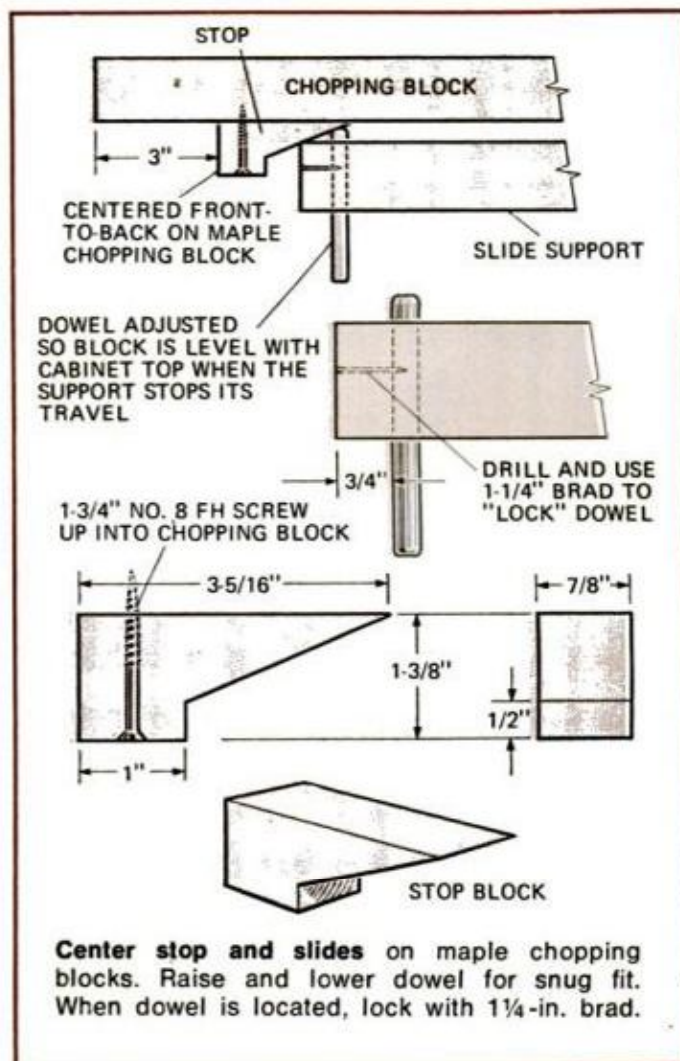


Position hardwood stop so slide-support assures drop leaf being level with cabinet top when extended.

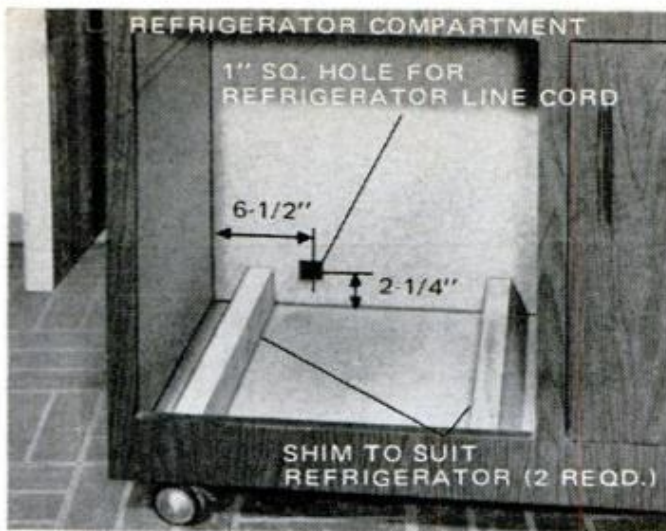
and the casters attached. This makes it easier to move the cart around as you advance to the finishing stages. Right the cabinet and you can go to work installing the flush-mounted storage door (after first fitting and laminating it). To keep this cart's look compatible with its match-mates, Soss hinges were used to mount the door. You could, if desired, pick a pair of flush-mount hinges that will match the door pull, but keep in mind that no such hardware was used on the other two carts (if you plan to build them).

The barbecue tools hang from 2-in. brass L-hooks. Simply lay out your set of tools as you prefer and turn the hooks into pre-drilled pilot holes. If your cooking-tool collection is substantial, add hooks at the right end of the cabinet.

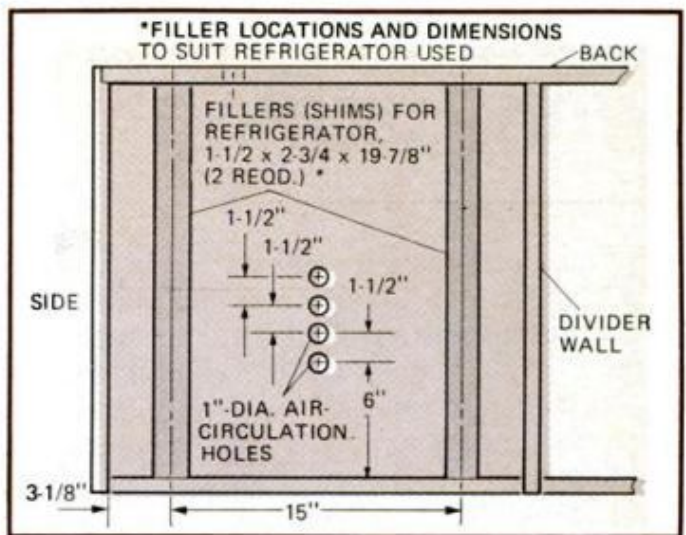
The slide supports for holding up the drop leaves look trickier to build than they actually are. Take the time to study the details in the drawings and photos. Notice that slide B inserts into slide A when both are pushed into the cabinet. You'll need four lengths of hardwood 28 in. long and



Center stop and slides on maple chopping blocks. Raise and lower dowel for snug fit. When dowel is located, lock with 1/4-in. brad.



Refrigerator compartment must be sized to suit model. Shims should be sized so refrigerator slides in and out easily—with space at top for air circulation.



Adequate venting is a must. Drill minimum of four holes—more if you select larger-size refrigerator. Shims beneath are then glued and tacked in place.

four lengths 12 in. long to make the pair. After gluing up the supports, plough the rabbet along the length of slide B which will travel on the 1/2-in. square guide. You can cut a blind rabbet, but it is easier to run the full length of the slide and then add a small filler strip at the outboard end.

After making your slides, position them in the cabinet to mark the guide location. At this time also check the stop position when slides are retracted—they should stop with 3 in. projecting from the cabinet.

To locate the small triangle-shaped slide support stops, lift the first drop leaf and extend the support exactly 15 in. Note: The slide should butt the stop snugly so that the leaf is level with the top. When you have achieved this position, mark and drill for fastening the stop. Repeat the procedure on the second drop-leaf.

The final step is to install the shims (fillers) on which the refrigerator rests. They should be level with, or slightly higher than, the bottom rail so the refrigerator can be easily removed. ★★★

### Manufacturers of materials

**Plastic laminate,** Butcherblock maple No. 204 and Gunstock Walnut No. 492, Formica Corp., 120 East 4th St., Cincinnati, Ohio 45202.

**Electric barbecue;** Electric Char-B-Que, New Shrewsbury, N.J. 07753.

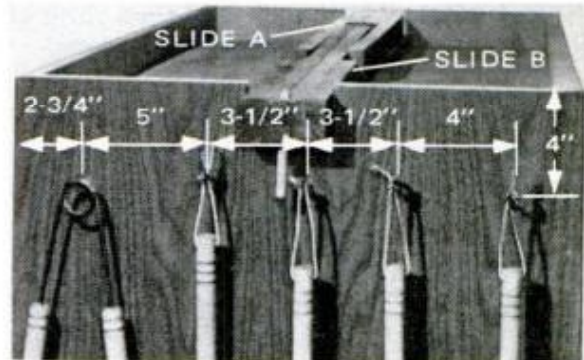
**Ground fault interrupter,** Model GFP-115, Harvey Hubbell, Bridgeport, Conn.

**Casters;** Saturn (SN) 3-in. lockable casters, Shepherd Casters, Inc., St. Joseph, Mich. 49085.

**Refrigerator;** Model 644.73872, Sears, Roebuck catalog.

**Door pull;** Model T 379 (AE), Amerock Corp., Rockford, Ill.

NOTE: LOCATION OF HOOKS FOR BARBECUE TOOLS TO SUIT OWNER'S COLLECTION



Barbecue tools are always at the ready on this cart. Hooks are spaced to suit owner's barbecue tools.

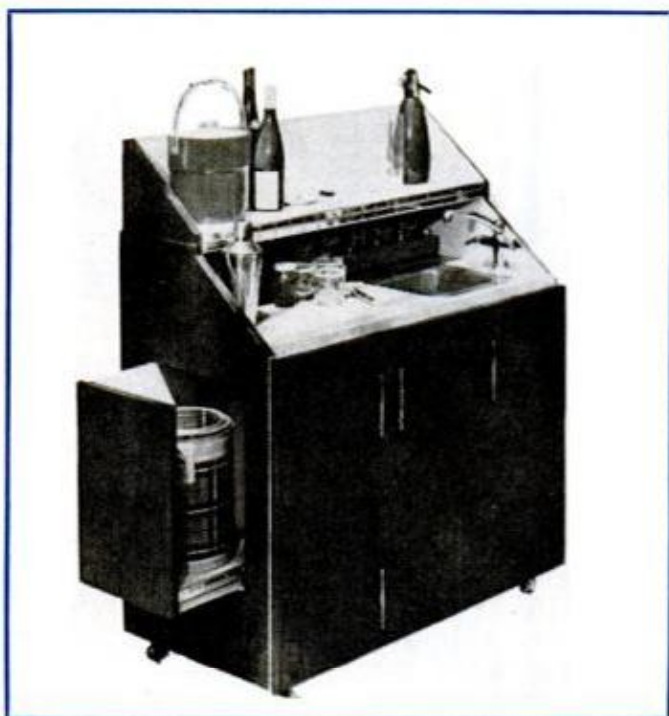


For safety, use ground fault interrupter on outdoor outlet. (model shown is by Harvey Hubbell). Use No. 12-ga. extension cord to power refrigerator, cooker.

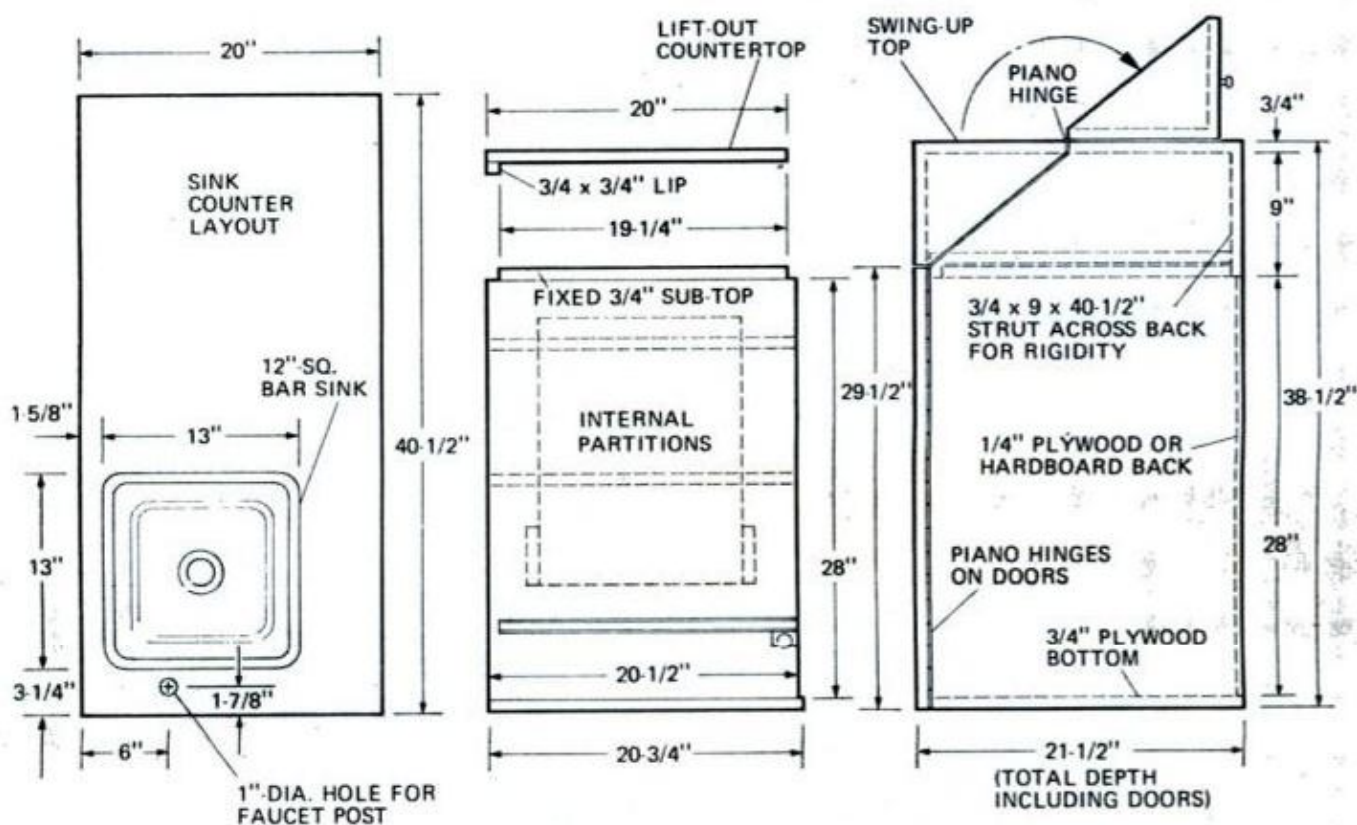
## 2. Roll-around wet bar with running water

You don't usually expect to turn on a faucet in a small home bar and really get running water—but you do with this one. Not only does the novel unit feature a built-in sink and water supply, but, like the mobile cooking center shown on the preceding pages, it's also designed for versatile, go-anywhere use—out on a deck or patio for summer entertaining or indoors in a play or family room for year-round enjoyment any time. Like the cooking center, it rolls on heavy-duty, ball-type Shepherd casters and is finished in the same exterior materials to have a similar appearance. The sink board is covered with Butcherblock Maple laminate—a new Formica countertopping that so closely duplicates the look of a real wood chopping board you have to touch it to tell the difference. The top, sides and doors are faced with Gunstock Walnut—another new Formica pattern with deep, rich, wood-grained walnut tones.

The rolling bar is designed around



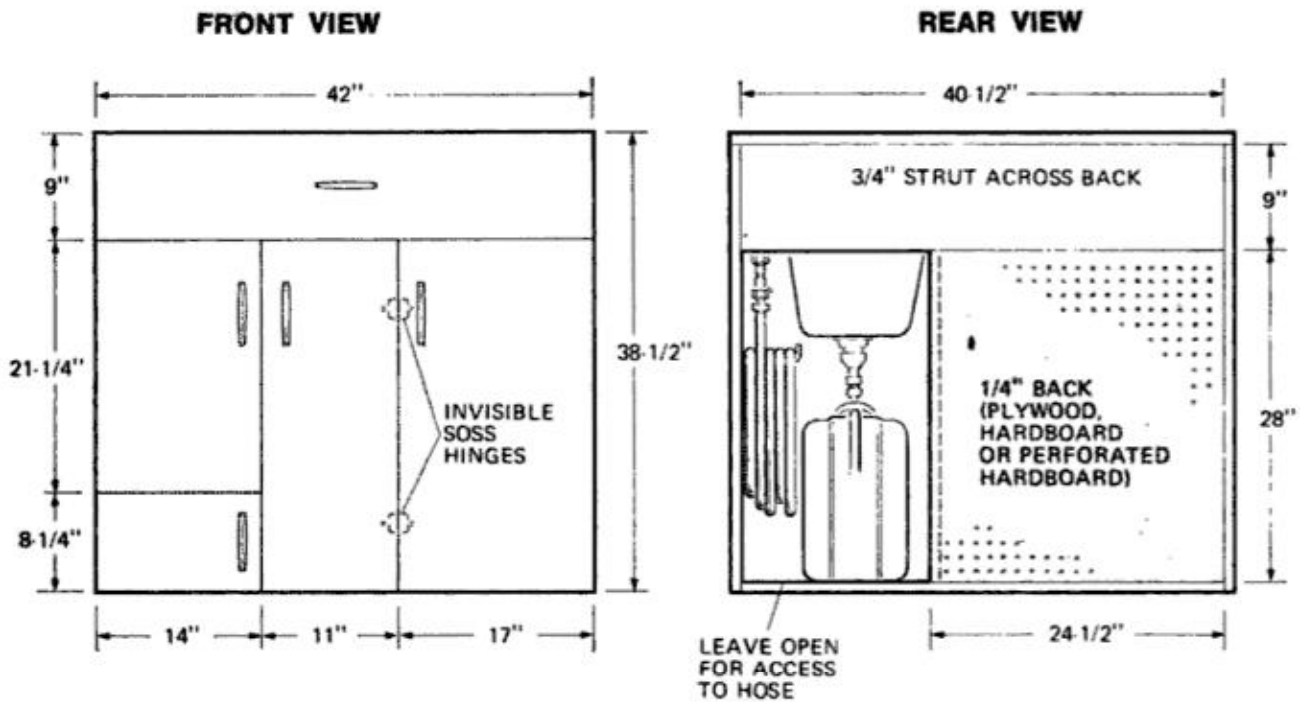
With top open, mobile bar provides a two-level work and serving counter for mixing drinks, with sink at right end on lower level. Slide-out drawer stores an ice cooler, matches similar wings on the hi-fi cart.



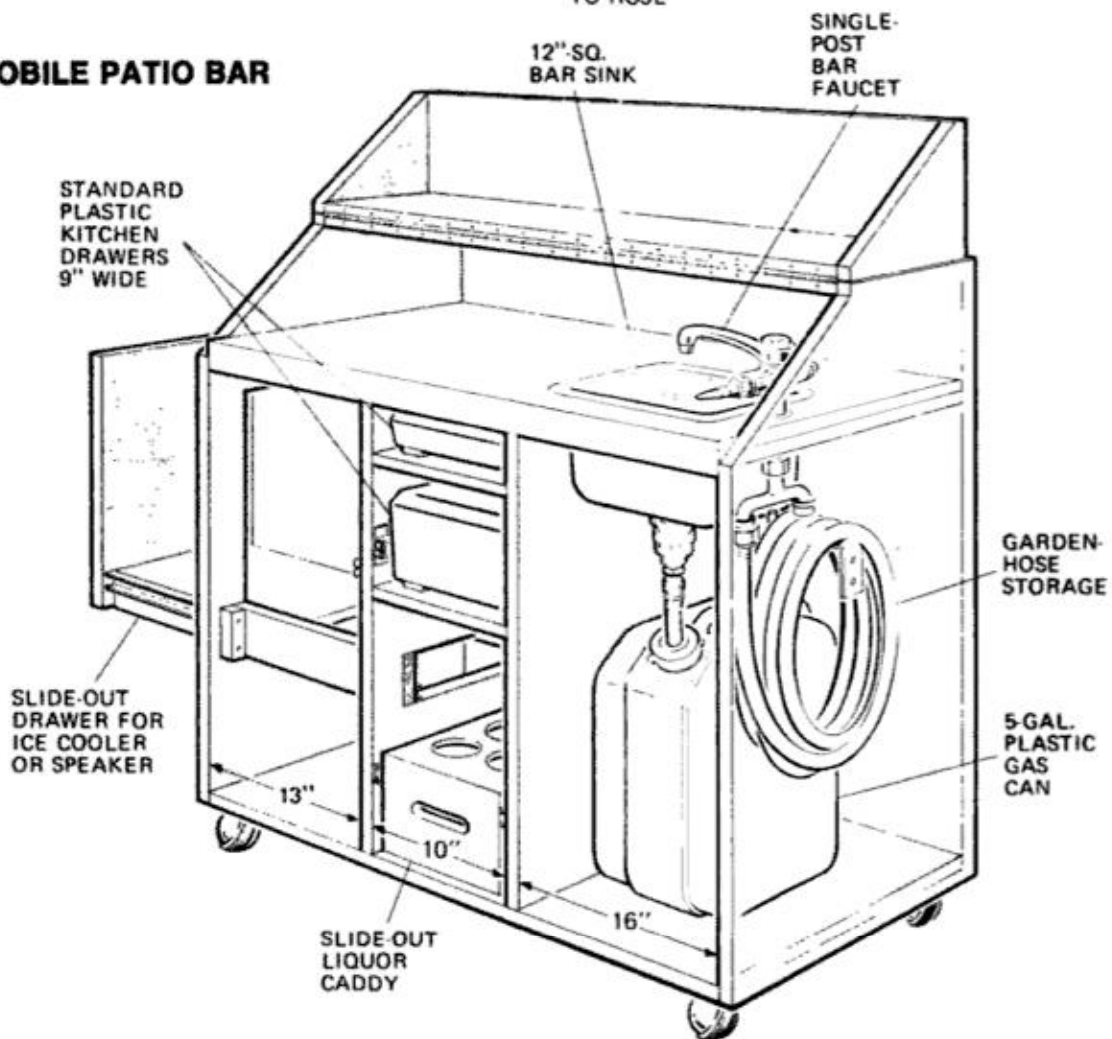


# By Sheldon Gallager

EXECUTIVE EDITOR  
DESIGNED BY THE AUTHOR

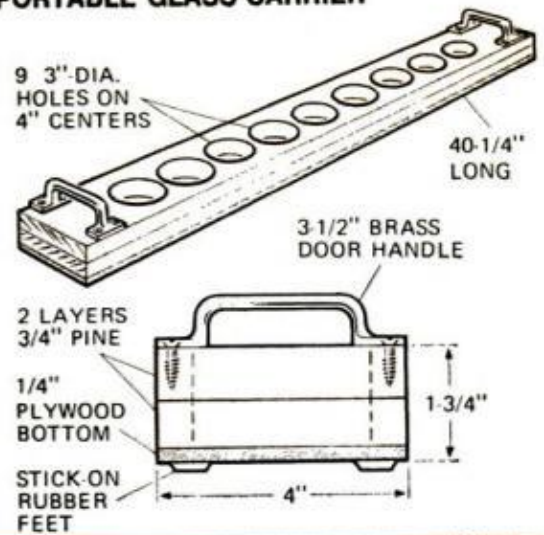


## MOBILE PATIO BAR

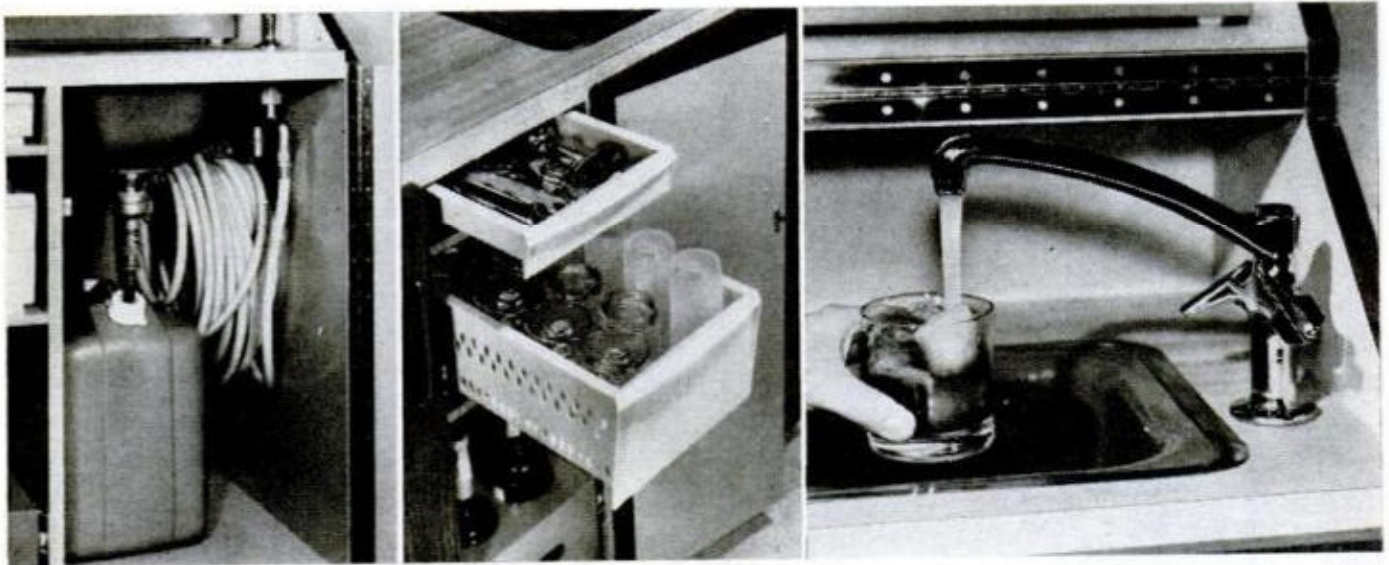




### PORTABLE GLASS CARRIER

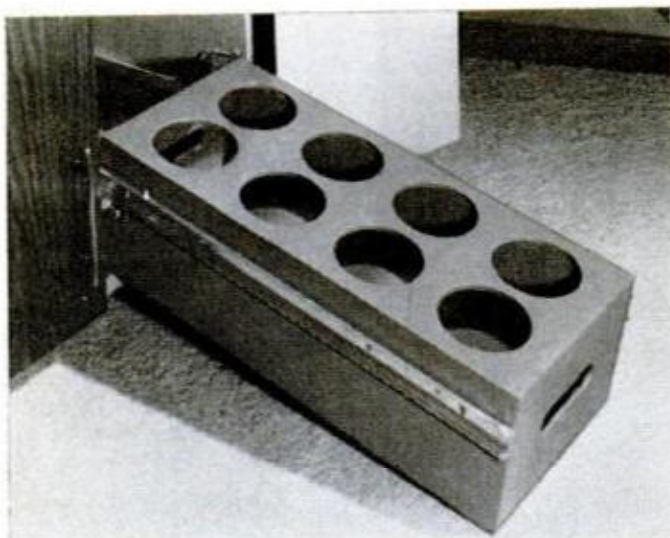


Portable glass carrier stores at rear of counter on lower level, but can be lifted out and placed on upper shelf for easier access when bar is in use. It holds nine short Old-Fashioned-type glasses in holes in rack.

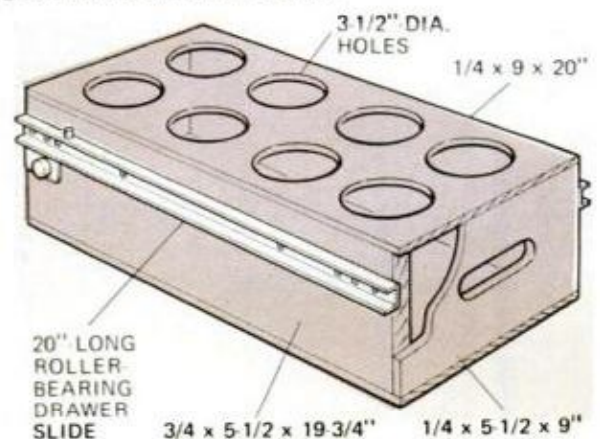


Sink drains into 5-gal. gas can (left, above) used as temporary "holding tank." Water is fed from garden hose stored on hanger alongside tank. The single-post

pantry faucet (right) is smart-looking, has high-mount spigot, making it easy to slip a glass under it. Plastic drawers (center) hold glasses, bar supplies.

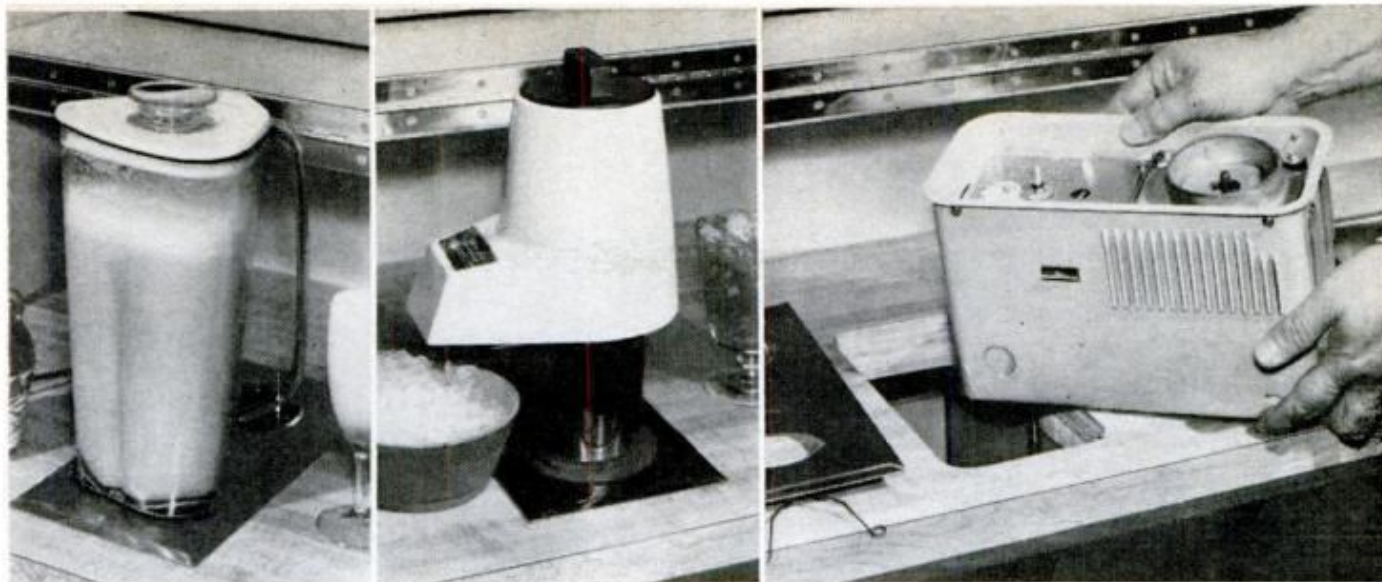


### SLIDE-OUT LIQUOR CADDY

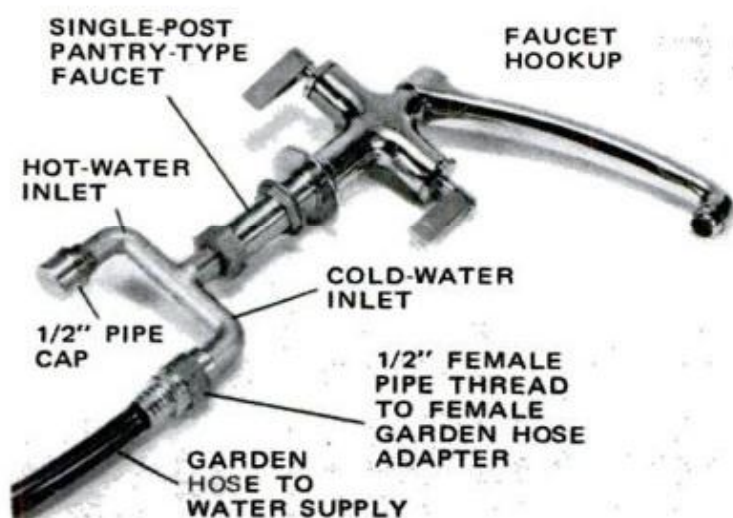


Slide-out liquor caddy is located at bottom of the center section in cart, rolls on standard 20-in.-long metal drawer guides. It is a simple box of 3/4-in.

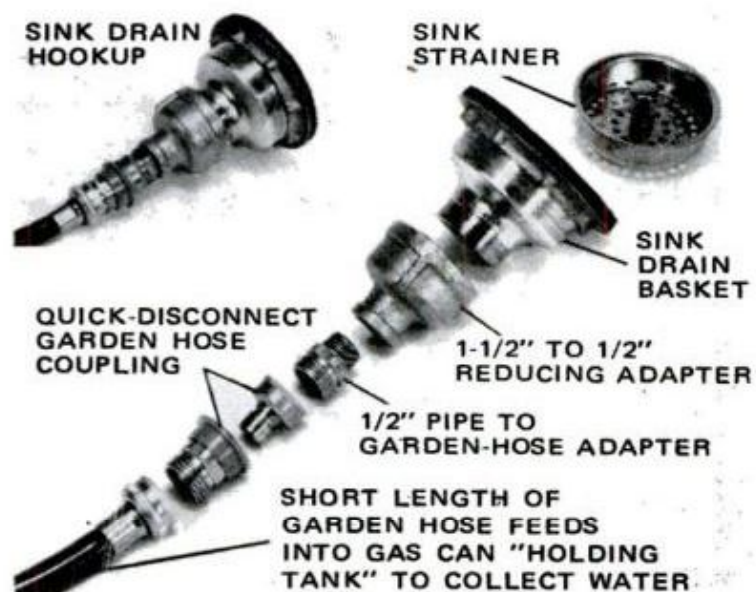
plywood with 3/4-in. sides. Eight 3 1/2-in.-diameter holes in the top hold most types of liquor bottles and keep them from tipping over when cart is rolled about.



Optional accessory that adds usefulness to bar is NuTone's built-in countertop kitchen-appliance center. Motor unit recesses into counter (right, above), takes snap-in drink blender (left) and ice crusher (center).



Simple faucet hookup to garden hose is shown above, using pipe-to-hose adapter. Hot-water inlet, unused, is capped off.



Sink drain requires 1½-to-½-in. pipe reducing adapter, plus garden hose coupling, to feed sink waste into holding tank.

a trim little 12-in.-square Kohler sink with a handsome chrome single-post, pantry-type Kohler faucet. The sink comes in several striking colors—bright red, deep blue, brown and orange. We chose the red, which adds a gay, colorful, festive touch to the maple bartop and walnut exterior. The pantry-type faucet is ideal for bar use because its high-mount spigot is easy to reach under for filling drinks and rinsing glasses. The water hookup is simple—merely a garden hose connected to the faucet's cold-water inlet by means of a hose adapter fitting, as shown in the photo at left. To be sure the hose stays clean, buy a new one and keep it for bar use only—never use one that's been lying around the yard collecting dirt.

Indoors, the hose can be connected to a laundry tub, washing-machine filler pipe or similar water source, or you can make a semipermanent hookup with plastic pipe or copper tubing. Since hot water is rarely needed in a bar, the faucet's hot-water inlet is capped off and not used.

The sink drains into a five-gallon plastic gas can that serves as a "holding tank" like those used in motor homes and campers. The can easily holds the small amount of water used in the course of an evening's party and eliminates the need for complicated waste plumbing. Since nothing really dirty goes into the tank, sanitation isn't a problem. Just remember to empty its contents after each use

### 3. Mobile hi-fi for music outdoors or in



With speaker wings extended (left), you have a complete hi-fi center with good stereo separation. Shown here are



Garrard Zero-100 turntable and Panasonic receiver. Closed (right), unit becomes stylish credenza.

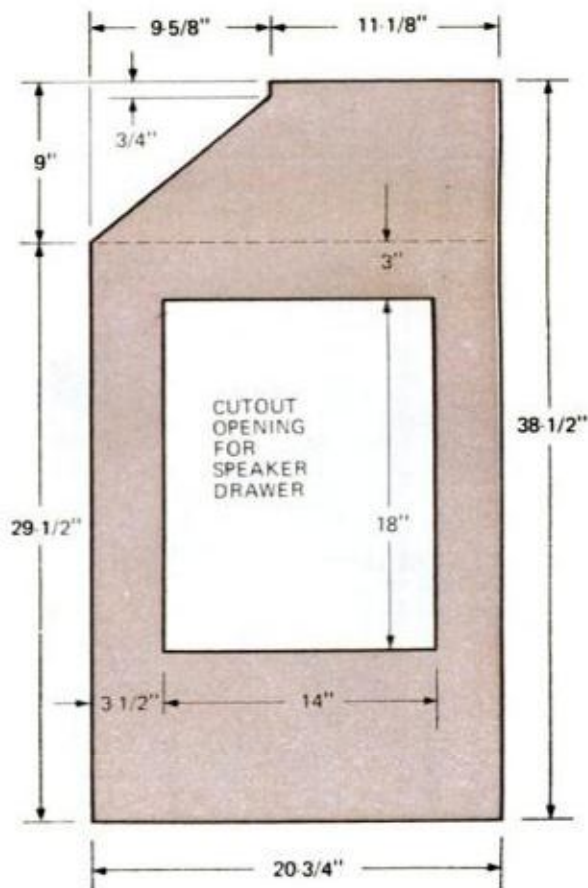
and rinse it out to keep it clean. The can stores in a compartment under the counter and is quickly detached from the sink drain for emptying. Using a slip-type, quick-disconnect hose coupling speeds the job.

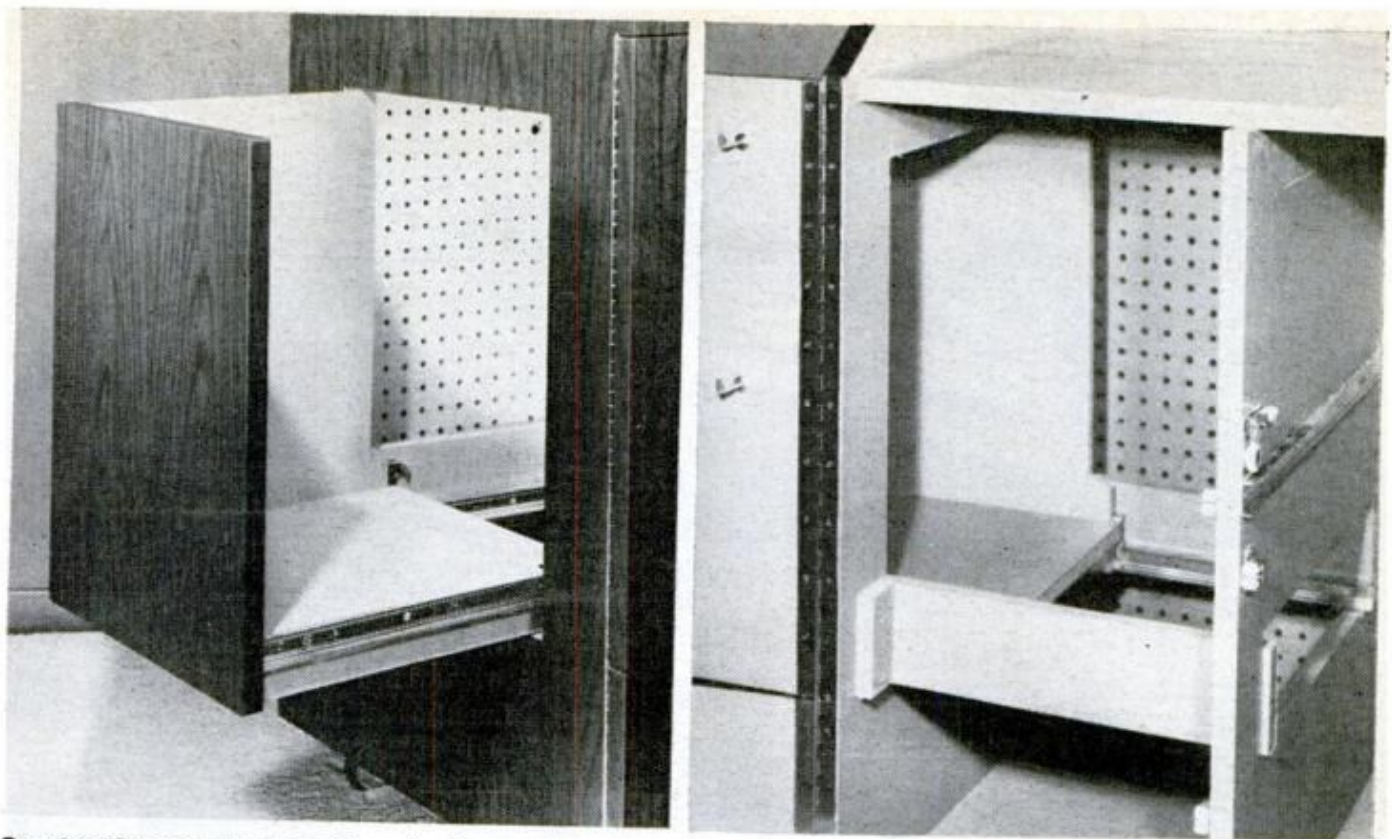
Besides the built-in sink, the mobile bar cart offers several other novel features. A hinged top swings up to form an extra serving shelf above the sink counter and closes to conceal the bar when it's not in use. There's a portable glass rack, a slide-out bin to hold an ice cooler at one end and a handy liquor caddy that stores whiskey bottles in neat, partitioned compartments to keep them from spilling when the cart is moved about.

As a companion to the bar, the identically styled mobile music center shown on these pages makes an attractive and useful match mate. Like the bar, it rolls on 3-in. Shepherd casters for use indoors or out, has a similar hinged top to hide its contents when not in use and is finished with the same Butcher-block Maple laminate for the counter and Gunstock Walnut for the exterior. In addition, the inside of the top on both the bar and hi-fi carts is finished with Formica's Harvest Gold laminate or can be painted if you prefer. To tell how these handsome look-alike carts appear in color, see pages 70 and 71. Here they're shown in an outdoor setting on Ozite's colorful, striped Sunnyside Up outdoor car-

#### OUTSIDE END PIECES

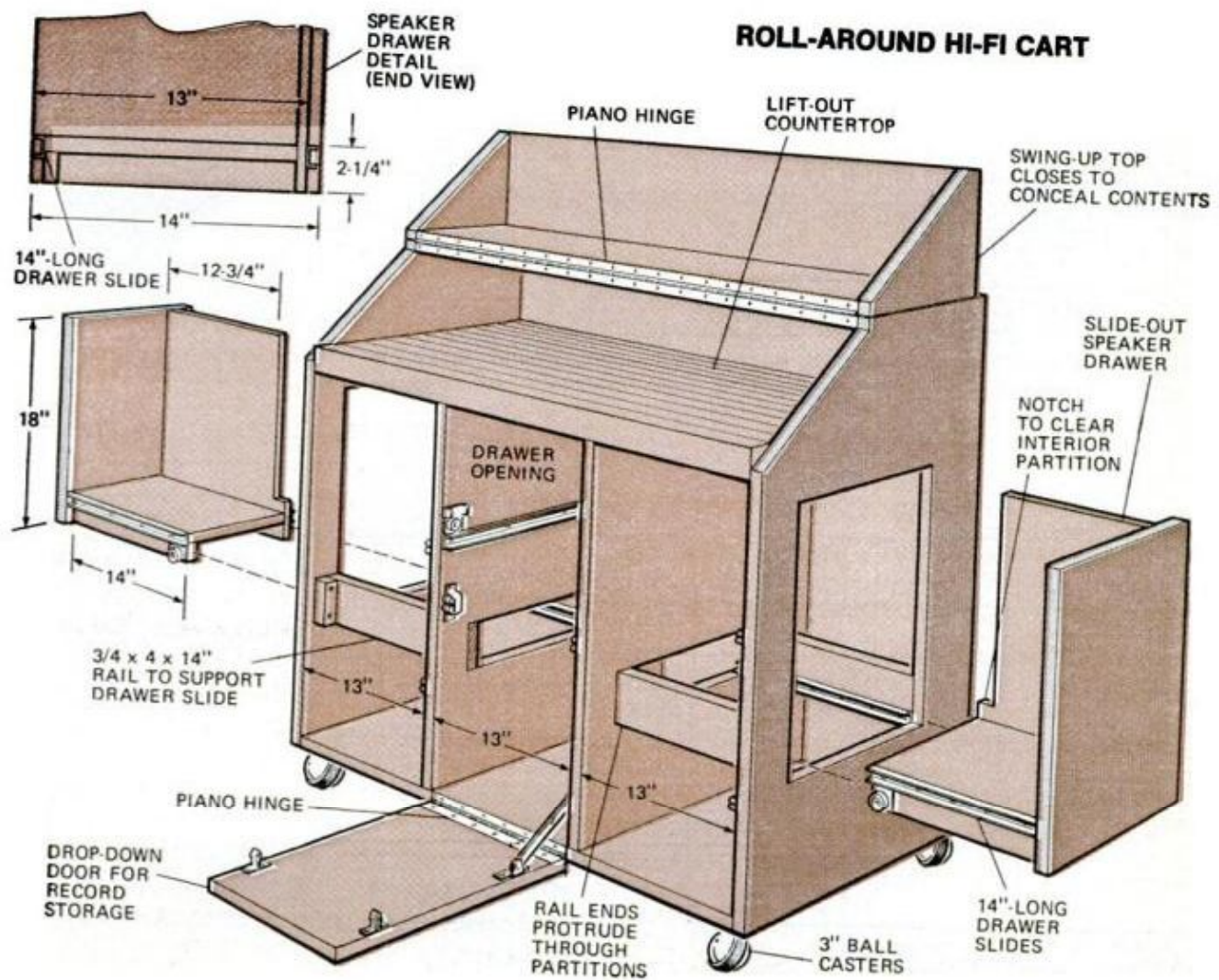
(SAME FOR BOTH CARTS)

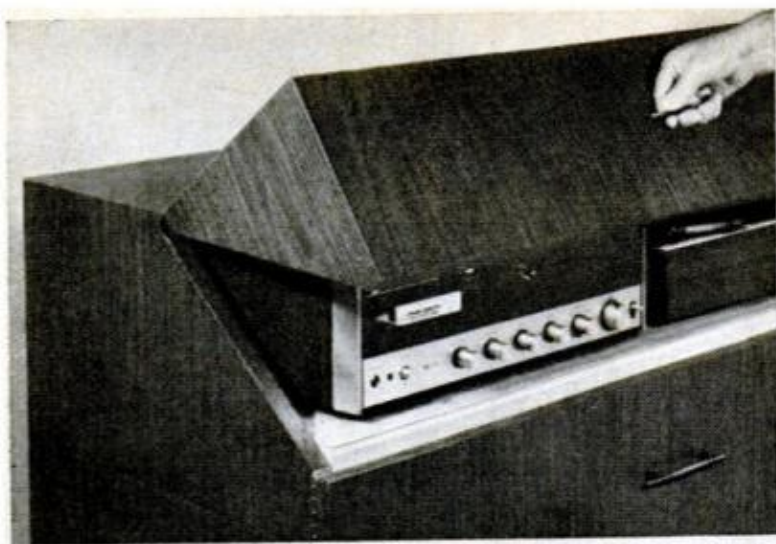




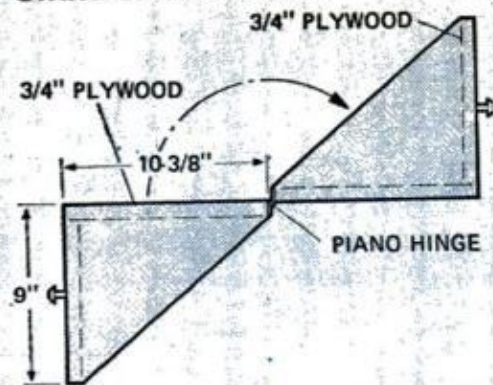
Construction of speaker wings is shown above. Interior view (right) shows how wings slide on standard

14-in. drawer guides held by wood side rails. Rail ends extend through partition for adequate clearance.





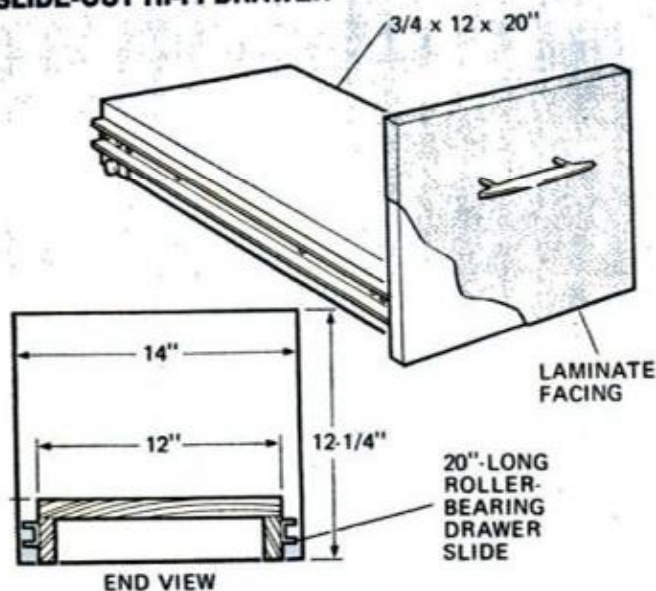
### SWING-UP TOP DETAIL



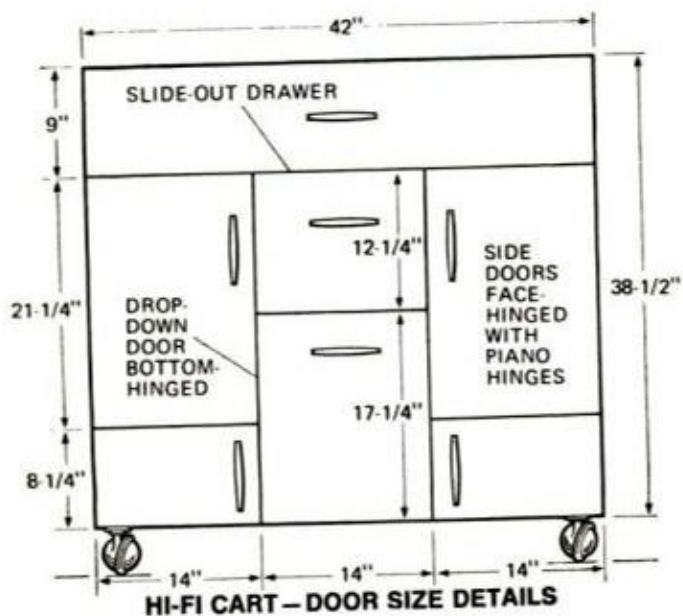
(SAME FOR BOTH BAR AND HI-FI CARTS)

Hinged top swings down to conceal contents when bar or hi-fi cart is not in use. Hinged section is deliberately made  $\frac{3}{4}$  in. shallower than rear half so that handle won't hit wall when top is swung back in open position.

### SLIDE-OUT HI-FI DRAWER



Slide-out drawer in music cart holds additional hi-fi equipment that won't fit on upper counter—here, a Panasonic cassette deck. It rolls on standard metal drawer guides, can also house slide projector set to go.

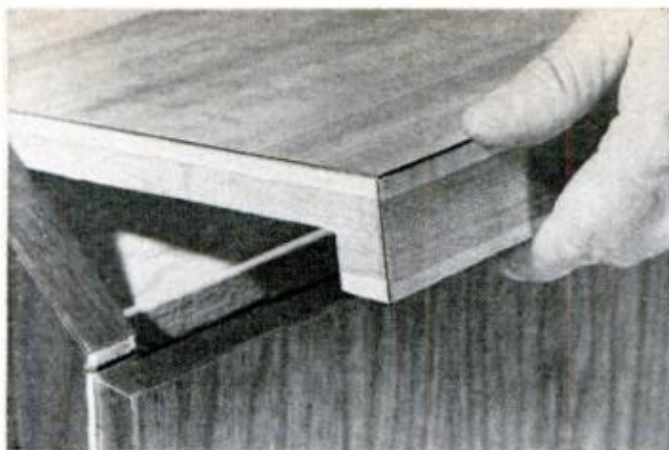


HI-FI CART - DOOR SIZE DETAILS

peting—an ideal covering for a deck or patio.

The music cart stows everything you need for a complete hi-fi system on wheels. There's room on the counter for both a receiver and record player or similar equipment, and a drawer pulls out from underneath to hold additional gear such as a cassette deck, tape recorder or slide projector. Twin speaker wings pull out from the ends for good stereo separation, then slide back in out of the way when they're not in use. There's also plenty of space for storing records, tapes and other supplies in drawers and compartments at the base of the cart.

To simplify construction, ready-made



**Lift-out countertop** is removable for easy cleaning. Note self-edged front lip for thick, rich appearance.



**Drawers under speakers** store tapes, other hi-fi supplies. Door backs are handy for hanging headphones.

plastic drawers are used in several places in both the bar and music carts. These are the type made by Rubbermaid for kitchen use and are readily available in hardware and variety stores. They come in stock 9 and 12-in. widths for several dollars apiece. The carts' dimensions have been carefully worked out to accommodate these standard sizes. There's provision for two 12-in. drawers at the bottom of the hi-fi unit and one in the bar cart under the ice cooler. The bar also takes two 9-in. sizes in its center compartment for bar utensils, cocktail glasses and other supplies.

The bar and hi-fi carts are identical in construction except for the arrangement of their internal compartments. Each is 42 in.



**Record-storage compartment** has drop-down door that doubles as convenient shelf for sorting selections.

long, 21½ in. deep and 42 in. high. The basic parts are all of ¾-in. plywood with lighter ¼-in. material for the backs, either plywood or hardboard. Note that the countertop in each is actually double-thick. There's a fixed sub-top to give the cart rigidity. On top of this is a separate lift-out counter board that can be removed for easy cleaning or for replacing should the board become marred or you wish to change to a new color scheme. This lift-out top has a ¾-in.-square strip tacked across its front edge to form a 1½-in. deep lip. The lip is self-edged in the same Butcherblock Maple laminate as the top surface, giving the counter the thick, rich appearance of a real chopping block. For tips on applying the laminate, see the section on building the mobile cooking center.

The dimensions shown here are for the wood parts alone and do not take in account the extra thickness of the plastic laminate. This is done for the convenience of those who may prefer to give the carts a natural-wood or painted finish, omitting the laminate. If you decide to apply the laminate facings, slight adjustments must be made in a few of the dimensions to allow for their ¼-in. thickness. With one exception, the doors and swing-up tops are all face-attached with full-length piano hinges, elimi-

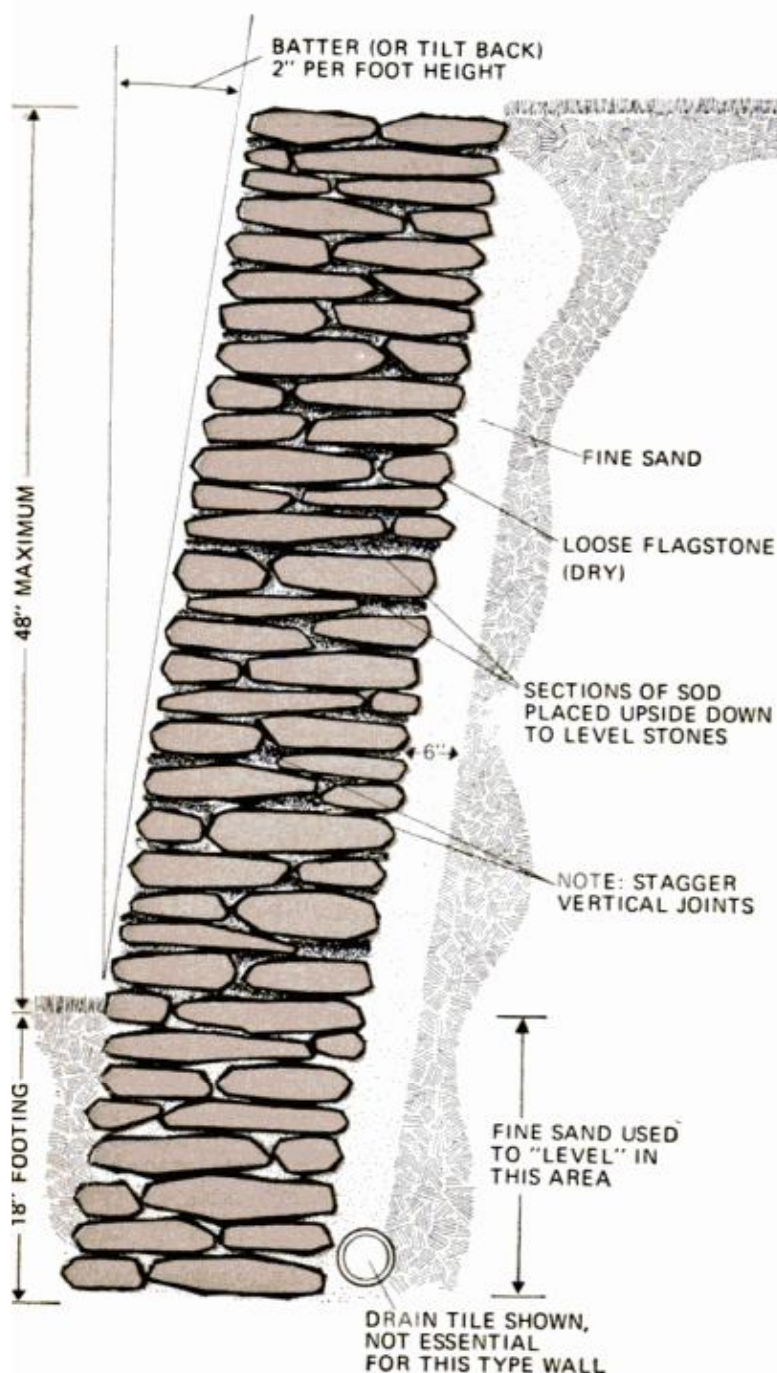
*(Please turn to page 182)*

# How to build retaining walls

Though a sloped piece of ground is often attractive, just as frequently it is a homeowner's headache. Water and wind erosion can raise havoc with the land and, though seeding may solve the problem, it creates another: The resulting growth is hard to maintain. In most cases, a retaining wall—if properly built—is the answer.

One important point to keep in mind: Water trapped behind a retaining wall will cause damage by freezing. Thus, you will need good drainage, such as that provided

by laying perforated drain tiles alongside the base of the inside wall as shown. Though drain tiles are desirable behind a dry (stone or tie) wall, they are a *must* behind masonry walls. Tiles should be pitched about  $\frac{1}{4}$  in. per lineal foot and lead to a dry well (or should be elbowed out through the earth at the end of the wall). You should also cover the tiles with at least 1 ft. of coarse gravel. Any moisture will then flow along the asphalted wall and be picked up by the tiles.



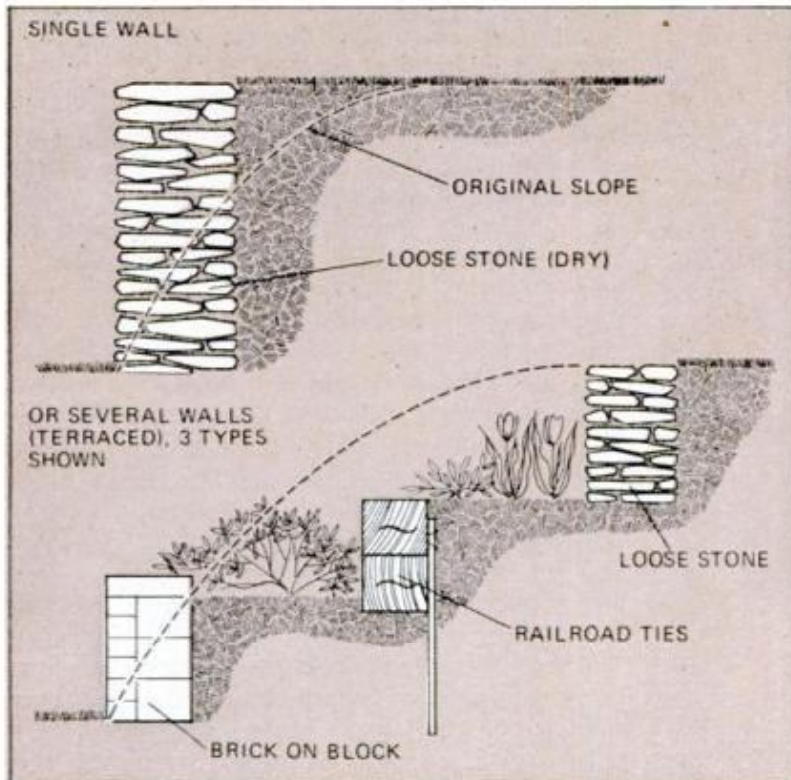
## Dry stone walls

A loose or "dry" wall of stone or flagstone is easiest to build, but this type must not be used when a height of more than 4 ft. is required. Its porosity will give such a wall some protection from the heaving and settling that's caused by weather changes, but it still should have a dry footing (sand) at least 18 in. deep.

Once the location has been determined, dig a trench 18 in. deep by 18 in. wide. Start laying the stone in place, taking care to see that adjacent stones are nearly the same thickness. Where there is an uneven thickness of stones in the footing, this may be leveled with an inch or two of fine sand. When you start the next course above, be sure to place the stones so that joints are staggered—solid stone above each joint in the course below—to "lock" the wall together.

After laying the footing, backfill and tamp behind each course as it is laid above the base grade; backfilling later could make the wall buckle. To level stones above grade, place sections of sod on them, upside down. Roots of the sod will hold the earth in place until settling is complete, also facilitate planting of vines or creepers in the finished wall. The wall should tilt back to get a finished face batter (rake) of about 2 in. for each foot of wall height—about 8 in. for a 4-ft. wall. A dry wall may taper to a minimum thickness of 12 in. at the top, but since an 18-in.-thick wall is stronger, it's recommended.

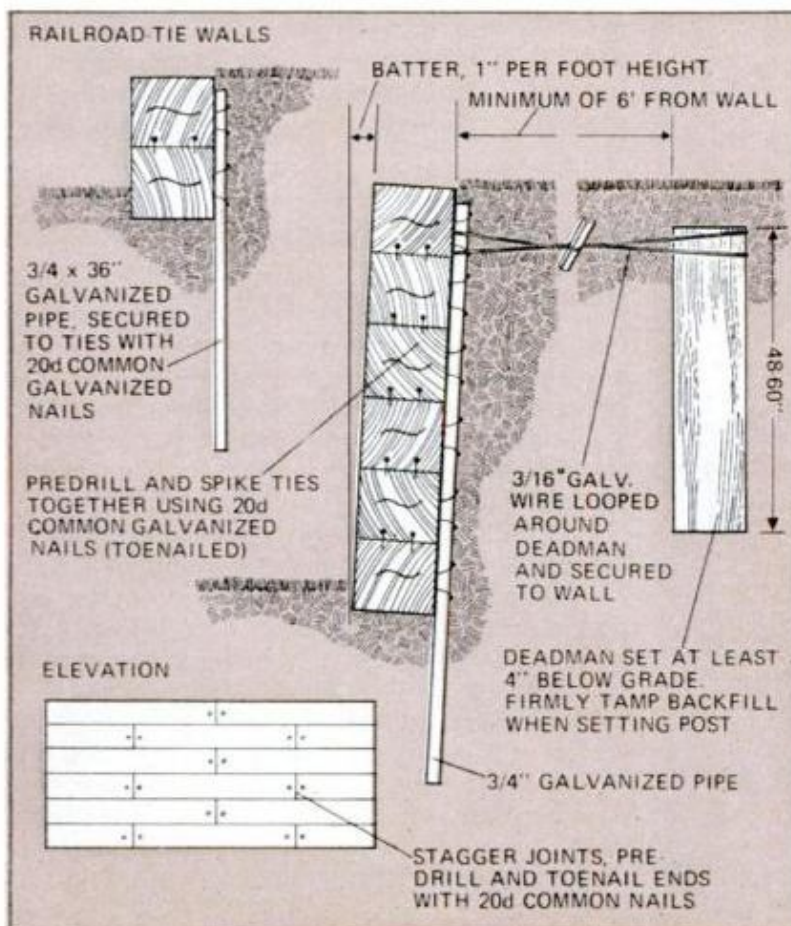




### Terracing alternative

The higher the wall, the more complicated and more difficult it will be to construct it. Especially for a greater drop, you may want to consider the alternative of "stepping" or terracing the slope with two or more smaller walls. These may be of different types, as shown in the drawing at left, or all the same.

To avoid the nuisance of having to mow grass on the steps, ornamental planting is suggested. Height of the walls and depth of the terraces will, of course, depend on the original slope of the land, and you must have enough horizontal space to step a given height or you will have to build a higher wall. As a rule of thumb, the depth of each terrace must be at least equal to the height of the wall below it; otherwise, the condition will be the same as that of a single wall that has been built too high and not strong enough.

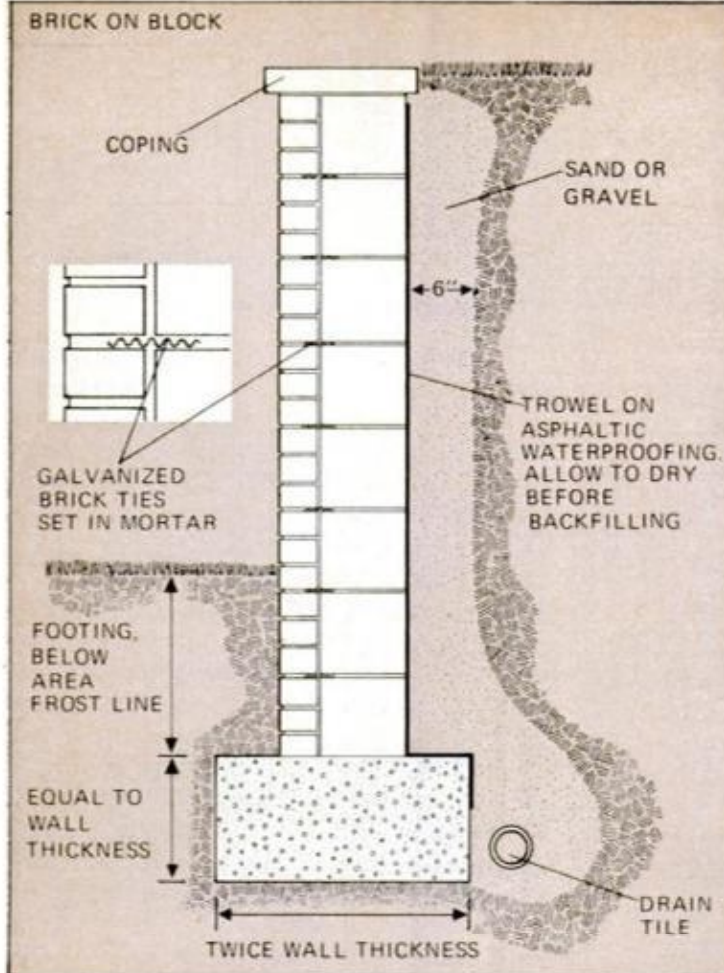


### Railroad-tie walls

A retaining wall made of used railroad ties is nearly as easy to erect as a dry stone wall. While the footing required is not as deep, hauling and placing ties—weighing about 210 lbs. each—will require help. Ties up to three tiers high can be stacked, if joints are staggered, with only a leveled trench 6 in. deep for a footing. A section of  $\frac{3}{4}$ -in. galvanized pipe, driven at least 18 in. into the earth and clinched to the ties with 20d galvanized common nails, will hold them.

Walls higher than three tiers should employ "deadmen" in addition to pipe support. A deadman is a device driven into the ground away from the wall (usually about 6 ft. back) and tied to it to help it resist outward earth pressure. A section of tie in a post hole is ideal as its width will keep it from cutting into the soil. You can also use galvanized pipe of at least  $1\frac{1}{2}$ -in. diameter driven into the earth. Either type deadman is fastened to the tie-pipe on the wall with several turns of  $\frac{3}{16}$ -in. galvanized tie-wire, tightened like a tourniquet.

For construction of retaining walls greater than 4 ft. high, see page 89.

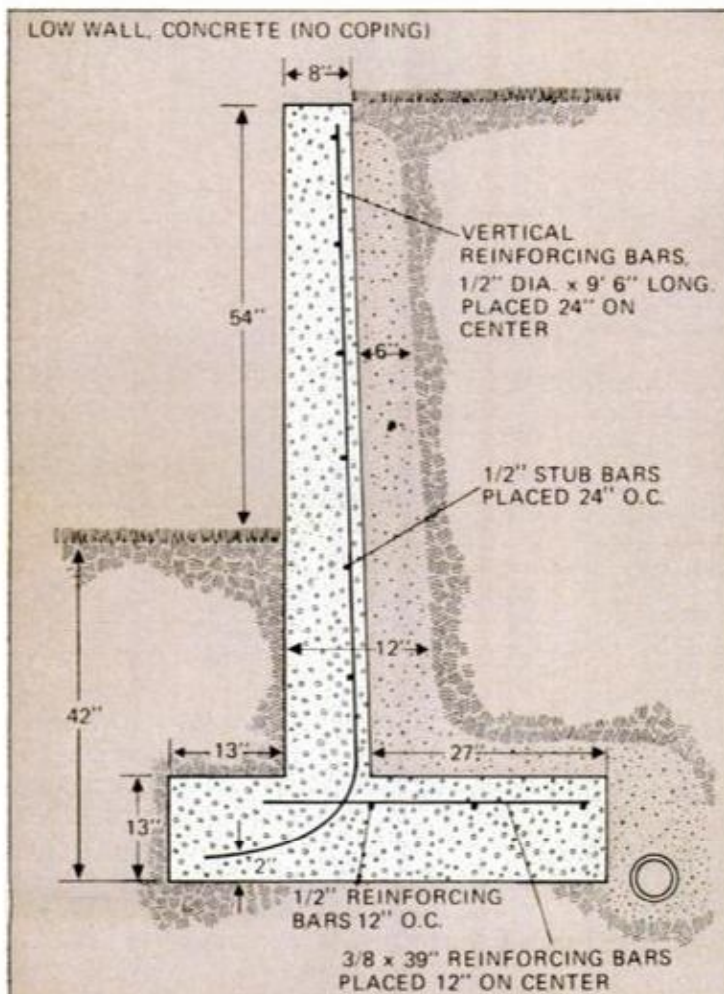


## Brick-on-masonry wall

A wall of concrete block with a brick facing is easier to build than one of poured concrete but, like the walls on the preceding pages, it should be no higher than 4 ft. It can be built in three stages—footing, block and brick. Determine its location and dig the footing of a width equal to twice the wall thickness at its base and a depth equal to the wall thickness. The bottom of the footing must be below the frost line in your area.

Pour the footing (see *How to Lay Out and Pour Concrete Slabs*, page 92); a rented mixer or ready-mix concrete is a must for this operation. Level top of footing with shovel or board; do not trowel. The next day, start laying the blocks. Mortar mix is 1 part cement, about 1 part lime and 4 to 6 parts fine mason's sand. Commercial mixes are available, but cost more than making your own. After mixing mortar with just enough water to make it workable, butter footing for a distance of about three blocks. Butter the ends of the blocks and set them in place. Level by tapping with a board and hammer; trowel excess mortar off joints. Continue for the length and height of the wall. For maximum strength, insert galvanized brick ties spaced 3 ft. apart into mortar to hold the brick facing (veneer).

When the block backup is complete, lay brick similarly, inserting brick ties in corresponding joints. Dress joints with  $\frac{3}{8}$ -in. dowel before they set. For best appearance, you may want to have a professional lay the brick. Coping or a cap is necessary to keep water out and prevent freezing damage. This may be of stone or flagstone, or brick laid in a soldier course, ends facing outward. Block should be coated on the earth side with a thick layer of asphaltic mix, and drain tile set before backfilling.

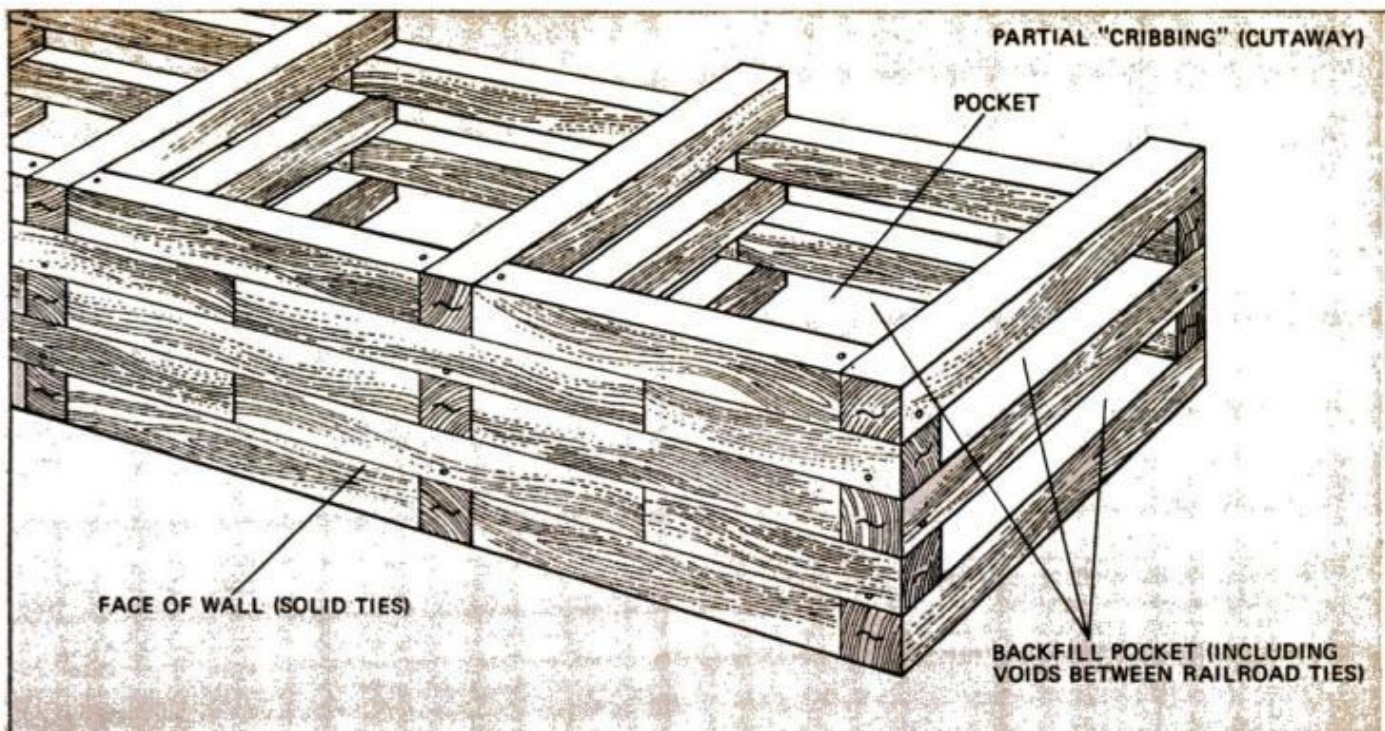


## Reinforced concrete wall

Few homeowners will want to take on the engineering and other work required for this type of wall. But if you should be contemplating having a reinforced concrete wall built, an understanding of the design principles is an important consideration.

The footing used here is an integral part of the wall and is tied to it by steel reinforcing bars. The "head" (weight) of earth behind the wall on the footing determines its size. If a contractor should tell you that a wall of this type is "no problem," watch out.

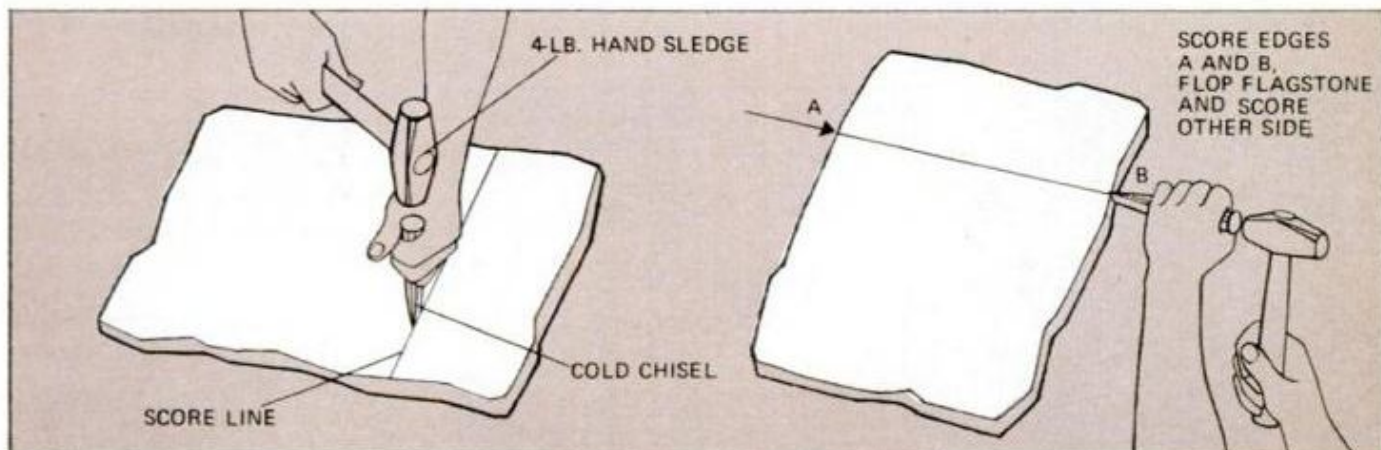
If a reinforced concrete wall is a must for you, it will be worth the \$75 to \$100 fee you would pay to have an engineer check your contractor's drawings. The engineer's fee will generally turn out to be only a very small portion of the total cost of a reinforced concrete retaining wall.



### Cribbing with railroad ties

If you need a retaining wall higher than 4 ft. and want to build it yourself, the method to use is called "cribbing" railroad ties. The job will be a lot of work, and you should allow plenty of time for it, but the result will be a self-draining wall of great thickness and strength. Essentially the construction of a series of boxes, cribbing requires cutting, predrilling and spiking of ties, as well as the moving of a large amount of earth. *Caution:* Railroad ties are "pressure-treated"—

creosoted clear through the wood—so be sure to wear goggles while cutting them (using a two-man saw or portable circular saw with coarse-set or rip blade). Face of the wall is solid, with joints staggered. Holes are predrilled and ties spiked together by toenailing with 20d galvanized common nails. Then the pocket is backfilled. Earth in the pocket acts structurally as part of wall; voids between ties allow for drainage through sides, reducing pressure on face of the wall.



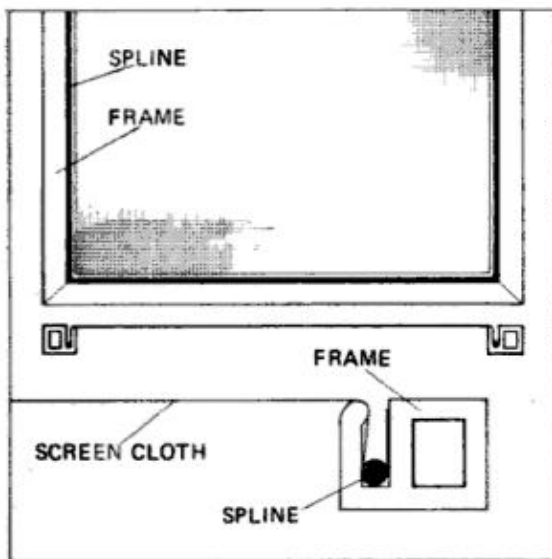
### Cutting stones

When you have to cut a piece of flagstone or fieldstone to get a straight edge to lay, use a cold chisel and hammer or mallet (hand sledge). First score a guideline on both flat sides of the stone, then nick the edges about  $\frac{1}{8}$  in. deep to join the score marks on the flat surfaces. Then lay the stone on the ground to nick the scoring on the flat sides, also to a depth of  $\frac{1}{8}$  in. When the scoring has been deepened on all four sides, continue

tapping, but now with harder blows. Go all the way around, working from the middle of each side outward toward the edges, until the stone breaks along the score.

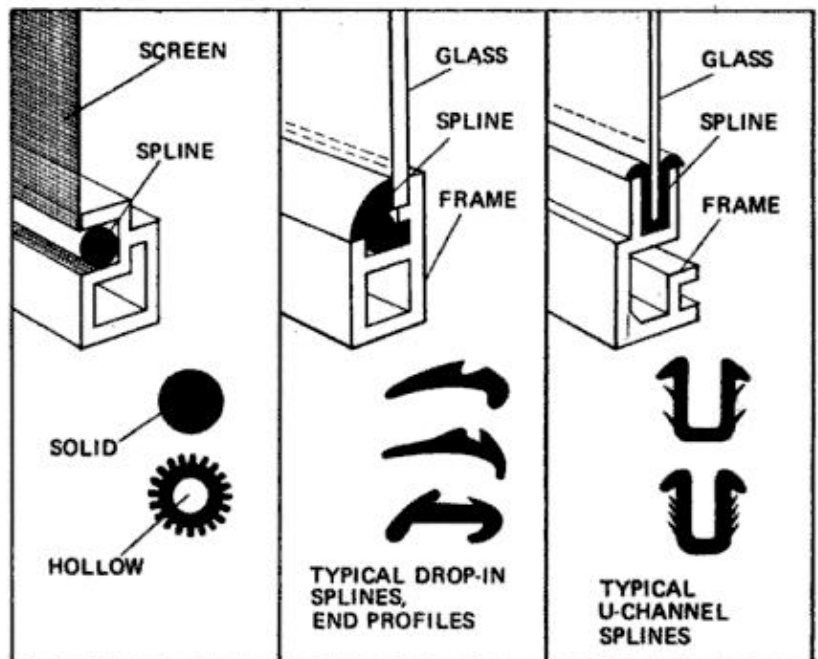
Done correctly, this entire operation should take about five minutes. Object of the scoring is to make the break occur where you want it; otherwise, efforts with hammer and chisel are almost bound to result in a fractured, useless stone. ★★

# How to repair aluminum storms and screens



## 1. Typical aluminum screen

The screen cloth is secured by a plastic spline in frame groove. Replacing a torn window screen is simple if proper technique and tools are used. Begin by locating the ends of the spline in groove, lift them with an awl or screwdriver blade and pull the spline out of groove on all four sides of the frame. If the spline breaks, it must be replaced. In that event, save a sample of the old spline in order to purchase the correct size for replacement (it's sold in most hardware stores).

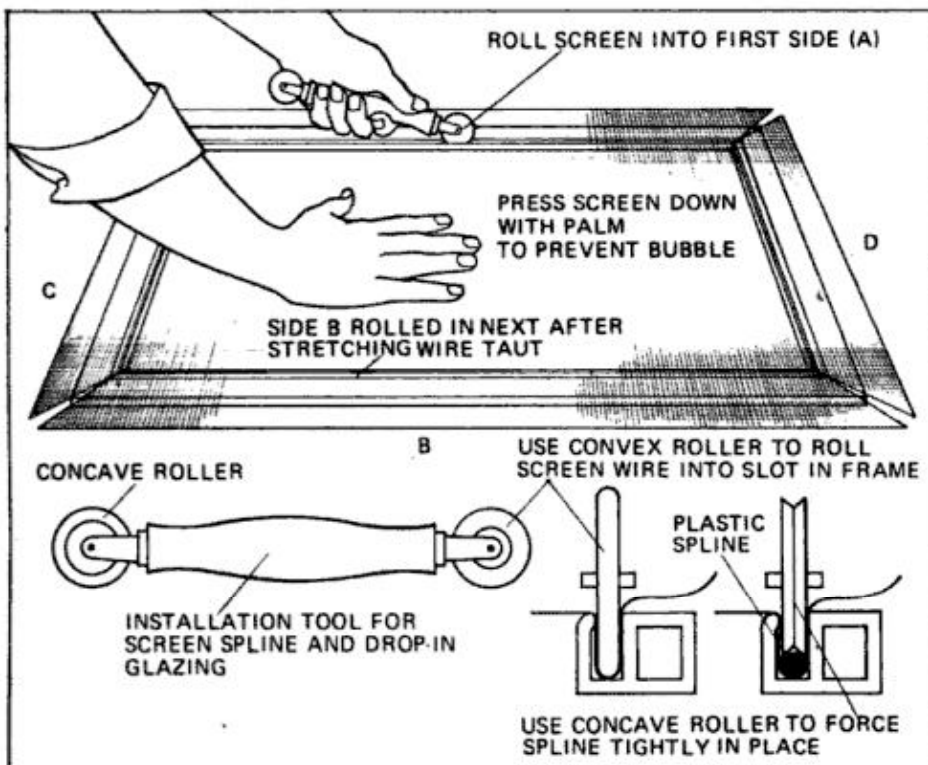


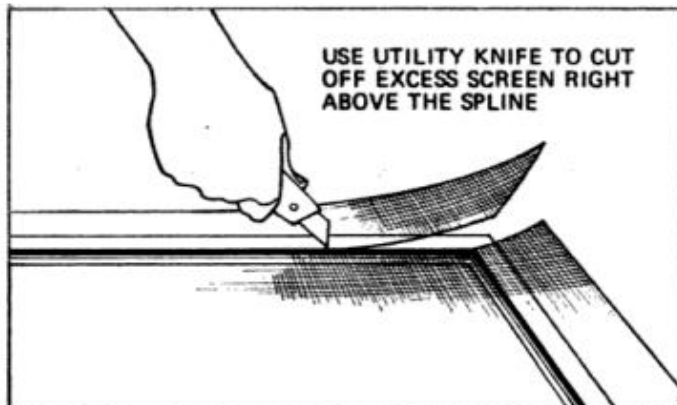
## 2. Splines for aluminum storms and screens

Splines are made in a variety of shapes. At left above are round splines, solid or hollow, used to secure screens to frames. There are two kinds of storm-sash frame, each with its own type of spline. Drop-in type, center, is easier to handle as it does not require disassembly of frame for re-glazing. Take-apart type, right, using U-channel splines, must be disassembled. Frame and spline designs vary considerably, depending upon the maker, but correct spline shape and size is usually available by the package or roll.

## 3. Reinstalling screen wire

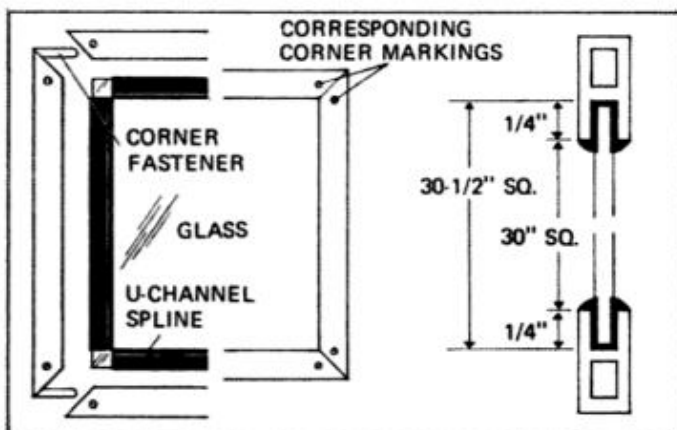
Push old screen out from back of frame. Measure outside length and width of frame and cut new screen at least 2 in. oversize in all directions. Holding screen down on frame, use installation tool's convex roller to force screen into groove with five or six passes—don't try it with one pass or screen will rip. Place spline on groove, force it in place with concave roller. Turn frame, repeat on opposite side, pulling screen tight and working convex roller down and to outside of frame. If frame bows, start over with new screen. If not, place spline with concave roller. Screen should now feel tight. Using scissors, make V-cuts in screen at corners to relieve tension; then finish last two sides in same way.





#### 4. Trimming the wire

After screen has been grooved and locked in with spline on all four sides, insert tip of utility knife just above spline in groove's outer side. Hold frame and run knife along inside edge. Excess screen can now be pulled away and discarded. Take care when cutting to avoid splines.

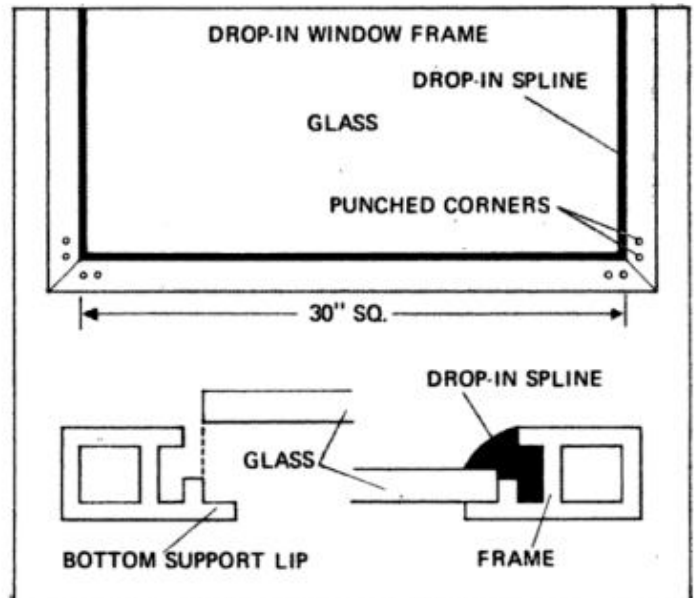


#### 6. Assuring accurate reassembly

6. Take-apart frame, above, should be match-marked at three corners to assure accurate reassembly. For width and height of frame for glass, take distances between opposite U-channel bottoms. Be sure to allow (subtract) for the spline. Fit U-channel spline over all four edges of the pane. Then, using a wood or plastic mallet, gently tap a section of the frame—one without corner fasteners—into place over the spline on the glass edge. Repeat on opposite edge, then line up frame sections to which corner fasteners are attached with corresponding holes on first two sides. After gently tapping frame together, replace corner assembly screws or clips (sketch right).

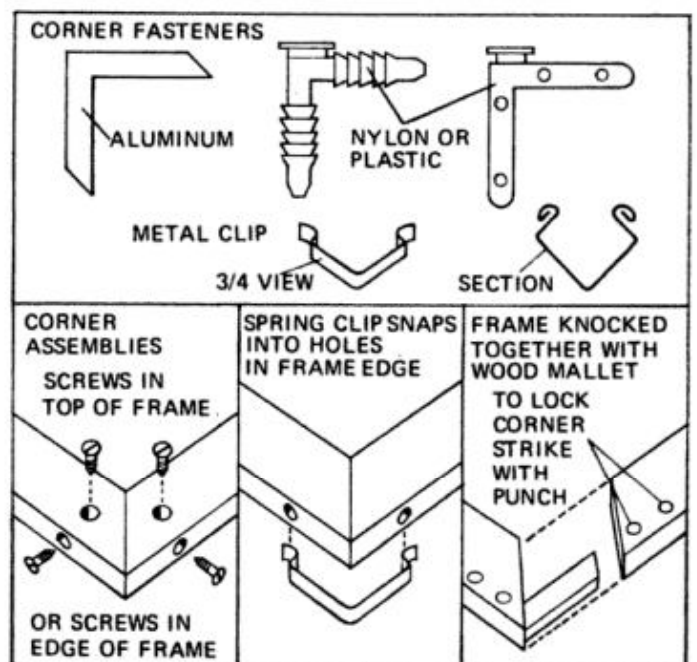
#### 7. For smooth operation

Keep window tracks clean and spray with silicone lubricant. Mild cleaner and water will remove discoloration; avoid abrasives.



#### 5. Reglazing aluminum storm sash

Replacement of glass in aluminum storm sash requires precaution of wearing gloves and safety goggles. To remove glued-in glass, brush the pieces with paint remover; save a scrap piece to assure you buy the right thickness for your replacement pane. Frame above, a drop-in type, does not come apart. Measure inside dimensions including support lips. Cut window glass to size and carefully lay it inside the frame so that it rests on the lips. Insert drop-in spline by laying it on the window beveled side up and pushing it into the frame with your fingers. Repeat the procedure for the other three sides and the window is finished. Here, too, if old spline breaks, replace it.



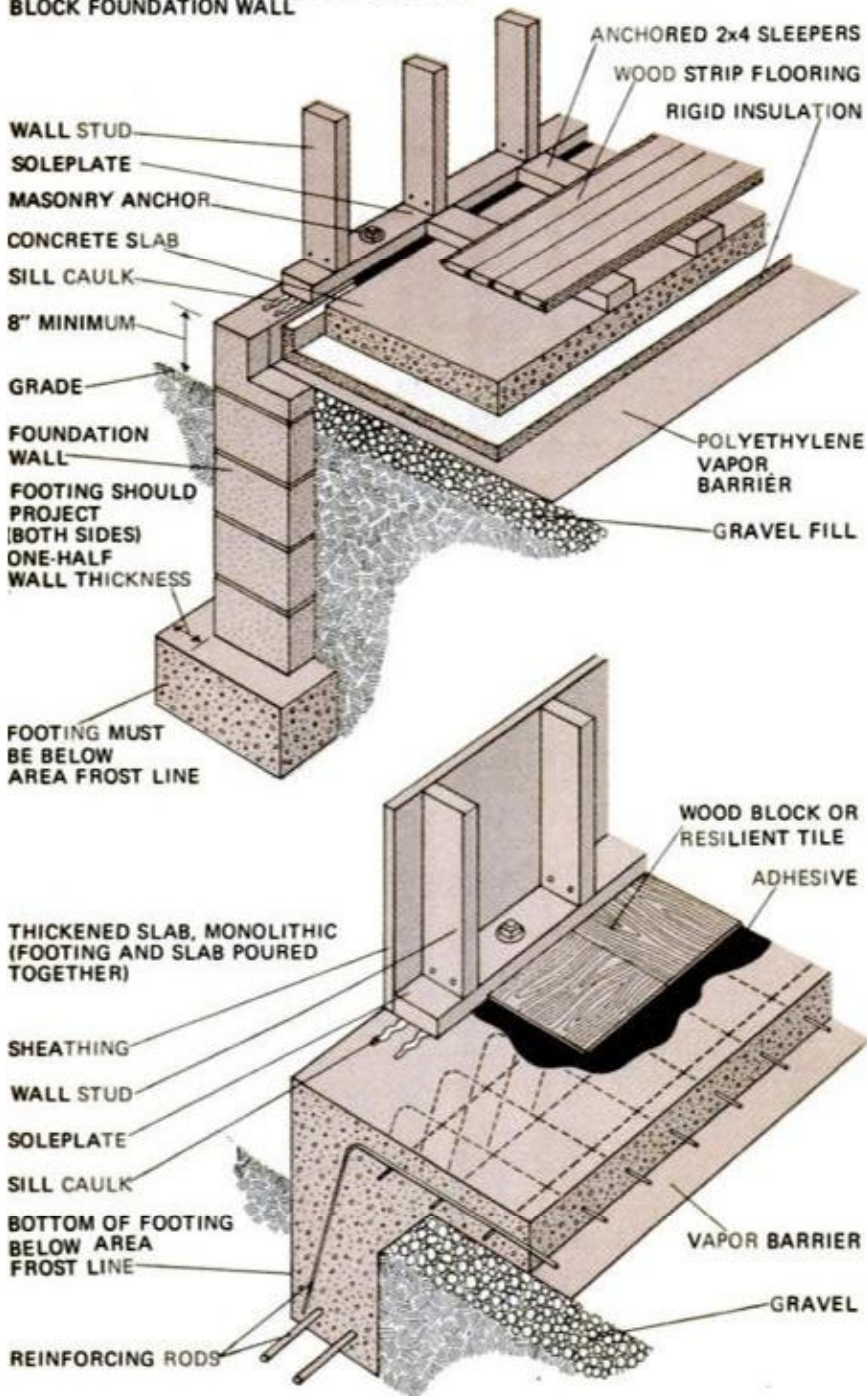
# How to lay out and pour concrete slabs

Make no mistake about it, plenty of hard work is involved in pouring concrete yourself. But there is an immediate reward; one you can see in your wallet. For example, recent rates in the New York area for a 4-in. slab, with footings, were about \$5.50 per sq. ft. when done by a professional. Do the job yourself and your cost will be closer to \$1.50 per sq. ft. But if you don't do the job right, you may have to live with a

cracked or heaving slab or drainage problems—that could require breaking up the slab into rubble and starting over. Use the professional know-how on these and the following two pages and your savings will be permanent.

For small jobs you'll find it most economical to buy the sand, aggregate (gravel) and cement and mix them yourself—by hand or with a rented cement mixer. Or you

INDEPENDENT CONCRETE FLOOR SLAB AND BLOCK FOUNDATION WALL



## Typical slab construction

Thickened-edge, monolithic slab-and-footing combinations are recommended for patios, with or without a roof structure or bearing wall above. Independent footings, foundation walls and slabs are the better way when an enclosed structure will be built over the slab; this allows for placing of perimeter insulation and vapor barrier in stages between pours. The bottom of the footing always must be below the area frost line.

Several basic construction rules should be adhered to throughout any job: First, never refill the excavation or trench with dirt if you've dug too deep—pour extra concrete instead. Second, most footings should be a minimum of 12 in. deep, and twice the width of the foundation-wall thickness. For example, for a wall built of 8-in. block, footings should be 16 in. wide, projecting 4 in. to either side of the wall. Third, if the soil is of a low load-bearing capacity, you may find it will be necessary to construct wider and reinforced footings.

"Load bearing capacity" refers to all the weight that will be imposed on each lineal foot of perimeter area (footing area) by the structure above, the live weight it will carry and the snow load on the roof. As all soil has a maximum bearing capacity in tons per sq. ft., it is an important factor in footing design. Imagine standing on a 1-ft.-square piece of plywood on dry beach sand, and then trying the same thing in a marsh—the plywood has to be a lot bigger or you'll sink. Your local building department can provide general information on soil load-bearing capacity in your area. If any question remains about your property in particular, you can have a qualified engineer (P.E.) check it for you.

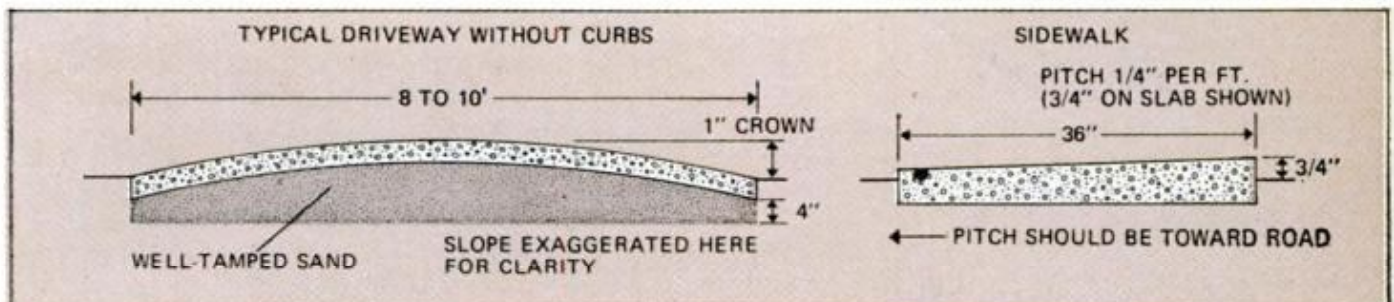
DATA BY JOHN GAYNOR

can use a commercially prepared mix sold by the bag. But for the big jobs—a driveway, for example—your best bet is to buy ready-mixed concrete.

The best time to pour is when the temperature is between 40° and 85° F. Cold-weather pouring adds so many complications the homeowner should avoid it. In hot, dry weather, subgrade and forms should be dampened. If it rains on the day you've

planned to place concrete, reschedule the job. If you want to color your concrete, use mineral-oxide pigment; it's sold in several colors at most paint and hardware stores. Mix it with sand before combining ingredients. Pigment used should never be more than 10 percent, by weight, of the cement used; otherwise it will weaken the slab. Colored ready-mix concrete is available, but usually only in large quantities.

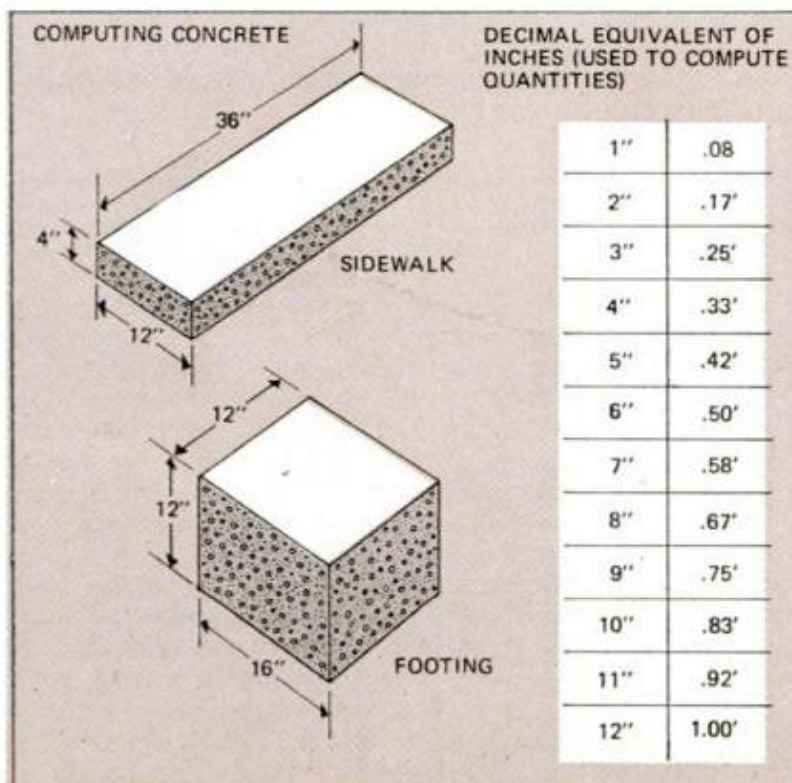
ILLUSTRATIONS BY ADOLPH BROTMAN



### Typical slabs for driveway and sidewalk

Each slab shown above is pitched for positive water runoff. A typical driveway (left), 8 to 10 ft. wide, has a 1-in. crown at the center and a pitch of 1/4 in. per foot along its length to divert rainwater. A sidewalk from edge to edge is also

pitched 1/4 in. per foot (right)—its low side toward the street, not your property. Driveway slab thickness should be 5 in. minimum; for heavy duty, pour 6-in. slab and use steel-mesh reinforcing. Typical sidewalk slab is 4 in. thick.



### Computing quantities

Ready-mix concrete is sold by the cubic yard; 1 cu. yd. is usually the minimum order. To compute the amount you will need, you must find the cubic footage of the slab to be poured, then convert this figure to cubic yards. Multiply length by width by thickness in feet, then divide by 27. Decimal equivalents of inches make the calculation easier.

Sidewalk slab, 4 x 12 x 36 in.:

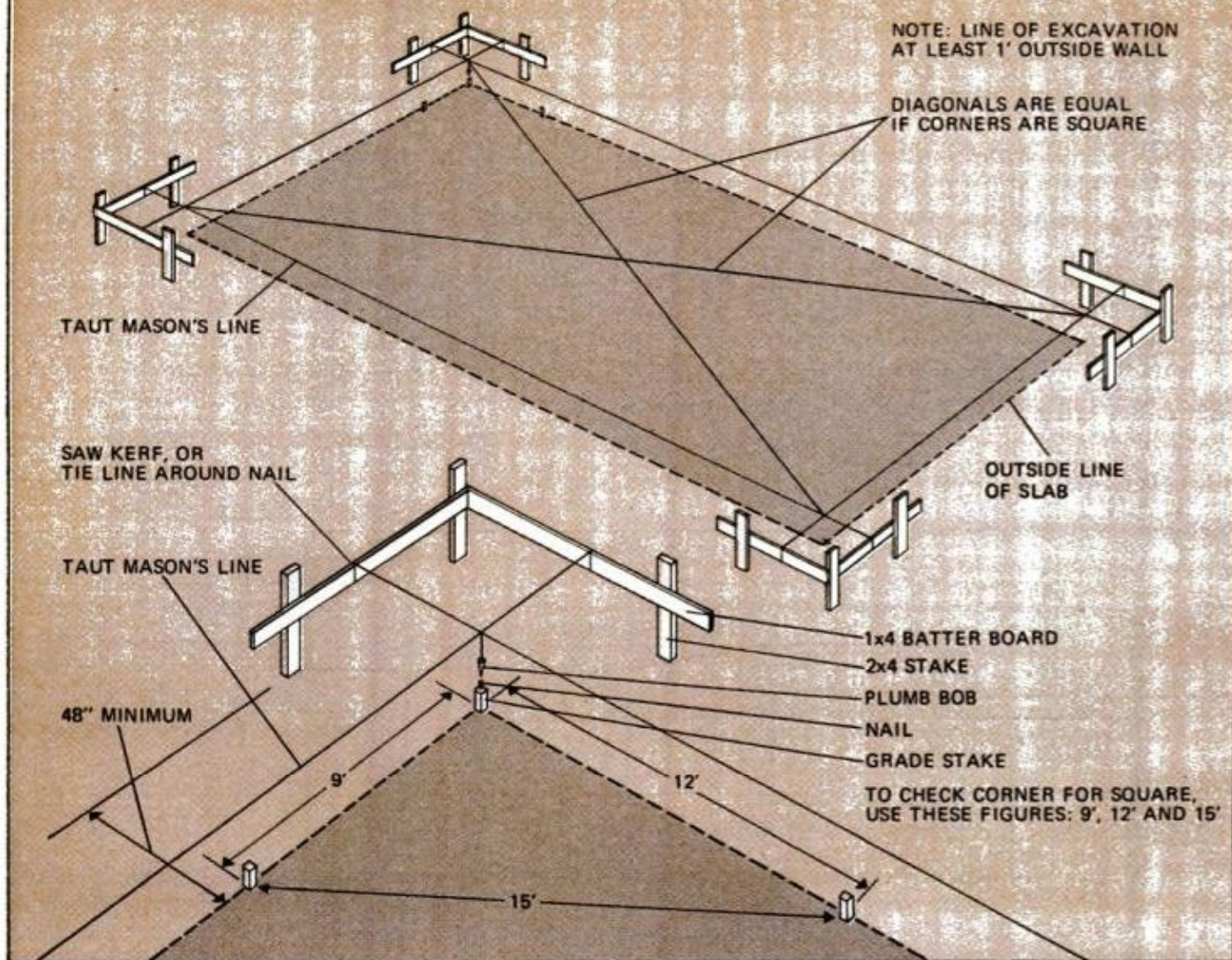
$$\frac{0.33 \times 1 \times 3}{27} = 0.037 \text{ cu. yd.}$$

Section of footing, 12 x 12 x 16 in.

$$\frac{1 \times 1 \times 1.33}{27} = 0.049 \text{ cu. yd.}$$

Thus, if your run (lineal footage) of this footing were 20 ft., you would need about 1 cu. yd. of concrete.

It is good practice to add about 5 percent for waste to your estimate—roughly, 1 cu. yd. for each 20.



### How to lay out a slab with square corners

To lay a slab, you must locate a grade stake accurately at each corner. Each way shown above will give precise, square corners. Batter boards (on firmly anchored stakes) should be leveled one to the next. Use plumb bob, or 20d nail or larger, to

set grade nails at corners. Fix mason's line to saw kerfs in batter boards or use common nails so line can be repositioned if disturbed. Allow for form width when excavating; tamp ground—below footing—before pouring.

### Water use important when mixing and pouring concrete

Water content of concrete is extremely important. For a strong mix, water should not exceed 6 gal. per full sack (94 lb.) of cement. Use clean water only—as a rule of thumb, if you can drink it, you can use it for concrete. Add just enough to make the mix workable. Although too much water makes pouring easy it also keeps cement from adhering to the aggregate. The result of such a pour will be a weak slab.

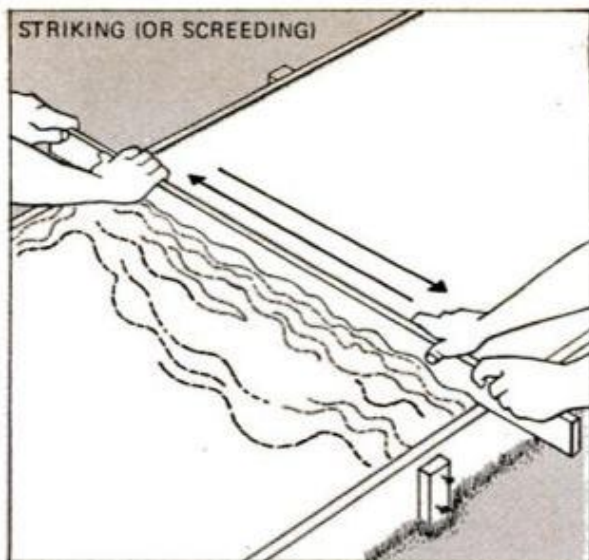
For most homeowner jobs, a mix ratio of cement to fine aggregate (sand) to coarse aggregate (gravel) of 1, 2 and 3 is best. Ready-mix concrete may not offer you a choice of ratios, and the mix may have to be varied with the size of gravel—measured by the maximum diameter of the pieces of stone—locally available. Coarse aggregate with a maximum size of 2 in. is not recommended for

slabs; 1 to 1½ in. is normal.

Mixing your own concrete, when practical, gives you greater control. For a 1:2:3 ratio, a good guideline is that the volume of sand used should be about 2/3 of the volume of coarse aggregate. For a 100-sq.-ft. slab 4 in. thick, you would need 0.64 cu. yd. of sand, 0.95 cu. yd. of gravel and 8.4 sacks of cement. You can figure on using about seven sacks of cement for each cubic yard of concrete at a 1:2:3 ratio.

Whenever possible, concrete should be poured continuously and kept practically level throughout the area being placed. Where the sides of a slab will be visible, smack the forms smartly with a hammer. This will prevent what is called a "honeycomb" appearance, caused by air bubbles, and give neat, good-looking edges.





### Surface finishing

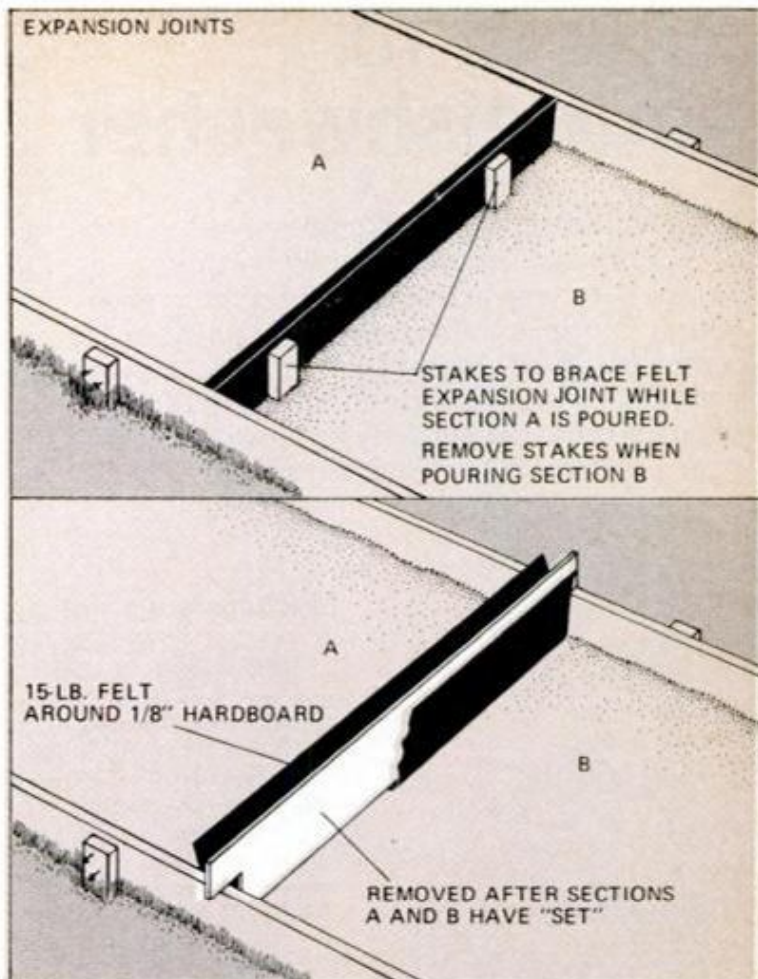
After concrete is poured, it must be struck (trade terms are striking and screeding) immediately by drawing a board back and forth across the surface. Use a side-to-side sawing motion as you advance; press projecting stones (aggregate) below the surface. When concrete built up ahead of the screed makes it difficult to move, shovel the excess away. To crown a driveway, the underside of the strikeboard is cut concave.

An hour after striking off, the surface can be "floated," bringing water to the top and texturing the concrete. Work a wood float in a swirling motion, taking care not to "saucer" any spot—or it will collect puddles. For a smooth surface, follow the floating with a steel trowel, used in wide, sweeping arcs. Do not trowel until the water sheen has left the surface. Keep in mind that neither floating nor troweling should be overdone—too much water brought up will make the slab weaker. Excess troweling also brings up "fines," small particles that make the surface produce dust.

After floating and troweling (if desired) and removing separators, round off slab edges with an edger and finish cross joints with groover.

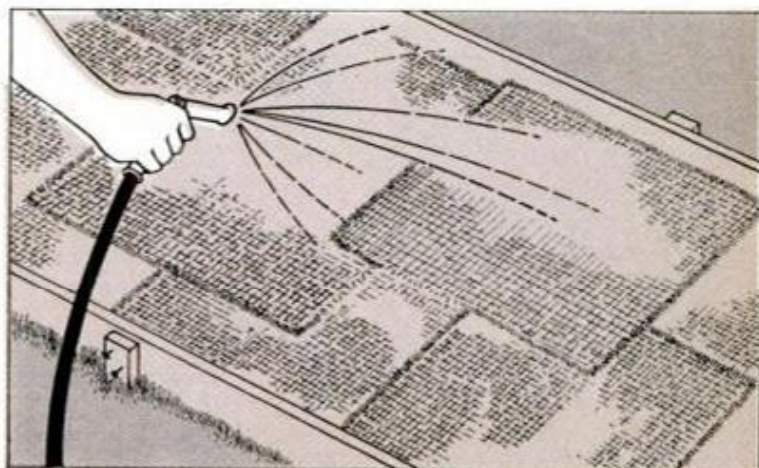
### Curing time extends for weeks

Curing of concrete is a chemical process that continues for weeks after pouring. New concrete must be kept damp or the evaporation of water will make hydration (the combination of water with cement and aggregate) incomplete and your slab weak. Cover the surface with burlap, felt or layers of newspaper and keep this covering moist for five to seven days—at least a week in hot, dry weather. Depending on temperature and humidity levels, moisten once or twice a day.



### Expansion joints

Driveways should be divided into 20-ft.-long sections using felt expansion joints (top drawing). Brace the joint as shown while pouring the first section. Remove stakes when enough concrete has been poured in the second section to make the felt immovable. If sidewalks are to have separated slabs, separators should be placed at intervals of 6 ft. You can make separators of  $\frac{1}{8}$ -in. tempered hardboard inserted in folded tarpaper. Place them at right angles to the slab forms, and pour concrete on both sides of each one to keep them straight. When you finish the surface, remove the hardboard but leave the tarpaper in place in the joint. Excess can be trimmed away after concrete has set. False expansion joints—for appearance—can be made with a groover after surface finishing has been done. ★★★



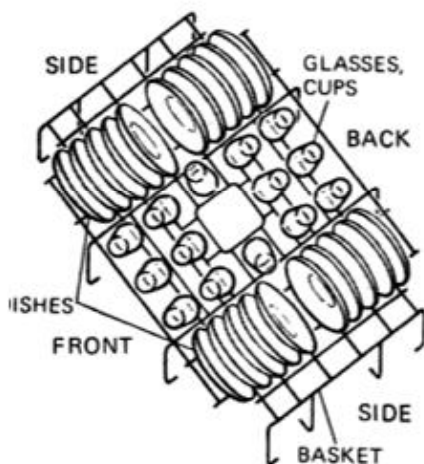
# How to fix your dishwasher

When dishwasher troubles occur, they are most often caused by washing conditions—water problems, detergent problems, improper stacking of dishes or a combination of these factors. The accompanying troubleshooting charts will help you correct these conditions, as well as common problems of mechanical origin. The il-

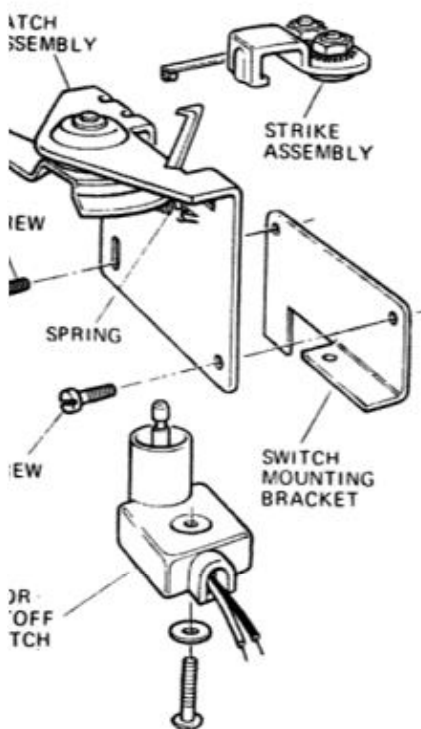
lustration on the facing page shows the typical locations of dishwasher components. The other illustrations show specific parts and assemblies from dishwashers made by several different manufacturers.

When making electrical checks and tests on a dishwasher or any other appliance, it is important to understand the manufac-

## PROPER STACKING OF DISHES



## DOOR-LATCH ASSEMBLY



## Machine does not operate

POSSIBLE CAUSES	ACTION TO TAKE
1. Door not latched.	Latch door. Make sure handle locks all the way to the right.
2. Door microswitch defective.	Press button on microswitch manually. You should hear a definite clicking noise. If not, replace switch.
3. Latch lever or spring not pressing against microswitch.	Attach door latch to fully depress button or bend or replace spring on microswitch.
4. Timer defective.	Turn on the timer very slowly. It should advance and turn the machine on. If not, replace the timer.
5. Line wires loose or apart.	Check line junction box under machine. All wires should be tight and capped or taped.
6. Blown fuse or tripped circuit breaker.	Check fuse or circuit breaker.
7. Selector buttons not depressed fully.	Press desired cycle button all the way in.

## Door will not close

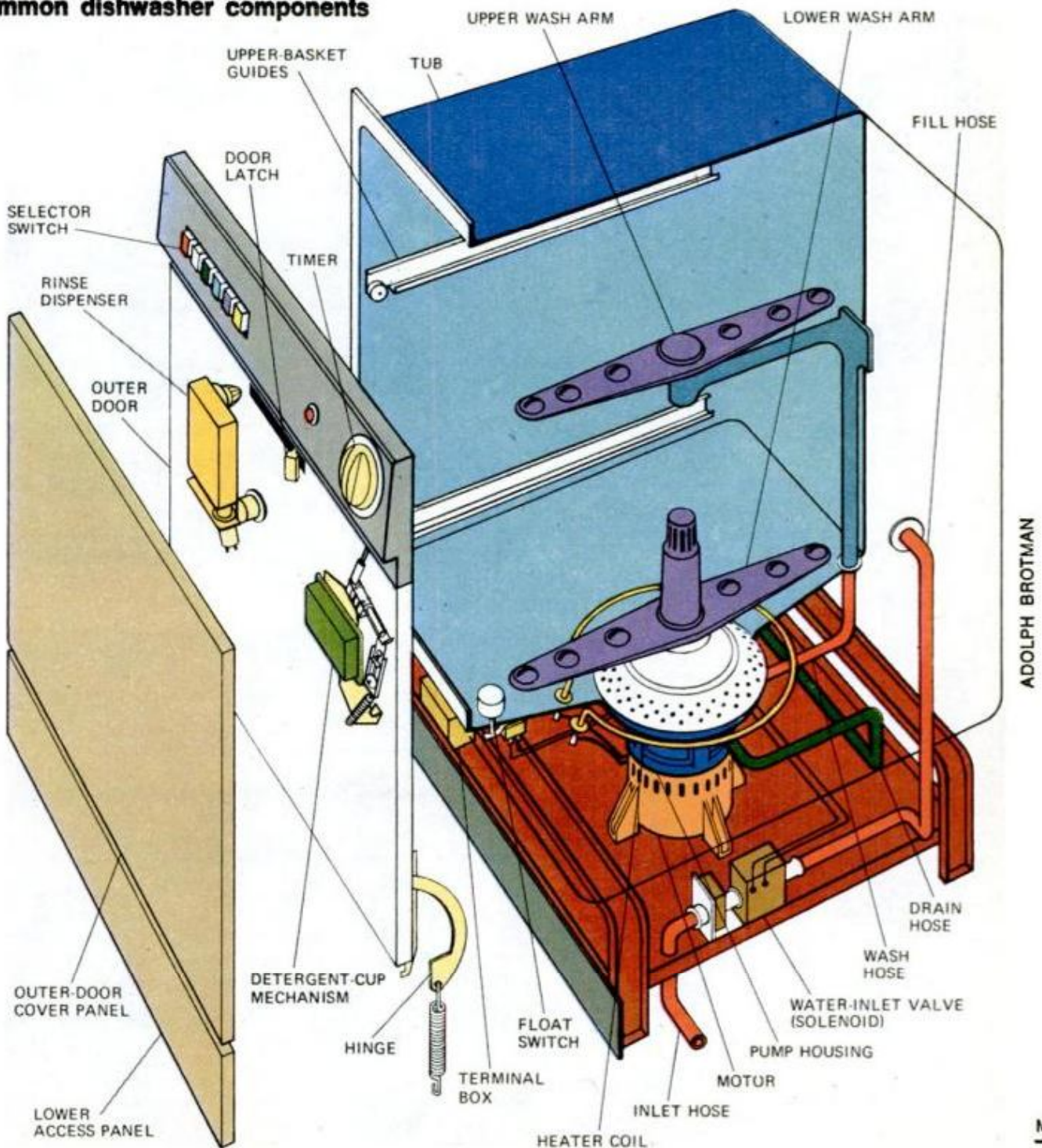
POSSIBLE CAUSES	ACTION TO TAKE
1. Door seal loose or binding inside tank.	Check entire door gasket. All gasket clips or points should be inserted in their proper slots.
2. Door striker.	Shim door striker until door latch catches it and closes very easily.
3. Improper installation.	Remove screw fasteners and let machine spring back, releasing it of any tension. Close door. If no binding, resecure screw fasteners in new position. Also, check level of machine.
4. Door hinges out of adjustment.	Check both hinges. If broken, replace. If out of adjustment, loosen hinge screws. Adjust door until it closes easily, then tighten screws.
5. Bottom service panel.	Check clearance of upper door with bottom service panel. If rubbing or binding, lower the panel or raise upper door by hinges.

turer's wiring diagram (for diagram symbols, see *How to Fix Your Automatic Washer*, page 66, Jan. '73 PM). This diagram is shown in the instruction manual for portable dishwashers. For built-in models, the diagram can be found either behind the front-door panel or behind the control panel at the top of the door. It may be glued to

the machine or rolled up. Since built-in dishwashers are wired directly to the main junction box, and because the combination of water and electricity can be lethal, it is important to use *extreme* caution when making any tests. Know what fuse or circuit breaker controls your dishwasher, and keep it *off* when working under the machine.

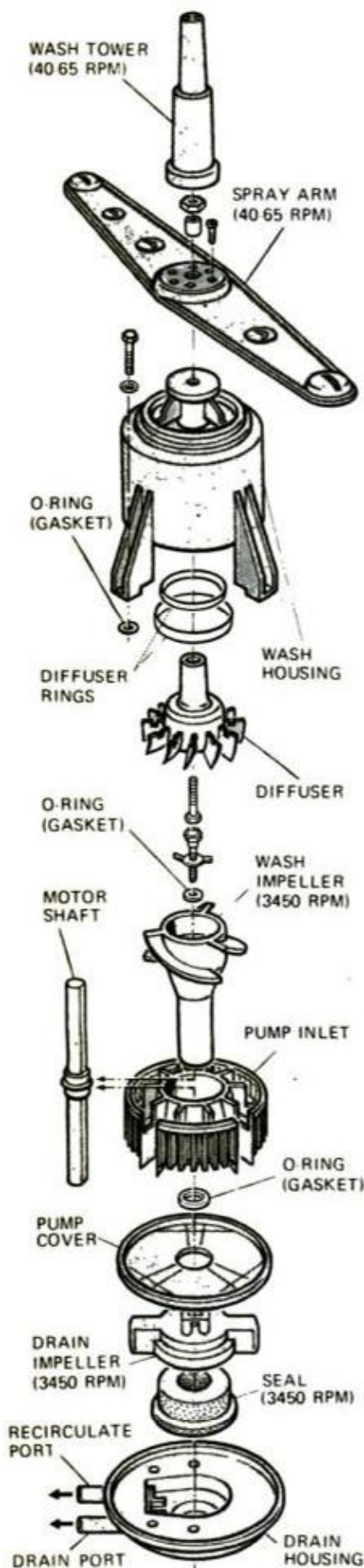
DATA BY ED FRANZESE

### Common dishwasher components



MORE  
→

## WASH MECHANISM



## Failure to fill

POSSIBLE CAUSES	ACTION TO TAKE
1. Water valve solenoid.	Turn timer to fill position. Check voltage with 115-v. test light at terminals. If voltage exists but valve won't open, replace solenoid.
2. Water inlet line.	Be sure water valve is in full open position.
3. Float switch (some machines).	Check float-stem position on float switch. It should sit squarely in seat. To test, pick up float inside of tub and let it drop. Definite clicking noise should be heard. Check also for loose or fallen wire from float switch.
4. Pressure switch.	Press rubber diaphragm disc of switch with finger. Definite clicking noise should be heard. If not, replace pressure switch.
5. Water valve assembly.	Filter screen can be clogged. Disassemble and flush line and screen. Check calcium buildup near diaphragm and pin. Replace bad parts if possible. If not, replace whole valve.
6. Low water pressure.	Check flow pressure with screw-on gauge at sink. It must be between 15 and 120 p.s.i.

## Water won't shut off

POSSIBLE CAUSES	ACTION TO TAKE
1. Water valve stuck open.	Disassemble and clean. Check valve. If it still hangs up, replace.
2. Water-valve bleed hole clogged.	Disassemble valve and clean bleed hole in solenoid valve with pin.
3. Timer stuck on fill cycle.	Check timer. Fill cycle should last about 60 seconds. If timer doesn't advance, replace.
4. Float switch defective.	Check float switch for internal short. Place 115-v. test lamp across terminals. Depress switch spring; lamp should light. Release switch button; lamp should go out. If not, replace switch. Also, listen for definite clicking sound. If none, replace switch.

## Dishwasher does not clean

POSSIBLE CAUSES	ACTION TO TAKE
1. Not enough water.	See section on "Failure to fill" above.
2. Water not hot enough.	Check water temperature. It should be about 150° F. Run hot-water tap in sink before turning on machine or change temperature setting on house hot-water heater.
3. Wash or spray arm clogged.	Check holes in wash or spray arms for blockage by food particles or, possibly, small pieces of broken glass.
4. Not enough detergent or wrong kind.	Adjust detergent to correct water hardness. If water is hard, add more detergent. If detergent is caked in detergent dispenser cup, switch to a more granular brand.
5. Wash arm not turning.	Make sure that no utensil or dish is stopping wash-arm rotation.
6. Dishes improperly stacked.	Restack with space around each piece; avoid any clutter or pile-up. Face soiled sides of cups in top rack toward center of rack.

## Water will not drain

POSSIBLE CAUSES	ACTION TO TAKE
1. Pump impeller jammed or broken.	Check impeller blades for pieces of food jammed into them. Clear items and test. If impeller has broken vanes, replace.
2. Pump motor winding defective.	Advance timer to a drain cycle. If motor hums, check for obstacles in impeller. If impeller turns freely and motor still hums, then pump-motor winding is defective. Replace motor.
3. Drain hose kinked.	Check for any sharp bends in the drain hose. Straighten hose and place helical spring (tube bender), a little larger than the o.d. of hose, over kinked area to prevent a recurrence.
4. Drain hose clogged.	Disconnect drain hose from motor housing. Blow through the hose until line clears and reconnect it.
5. Timer stuck in wash cycle.	Check timer. If timer doesn't advance by itself, replace it.

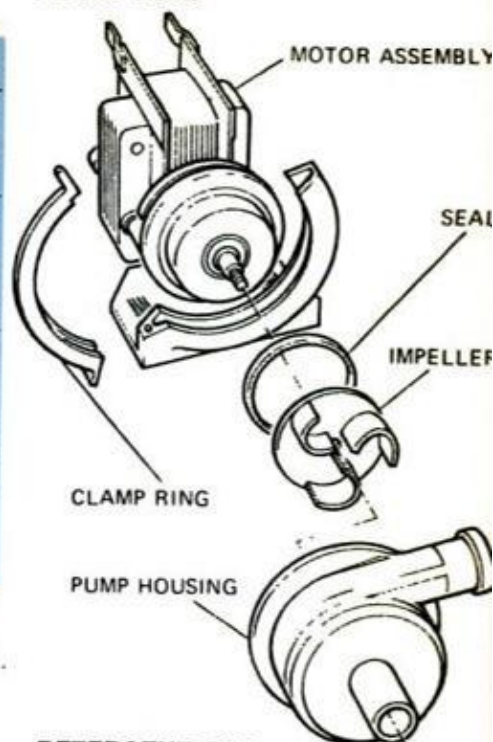
## Detergent cup fails to open

POSSIBLE CAUSES	ACTION TO TAKE
1. Detergent left in cup too long, or put in a wet cup causing it to harden.	Use only amount of detergent specified by the manufacturer. Make sure cup is dry. If the detergent still cakes, switch to a more granular brand.
2. Improperly racked dishes or utensils.	Reposition around detergent cup all dishes or utensils that could possibly prevent the cup from opening.
3. White calcium deposits around cup lid or shaft mechanism (due to hard water).	Clean all calcium deposits around mechanical operating mechanisms of the detergent cup. Use vinegar.
4. Detergent-cup solenoid valve.	Place 115-v. test lamp across both solenoid terminals. Advance timer in fill cycle until test light glows. If solenoid doesn't work, replace.
5. Timer.	Advance timer to positions in the fill cycle that activate detergent-cup mechanism. Place 115-v. test lamp across solenoid terminals. If no voltage is indicated, timer contacts are defective. Replace timer.

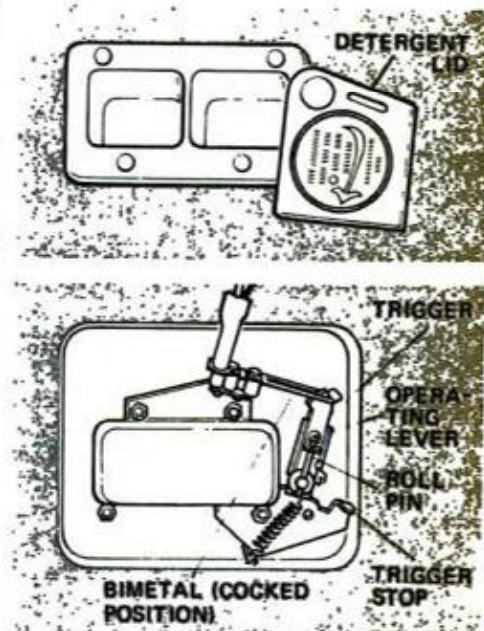
## Motor will not run

POSSIBLE CAUSES	ACTION TO TAKE
1. Motor hums.	Check for a food particle or piece of broken glass that's jammed in pump impeller. Clear and test.
2. Motor kicked out on overload.	Check line voltage, $\pm 10$ percent of 115 v., or binding of the motor shaft. Turn by hand to free shaft.
3. Timer defective.	Advance timer to all wash and drain cycles. Check motor operation on each one. If motor fails to run, replace timer.
4. Motor defective.	Direct-test motor with test jumper. If motor still fails to run, replace it.

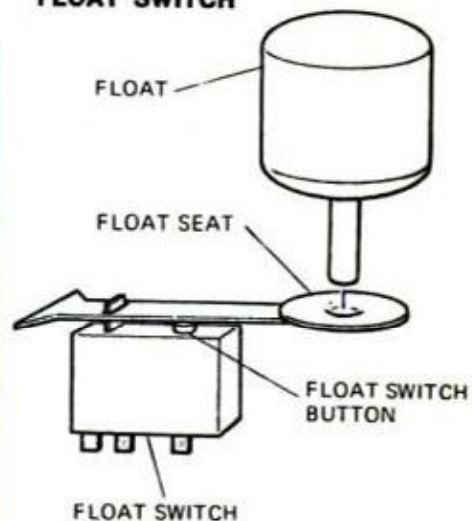
## DRAIN PUMP



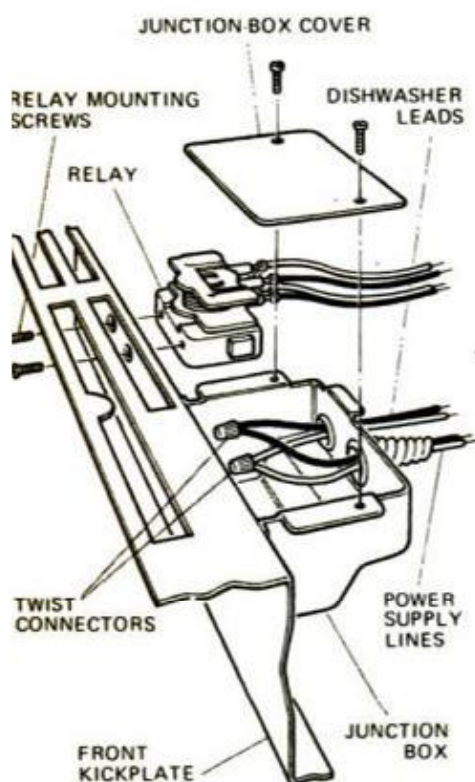
## DETERGENT-CUP ASSEMBLY



## FLOAT SWITCH



## JUNCTION-BOX ASSEMBLY



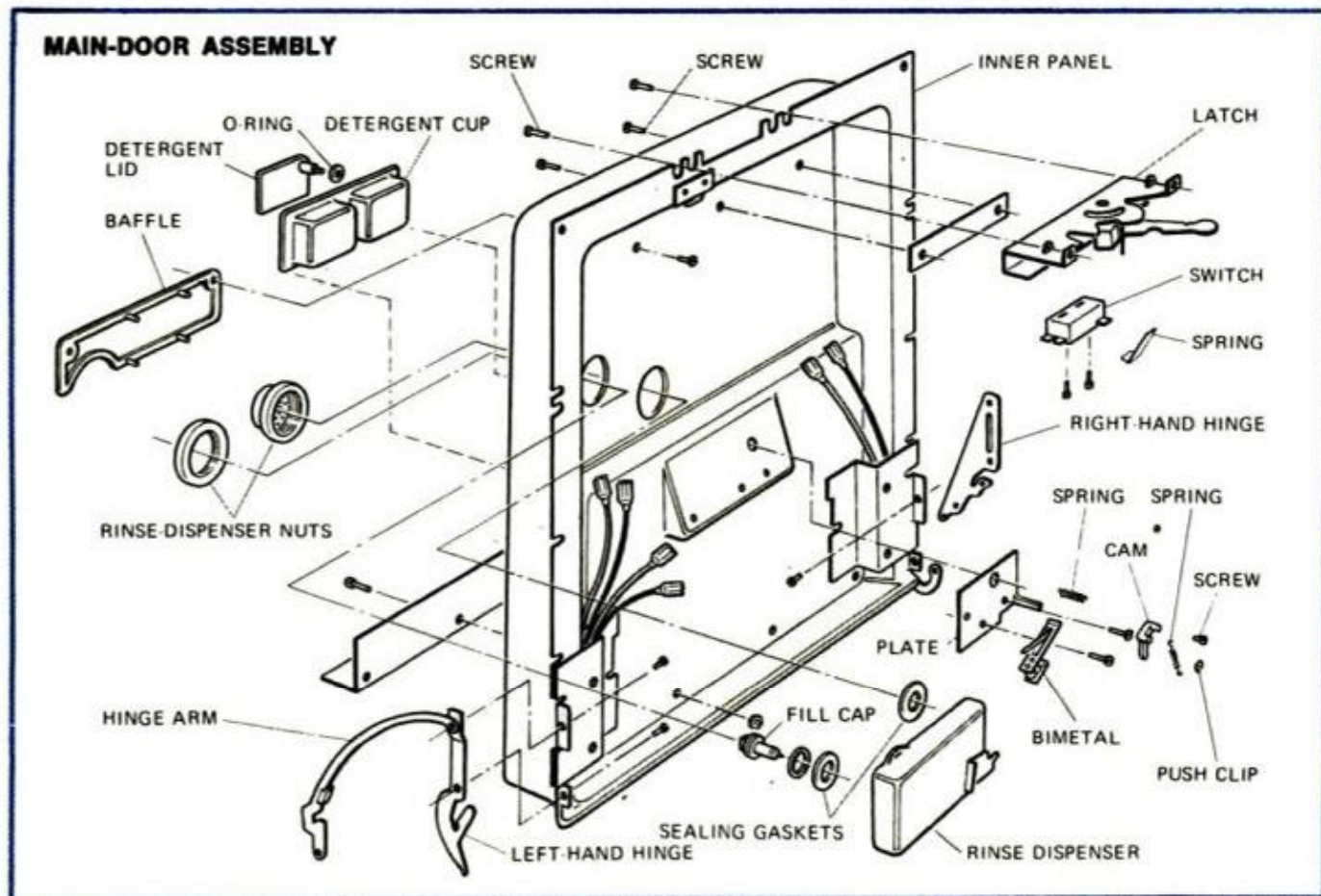
## Dishwasher operates when door is open

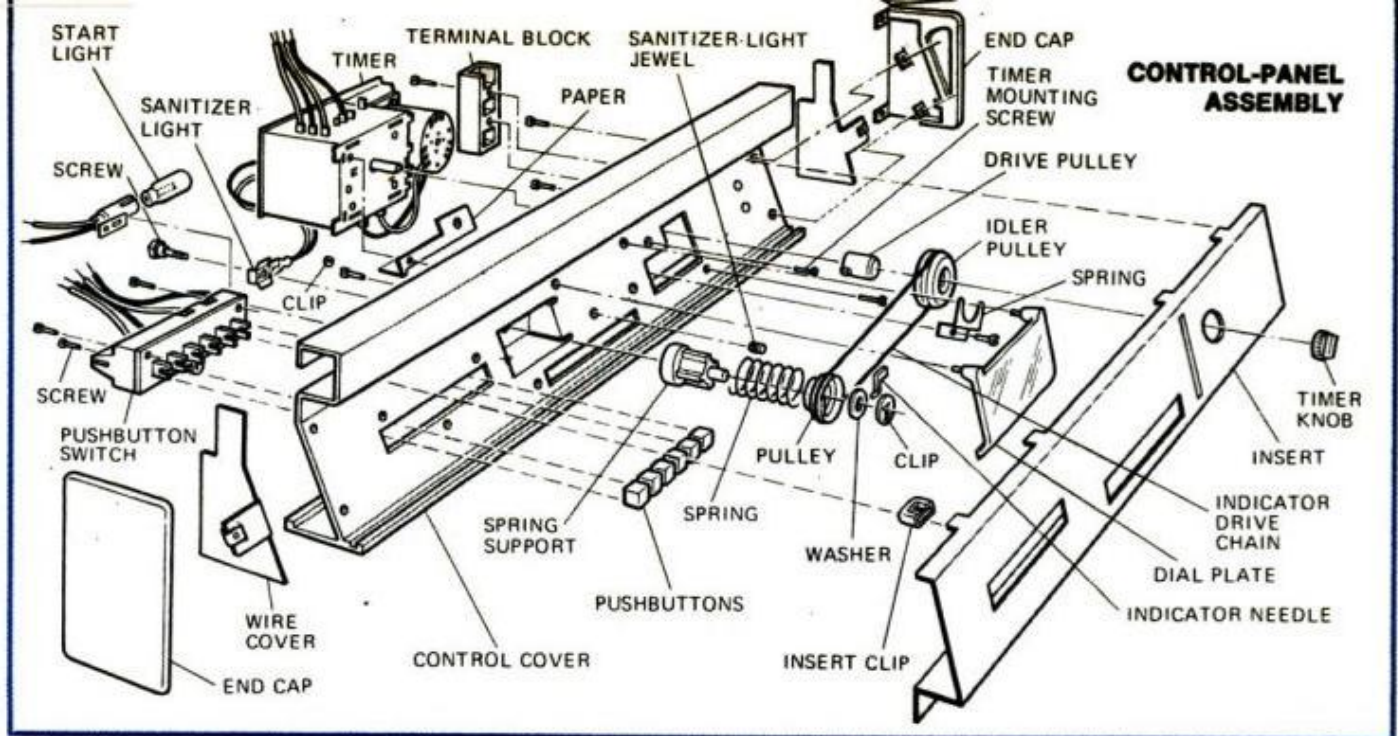
POSSIBLE CAUSE	ACTION TO TAKE
1. Door switch is shorted.	Replace door switch.

## Dishes do not dry

POSSIBLE CAUSES	ACTION TO TAKE
1. Heater element burned out.	Replace heater element.
2. Calcium buildup on heater element.	Clean heater element of all calcium deposits.
3. Wire off heater element.	Replace wire and tighten connections.
4. Water not hot enough.	Check water temperature. It should be approximately 150° F.
5. Water still in dishwasher.	Refer to section "Water will not drain," page 99.
6. Improper stacking of dishes.	Rack the dishes so that there is air space provided around each and see that they are neither jammed together nor piled on top of each other.
7. Fan motor inoperative (some machines).	Direct-test the fan motor with a test jumper wire. If the motor still fails to operate, replace it.

## MAIN-DOOR ASSEMBLY





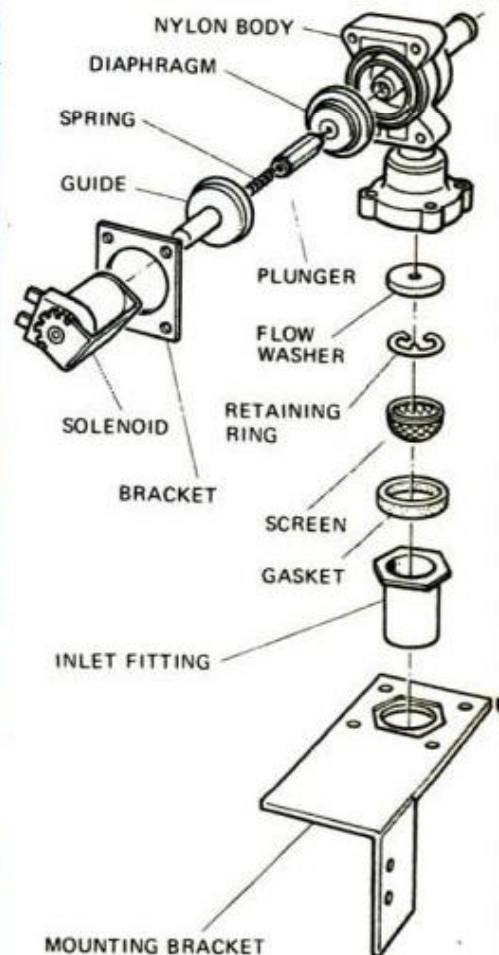
## Dishwasher is leaking

POSSIBLE CAUSES	ACTION TO TAKE
1. Door gasket loose or worn.	Check door gasket. It should be clipped in its proper slots. If gasket is torn or flat with no compression left, replace.
2. Door hinges broken or out of adjustment.	Replace broken hinges. Loosen hinges so door sits tight against gasket and retighten.
3. Inlet line fitting.	Check inlet line near water solenoid valve. Tighten compression nut.
4. Motor seal.	Check for water stains or leaks around motor shaft. Replace motor seal.
5. Door alignment.	Check door fit on gasket; it should not bind. See section "Door will not close," page 96.
6. Loose hose clamps.	Check all hoses and connections under machine for slippage or water stains.
7. Heating element seals.	Check seals at heating-element holes. If leaking, tighten. If leak remains, replace seals.
8. Nuts, bolts and screws.	Check attachments to tub. Noticeable dripping can be corrected by tightening or caulking the fasteners with putty.

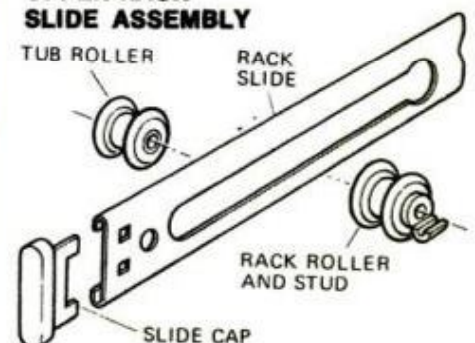
## Abnormal water noise

POSSIBLE CAUSES	ACTION TO TAKE
1. Water hammer "thud noise."	Install water-hammer eliminator or pressure reducer (from maker) on inlet line to lower water pressure. Set water heater to 150° F.
2. Water chatter "low-frequency pulsing."	See that inlet piping is at least 3/8 in. i.d. Secure piping to avoid vibration. Set water heater to 150° F.
3. Water flutter "rumble."	Set water heater to 150° F. Install small hand valve in inlet line to cause partial restriction. If valve is already in line, close or open more to adjust pressure.
4. Water whistle "hiss" to shrill whistle.	See answer to No. 3 above and apply the same action.

## WATER-INLET VALVE



## UPPER-RACK SLIDE ASSEMBLY





# Big-scale thrills at small-scale prices

Today's growing interest in outdoor hobbies is bringing with it a brand-new generation of colorful, low-cost flying models for fun and excitement your whole family can share.

by Sheldon M. Gallager

A bright blue and red Fokker struggles frantically to evade a Sopwith Camel closing in on its tail. A tiny red and white Pitts Special loops, rolls and does wing-overs almost as realistically as the world-famous aerobatic stunt plane it's patterned after. A strange-looking space missile carrying two smaller rocket planes blasts off its launching pad and soars to a height of several hundred feet as the two piggyback ships automatically detach themselves and glide gracefully back to earth—the latest in model rocketry depicting how a future space shuttle might operate.

All over the country, the air is filling with the high-pitched whir of miniature props and the nostalgic scent of burning engine fuel. The fun of flying model planes and rockets is being rediscovered in a new era—with new thrills, new equipment and a new interest in outdoor hobby activities the whole family can enjoy. The models have come a long way from the balsawood and tissue-paper days when you spent weeks on

**Classic Fokker DVII** World War I German fighter is typical inexpensive gas-powered plastic Cox model. It costs about \$10, has readily replaceable parts.







**Newest, most spectacular** rocket to join growing model fleet is this ingenious three-part space shuttle replica by Cox. On takeoff, main booster stage carries with it two smaller rocket planes attached to the sides. At top of the flight, the nose cone separates, the two rocket planes detach and glide back to earth in slow, gentle spirals, and booster floats down on a gaily colored parachute.

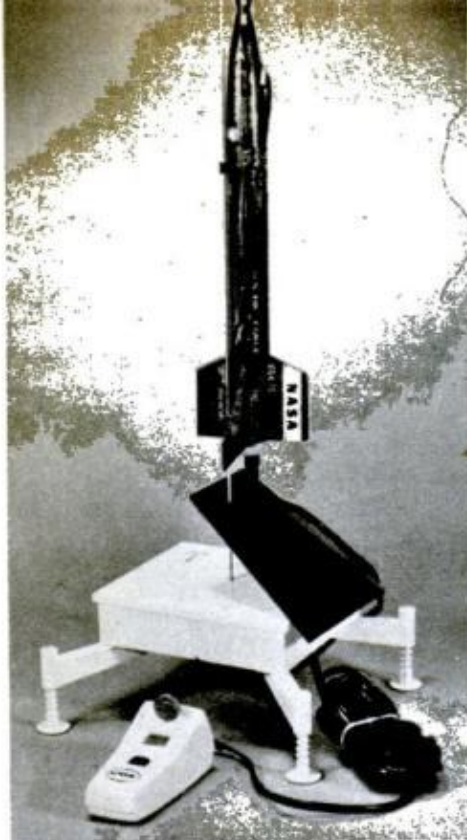
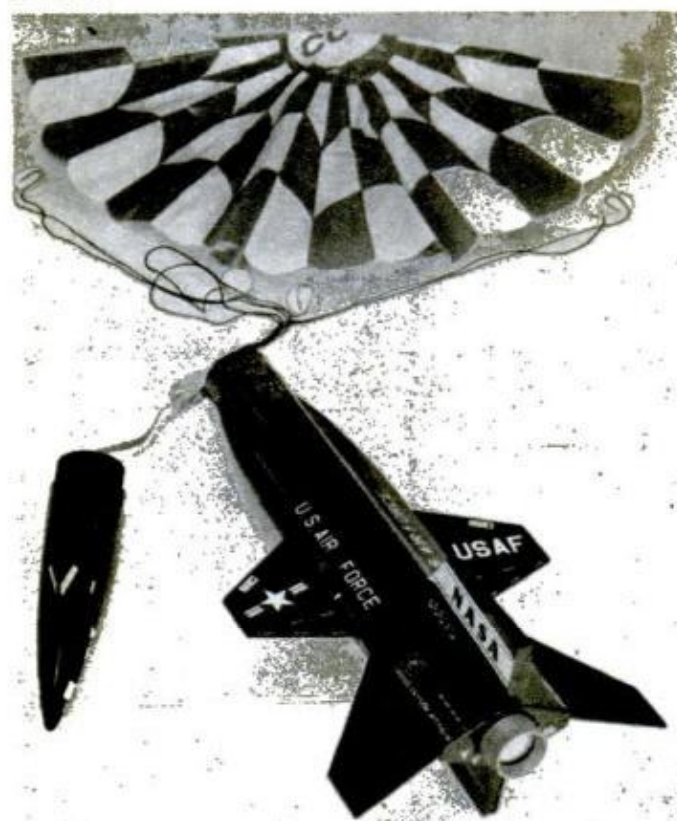


**One of hottest racers** ever to cross a finish line is P-51D "Miss America," authentically reproduced in colorful model at left.

**Unusual prop-powered speedster** at left, below, is patterned after Bonneville Shrike racer. All models shown here are by Cox.

**Two aerobatic biplanes** play tag in simulated flight shot below. One at right is copy of world-famous Pitts Special stunt plane.





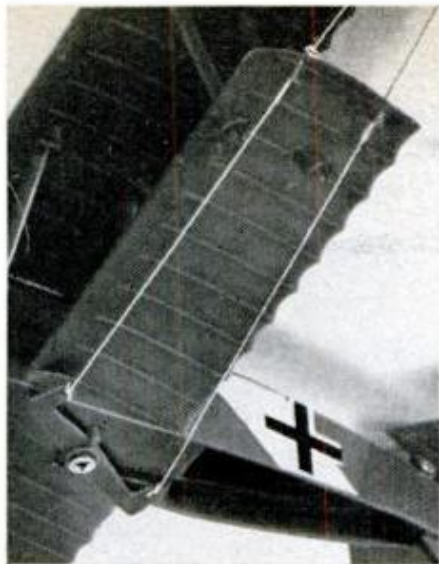
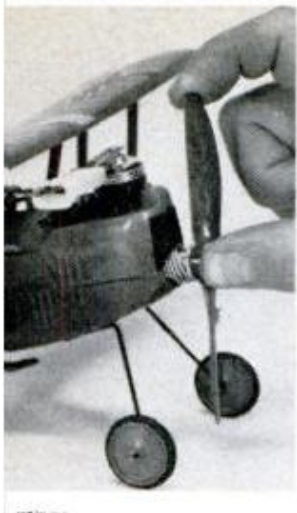
**Poised for takeoff** on a realistic-looking launching pad is authentic reproduction of NASA's sleek X-15 rocket plane, first ship to explore the fringes of outer space. Original reached altitudes of 350,000 feet and hit speeds of more than 4500 mph. This Cox scale model automatically deploys a parachute at top of flight and floats gently to the ground.



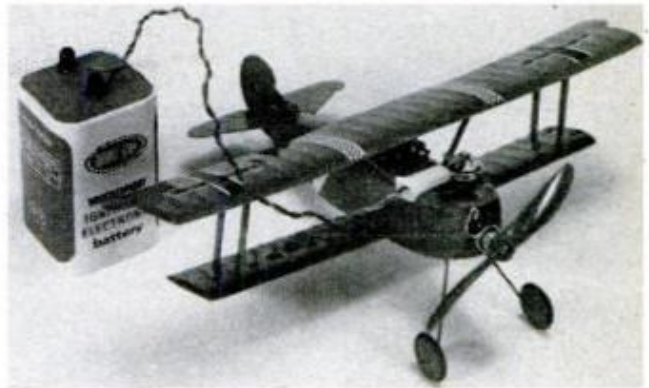
**Camouflaged P-40E Warhawk**, an historic World War II fighter, comes ready to fly in kit containing fuel and all other necessary supplies. Made by Testor, it sells for \$9.95, is molded of tough, unbreakable plastic.

**Rivets racer**, modeled after Bill Falck's all-time Formula I air race champion, comes in for smooth landing at right. Cox replica has 23-inch wingspan, is powered by .049 engine.



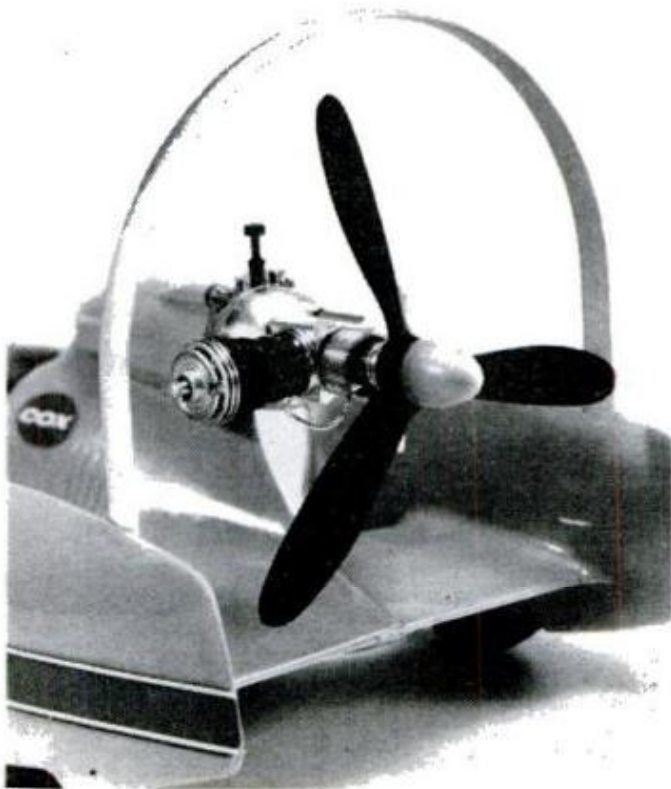


**Starting is easier nowadays.** Coil spring (far left) spins prop for you—you just wind it up and let go. Improved battery clip (below), unlike old alligator type, slips firmly onto cylinder. Center photo shows simple bell crank for moving elevator up and down.

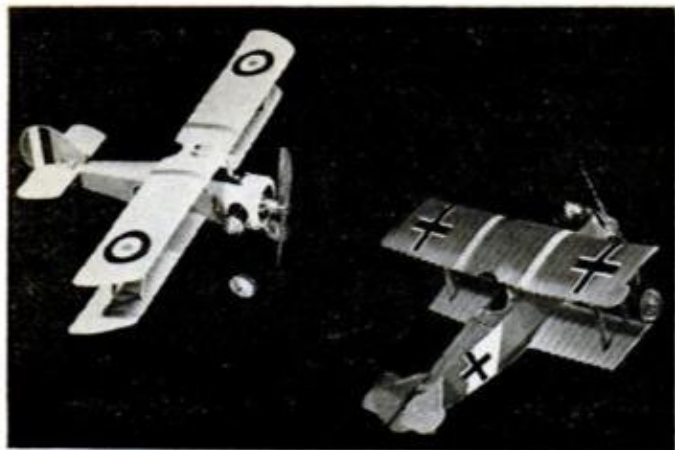


elaborate construction only to have your prized creation end up in a heartbreaking heap of scrap after its first brief flight. Today's gas-powered models, for the most part, come preassembled and ready to fly. They're made in eye-catching colors of tough, virtually indestructible plastic. If you should break a part, it's easily replaced. Cox, one of the biggest makers of gas-powered, control-line planes, supplies a full list of replacement parts with each one you buy. Prices for ready-to-run models range from under \$10 to less than \$20, complete with engine and control line—about as inexpensive a hobby as you can find.

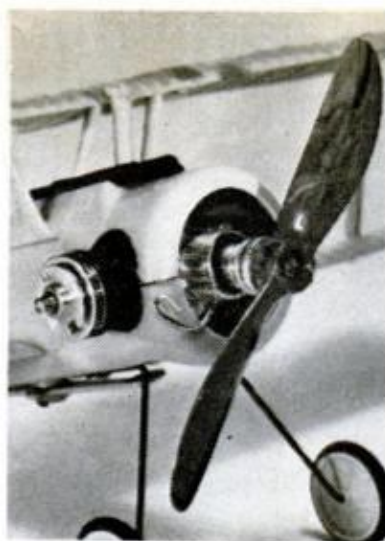
Improved engines, fuels, batteries and other parts also make model flying easier and more fun than ever. Gone are the finger-blistering days when you spun the prop over and over by hand, praying the engine would catch, only to have it fizzle out a few seconds later after it did. Today, many models incorporate spring-wind starters that make engine starting almost automatic. You merely hook the prop in the spring, wind it backward and let go. Off she roars—usually on the first try. Most models can be flown in as little as a 30-foot circle. With practice, you can do dives, climbs, loops and other exciting maneuvers using a simple



**Unusual prop-powered racing car** is model of actual Shrike speedster tested on Bonneville salt flats in Utah. The Cox replica, 12 inches long, is driven by same .049 engine used in many gas-powered model planes. It can be run free on a straight course or tethered to a stake for operation in a small, circular pattern where space is restricted.



World War I fighters go at each other in simulated dogfight above. Sopwith Camel at left and Fokker D.VII at right have 13-inch wingspan, are powered by .049 engines, sell around \$10. Photo at far right shows how Cox models are easily disassembled to replace parts. Cox kit (near right) has fuel, battery, wrenches, supplies.



Kit-built Bomarc missile consists of preformed plastic and balsawood parts, goes together to produce dramatic 23-inch-long replica of Air Force's surface-to-air interceptor. Made by Estes, kit is \$6.50. The launching stand and remote-control, electric-firing system are available separately for \$11.95.



control linkage that moves the model's elevator up or down.

Cox offers a wide range of preassembled models from vintage fighters to modern racers. They're all there—Camels and Fokkers from World War I, Mustangs, Corsairs and P-40 Warhawks from World War II, and sleek stunt and racing planes like the famous Miss America and Pitts Special. Also available from Cox is a selection of gas-powered racing cars and propellant-powered rockets. Another maker of inexpensive ready-to-fly models is Testor's. For those who like to build their own, Estes offers a line of propellant-powered rockets and missiles in kit form. These sell for as little as \$2.25 to \$6.50. Some Cox rockets are also available as kits for do-it-yourself assembly. Catalogs, prices and additional information can be obtained from the following companies: L. M. Cox Mfg. Co., Inc., 1505 East Warner Ave., Santa Ana, Calif. 92705; Estes Industries, Inc., Box 227, Penrose, Colo. 81240; Testor Corp., 11500 Tennessee Ave., Los Angeles, Calif. 90064. ★★★



# Custom rod to fly with



PHOTOS BY L. LAREDO



**F**ly-fishing is considered the ultimate art for the angler, but also one of the most expensive when you're first fitting out. Experts have paid \$200 and up for their perfect rod, but now Phillipson—one of the top brands and a new division of 3M—offers a kit for \$25 that provides the added pleasures of making your own.

Highest quality epoxy-bonded Scotchply fiberglass blanks and stainless guides, plus a carboloy stripping guide, are provided. After reel seat and cork grips are installed, guides are positioned and secured in place with wrappings of nylon thread supplied. Figure an evening's work to do this, following the detailed instructions. Wrappings are finished with five or six coats of varnish. Write your name on the butt section and varnish it as well. Dealer sources are available from 3M/Phillipson, 3M Center, St. Paul, Minn. 55101.—*Bill McKeown*

**Sensitive flex** is only one of the pleasures you get with the new custom 3M/Phillipson fly rod. Kits are being offered for glass or bamboo fly and spin rods.



**Cork grips and reel seat** are firmly secured in place with a rod cement that comes with the kit. The cork is predrilled, providing a perfect fit to glass blank.



**Guides for fly line** are positioned along the rod sections, as with this 8-footer, at spacings shown in kit instructions and are merely Scotch-taped in place.



**Nylon thread** that's tensioned by running it through stacked books replaces tape to wrap and fasten the guide feet. Varnishing the wrap completes the rod.

# IT'S NEW NOW

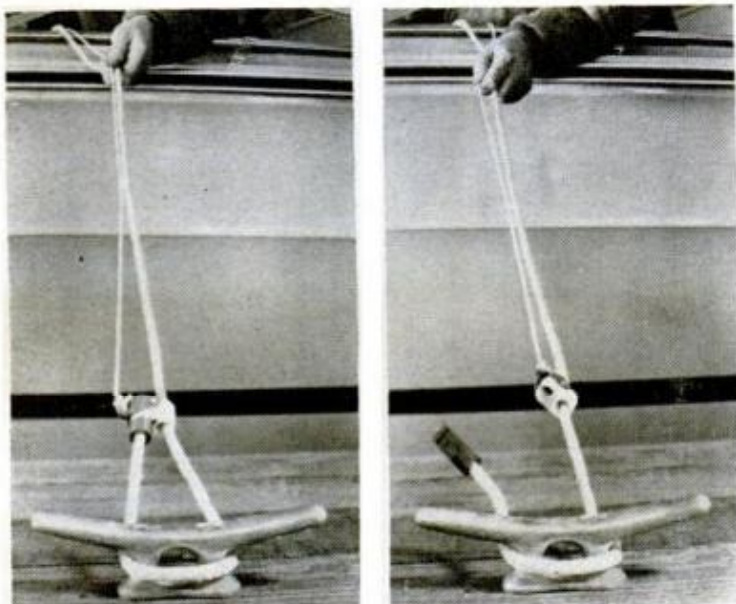


## Modern British liner to sail all the way from Mexico to Alaska

Anyone who thinks ocean liners are dead will have to take another look—specifically at this modern new British giant, the "Spirit of London." The 17,000-ton vessel is virtually a floating city with luxury accommodations, huge shopping center, a variety of restaurants, swimming pools, ballrooms, gymnasiums and other deluxe facilities. The ship will cruise the West Coast from Mexico to Alaska.

## Flameless heater is safe even near explosive fumes

You can safely use this portable flameless heater around cars, spray paints and in other situations where flammable liquids or fumes would be hazardous near conventional space heaters. Unit works on a chemical catalytic principle; models give 5000 to 32,000 B.T.U.s of heat. Prices start at \$32. For further information, write Impala Industries, 1106 East 37th St. North, Wichita, Kans. 67204.

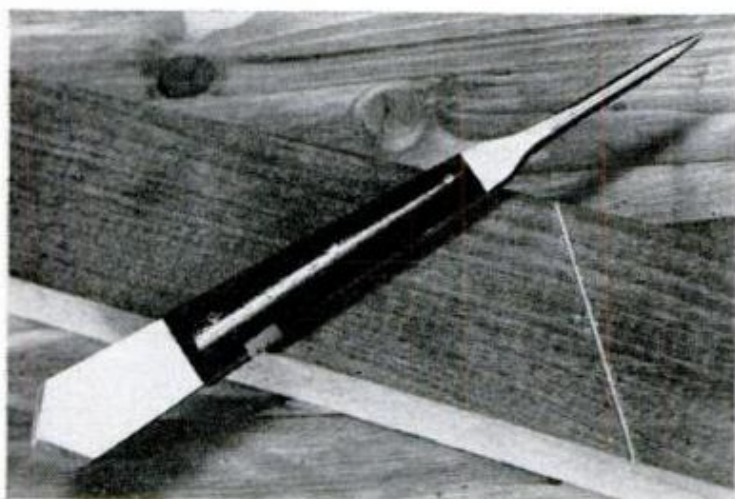
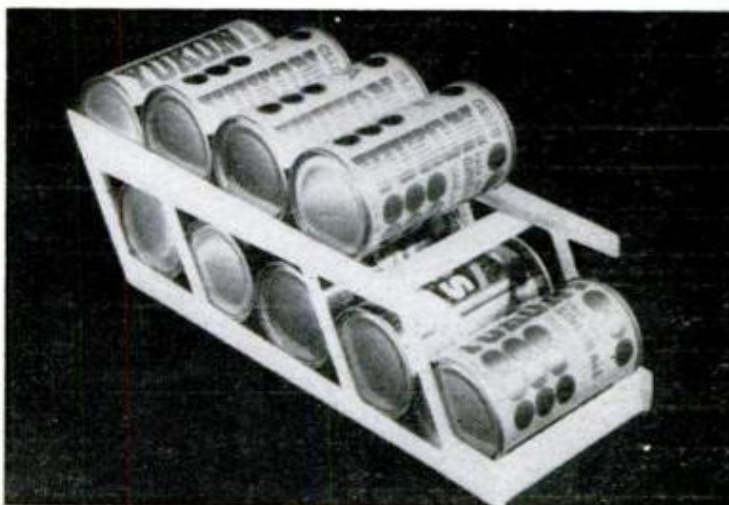


## You don't have to jump in and out of your boat to release this mooring line—just give it a yank and it slips free by itself

How do you cast off a mooring line without getting out of the boat to untie it? With this self-releasing line, you can do just that. The line is looped around a dock cleat and its end inserted in an eye fitting to hold the loop closed. Pulling a release cord retracts the eye, allowing the loop to open and slip free from the cleat. The 12-foot nylon Mooring Mate is \$5.95 from Pacific Diversified Products, 732 S.E. Powell Blvd., Portland, Ore. 97202.

## Dispenser rack keeps cans of refreshment at your fingertips

This dispenser rack neatly stores 10 12-ounce cans of your favorite beverage in your refrigerator, uses space efficiently and ends battles with stubborn plastic-ring can holders. Load it from top, and the coldest can will always be up front, ready for use. Dispenser sells for \$1.99 plus 50 cents postage and handling from Paval, Dept. PM, 1709 North Chestnut St., Arlington Heights, Ill. 60004.



## Mark wood indelibly with cabinetmaker's scriber

A line scribed with a knife or an awl can be easier to follow than a smudgeable pencil line when working with wood. This cabinetmaker's "striking" knife has both—two cutting edges at one end and an awl at the other—and rosewood grips besides. Made from one piece of hand-forged Sheffield tool steel, it's \$1.95 plus handling and shipping costs from Brookstone Co., Peterborough, N.H. 03458.

## Fiberglass kit for fixing practically anything includes everything packed in its own mixing tray

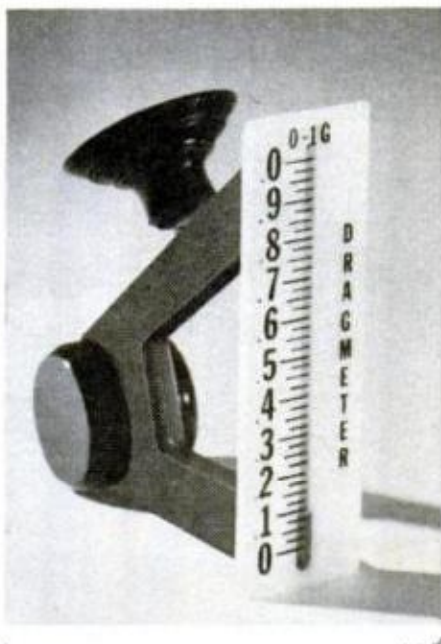
With this \$4.95 kit, you can use fiberglass to repair almost anything—such as an auto body or a boat hull—or to make useful articles. It includes three square feet of a specially treated glass-fiber cloth, eight-ounce can of resin, tube of liquid hardener and spatula—all nested in a plastic mixing tray with step-by-step instructions. The handy kit is marketed by Woodhill Chemical Sales Corp., Box 7183, Cleveland, Ohio 44128.





## Two neat, invisible ways you can conceal those pesky speaker and TV wires

Here are two ways you can neatly hide wires for hi-fi speakers, home intercoms, burglar alarms, TV antennas and other low-voltage applications without drilling holes in walls and fishing cables between studs. In the system shown at far left, hollow plastic molding strips are fastened in the corners along walls and ceilings and are capable of carrying several pairs of wires. The strips come in 6 and 8-foot lengths and can be painted to match existing decor. For prices, write New York Testing Labs, 81 Urban Ave., Westbury, N.Y. 11590. At near left is a self-adhering tape with two thin, flat conductors that can be pasted on any wall or ceiling surface and painted or papered over for a virtually invisible installation. The Conduct-O-Tape is also made in a three-wire version and in one designed especially for 300-ohm TV twinlead. A starter kit containing 50 feet of two-wire tape and connector fittings is \$8 from Sun Spot Products, 417 North State St., Chicago, Ill. 60610. Additional 50-foot lengths are \$3 each. Longer lengths and the special three-wire and TV twinlead types are available in rolls of up to 500 feet from the manufacturer, Hobby Hill, Inc., 415 North State St., Chicago, Ill. 60610.



## Instant acceleration checker for your car

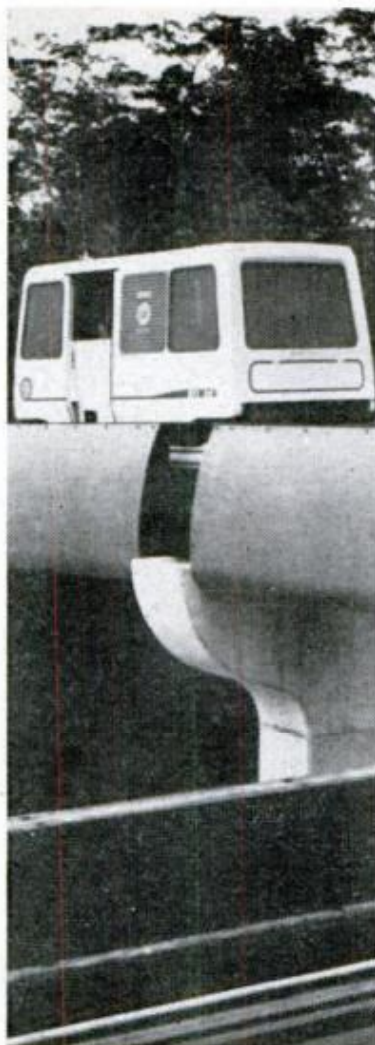
You can check your car's acceleration merely by watching the graduated vial in this inexpensive accelerometer. As you tromp on the gas, a red liquid rises to indicate maximum acceleration in tenths of a G. Because the instrument reacts instantly, readings can be taken within 20 feet at low speeds, ending the need for making timed 0-60-mph runs—often difficult or illegal on public roads. For comparison, standard G performance ratings for all popular car makes are included. Dragmeter attaches to windshield with suction cup, is \$7.95 from General Axial Engine Co., 38 Franklin Ave., Lockport, N.Y. 14094.





**Miter table guide for portable circular saws**

Precision cutting with a portable saw is offered by Motor Miter. According to the manufacturer, it lets you use any small-base portable circular saw for accurate angled ripping, crosscutting and dadoing, and permits compound miter cuts as well. Angular adjustment is regulated by means of a graduated dial and setscrew. Workpiece can be fed through the saw or the saw can be passed over it. Unit mounts on a workbench or, for outdoor use, clamps onto a sawhorse. It weighs 28 pounds, disassembles rapidly for portability. The tool sells for \$69.95, plus shipping, or \$103.50, plus shipping, with Skil Model 574 saw. Motor Miter Co., Highway 35, Prairie du Chien, Wis. 53821.



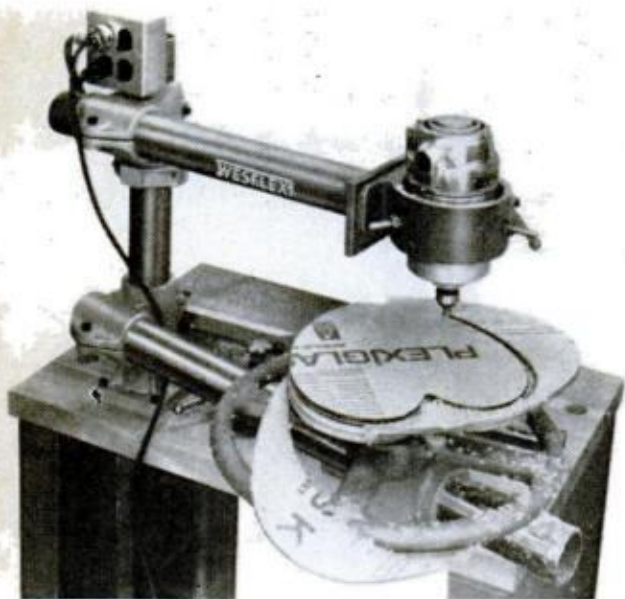
**Private 'el' for college students**

Not many college students have their own rapid-transit system like those at West Virginia University at Morgantown, W. Va. Small electric-power cars scoot back and forth across university grounds on elevated trestles, whisking the lucky students to and from classes without their having to poke their noses outside. The cars are actually part of an experimental, high-speed automated transportation system being developed at the university for future public use. Stopping, starting, switching, routing of cars to various destinations are fully computer-controlled.



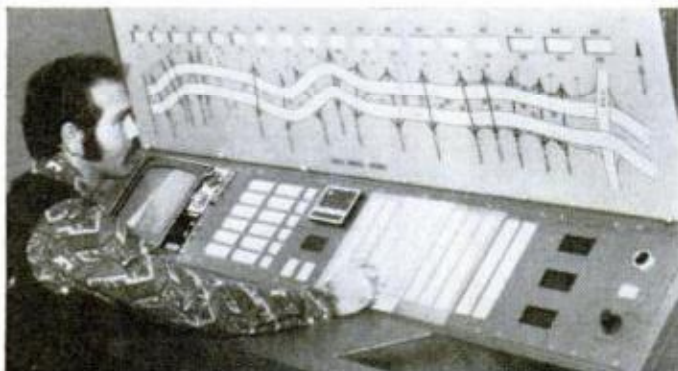
**Two easy-to-build, low-cost weekenders**

Here are two inexpensive ways to get a weekend home. At top is a canvas dome on geodesic frame of slip-together aluminum tubing. Its diameter is 14½ feet; floor space, 160 sq. ft. Framing can go up in hour, disassembles to fit in car trunk; \$549 from New Earth, Box 6820, San Francisco, Calif. 94101. Kit-built wood-frame cabin below is sold as shell you erect and finish yourself. It's 24 by 32 feet, with 768-sq.-ft. space, three rooms, bath, L-shaped sun-deck. Basic shell less foundation and fixtures is \$4495. Adventure Homes, Inc., Box 243, Fairlawn, N.J. 07410.



## Radial arm for router has vacuum workpiece hold-down

If you're planning a supershop, you'll want one of these versatile tools. It's the Wesflex Radial Arm Router/Shaper. Put an electric or pneumatic router into its universal bracket, and it will cut any shape from sheet material—any size from 48 inches down to two inches diameter. Dustproof vacuum pump holds template and workpiece in place. Optional accessories include shaper fence assembly and under-table bracket, pneumatic downfeed assembly for internal cuts and grooving of sheet surfaces. Basic unit, less router and stand, is \$740 from Wesflex Machine Co. Inc., 287 Riverside Ave., Westport, Conn. 06880.



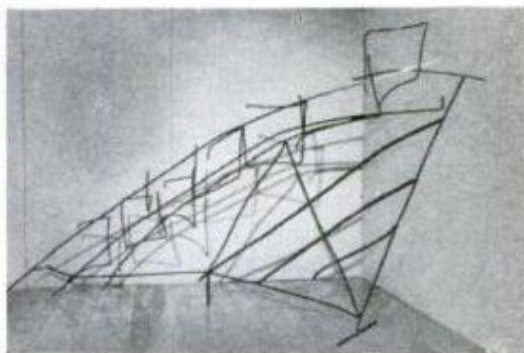
## Now computers operate highway traffic, even park cars by remote control

Automotive traffic is becoming more automated every day. Men pressing buttons at huge consoles are controlling cars on highways, bridges and in parking garages just like railroad dispatchers are routing trains. In photos at top, a console operator keeps traffic moving over busy Santa Monica Freeway near Los Angeles. Road sensors transmit traffic density, lane blockages and other data to a maplike indicator board. From this the

operator can flash messages to motorists on roadside signs about conditions such as "Accident Ahead." GTE Sylvania developed the computerized system. At lower left, a police "towerman" controls traffic on the Verrazano-Narrows Bridge in New York City, watching TV monitor screens in a Cutler-Hammer system. At lower right, cars are parked by remote control in an electronically automated garage in Munich, Germany.

**Mini-battleship looks like the real thing, even has water-firing turret guns**

Look at the lower photo at right and you can't be sure whether you're seeing a real battleship or not. The giveaway is the upper view, showing an inside close-up of what is actually a superdetailed, operating replica of the now-retired USS Massachusetts battleship used in World War II. The 18-foot-long model, built on a scale of 1 to 38, is powered by a 6-hp outboard engine, carries a crew of two and, for simulated realism, fires streams of water from swiveling turret guns. Her fiberglass superstructure swings up for access to the cockpit, and the engine is concealed under her after turret gun. A small exhaust fan carries away engine fumes to keep them out of the crew's quarters. The mini-battleship's captain and builder is Cecil Gates, a California high-school shop instructor who plans to sell the model in kit form for about \$825. It weighs 800 pounds, has a beam of four feet and makes about eight knots. Two 12-volt car batteries power horns, searchlights, a PA system and pumps for the water cannons. Information about the model and kit is available for 50 cents from Cecil Gates, 22942 Dolorosa St., Woodland Hills, Calif. 91364.



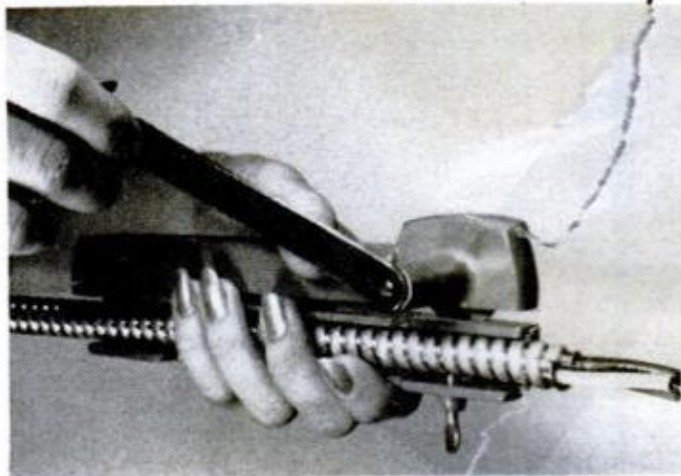
**From famous doodles to artistic sculpture**

Casual doodles don't usually end up as works of art—but those of the late President John F. Kennedy have done just that. Sculptor Ralph Mitchell Tate, fascinated by the imaginative scribblings, produced 21 pieces of wire sculpture from them, including the sailboat at left and stairlike structure at right. At center is a sheet of the doodles from which he worked.

# NOW

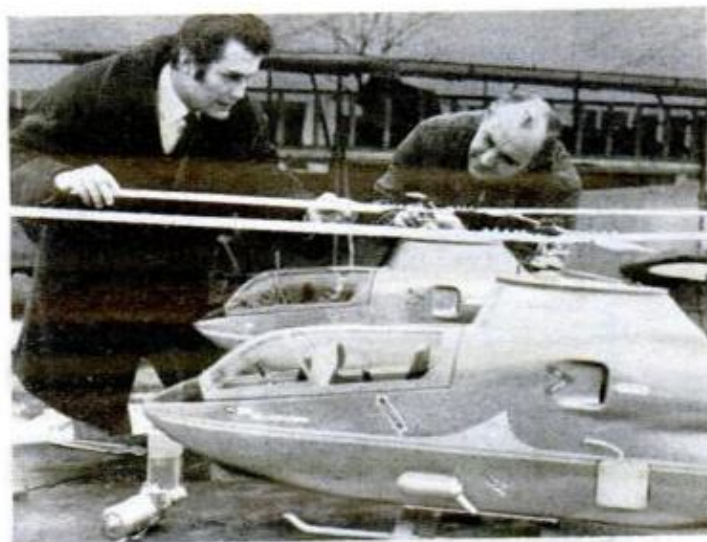
## Yesterday's news is today's furniture

Here's a new way to make furniture and avoid the cost of lumber at the same time. You build smart, modern bookshelves, desks, tables and chairs with rigid tubing made from recycled paper. A California company has a special process for treating the paper waste so that 75 pounds of it, for example, becomes a coffee table. Lengths of tubing are sold in a variety of colors. They are assembled with plastic connectors, so that they can be taken apart and rearranged quickly; shelving and tabletops are added. Prices range from \$17 for a small rack to \$33 for a large bookshelf. Maker claims tubing is as strong as conventional materials. For information, write Environmental Concepts Products Co., 9100 Wilshire Blvd., Beverly Hills, Calif. 90212.



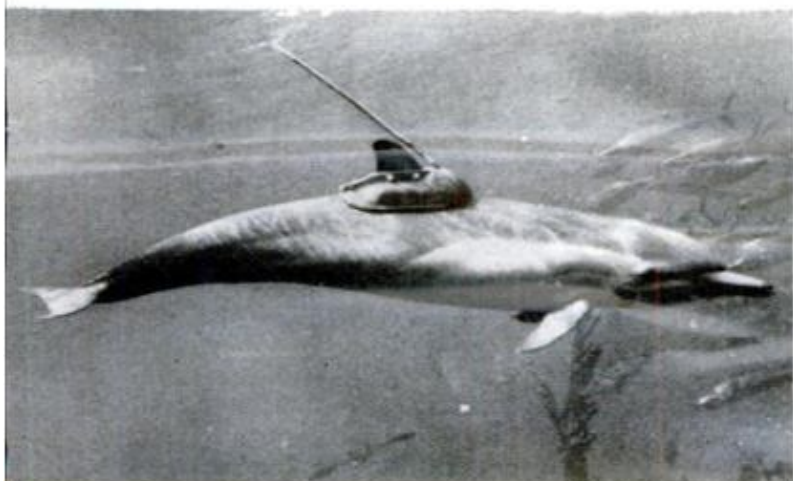
## Quick cutter for armored cable

Roto-Split is claimed to cut thinwall conduit and BX cable from  $\frac{3}{8}$ -inch to  $\frac{5}{8}$ -inch diameter quickly and conveniently with a few turns of its handle. It has an automatic stop to prevent damage to insulated wires inside. Open-channel construction of the nine-ounce tool permits cutting in middle of a roll. Price is \$8.95 plus \$1 postage from Seatek Co., Dept. PM, Box 74, Norwalk, Conn. 06856.



## Pretty models cost a pretty penny

Almost big enough to fly in yourself, these giant 6-foot-long radio-controlled model helicopters are powered by 1-hp gasoline engines; hit speeds up to 60 mph and can stay aloft 20 minutes. Patterned after the Bell Huey Cobra, they're made by Hegi Co., Nuernberg, Germany. No toys, the elaborate replicas sell for 2200 marks—nearly \$800 in U.S. money.



### 'Wired' porpoise tracks tuna for fishermen

Sprouting a radio antenna from its dorsal fin, this obliging porpoise transmits its position to waiting tuna fishermen. Why are tuna fishermen interested in porpoises? Well, porpoises and tuna are natural aquatic companions so wherever the porpoise goes there's likely to be a school of tuna swimming with it—and that's what the fishermen want to find. The tracking test is taking place off San Diego.



### Craft sets for youngsters offer professional features

These kits will let rockhounds and ceramists aged 10 and up make brilliant gemstones and symmetrical pottery. Rock tumbler (top) has an all-rubber barrel for quieter, leakproof operation. Set includes stones, grit, polish and blanks for making jewelry. Under \$20. Pottery wheel has variable-speed motor—high speed for centering, low speed for finishing. Outfit requires no heat, includes self-hardening clay, air-dry glaze. Under \$45. Sold in department and toy stores. Skil-Craft Corp., 325 West Huron St., Chicago, Ill. 60610.



### Kit for welding aluminum

Repairing aluminum articles in the home or shop is easy with a butane or oxyacetylene torch and this Aluma-Weld Kit, the maker says, with welds at least as strong as the original metal. Kit consists of 18 inches of highly deoxidized welding rod, flux and instructions. \$5.95 postpaid from Multi-Product Co., Box 5517, San Antonio, Tex. 78201.

# NOW



## Book plus kit helps you build wide range of electronic projects

Two for the price of one is the object of this novel book-kit combination. You get a book of plans for building dozens of simple electronic projects plus a kit of parts for making one particular device. The sets are available in a choice of 10 kits, including an audio mixer, power amplifier, wireless mike, diode tester and the garage light control shown at left. \$4.95 to \$9.95 from Tab Books, Blue Ridge Summit, Pa. 17214.

## Lively camper-cruiser puts you out where the breezes blow

Up-front lounging is provided for in this new Glastron Vagabond camper-cruiser—a welcome feature for those who like to climb out on the bow. The 21-footer packs a lot of living in a small hull—sleeping accommodations for four, full galley, head, dinette table and cockpit lounges. The cabin has a hardtop sun roof and can be completely enclosed with canvas for camping. Standard power is 302-cu.-in. V8 engine. Glastron Boat Co., Box 9447, Austin, Tex. 78766.



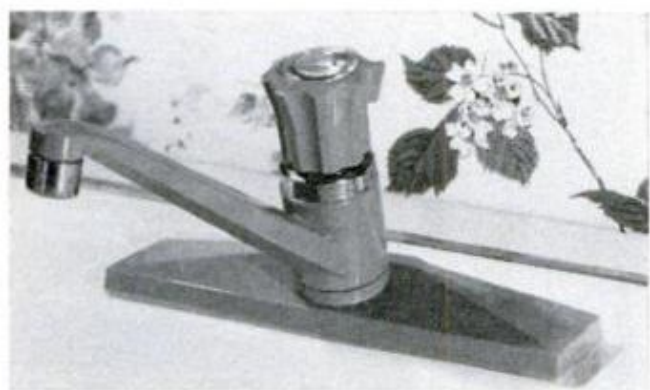
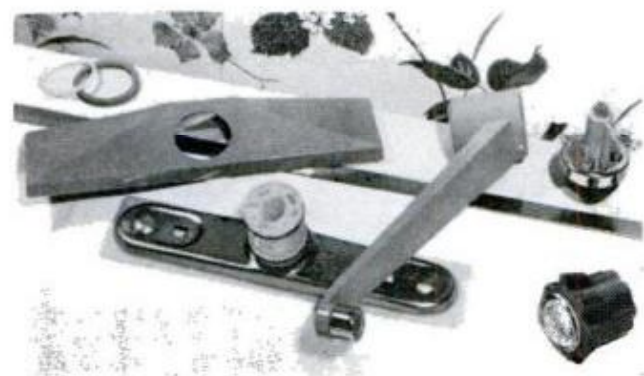
## Just flip a lever to change tanks on this quick-release scuba pack



Changing scuba tanks on this quick-release backpack is a simple matter of flipping a handle at the side. The handle, shown at far left, operates a cam-action clamp arrangement that opens the tank-retaining band just far enough to let you easily slip out one tank and insert another without having to fuss with screws—especially handy if you don't have a screwdriver with you. The pack also features molded-in handgrips for carrying and dual-release buckles on waistband and shoulder strap. \$28 in black or orange. Healthways, 5340 West 102nd St., Los Angeles, Calif. 90045.

## Navy men get a new type of 'life preserver'—for smoke, not water

The sailor at right isn't warding off bees or mosquitoes—he's demonstrating a new emergency escape breathing device designed by the Navy to reduce the hazard of smoke inhalation in shipboard fires. The simple, lightweight aid, destined to become standard equipment for all Navy personnel, consists of a collapsible plastic face mask connected to a small canister of compressed air. The air lasts eight minutes—enough for the wearer to reach safety, even in dense smoke on a large ship.



## Chameleon faucet can change its color to match your decor

This single-handle lavatory faucet can change colors in minutes when you redecorate, and the manufacturer says its mechanism, with just one moving part, should last almost indefinitely. Handle, shell and underbody can be replaced in any of five colors in 10 minutes with a Phillips screwdriver, according to maker, Bradley Corp., Menomonee Falls, Wis. 53051.



## Electric 'wheelchair' helps the handicapped get around easier, faster

Gliding smoothly along on small, concealed wheels under its base, this new pedestal-type, electric-powered wheelchair can move in any direction, pivot on its own axis for quick turns and raise and lower its seat height to any desired level—all at the touch of pushbuttons. The Queensway Chair was developed by engineers at Queen Mary College in London.



## 'Instant' trenches for combat troops—or 'My, what big teeth you have, Grandma!'

Weary British foot soldiers won't have to dig their own trenches and foxholes with this big mechanical jaw to do it for them. Developed by the Royal Engineers, the machine has a series of claws on an endless belt that scoop out earth and carry it up to a second conveyor running crosswise at the top. The upper conveyor dumps the soil off to the side, forming an additional raised barrier along the edge of the trench. It can throw the earth to either side—depending on which way the enemy is coming.



## Compact heaters warm up chilly places

Electric heat you can put where you need it is offered by Singer's line of unit heaters. They have high-capacity elements in cast-aluminum heating grids, and can be hung from brackets or placed temporarily where needed. They're available in several models, delivering as much as 42,000 B.T.U. per hour, with or without thermostatic control. For information, prices, write The Singer Co., Climate Control Div., 62 Columbus St., Auburn, N.Y. 13021.



## A sportsman's scope you wear like a wristwatch

Worn like a wristwatch, this tiny six-power monocular scope gives you a quick view of distant objects without having to carry a heavy pair of binoculars around your neck. Designed for nature lovers, hunters, boaters and other outdoorsmen, Wristscope weighs only 3½ ounces, is smaller than a pack of cigarets. It focuses from 10 feet to infinity and has a wide field of view (210 feet at 500 yards). \$17.50 from Ranging, Inc., Rochester, N.Y. 14625.



## People-sized checkerboard makes an outdoor playground for giant-sized fun

Housing developer J. Edward Thornberg of Clear Lake, Iowa, has come up with a novel idea in community playgrounds. It's a huge concrete checkerboard with large squares painted alternately red and black. The playing pieces are 16-inch-diameter wood circles light enough for youngsters to move easily from space to space. To accommodate a number of neighborhood kids, the game is played with teams of four to a side, each child making every eighth move. Otherwise, standard rules are followed.



## Tray for shop or kitchen is sold ready to roll

A convenience for kitchen or workshop, this preassembled roll-out tray is quickly installed with four screws at the base of any cabinet or on top of open shelves. It has ball-bearing slides and is finished in white wood-grained vinyl. Three inches high and 20 inches deep, it's available in widths from 10 to 22 inches, priced from \$12.50 to \$17.50 through building supply dealers or from Hardware Designers, Inc., 120 Kisco Ave., Mount Kisco, N.Y. 10549.



## Fuji offers free 'Do Not X-Ray' labels to traveling photographers

Travelers worried about having film ruined by X-ray inspection at airports and other checkpoints can avoid the problem by pasting colorful warning labels on their camera bags, luggage and shipping cartons. The labels alert inspectors who, as an alternative to X-raying, will examine the contents visually. A set of six is available free by sending a request and self-addressed, stamped envelope to Fuji Photo Film, 350 Fifth Ave., New York, N.Y. 10001.

# Strong workmanship but weak torque on the low end

A nationwide survey based on 2 million owner-driven miles.

by **Michael Lamm**  
WEST COAST EDITOR

There are two dash bins, in addition to regular glove compartment. Grab handles are a thoughtful touch, but rear windows should open out.



Front-wheel drive, plus radial tires, gives surefooted traction. Drivers learn not to back off in real hard cornering, which causes rear to slide as with all fwd cars

The German Audi 100, produced by the same people who make Volkswagen and Porsche, is claimed to have the virtues of "the world's seven greatest cars"—at a price below all but one of them. Outwardly the Audi looks like a smaller Mercedes, and not by accident. Its designers tried hard to capture some M-B flavor.

But is the Audi as great as its admen make it out to be? In the area of workmanship, definitely yes. Nearly 88 percent of the owners we surveyed rated Audi workmanship "good to excellent." That's the highest percentage we've gotten this year, the 1973 average being 65.5 percent so far.

Also high on drivers' lists of praises is the Audi's handling. With front-wheel drive, standard radial tires, rack-and-pinion steering and power disc brakes, owners feel they're in a sports car, not a family sedan. Owners likewise nod appreciatively at such thoughtful touches as *comfortable* and *easy-*



to-use inertia-reel shoulder harnesses, admirable gas economy (18-22 mpg), adequate rear legroom and a full-sized trunk.

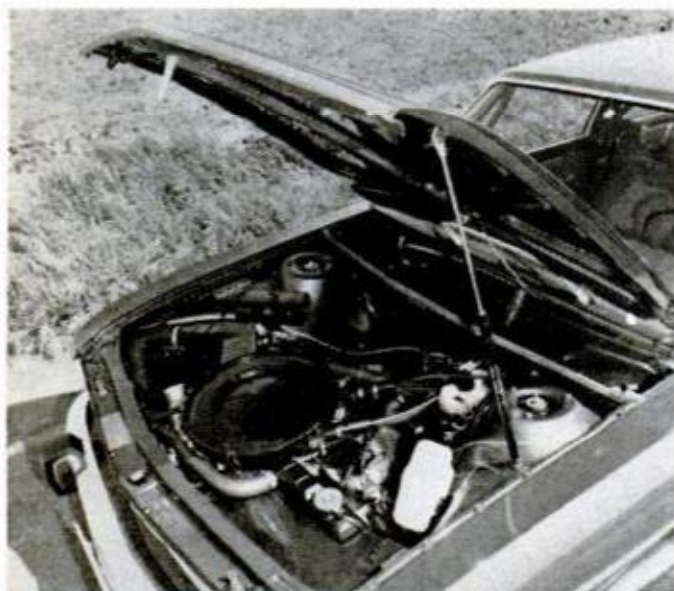
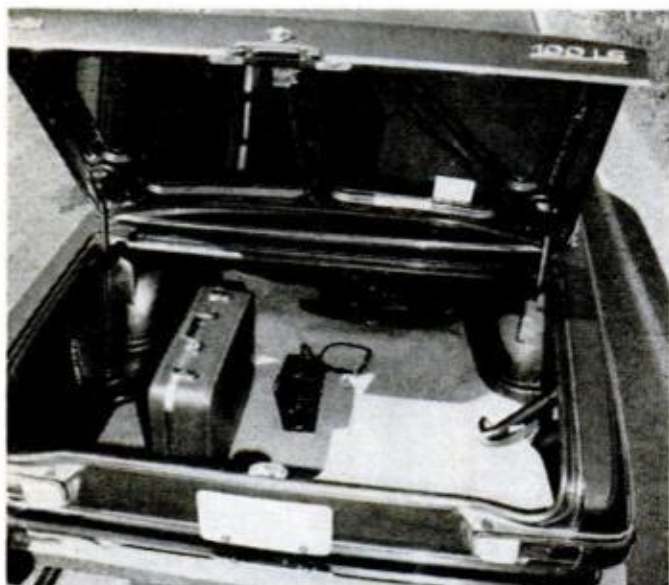
On the minus side, the most serious complaint seems to be a lack of low-speed torque. The four-cylinder, water-cooled engine displaces 114.2 cu. in. (1871-cc) and puts out 91 bhp at a very high 5100 rpm. Torque rates 111 lb.-ft. at 3500 rpm. This last figure means relatively weak muscle at low rpm, which in turn means it takes a lot of revving and clutch slippage to get the car rolling from standstill (with standard transmission). Owners of automatic-equipped Audis also feel the lack of low-speed torque and complained additionally of rougher shifts than they'd been used to with American cars. (This "slowness" certainly hasn't been inherited by the smaller, just introduced, Audi Fox. See *Cars the Red Baron Would Love*, page 138, July PM.).

Another, more surprising gripe focused

**Mini-Mercedes styling** satisfies owners' ego and is their main reason for buying Audi. Relatively narrow pillars give good vision, and while the car looks small outside, it's not at all cramped in rear seat or front buckets.



## 'I bought my Audi because . . . I wanted something different.'



There's lots of room in the trunk and two handy storage compartments at sides. Four-cylinder engine stands ahead of transaxle, with radiator offset to left and cooled by electric fan. Everything's accessible.

Inboard front disc brakes are standard, but several owners would have liked power steering (not offered). Audi's 185.2-inch overall length makes parking easy. Car's unitized body-chassis isn't free from rattles.



on body rattles. Why should a car with a unitized body/chassis rattle, especially one that rates so high on workmanship? No one seems to know the answer, but there it is—that consistent mention of annoying rattles.

Nor were Audi owners too crazy about dealer service. Sixty percent rated it "average to poor" despite (or perhaps because of) the Audi's 12-month, 20,000-mile warranty.

But let's hear it from the owners.

"I find the car very comfortable, and so do my passengers. They have all expressed amazement at the Audi's room and ride," purrs an Illinois landscape contractor. A New York crane oiler: "I bought my Audi because I was tired of all those standard-looking American cars. I wanted something different." (Styling ranks first as the owners' principal reason for buying the Audi.)

"The Audi is very deceptive when you first see it from the outside," notes a Massachusetts secretary. "because when you get inside it has as much room as a big U.S. car."

A high-mileage Ohio traveling salesman: "I'll buy another Audi if this one holds up well to 120,000 miles without major repairs. The only thing wrong now (at 17,000 miles) has been that the carburetor needed reworking. Complaint: The windshield wiper on the driver's side doesn't wipe far enough to the left. This leaves a large unwiped area."

A Wisconsin nontraveling salesman: "This is my fourth new car and by far the most superior in engineering and dollar value. It's good-looking, has no blind spots, the front drive gives complete control in slippery situations, shifting is smooth, it gets good gas mileage, and it has the best seat belts I've ever used. My only suggestion would be to replace the idiot lights with real gauges. Otherwise I'm a very pleased Audi owner and recommend it highly."

An Indiana research chemist: "It could possibly use power steering and a little more horsepower, but not at the expense of fuel economy. Front-wheel drive is great in heavy snow. It's the right-size car for me, with the right amount of room inside and in the trunk."

A Virginia retired federal employee: "My chief objection to buying an Audi was my preference for a U.S. car for patriotic reasons. But better vision, headroom and



**Receptacle ends** for beautifully designed, three-point inertia-reel belts are always at hand. Twin dials on

dash are easy to read; owners prefer gauges to idiot lights used. Bigger overrides would protect the grille.

legroom made me decide in its favor. I am 5-8. Among U.S. cars, I checked out the Dart, Hornet, Nova, Omega and Valiant. Only the Valiant had satisfactory vision and room, but the Audi seemed better engineered, and surface workmanship was obviously better."

A dissatisfied New York dairyman complains: "I leave the car for a full day for service. When I pick it up, I am told it has been fixed, but it never is. I bought the car only because of Audi's advertising. Workmanship is poorer than expected. The car simply isn't worth the price. Passengers find the rear uncomfortable because the rear windows won't open. I have no praises for this car, but it does look nice from the

outside. The windshield still leaks, and the oil light comes on constantly, even though there's plenty of oil in the engine, and the warranty seems highly overrated. I am very disappointed with this car."

A Wisconsin teacher counters and sums up: "I think the Audi is every bit the car it's advertised to be. I'm not a car lover by any means—in fact, to me cars have more negative than positive virtues. But the Audi is a more sane approach to individual transportation than the monsters Detroit produces. I'm all for smaller-sized, quality cars, and the Audi is a good example. I paid more for the Audi than I've ever paid for a car before (\$4250), but at this point I'm not sorry." ★★★

## Summary of 1973 Audi Owners Reports\*

<b>Total miles driven</b> .....	1,942,253	<b>Ride</b> .....	21.6	<b>Dealer repairs satisfactory?</b>	
<b>Series:</b>		<b>Workmanship</b> .....	14.6	Yes .....	61.9%
Audi 100 .....	2.6%	<b>Specific dislikes:</b>		No .....	38.1
Audi 100-LS .....	92.4	<b>Rattles</b> .....	15.3%	<b>Dealer service opinion:</b>	
Audi 100-GL .....	4.9	<b>Poor gas mileage</b> .....	11.5	Good to excellent .....	40.1%
<b>Body style:</b>		<b>Poor dealer service</b> .....	10.9	Average to poor .....	60.0
Two-door sedan .....	27.5%	<b>Transmission</b> .....	10.9	<b>Workmanship opinion:</b>	
Four-door sedan .....	72.5	<b>Brakes</b> .....	8.5	Good to excellent .....	87.9%
<b>Transmission:</b>		<b>What changes would you like?</b>		Average to poor .....	12.1
Automatic .....	58.8%	<b>Add power steering</b> .....	11.9%	<b>Is the Audi your only car?</b>	
Manual .....	41.2	<b>Fewer rattles</b> .....	8.7	No .....	59.7%
<b>Average miles per gallon:</b>		<b>Bigger engine</b> .....	8.4	Yes .....	40.3
Local driving .....	18.0	<b>Better battery location</b> .....	8.4	<b>Other makes of cars owned:</b>	
Long distance .....	22.0	<b>(it's under the rear seat)</b>		Volkswagen .....	23.8%
<b>Why the Audi?</b>		<b>Less engine surge</b> .....	6.5	Chevrolet .....	16.0
<b>Styling</b> .....	27.9%	<b>More power</b> .....	5.8	Ford .....	10.2
<b>Economy</b> .....	25.9	<b>Had any mechanical trouble?</b>		Buick .....	5.3
<b>Size</b> .....	22.9	Yes .....	68.2%	Pontiac .....	5.3
<b>Quality</b> .....	15.6	No .....	31.8	<b>Age distribution of owners:</b>	
<b>Reputation</b> .....	14.1	<b>What type of trouble?</b>		15-29 years .....	33.0%
<b>Handling</b> .....	12.9	<b>Carburetor</b> .....	30.3%	30-49 years .....	47.0
<b>Specific likes:</b>		<b>Electrical</b> .....	15.4	50-plus .....	20.0
<b>Handling</b> .....	63.2%	<b>Transmission</b> .....	11.1	<b>Would you buy another Audi?</b>	
<b>Comfort</b> .....	50.6	<b>Brakes</b> .....	7.3	Yes .....	87.5%
<b>Styling</b> .....	38.6	<b>Oil leaks</b> .....	6.4	No .....	12.5
<b>Economy</b> .....	36.3	<b>Did you repair it yourself?</b>			
		No .....	98.3%		
		Yes .....	1.7		

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

# Snappy little two-seater you can build yourself

by Sheldon M. Gallager  
and Howard Levy

When the Davis DA-2A was first unveiled a few years ago, it drew such humorous quips as "Is that an airplane or the crate it came in?" Admittedly, the boxy little two-place monoplane is not likely to win any beauty contests, but for the beginning home builder it represents the ultimate in design simplicity and ease of construction. The all-metal craft is as flat-skinned, slab-sided and square-cornered as you can get—all deliberately calculated to make assembly a breeze. What it lacks in sex appeal, it makes up for in surprisingly snappy performance. Pilots who have flown it claim it has the oomph of a Cherokee on half the power and handles as smartly as an aerobatic Pitts Special.

Despite its packing-crate resemblance, the DA-2A manages a trim, sporty look nonetheless. Its most distinctive feature is a jaunty V-tail, chosen both for its rakish appearance and also because it's actually simpler to construct than a conventional tail—you build only two control surfaces instead of three. The twin "ruddervators" are cleverly coordinated through a gimbal arrangement that permits them to function simultaneously as both rudders and elevators. The stubby wings have no flaps, and the tricycle landing gear is nonretractable—again for the utmost in simplicity.

The DA-2A's designer is Leon Davis, a top mechanic for Aero Commander. Proof that he must be doing something right is the fact that he's sold more than 140 sets of plans for the DA-2A to other home builders. The plane has also won two awards from the Experimental Aircraft Assn. for "Most Outstanding Design" and "Most Popular Aircraft." Dual-control, side-by-side seating makes the ship ideal as a trainer for beginning pilots or for two fliers who enjoy tak-



**V-shaped tail** has only two movable control surfaces that double as both rudders and elevators. While the arrangement looks tricky, it's actually easier to build than a conventional tail, gives ship a rakish, sporty appearance.

ing turns at the controls. Either control stick is quickly removable so as not to interfere with nonpiloting passengers just along for the ride. In back is luggage space that can be converted to extra seating for two youngsters—handy for family outings.

Another feature of the DA-2A is its relatively low cost—about \$1600, including engine. The prototype is fitted with a 65-hp Continental, but can take engines of up to 100 hp for those wanting something a bit hotter. Even on its modest 65 horses, the DA-2A is no slouch. It can hit 120 mph, cruises at 110, climbs 600 feet a minute and has a range of 450 miles on a 20-gallon fuel tank. Empty weight is 610 pounds, 1125 gross. Overall length is 17½ feet, and the wings span 19 feet. Complete plans for the DA-2A are \$110 from Leon Davis, 3501 Baumann Ave., Midland, Tex. 79701. An information kit is also available for \$2 for the convenience of those desiring more details before purchasing plans. ★ ★ ★



PHOTOS BY HOWARD LEVY

Despite its boxy design, ship is snappy, outperforms many homebuilts of equivalent size and power.



Wide, roomy cockpit with dual-control, side-by-side seating (right) offers unusual comfort and spaciousness for craft of DA-2A's size. Instrument panel, shown partially completed, includes full instrumentation and radio in finished form. One control stick is removed here.



Simple tricycle-type landing gear (near left) is nonretractable, has two main fixed wheels on spring-steel tubular struts, plus nose wheel. The nose wheel is steerable, has series of rubber doughnuts to cushion shocks, saving cost and weight of hydraulic absorber. Photo at far left shows plane's nose with prop and engine cowling removed. Prototype has a 65-hp Continental engine, but is stressed to take heftier powerplants of up to 100 hp.



The long shadows of sunrise and sunset bring out details that would fall flat if photographed in the high noon of day as in these desert badlands.

## How to get great pictures in the great outdoors

A professional wildlife photographer's secrets

by E.P. Haddon

For the sportsman, outdoor photography is a hobby within a hobby. And it's a hobby you can master with nothing more than a small camera that fits in your shirt pocket, plus some knowledge of and attention to simple techniques.

The basic requirement is a good camera that's easy to tote—but even the least expensive Instamatic can give good results if it's used properly. And even heavy telephoto outfits (good for camera-stalking game) are totable on long hikes: Just transfer the camera's weight to your pack frame with two belt hooks and some nylon tape (see top photo, facing page).

Good pictures start with good framing and composition. If you studied all the volumes on good composition and then squeezed out the nonessentials, it would boil down to this: An effective picture has good balance, it is pleasing to the eye



and it contains no unnecessary distractions.

Low camera positions are a helpful compositional trick many photographers ignore. Shooting upward from a low angle, you can dramatize subjects by making them look taller and by emphasizing the texture of the foreground. And aiming upward to shoot your subject against the sky eliminates much background clutter.

To make the sky more interesting, clouds can be emphasized with filters: For black and white, you can use yellow, orange or red filters for increasingly dramatic (and decreasingly natural) effects; with color, you can use only a polarizing filter, which darkens that portion of the sky at a right angle to the sun, and which also can be used with black and white film. When shooting distant scenics, or whenever shooting color at altitudes above 5000 feet, you should use skylight or haze filters to eliminate excess blue. Shooting bighorn in the Sangre de Cristo mountains, two miles above sea level, I find my shots look sick without such filters. (If you're shopping for an interchangeable-lens camera it pays to look for one whose lenses all take the same filter size.)

Focusing also affects your background. If it's cluttered and unattractive, use a wide-open lens to throw it out of focus. But for general scenics or action whose exact distance you can't foresee, use the smallest lens opening that permits an adequate shutter speed, to keep the greatest possible range of distances in focus; and use your lens's depth-of-field scale (most non-



A spotlight held this frog fascinated while we shot close-up from 3 feet away with a 90-mm tele. Flash on camera was augmented by slave flash held by a friend.

PHOTOS BY THE AUTHOR



Transfer your camera's weight from your neck to your packframe when backpacking, and you can hike for days. Author did it with nylon tape and belt hooks (circle).



Backlighting is most effective in open meadows, snow-covered landscapes and on the beach—especially when there is some wildlife around to cast extra shadows.

**Bird photography takes patience.** It is best to hide where birds nest, feed or gather. Blinds are necessary for close-ups of waterfowl and other nervous birds. This prairie falcon was snapped from hiding, with a long, 180-mm telephoto lens.

**Author hid, flash at the ready, by log where crocodile was likely to climb.** Flash off camera on 5-foot cord dramatized eye and teeth with sidelighting.



**Deadly cottonmouth moccasin**, shot from 20 inches with 90-mm lens and close-up attachment, couldn't strike—he was not coiled. Electronic flash stopped tongue.



automatic cameras have one) to place that depth where it will be most useful.

The subject's angle to the camera is also important. Animals and people are best shot facing the camera, and action is best shot moving into or across the picture, not out of it—basically a matter of aiming the camera a bit ahead of the action, so there will be more space in front of the action than behind it.

Action that's moving toward the camera is also easier to stop than action moving across the camera's field of view. A deer coming head-on at full-speed might be stopped with a shutter setting of 1/500 second (see photo on facing page); but running broadside across the camera's field close by, he might need 1/1000.

Where you expect to be shooting action in subdued light (or where you'll need fast shutter speeds to reduce the effects of tele lens shake) use a fast film such as High Speed Ektachrome for slides, or Tri-X for black-and-white prints. But slower films, such as Plus-X black and white, Ektachrome and Kodachrome for color slides, and Kodacolor for color prints will give you finer detail, so use them where high film speed isn't needed.

A faster film also helps you shoot on overcast or rainy days, when colors are soft and greens especially vivid. When the sun is out, try to shoot in the early morning and afternoon when the light is most dra-



**Barbary sheep**, among the wariest of big game, are hard to stalk. These were shot from a hiding place across the canyon, with a 500-mm telephoto lens on a  $2\frac{1}{4} \times 2\frac{1}{4}$  single-lens reflex camera. Telephotos are among most useful lenses for wildlife.

**Using trees for concealment**, author shot this elk herd storming past the camera. For such head-on action,  $1/500$  second is a fast-enough shutter speed. But broadside close-ups taken just as the elk moved past the camera required a faster shutter speed,  $1/1000$  second.



matic and long shadows accentuate landscapes and the animals that move across them. Early light is especially good for features of distant mountains that fall flat at high noon. If you find sunset or sunrise light too red, you can cool it down a bit with an 92A filter; if you want to accentuate the redness, try a Sky 1A or Haze.

Noon, oddly enough, is a good time for flash. Use it to fill in the shadows under noses and hat brims. When the sun is lower, flash fill-in lets you face subjects away from the sun, for more relaxed, squint-free expressions; properly done, such back-lighting is more dramatic, too. Fill-in is also good with sidelighting. The technique of fill-in flash is basically a matter of juggling flash and sunlight exposure so the subject gets its main exposure from the sun and a bit less exposure from the flash—the object is to lighten the shadows, not to wash them out altogether.

Flash is about your only choice when shooting game at night. The flash is too quick to scare the game, and it stops action beautifully. Nighttime flash shots do have an artificial look, with dark backgrounds, washed-out foregrounds and red eyes. But you can eliminate the red eyes and get more natural lighting by using a long flashcord and holding your flash off the camera. You can attach the flash to an overhanging tree limb with a camera clamp.

Electronic flash beats bulb flash on the

**Snow and beaches** can fool exposure meters—take a reading from your gloved hand, or follow exposure recommendations on your film's instruction sheet.



**90-mm medium tele** knit together this shot of falconer and dog by bringing the distant peaks into greater prominence.



**Camp scenes are a must** for thorough coverage of a pack trip. Here, the low morning light brought out considerable detail in light-colored sand, tent and kayak.

trail. A pocket-sized flash can give you as many as 150 shots or more on two sets of alkaline AA batteries (more batteries are easy to bring along), and there are no used bulbs to be carted back or to litter up the trail. Rechargeable flashes are okay, but only if you'll be back regularly to an a.c. power line for recharging.

Both electronic flash and cameras can be damaged by moisture. So take plenty of plastic bags to protect them from rain. You can even shoot single-lens reflex cameras while they're in a bag: Just cut holes for the lens and eyepiece, and clamp the edge of the bag to the lens with a lens hood.

If you're going to expose your camera regularly to heavy rains, snow, salt spray or canoe upsets, the Nikonos is tops. Sealed for underwater use, it also makes a great all-weather camera. It's my favorite for use on boats, but I've also used it when stalking mountain sheep above the timberline during summer rain and hail storms.

Whatever game you're stalking with a camera, you need the same tricks hunters use. Cling to the shadows, keep upwind from easily spooked game, walk slowly with



**With self-timer and pocket-sized camera clamp, you can become part of the picture. Wide-angle lens caught depth of field.**

a light tread, and anticipate what lies ahead. Preset your shutter speed and lens opening for existing conditions (automatic, electric-eye cameras do this for you) so you'll have nothing to do when an animal appears but aim, focus and shoot. If you're lying in wait at a water hole, salt lick or wherever the animal's location is predictable, you can save even more time by pre-focusing where you expect to see him.

The right equipment does make a difference in wildlife photography. A camera clamp is among the most useful pieces of gear, holding the camera so you can set a self-timer and get in the picture yourself, steadying it for time exposures, or holding a flashgun away from the camera. Add a long rubber-bulb or cable release and a camouflage poncho, and you're equipped to shoot birds in their nests. For close-ups of plants, insects and trout flies, use a single-lens reflex camera with auxiliary close-up lenses or extension tubes. With a polarizing filter, to cut through water-top reflections, you can even shoot a close-up portrait of a feeding fish. And reflex cameras are great

*(Please turn to page 187)*



**Tripod straps easily to the "Expedition" pack. When an ice ax is carried, the tripod can be strapped to the top of the pack frame. This Vivitar weighs under five pounds.**

# Bombs on Main Street

Dangerous cargoes roll across America by truck and rail. Too often they bring disaster to a community.

by Frank A. Tinker



A holocaust was touched off on a busy street in Indianapolis when a gasoline truck flipped and burst into flame. The driver, seen at bottom of photo, crawls from wreckage, his clothing on fire.



Last May the 18,000 residents of Roseville, Calif., learned what it was like to be under siege. Bombs blasted, shrapnel whistled, fires raged and mushroom clouds billowed in a violent nightmare that lasted 36 hours. The bombardment destroyed 10 homes, damaged about 400 others, and sent more than 30 persons to the hospital.

The source of the destructive power was a munitions train in Roseville's big rail yard. The train had contained some 7000 bombs bound ultimately for Southeast Asia. A fire apparently had touched off the first blast, but investigators were unable to explain how it got started. At this writing, that remains a mystery.

The Roseville disaster is by no means an



**Indianapolis inferno** claimed the lives of four when three cars plowed into wrecked truck. The tragedy occurred in 1966.

isolated event. Explosives constitute just one of 1000 different kinds of hazardous materials—simply called HM in the transportation field—that are shipped daily by rail and truck in all sections of the country. It's estimated that the railroads alone experienced 80 "serious" HM accidents in 1972. Six involved explosions, one of which caused injury to more than 230 persons.

Shipping hazardous materials is, of course, legal and very necessary for a nation as highly industrialized as ours. Among the most common hazardous materials are gasoline, propane and hydrogen, all carried in trucks marked **FLAMMABLE**.

If the warning label says **POISON**, the cargo might be a pesticide like parathion,

closely related in composition and effect to the nerve gas of World War II. **POISON GAS**, on the other hand, may indicate a cargo of phosgene, which is not only a war weapon but a common ingredient in plastics manufacture and in typewriter-ribbon dyes.

Federal regulations call for trucks carrying HM to follow sparsely settled routes, but these restrictions are hard to enforce. Though most hazardous cargo is moved without mishap, the list of near catastrophes makes frightening reading. Poison cargoes have as much potential for tragedy as do the more explosive substances. An agent of the Office of Hazardous Materials, an arm of the U.S. Department of Transportation, admits that authorities keep their

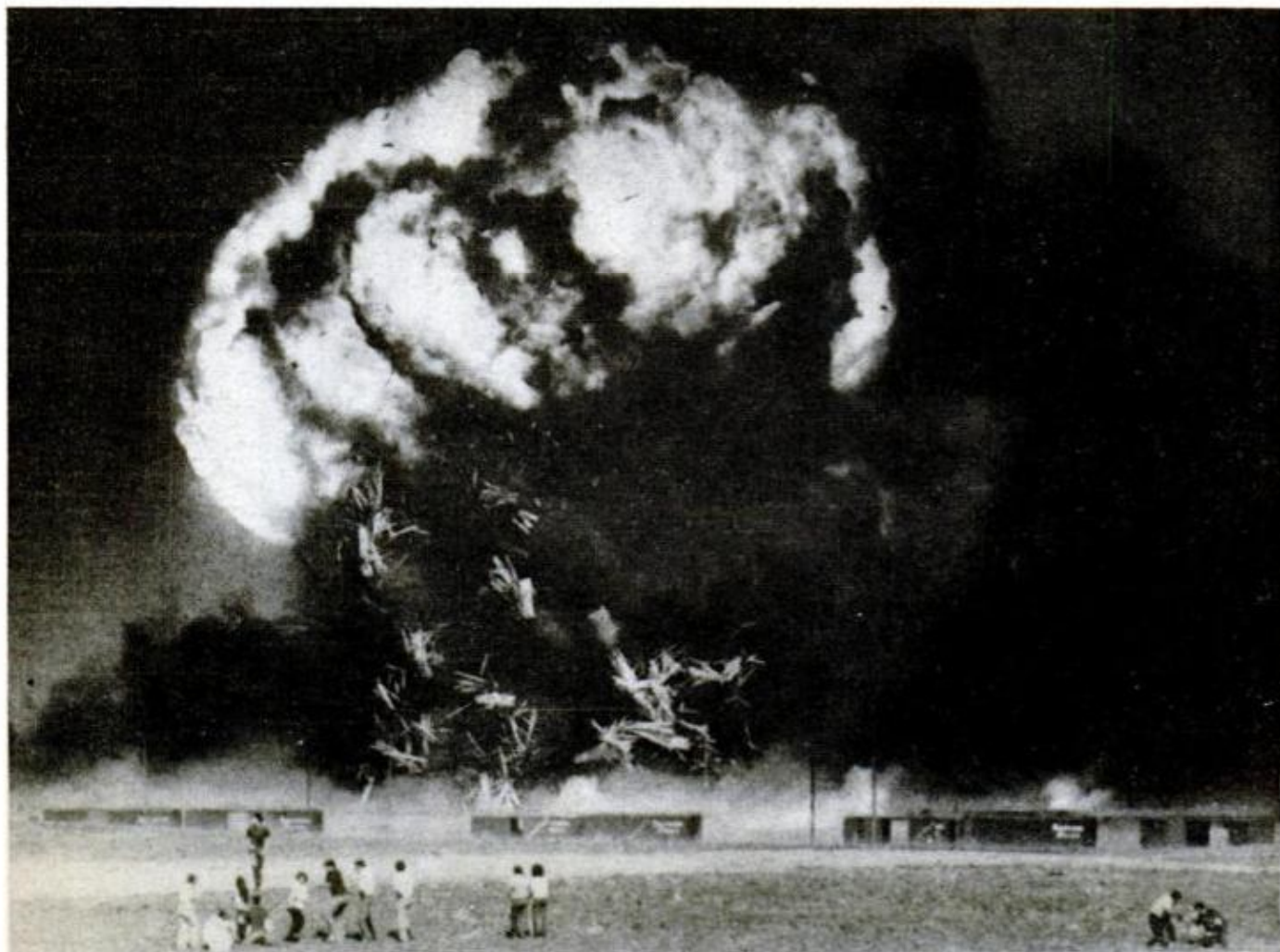
fingers crossed against the possibility of a poison spill in a populated area.

A few years ago a trailer loaded with parathion overturned in the desert near Blythe, Calif. Some of the truck's containers ruptured and a small part of the cargo spilled onto Highway 80. The shipment was poorly labeled and before the danger was recognized several persons had walked through the spillage. Eventually the highway was closed and a radio alert broadcast. Some 60 persons were given medical inspections and released; the driver and two investigators required hospital treatment.

"Why it didn't kill off half of the people passing through that area I'll never know,"

a state highway agent observed. Only some 85 gallons of the concentrate was actually spilled, however, and this in an outlying desert area. If the truck's entire cargo of about 20,000 pounds had been released a few miles east in Blythe itself, the story would have been tragically different.

With such cargo aboard their vehicles, drivers would be expected to exercise particular caution. The majority do. Some, amazingly, appear to be indifferent. Investigators in this field give as an example the disaster that occurred at Roseburg, Ore., in 1959. Thirteen persons died, 125 were injured, and an eight-block area was wiped out when a dynamite truck exploded.



**Booming explosions, flame, flying debris, mushroom clouds** filled the air when a munitions train blew up in the Roseville, Calif., rail yard last May.

**Damage** was estimated at more than \$5 million. Some 120 railroad cars were destroyed and 150 damaged. Many homes in the area were also hit.



Rule 397.5, Department of Transportation's regulations states—and stated then—that such a cargo “. . . must be attended at all times by its driver or a qualified representative . . .” Nevertheless, the driver parked the truck near a lumberyard and went to bed. During the night the yard caught fire and touched off the holocaust, destroying an industrial section of the city.

A 1970 analysis of accidents involving HM compiled by the Bureau of Motor Carrier Safety lists many disquieting mishaps. A trucker with ammunition aboard dozed, drifted across the center line, and died with two other drivers when he collided head-on with their tractor-trailer. In Oregon, a truck driver who apparently fell asleep at the wheel was killed when his flatbed trailer carrying anhydrous ammonia overturned. (Fumes from this common chemical have killed people who happened to be near such a spill.)

In Ohio, fire engulfed a loading area when a driver pulled out without uncoupling the hose leading to a gas storage tank; six persons died and \$250,000 damage was done. The '70 study shows that gasoline, simply because it is the most frequently transported HM, heads the list in causing property damage and deaths.

In the case of railroads, poor maintenance and faulty equipment are the most common causes of HM accidents. This industry's shaky financial situation has caused extensive deterioration of roadbeds and rolling stock, reflected in a rising derailment rate. It is estimated that one-fourth of the freight cars and half the locomotives now in use are overage, while trackage on some lines is literally falling apart.

The railroads claim an accident rate less than that of trucks, but they would have a hard time selling that claim to many people in Ohio, Texas and other states.

Some months ago, 40 cars were derailed in Ohio—tankers loaded with chemicals that caught fire and menaced a nearby community. When the same thing happened in Houston, Tex., in 1971, firemen were caught by an exploding tank of chemicals as they fought the fire. The blast leveled the switching yard.

Town after town has been hit by such accidents. In 1969 a train buckled when brakes were slammed to avoid a pedestrian near Glendora, Miss. Tank cars carrying vinyl chloride began exploding, wrecking the area and causing toxic gas to accumu-



**National guardsmen** watch smoke rise from wreck at Glendora, Miss. (top photo). Thousands were evacuated from their homes when lethal gas leaked from cars.

**Exploding gas** following a 1970 derailment at Crescent City, Ill., resulted in injury to 66 persons and property damage estimated at \$1.7 million.

late in low-lying sections. Eventually 17,000 people had to be evacuated.

Another derailment in '69, in Nebraska, caused a tank car to fracture, releasing 29,000 gallons of anhydrous ammonia. Six people were killed and 53 injured from breathing the caustic fumes. The National Transportation Safety Board found that the accident was due to "track deficiencies."

What can be done to lessen the dangers inherent in transporting hazardous materials? Part of the answer is money—lots of it—to modernize railroad equipment.

According to the Federal Railway Administration, which oversees railroad operations, causes of mishaps are divided almost equally between human error and defective equipment. This agency is drawing up regulations designed to overcome deficiencies in safety inspections, hasten retirement of old rolling stock, and place speed limits on freight trains. The rail industry is said to be working on a study of tank-car safety.

How to minimize the HM danger on highways is another problem. Complicating it is the very number of hazardous materials that are shipped. About 1000 HM categories and more than 200,000 specific substances are now listed by the government. Many require special methods of packaging and handling.

"What we need is education—for shippers, carriers and the public!" says Judd Shelton of the Bureau of Motor Carrier Safety. "We can go into any warehouse and find violations of hazardous-materials regulations."

He cites the example of a gunpowder shipment marked as weighing only 1 pound when it actually weighed 100 pounds. The shipper had deliberately avoided more expensive packaging and labeling by listing the lower weight.

Tragedies have occurred, he emphasizes, simply because labels or placards have been in error or disregarded. The railroad fire at Houston claimed its victims because of inadequate marking on the overturned cars and the unavailability of the shipping documents, which left firemen facing an unknown combustible.

This type situation helps account for the fact that 65 percent of people killed due to HM emergencies are firemen and police.

"These loads are not placarded just because someone thinks it's a good idea," says Shelton, "but because people have been

*(Please turn to page 183)*



**Because so much of it is shipped,** gasoline heads list of causes of hazardous-materials accidents. A wrecked truck (top photo) can do great damage.

**Arizona state agents** check truck stops and shipping terminals for violators of safety regulations. Trail of liquid on road led to this truck (middle photo).

**Vehicle inspection** is carried out by highway patrolman and state agents. Safety experts found several items of faulty equipment on this rig.

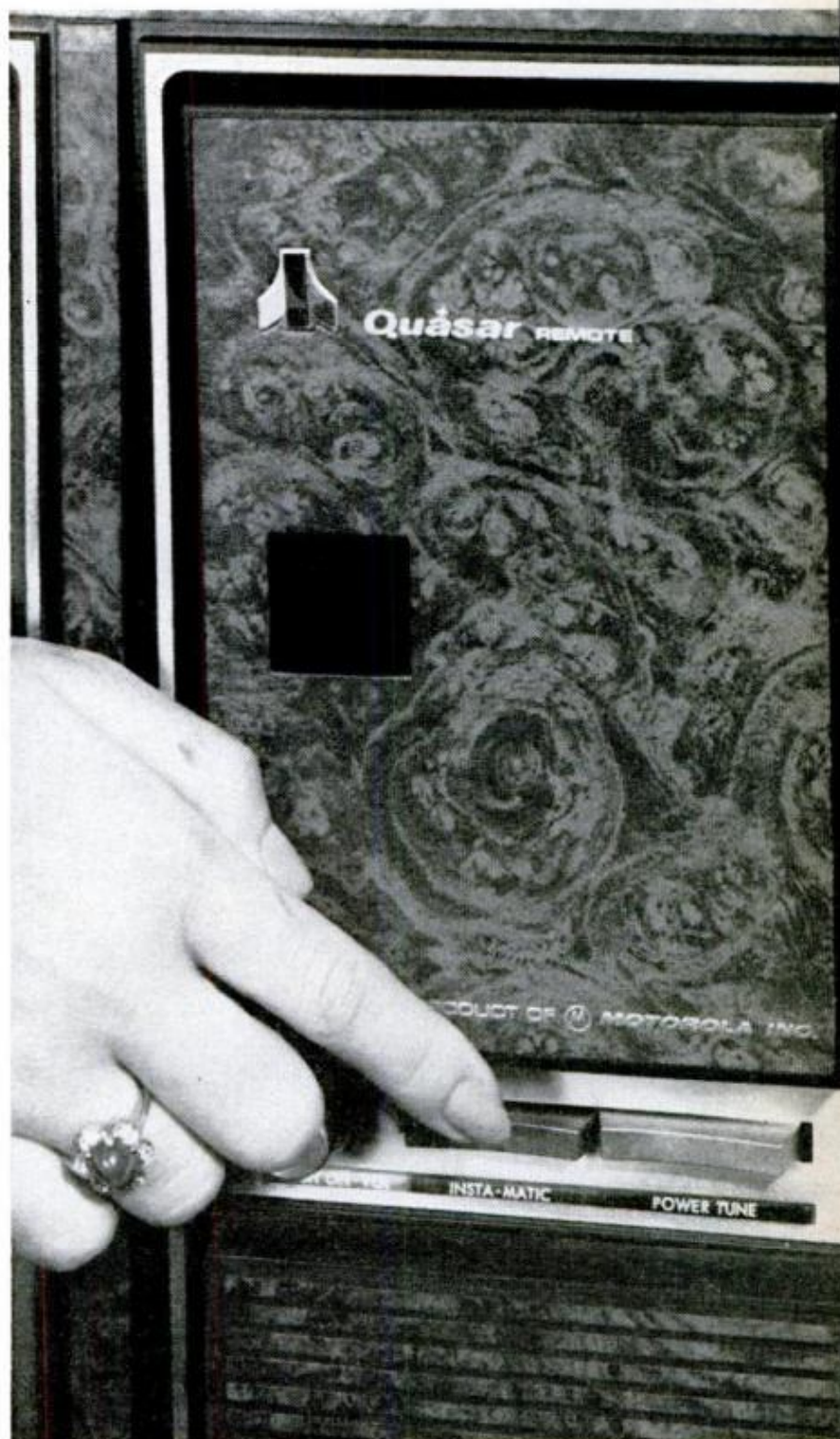
# Those color-TV tuning buttons: What they do—and don't do

by Jim Lockett

Those automatic tuning systems color TV makers have added to their products in recent years make it a lot easier to get and keep a good color picture on your set—but a lot harder to figure out which set best suits your needs and offers the greatest value. And just to make things a little harder for you, manufacturers have planted a thicket of made-up terms and advertising claims between you and any understanding of what they really have to offer.

Despite the impressive-sounding Madison Avenue names—InstaMatic Permalock, Color Master, AccuMatic, ABC—most systems are simply a combination of fairly standard circuits. But this doesn't mean all are alike. Each manufacturer employs his own particular combination of automatic tuning circuits and some have come up with much more convenient total packages than others.

Basically, there are two classes of automatic tuning systems: preset and active. Preset systems generally have one or more pushbuttons that switch picture controls to levels preset at the factory, overriding the viewer's manual controls. Active systems, such as automatic fine tuning or automatic color control, employ circuitry that continuously compensates for changes in the incoming signal or in other conditions. Most sets nowadays





Electronic sensors (on screen) help factory technicians adjust preset controls for "pushbutton" color.

employ both, in one form or another. In many cases, both preset and active circuits are activated by a single pushbutton on the front of the set and are promoted by the manufacturer under a single, all-encompassing name of his own invention.

Let's look at the preset systems first. The simplest type uses a single pushbutton to completely disconnect manual picture controls, setting and locking tint, color intensity, contrast and brightness at predetermined levels. In some cases, one or two picture adjustments may not be tied into the preset pushbutton, or the various adjustments might be divided between two buttons instead of grouped on one, but the principle is the same.

Pushing the preset button will usually give you an acceptable picture, but not as

COMPANY	NAME OF TUNING SYSTEM	AFT	MAIN TUNING CONTROL OPERATES:				
			ATC	PRESET COLOR LEVEL	PRESET TINT	PRESET BRIGHTNESS	PRESET CONTRAST
ADMIRAL	Color Master	Yes	Yes	Yes	Yes	No	No
AE	One Touch Color	Yes	Yes	Yes	Yes	No	No
AIKACHI	APS Plus	No	Yes	Yes	Yes	Yes	Yes
ALCANTARA	Color Lock	Yes	No	Yes	Yes	No	No
ALCANTARA	Videomatic	Yes	No	Yes	Yes	Yes	Yes
AMONTGOMERY WARD	Auto Color	Yes	No	Yes	Yes	Yes	Yes
AMPHIPHON	Insta-Matic	Yes	Yes	Yes	Yes	Yes	Yes
ANASONIC	Q-Lock	No	Yes	Yes	Yes	Yes	Yes
APC. PENNEY	Chroma-Lock	No	Yes	Yes	Yes	Yes	Yes
ARLCO	Philcomatic II & III	Yes	Yes	Yes	Yes	Yes	Yes
ARLCO	AccuMatic IV	No	Yes	Yes	Yes	Yes	Yes
ARLCO	Trimatic	No	Yes	Yes	Yes	Separate button	"Bricon"
ARLCO	One-Button Color	Yes	Yes	Yes	Yes	Yes	Yes
ARLCO	ACS	Yes	No	Yes	Yes	Yes	Yes
ARLCO		Yes	No	Yes	Yes	No	No
ARLCO	Perma-Lock	No	No	Yes	Yes	Yes	No
ARLCO	Tele-Magic	Yes	Yes	Yes	Yes	Yes	Yes
ARLCO	ABC (Automatic Balanced Color)	Yes	Yes	Yes	Yes	Yes	Yes
ARLCO	Chromatic	No	Yes	Yes	Yes	Yes	Yes

good as you can tune yourself if you're any good at knob twiddling. Of course, you can always change the preset levels—they can usually be adjusted from the back of the set using a screwdriver—but when you change channels, you'll be right back where you started. The problem is, broadcast signals vary too much. Even without changing channels, readjustment of color and tint is often necessary from time to time. Then, too, at different room light levels you'll want different amounts of brightness and contrast; and different members of your family may prefer different color and tint settings.

Still, the preset pushbutton has advantages. If there are people in your family who can't get the hang of adjusting a color set, the pushbutton will give them a watch-

able picture and reduce the likelihood that they'll scramble all the manual controls in a hopeless effort to get a good one. And any time you're feeling lazy, or not very particular about the picture you're watching, the button may prove convenient. On the other hand, there's nothing a preset pushbutton can do that a mark on each of the manual controls wouldn't do just as well. If you already own a color set without a preset pushbutton, or you want to save a few bucks by buying a set without one, why not tune up the set very carefully and then put a dot of nail polish on each control and a dot on the control panel next to it? It won't have as much gimmick appeal, but it will accomplish the same purpose.

Zenith used to put a mark on each picture adjustment knob, on the theory that the

SEPARATE AFT CONTROL OR DEFEAT?	EFFECT OF MANUAL CONTROLS IN AUTO MODE	OTHER REMARKS
No	None	
No	Slight	Separate, 3-way flesh-tone (ATC) adjustment.
Yes	None	
Yes	None	ATC always on.
Yes	Slight	In auto mode, "Videomatic Eye" compensates for room-light-level changes. ATC always on.
Yes	None	ATC always on.
Yes	None	ATC always on.
Yes	Slight, on color and tint only.	
Yes	Slight, on color and tint only.	
AFT shuts off when fine-tuning knob is touched.	Slight	Light indicates when fine tuning is within range where AFT can operate.
Yes	Slight	
Yes	None	Separate buttons for: AFT; ATC, tint and color; brightness and contrast.
No	Slight	
No	None	Separate ATC control. Some remote-control models show channel numbers on screen.
Yes	Slight	Pushing fine-tuning knob defeats AFC. No ATC.
Yes	None	ATC always on.
Yes	None	
No	Slight	Green-correction circuit operates in auto mode, for less blue flesh tones.
Yes	Slight, on tint and color only.	"Power Sentry" keeps picture quality constant despite power surges or reduced line voltages.

## Some automatic systems let you make minor adjustments

user could find the best setting, pull the knob off and then put it back on with the mark at 12:00 o'clock. It was a good idea, but they apparently found they couldn't compete with the "magic" of pushbuttons. Most people are impressed when a salesman, with the press of a button, snaps in a good picture on a completely misadjusted set.

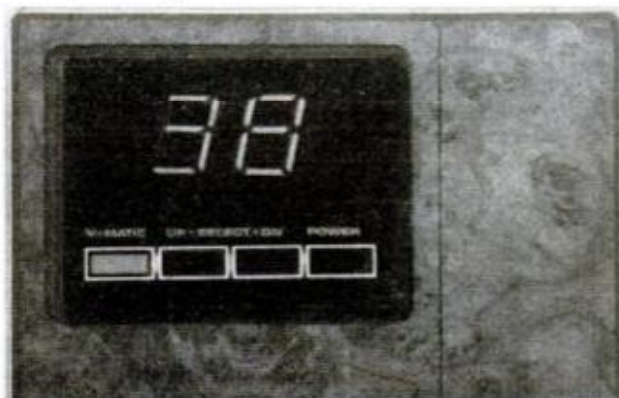
A variation on the basic preset pushbutton that is becoming increasingly common allows the viewer to make minor adjustments, using the manual controls, even when the pushbutton is engaged. With the pushbutton disengaged, manual controls have full effect; but when you push the button in, the effect of the manual controls is reduced to a narrow range that still allows for differences in viewer preference and signal transmission. The amount of adjustment that is possible with the pushbutton engaged varies from manufacturer to manufacturer. Some allow so much range that you could still get a pretty awful picture if you wanted to. Some others allow so little range that you almost couldn't tell you were affecting the picture at all if the maker didn't tell you so.

Systems that allow you to make minor adjustments even when the pushbutton is engaged offer greater flexibility—and more opportunity for error. But they do nothing that marking the dials wouldn't do if you marked off a range on the dial instead of just indicating a single setting.

But active color-tuning systems do accomplish more than could be done with marks on dials. In theory at least, they reduce the number of times you have to get up and readjust your set, because they compensate automatically for variations in the broadcast picture.

Automatic color control (ACC) and automatic tint control (ATC) are the most common types of active color-tuning systems. ACC is nearly universal, though some sets have more effective versions of it than others. Its purpose is to eliminate variations in color intensity that might result from changes in reception conditions.

ATC is designed to produce pleasing flesh tones in the picture, eliminating reddish or greenish faces. It works by emphasizing the range of colors that is normally found in human skin—but unfortunately, elec-



**New Magnavox tuning system** has digital channel read-out, no knob (one button sweeps to the higher channels, another tunes set to the lower ones). Its "V-matic" button controls automatic color-setting system.

tronic circuitry can't tell if it's masking out the green shadows on a person's face or muddying a football field that's actually supposed to be bright green. All shades of color in the picture that are close to flesh tone, especially greens and yellows, are "pushed" toward flesh color by ATC. Even so, a subtle amount of flesh tone emphasis is probably desirable, despite the accompanying loss of color fidelity. Given the imperfect state of color broadcasting and receiving equipment in the country today, ATC is probably the only way to get consistently acceptable facial coloration without hovering over the tint control yourself. But when buying a color set, be sure to avoid those with an overzealous ATC that gives the whole picture an orange cast.

Unfortunately, ATC is usually activated



**Experimental Panasonic** shown last year had 11 plates, each of which tuned in a preselected channel when touched lightly. Panasonic also exhibited a prototype having a digital channel indication.



**Making remote-control tuning easier**, too, this new Sharp displays a big, bright channel number on its screen for a few seconds each time you tune in a new channel: then the number merely fades away.

by the same pushbutton that switches picture adjustments to preset levels. That means you can't have one without the other. Still worse are the few sets that provide no way of turning off ATC at all. With these, you can never have true color reproduction, even under ideal conditions. Those few sets that have separate switches for ATC are best.

There are two types of devices for making fine tuning easier: memory fine tuning, which is really a preset system, and automatic fine tuning (AFT). Memory fine tuning "remembers" the last setting of the fine-tuning control that was used on each channel. After you go around the dial once and tune in each station, you shouldn't have to touch the fine tuning again for at least a couple of months. AFT electronically

locks in on the strongest signal near the frequency that the set is tuned to, so you may never have to adjust fine tuning yourself. Almost all sets have memory fine tuning; all but the cheapest also have AFT.

There are times when you will want to defeat AFT, as when a strong interference signal is present on nearly the same frequency as the station you are watching. If AFT wasn't deactivated in such a case, it might lock onto the interference instead of the desired signal. On some sets, AFT is activated by the same button as preset picture controls, so if you turn off AFT, you have to manually adjust picture controls as well. What's worse, if you want to activate AFT on these sets, you have to settle for the preset picture adjustments, too. Some sets have an AFT defeat switch which eliminates the first problem but not the second. Fortunately, many sets, including those made by RCA, Zenith and several Japanese manufacturers, have a completely independent AFT control.

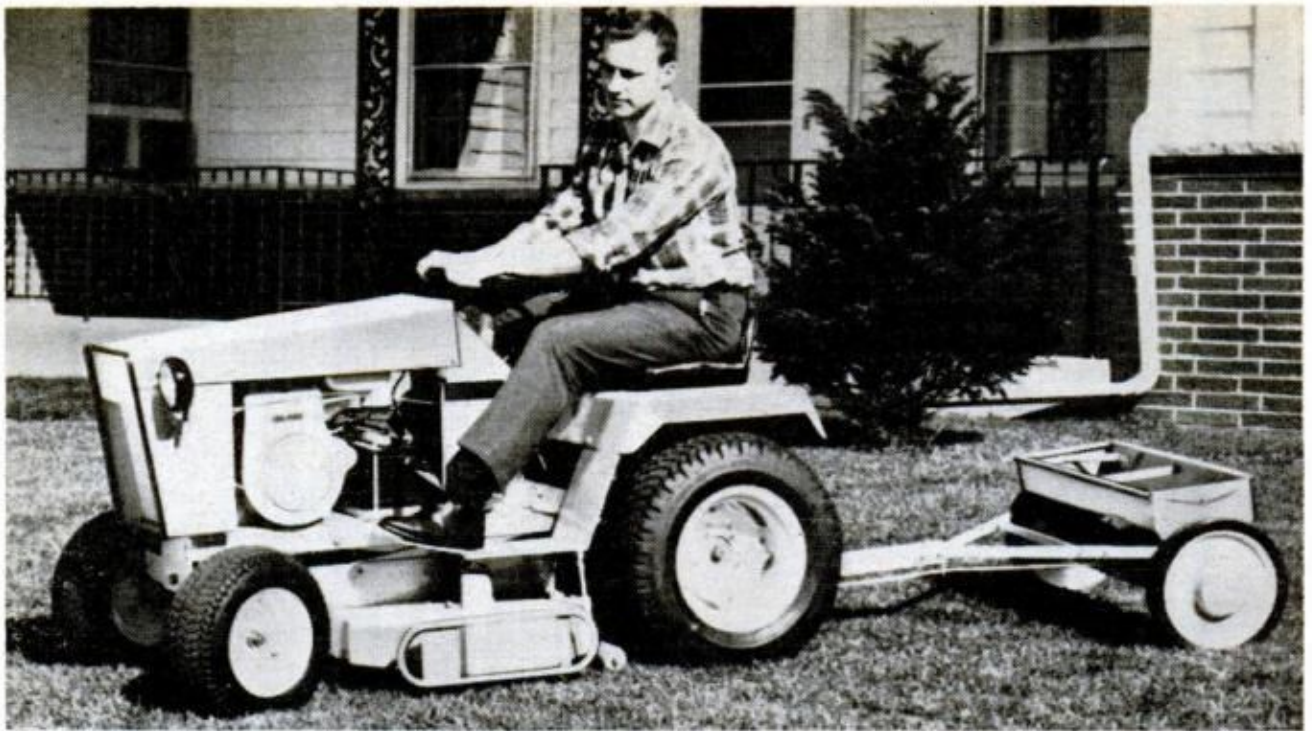
Only Magnovox offers an active "tuning" system that compensates for changes in room light levels. On some of its sets, a light-dependent resistor, called a "Videomatic Eye," senses the amount of light in the room and either increased or decreases brightness, color intensity and contrast to coincide with changes in room light. Most people don't vary the amount of light in the room very much when watching TV, but Videomatic is an interesting gimmick

*(Please turn to page 182)*

## How to evaluate AFT

First, determine how great a range the AFT has. Turn the AFT off, slightly misadjust the manual fine tuning, then turn the AFT back on. If the picture snaps back perfectly (or at least as good as you can get by careful manual adjustment), AFT is doing its job. Repeat this procedure, detuning the manual fine-tuning control more and more each time, until you go beyond the range of the set's AFT. This tells you exactly how far off fine tuning can be without being beyond AFT's reach.

Next, check to see how accurate the AFT is: With the AFT off, carefully adjust the manual fine-tuning control for the best possible picture. Then, turn the AFT back on. There probably won't be any change for the better, but there certainly should be none for the worse. (In some sets, AFT actually locks in offcenter, which is a lot worse than having no AFT at all.)



Powerful 12-horse kit-built tractor purrs along pulling a spreader above, has headlights for night use.

## Garden tractor you can build from a kit

by Gerald Kratsch

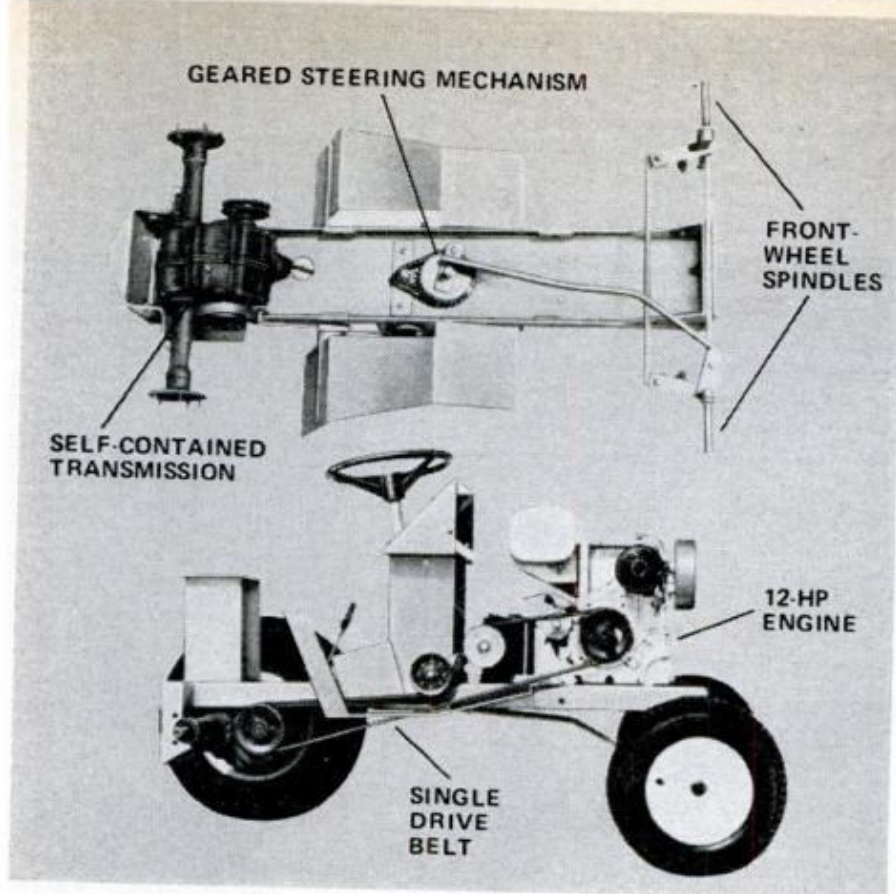
You can build a lot of things from kits these days, but one of the latest and most unusual is this assemble-it-yourself garden tractor that arrives in a carton of parts. Made by Struck, the kit tractor is available with two power options—a 12 or 16-hp Tecumseh engine—and with either manual or electric start. Base price for the 12-hp version is about \$600—several hundred dollars less than ready-made models of comparable size and power. The 16-hp kit is about \$850 and includes electric start, again offering substantial savings over equivalent store-bought machines.

Though lacking some of the decorative frills of ready-builts, the Struck Turf-Rider is designed for simple assembly, easy maintenance and rugged use. Its 48-inch wheelbase, 23 by 8.50-12 oversize rear tires and hefty weight of 650 pounds all combine to give it good traction and muscle for handling a variety of tough yard jobs. Attachments include a 55-inch rotary mower, snowthrowers up to 48 inches in clearing width, a bulldozer blade, spreader cart, lawn roller and several plowing and tilling accessories. For added traction on snow, soft ground or



**Kit of parts** looks like this when it arrives. Note engine and transmission already mounted on prewelded chassis to speed assembly. Doing your own work saves money, also makes replacement of parts easier later.





**Simple construction** is shown in stripped-down chassis views of 12-hp model at left. Near-vertical steering-wheel shaft turns small sprocket underneath that, in turn, drives larger sprocket with crank arm attached to move front-wheel spindle linkage. This, in effect, provides geared steering arrangement through a reduction ratio for easy turning of the tractor's front wheels with a minimum of effort.

rough terrain, the 16-horse model can be fitted with a half-track conversion drive priced at about \$250. A 400-pound-capacity front-end loader is also available in kit form for about \$250.

Building your own tractor is not as much of an undertaking as it may seem. The kit comes partially preassembled to speed construction. The engine and a self-contained Peerless transmission are already mounted on the chassis frame. From there on, it's mainly a bolt-together operation. All holes are predrilled, and no welding is required. A few wrenches are virtually the only tools needed. Assembly time averages five to seven hours depending on how fast you work—an easy weekend job.

The drive is basically simple, consisting of a single V-belt from engine to transmission, with a foot pedal that combines the functions of brake and clutch in one control. A sprocket arrangement provides the equivalent of geared steering for easy turning of the tractor's front wheels. Powered accessories are quickly attached and removed in minutes. For further information on the Turf-Rider kits, write C. F. Struck Corp., Cedarburg, Wis. 53012. ★ ★ ★



**Heftier 16-hp model** comes with half-track crawler-tread drive for added traction on snow or difficult terrain. It can also be fitted with a front-end loader, shown above, having 400-pound capacity.

# Will clean-air cops confiscate your car?



The deadline on our freedom to drive “any old car” anywhere we want is closing in—because that freedom affects our health and the health of others. To meet federally prescribed standards for healthful air, state governments may soon change your driving habits and hit your pocketbook with some or all of the following measures—unless the air in your locale can be kept clean without them: Inspection of all vehicles for emissions; retrofitting of older vehicles with emissions-control devices, and banning of cars from downtown areas.

In California, the retrofitting of older cars with antipollution devices to decrease emissions of oxides of nitrogen ( $\text{NO}_x$ ) is law. Here is what motorists in that state need to know about driving a legal car.

## by Michael Lamm

WEST COAST EDITOR

California owners of 1966-70 model cars are now required by law to install new antipollution devices on their cars. Month by month, almost all of the state's 4.5-million cars of this vintage must be retrofitted according to a prescribed schedule. What is the cost for such a device, and its installation? It can't exceed \$35, as prescribed by law. But there are many more questions in the minds of motorists; here are some of them, and the answers.

### *What are these various devices for?*

They are designed to cut exhaust emissions of oxides of nitrogen ( $\text{NO}_x$ ). The reason is that hydrocarbons (HC), in combination with  $\text{NO}_x$ , react in sunlight to form photochemical smog, which particularly plagues Southern California.

### *Who needs them?*

By state law, passed in 1971, they are required on all 1966-70 cars registered in the state of California.

### *Why only on 1966-70 cars?*

To achieve reductions in HC and carbon monoxide (CO), the auto manufacturers during those years used higher combustion temperatures. This resulted in reductions of HC and CO, but *increased*  $\text{NO}_x$ . The retrofit (add-on) devices are designed to decrease  $\text{NO}_x$  on these model-year cars.

### *Don't earlier and later model cars have to have them, too?*

Some 1970 and all 1971-and-later cars were redesigned so as to reduce  $\text{NO}_x$  as well as HC and CO. Pre-1966 cars were not considered to have as acute an  $\text{NO}_x$  problem. They must, however, now have devices of their own that reduce both HC and  $\text{NO}_x$ .

### *What are they?*

One of two devices, both basically vacuum

spark-advance disconnect, designed to reduce the two emissions that cause photochemical smog. The approved devices are made by Air Quality Products and General Motors. Along with the disconnect, the AQP device has some additional spark retard at low speeds, restores normal spark advance at higher speeds and also functions as an electronic ignition system. The GM device is simpler, with an override to restore spark advance at high coolant temperatures. By law, the installed cost of each must not exceed \$85. The AQP device costs \$65-85, depending on the mechanic's labor rate in your area. The GM device is about \$25.

### *Does that mean I have to put one on my 1949 Chevy?*

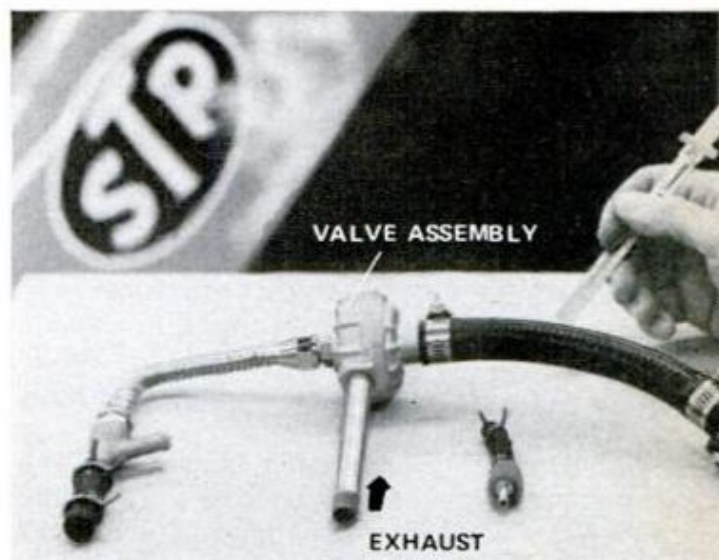
No. They're required only on 1955-65 models, and only upon resale or when first registered in the state.

### *Who's responsible for its installation?*

The seller, since the vehicle cannot be transferred unless proof of installation is shown by a Certificate of Compliance and a window sticker issued by state-licensed installation and inspection stations.

### *Who are these stations?*

Some 9000 shops throughout the state, approved by the state's Consumer Affairs Bureau of Automotive Repair. Each is iden-



**Exhaust emissions** are measured with equipment as shown on the facing page. Proposed state emissions checks would use this type of equipment at inspection stations. Police in California are using portable equipment in roadside checks. A type of pollution-control device required in California, shown above, connects between exhaust and intake manifolds metering gas back to the combustion chamber to inhibit the formation of undesirable  $\text{NO}_x$ .

tified by a blue-and-yellow shield to indicate that it is an "Official Pollution Control Device Station." They can be auto shops, car dealers and service stations.

*Who makes the devices for the 1966-70 cars?*

Six different approved devices, or systems, for cars with engines over 140-c.i.d. are made by Echlin, Dana, STP, Carter, Contignitron and Carco. The latter two, however, are only "conditionally approved" until these two smaller companies can establish proof of "financial responsibility and marketing ability." One device by STP has been approved for cars under 140-c.i.d. and down to 50-c.i.d.

*Who decided these devices were the best ones?*

The California Air Resources Board, a four-man, one-woman board appointed by the lieutenant-governor of the state.

*Who tested them, and to what standards?*

Compliance with the initial standards, based on a reduction of  $\text{NO}_x$  by at least 30 percent on engines over 140-c.i.d., was judged on the basis of data submitted by each manufacturer on from 16 to 24 vehicles he had tested. In most cases, the ARB engineers conducted confirmatory tests on state vehicles.

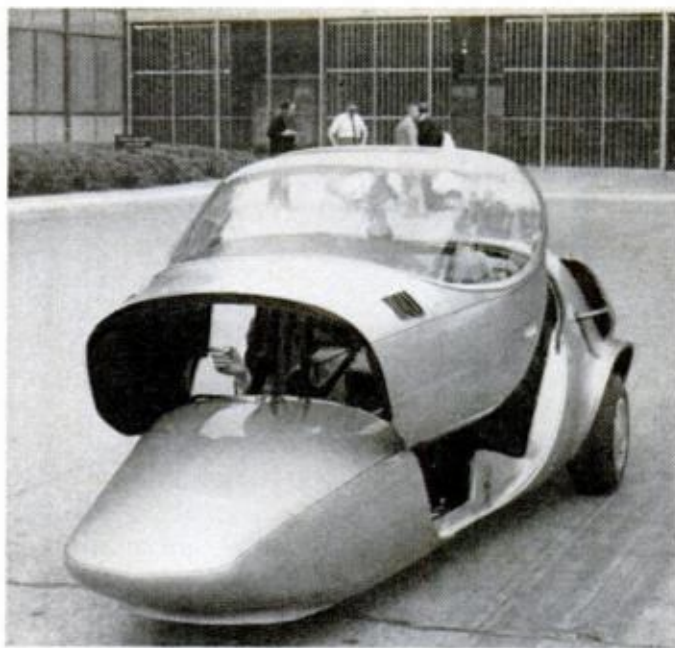
After the first device for the larger engines was accredited (Echlin's) with a  $\text{NO}_x$  reduction of 42 percent, that became the new standard the others had to achieve for engines of that size. The STP device for the smaller engines (under 140-c.i.d.) was working against a 20 percent  $\text{NO}_x$  reduction standard. They achieved a 42 percent decrease also, which has become the new standard for any other manufacturer seeking approval for his device in this class.

*What are the differences among the various devices?*

The major difference is in whether they use vacuum spark-advance disconnect (VSAD) and/or exhaust-gas recycling (EGR). Echlin, Carter and Contignitron all use VSAD in conjunction with other controls or systems. Carco uses full VSAD. The Dana and STP devices are basically exhaust-gas recirculation with VSAD under some conditions.

*Why do some of the devices use VSAD*

## A large market for small cars? Automakers are ready



**Small urban vehicles**, such as these experimental electric and gasoline-powered cars shown by General Motors Engineering, are sensible transportation packages for downtown areas—as long as they are not sharing roads with full-size cars and taxis, which would be suicide. If the demand for clean air (and less congestion) banishes private cars from the centers of American cities, there will be a big market for these and other concepts of ecological people movers.

and others EGR? What's the difference?

VSAD is simple to achieve, costs little and reduces NO<sub>x</sub>. But, most experts agree that it can also result in engine overheating, exhaust-valve damage and higher fuel consumption. When coupled with spark retard, exhaust-gas temperatures tend to go even higher, and fuel economy drops even further, ARB engineers say. Manufacturers using VSAD disagree on claims of exhaust-valve damage, however.

As for EGR, this is a system also used on 1971 and later Detroit production cars to control NO<sub>x</sub>. Some concern about the possibility of accelerated engine wear due to iron oxide in the recycled gas has been expressed, but no data seems to support it.

*What are the other differences among the various devices? How does each work?*

Carter's is basically a VSAD system with some overrides. When installed timing is retarded, idle is adjusted to "lean best," and the carburetor vacuum source is plugged. To restore vacuum spark advance over 65 mph, or when engine coolant temperature exceeds 225° F., an electrically operated vacuum solenoid valve and electronic speed sensor team up to do the job.

Dana's Retronox system uses engine speed to selectively control exhaust-gas recirculation and the spark advance. At lower engine speeds, the system operates as a vacuum spark-advance disconnect. As speed picks up, an engine-speed switch is actuated, supplying vacuum to the distributor and EGR valve servo motor. This reconnects vacuum spark advance and recycles some exhaust from the exhaust manifold back to the intake manifold.

The Echlin device consists of a "sonic generator" said to create ultrasonic waves which travel through a flexible tube to a plate under the carburetor. These waves are said to impinge on the air/fuel mixture, breaking up the fuel droplets into even finer particles. In addition, vacuum spark advance is disconnected, ignition timing is retarded, and the idle is reset.

STP's device is basically an EGR system. It has an EGR valve that meters either exhaust gas only, or a combination of gas and fresh air—depending on throttle position—through a velocity nozzle to a point below the carburetor. A vacuum (air) bleed fitting in the distributor vacuum-advance line lowers the vacuum in the line, modifying the vacuum advance.

Contignitron has a "solid-state device" using transistorized and electronic switches to control current switching and spark time duration. Vacuum spark advance is disconnected.

Carco's "device" is a simple plugging off of the vacuum source to the distributor with rubber caps, along with additional timing retard.

*Will any of these devices make my car run better?*

Not according to the ARB. Some of the manufacturers claim their devices do improve performance.

*If they don't make it run better, what good are they?*

The main purpose is to reduce NO<sub>x</sub>. They all do that, anywhere from 40 to 50 percent.

*Will they make my car run worse?*

That seems to depend on the type of de-

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#### **NEXT MONTH:**

#### **What Detroit is doing to meet the clean-air standards for 1975-76.**

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vice—and whom you listen to. The EGR devices (STP and Dana) get the highest marks from the ARB. Both have less exhaust-gas temperature increases, and less effect on coolant temperature than the VSAD-type devices (Echlin, Carter, Contignitron and Carco), according to a report by the Air Resources Board.

*What about fuel economy?*

The ARB says the Dana and STP devices will give an average fuel penalty of from 3 to 7 percent in city driving. The others, they say, will penalize a car from 6 to 10 percent. It also depends on how you drive and at what speeds.

*Can any of these devices cause damage to my engine?*

Any of those using VSAD under most conditions, plus additional spark retard, ARB engineers say, can cause overheating of the engine coolant, higher exhaust-valve temperatures, with possible damage to the exhaust valves themselves.

*What do the various devices cost?*

By state law, no installer can legally

*(Please turn to page 184)*

# New electric kicker for a new bass catcher

A little pedal-steered mill joins a plushly appointed rig for landing lunkers in luxury.

by Bill McKeown

Lately our finny friends underwater have been looking up at an amazing assortment of new hulls, powerplants to push them and an appetizing array of different lures.

But two of pleasure boating's biggest producers, Johnson outboards and Starcraft boats, apparently decided there is still room for improvement. Both have just come up with specialized products for the booming sport of angling.

Johnson Motor Co., offered PM an exclusive preview of a trolling outboard that should be available any day now. This is the first electric with the Johnson name. Evinrude is reported to be introducing a similar mill shortly (though it had a not-for-sale electric back in 1933 for floating sight-seers through the Chicago World's Fair, before the days of quieter kickers).

Our test boat is the latest from the company that may be volume leader in fiberglass and aluminum boat production. Called the Starcraft 16 Bill Dance Pro, it is a model that aims to include all the features bass-chasers could want. Fabled fisherman Bill Dance, the Memphis ace who has won first slot in 12 out of 25 national tournaments and placed in eight others, helped design the layout and fittings.

Electric motors aren't new, but recently sales have been booming as inshore anglers learn the advantages of cutting off their



Lunker bass sitting on cypress knees can't hide from new bass boat and Johnson outboard combo. Bow motor lifts easily for following fish into shallows.



Starcraft 16 Bill Dance Pro model tops line of special models for fishing. It's rated for 70-hp motor on transom, 5.6 passengers or 1300 pounds of gear aboard.



3 4



2



5

**1. Standard equipment** included in the \$1995 boat are running lights and interior lights, a locking fuel and battery compartment, a live well hooked up to an aerator and a recirculating pump, two anchormates, a bilge pump and a locked cabinet for rod storage.

**2. Two fishing chairs** that swivel, are well upholstered, have adjustable arms and will rock back are among the comfort features that were specified by Bill Dance as standard equipment in the new Starcraft. Upright safety flotation is also included.

**3. Johnson** electric motor's mounting bracket allows an easy lanyard pull for the tip-up when the water gets too shallow or a switch is made to standard power. Dangerous lean overboard is not needed for change-over. Vertical adjustment is 15 inches.

**4. Switch panel** below the Lowrance Locator/Sounder, an optional accessory, has controls for lighter, bilge pump, live-well aerator and recirculating pump and drain, as well as running lights and interior lights. Mechanical steering is standard.

**5. Testing fish** as well as the new boat and electric mill (and taking a sneak preview of Johnson 70-hp motor for 1974), PM's McKeown and Outboard Marine electric engineer Wayne Beem (seated) approved the open layout and forward platform for casting.



PHOTOS BY JERRY IMBER  
at Cypress Gardens, Fla.

AUGUST 1973 149



1

**1. Locking down new electric** on bow deck before a fast run over chop is aided by rubber tab fitting rudder fin slot. Foot-pedal control stows under gunwale.

**2. Powerhead direction pointer** proved convenient when steering, driving boat by battery and when lifting out motor. Dial lights for night fishing.

**3. Final test of any fishing rig** is the catch. A fast, smooth ride at speed and quiet controllable battery performance indicate boat can get to the lunkers.

big stern powerplants to switch on silent little electric spinners that can sneak up on lakeside lunkers. Guesses place electric outboard sales between 150,000 and 300,000 last year with 15 companies already in the field. Johnson is joining a busy league, but has some interesting extras for its entry.

Speeding across a choppy chain of lakes near Florida's Cypress Gardens at Winter Haven, we were first impressed with the way this midget mill could ride a bouncing bow. A lock latch for the mounting bracket plus an additional rubber tab that snugs between motor housing and rudder fin combine to hold the rig tight to the foredeck. We have seen other makes bounce, lash and threaten to tear free at less speed than the 30-plus we were winding from a peppy prototype of Johnson's 1974 70-hp Seahorse.

A handle and lanyard make unlatching and locking down the electric for drive position easy while seated—with no need to



2

3



lean far outboard and chance falling in. Clips to clamp to a battery are supplied. Our Starcraft, however, had a built-in socket for plugging in the motor or a battery charger. About 3½ hours of full speed operation is estimated from a 70-amp/hour battery. The foot-pedal steering control proved quite easy to use, and the variable-speed dial with clear numbers plus on-off switch on the pedal are large enough to use with lug bottom boots. Particularly useful is a propeller position pointer (lighted for night use) in the top of the power unit that shows direction of its ¼-hp thrust.

Though the Bill Dance Pro has the same dimensions, 5.6-passenger and 70-hp capacity, as Starcraft Bassmaster and Deluxe models, all the locking cabinets, wells, lights, anchors and recirculating aerator pumps that are standard equipment for under \$2000 make it one of the best bass bargains around. ★★★



# Boat booster for \$10

by Mark Sosin



**Cartopping a boat** takes a lot less brawn when twin slide rod pipes are fastened to the roof brackets.



**Slant of pipes** clears side of the car, allowing the gunwales to ride at an easy angle up onto carrier.



**Roof rack is drilled** on right side of the car to take bolt securing the pipe. Rack is rounded off at top edge.

A cartop boat booster for under 10 bucks is a bargain even if you don't have a bad back like fisherman Les Hodax. To handle his hull without help, he designed the simple system shown.

Most boats are slightly wider than standard rooftop carriers. You can mount 2x4s to extend your carriers a few inches more than the distance between the gunwales of your boat. Mount the 2x4s to your carriers with through-bolts, but countersink the bolt heads so they will not catch the gunwales as the boat slides into position.

In addition, you will need two lengths of light-walled pipe about one inch in diameter and two bolts from six to eight inches long. Length of the pipes will depend on the height of your vehicle. They should slant to the ground without touching the side of your car. One end of each 2x4 is notched out to receive the pipe in the center, and that end is rounded off to make sliding the boat on and off easier. A 1/4-inch hole is drilled through this end of each 2x4 and also through one end of each pipe. Now all you have to do is lay the pipe in the notch, slide the bolt through the matching holes, and your pipe rails are ready for the boat.

To prevent the boat from sliding too far, and to help secure it while traveling, Hodax loads from the right side and has mounted angle irons on the left side of his 2x4s to hold the boat in place. ★★★



**Angle irons on left side** of the roof rack prevent the boat from sliding too far; help hold it for travel.

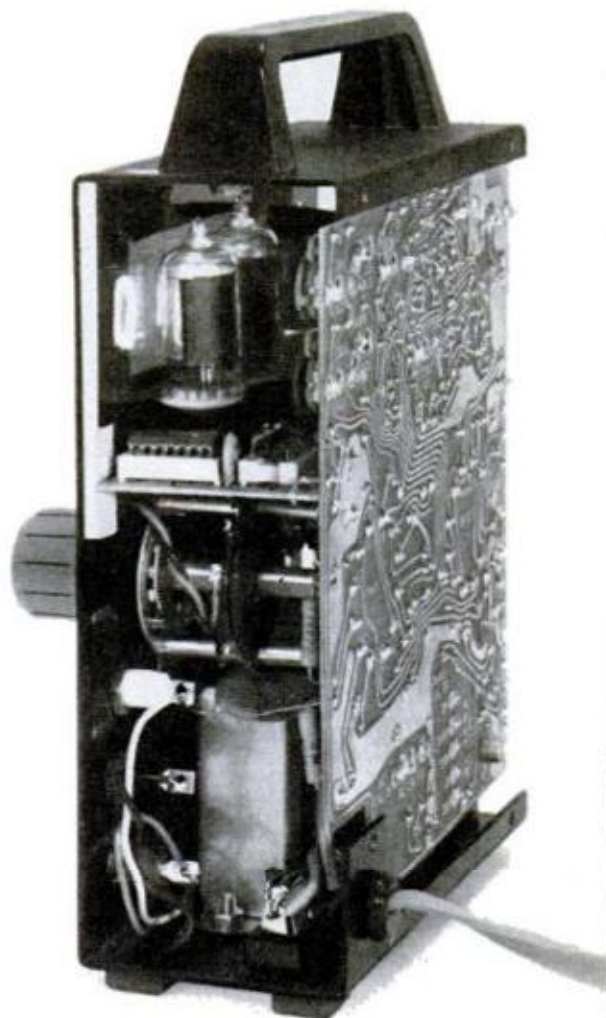
# Low-cost, no-squint meter kit reads volts, ohms, amps.

by Karen McKenzie

Wouldn't it be great to have a multi-meter you could read clearly across the width of your workbench—or from across the room? Especially one that didn't cost an arm and a leg? Now you can, with Heathkit's new IM-1202 digital multimeter.

For only \$79.95, it gives you direct readings, in illuminated numbers  $\frac{1}{16}$  inch high, of a.c. and d.c. currents from .01 milliamperes to 1990 ma. (1.99 amps.); d.c. volts from .01 to 1000; a.c. volts (rms) from .01 to 700, and resistance from .01 to 1990 ohms. Though there are three cold-cathode readout tubes, the IM-1202 is called a "2½-digit" meter, because its first digit reads only "1" or blank; a full, three-digit meter would read from 00 to 999, rather than the Heath's 00-199 range. The decimal point moves automatically as you switch measurement ranges and doubles as a "comma" after the first digit in the 0-2000 range.

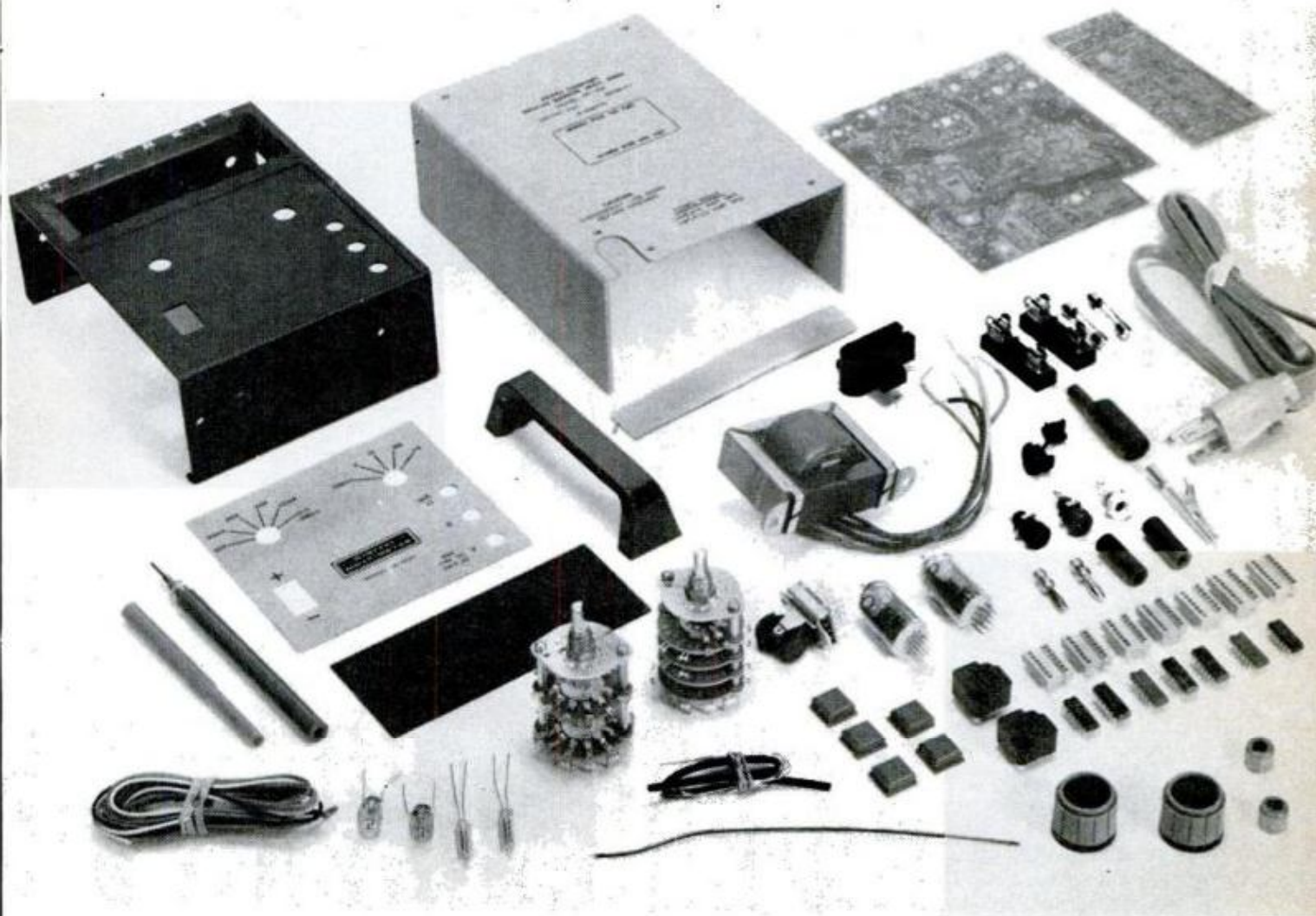
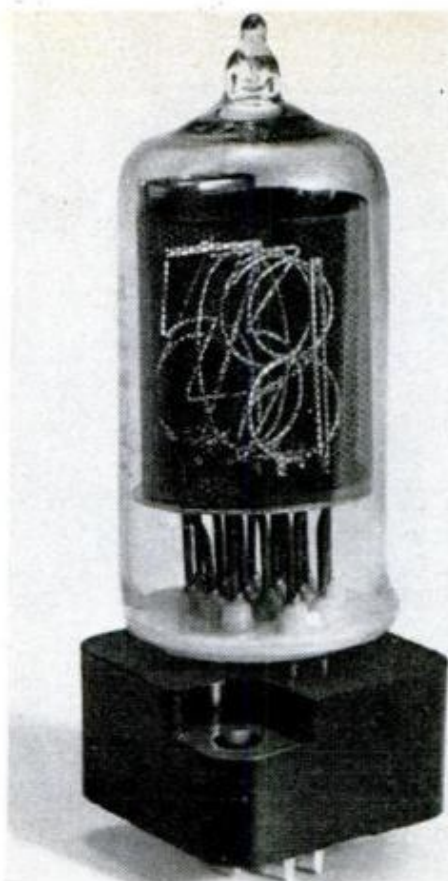
Digital metering has many advantages: You can't "pin" the nonexistent needle; instead, over-range inputs are indicated by a rather dim signal light, and reversed-polar-

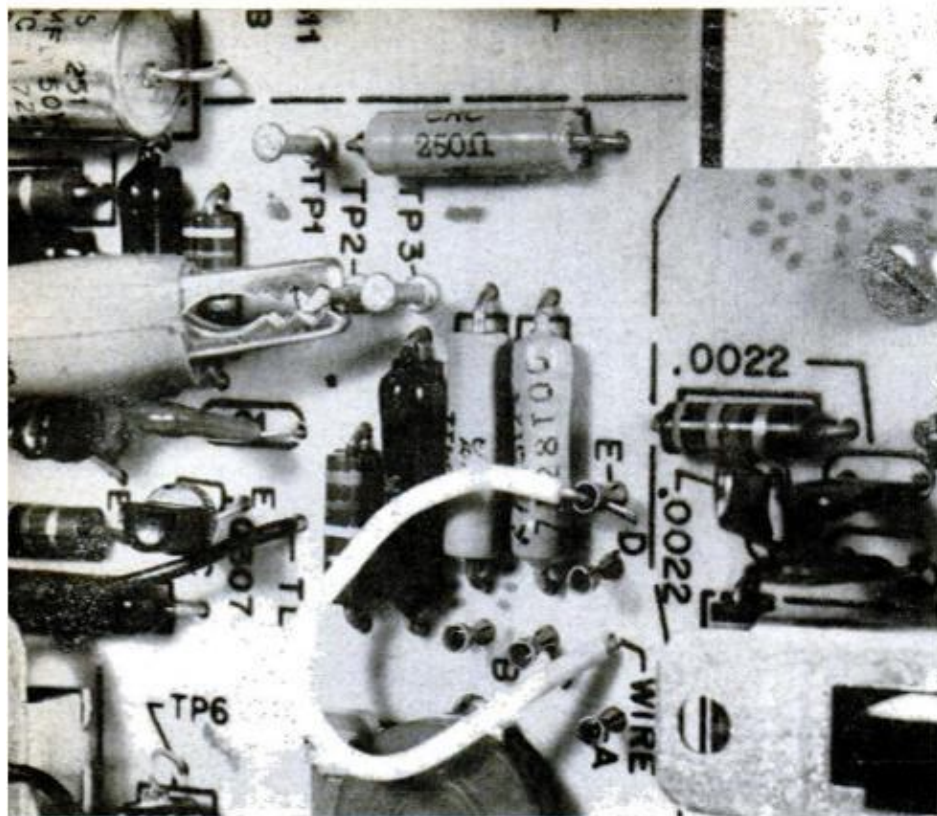


ity d.c. signals just read "00" until you flip the handy polarity-reversal switch. Additional indicators also remind you which way that switch is set. With a digital meter, you can't read the wrong meter scale (or read the meter wrong because you're seeing the needle from an angle), and resistance readings—usually jammed up in one part of the ohms scale and widely spaced in another—are linear throughout the measuring range. Also, the IM-1202 doesn't use a battery for resistance measurements, so you never have to worry about a dead battery or corroded terminals, and you don't have to set "zero" or "ohm" adjustment pots before use. The only drawbacks are the lack of decibel (db) and center-channel scales.

The kit builds quickly (eight hours) because construction, though tight, is all on plug-in boards. The IM-1202 offers lots of convenience for a modest amount of your time and money. ★★★

**Cold-cathode tube** (right) gives bright, clear display (opposite page, left). Few parts (below) mean an easy, eight-hour assembly, despite the tight construction.

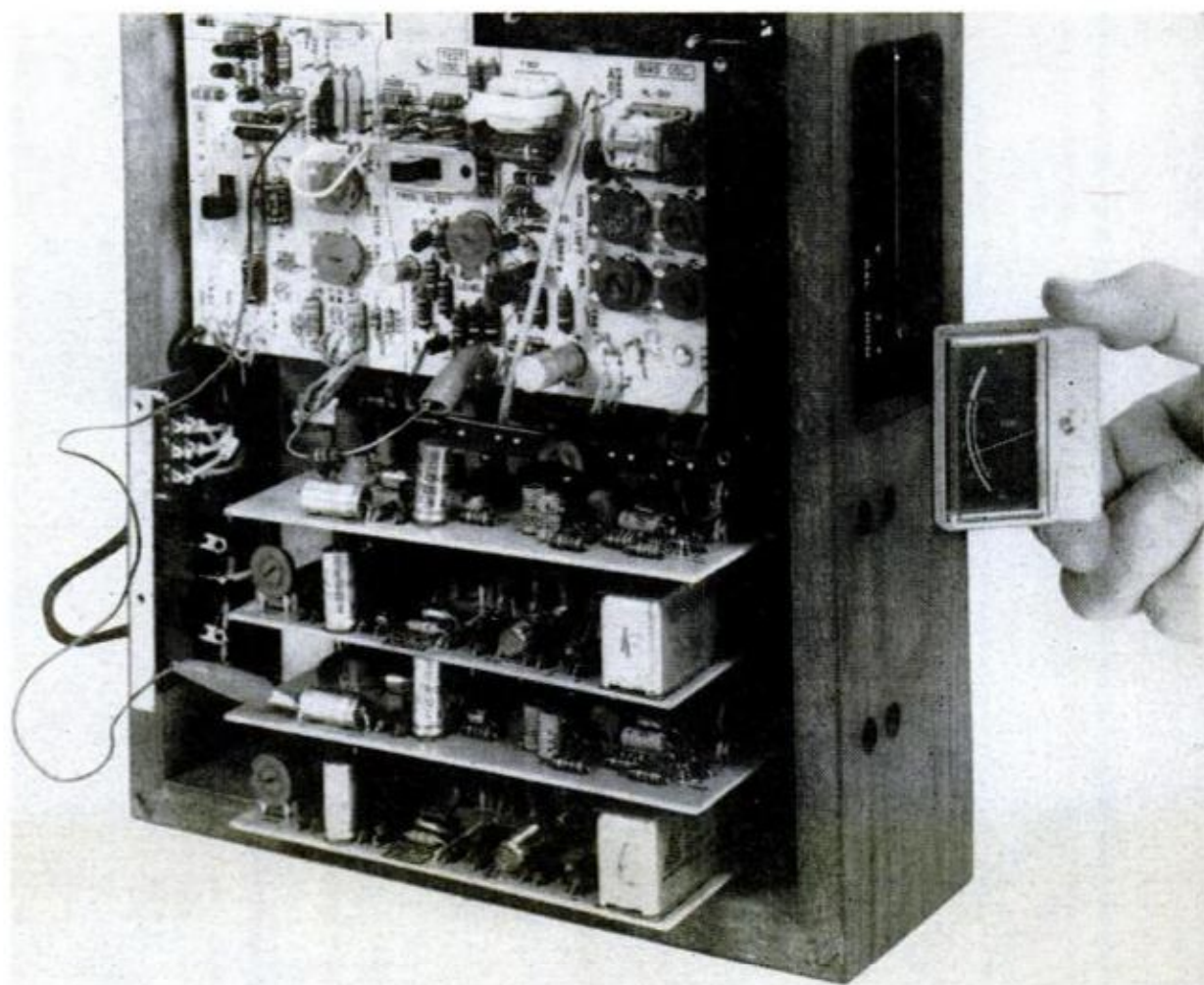




# Heath's quietest cassette deck

by Ivan Berger  
ELECTRONICS EDITOR

PHOTOS BY ROBERT D. BORST



**Circuit checks are easy**, as in most of today's Heathkits, using a built-in mirror—here, the right-channel VU meter. Close-up (top) shows test-point studs and holes (A, B, C, D, E) for test-programming wire, but not all test points were as easy to find.

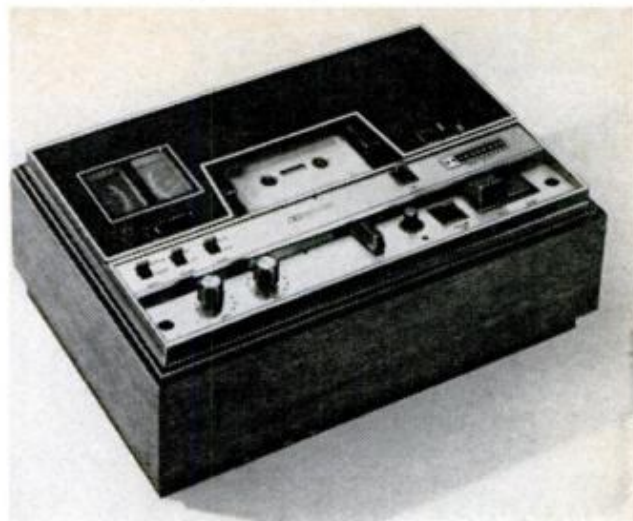
Noise (tape hiss, to be exact) and fluttery tape-speed variations are the biggest enemies of high-quality cassette recording. The Dolby noise-reduction system has just about conquered the first problem, and 3M-Wollensak has a cassette transport mechanism that pretty well takes care of the second. Now, Heath has put them both together in a \$250 cassette deck kit.

As a result, the new Heathkit AD-1530 sounds as good as many open-reel tape decks: Its frequency response goes from 40 Hz to 14 kHz ( $\pm 3$  db) on the new chromium dioxide tapes, 40-12 kHz on regular iron oxide ones. (A switch sets the recording bias, input levels and playback equalization for regular or CrO<sub>2</sub> tape formulations.) With the Dolby switch in, the signal-to-noise ratio above 4000 Hz (where the hiss is) becomes a highly respectable -58 db (better than studio machines were just a few years ago). With Dolby switched out (as it would have to be when you played recordings not made with the Dolby system), the signal-to-noise ratio is 48 db; that's respectable for a cassette deck, but no match for open-reel machines.

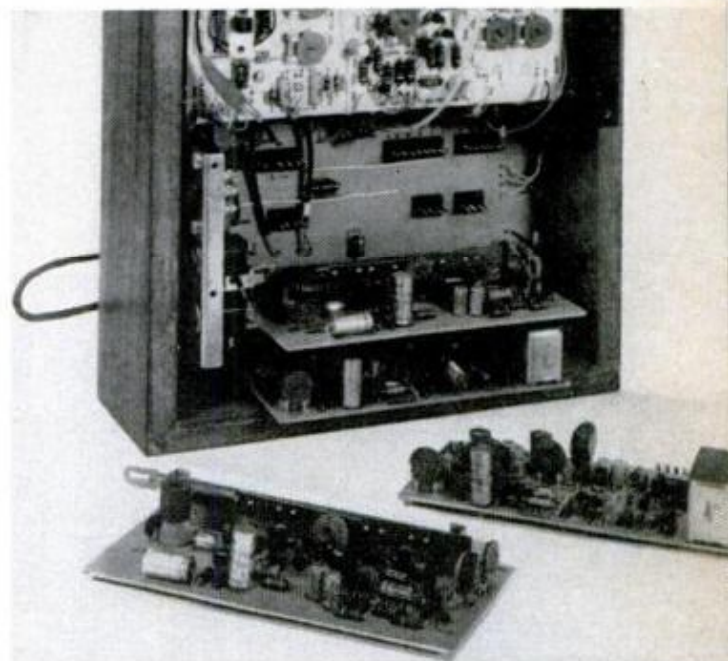
The Wollensak transport comes preassembled, ready to wire in. Instead of the common keyboard controls, it uses pushbuttons for stop and start (interlocked with the on-off switch, so turning off the power puts the transport in stop mode, while pushing the play switch turns the power on), a smaller button for record, two small, flip levers for pause and eject, and a larger, side-to-side lever for fast-forward and rewind. This sounds confusing, but in practice you learn to operate it by touch.

When the tape comes to an end, the controls shift automatically to "Stop" mode, saving wear and tear on both tape and transport. The rewind-forward lever doesn't lock, so you have to hold it until you've reached your desired stopping point on the tape. But since the AD-1530 takes only 45 seconds to rewind an entire C-60 cassette, that's less of a bother than it could have been. And wow and flutter are a reasonably low 0.25 percent or less.

Electrical controls—the input level controls, stereo/mono, CrO<sub>2</sub>/regular, and Dolby switches—and the big, bright VU meters are all grouped on the left side of the machine. Mike inputs and the mike/line selector switch are on the front panel; line inputs and outputs and the Dolby calibration tone switch are on the rear.



If Heath's new AD-1530 looks like a Wollensak, that's because it uses the same transport mechanism.



Amplifier (left) and Dolby (right) circuits are on plug-in boards. Interchangeable left and right-channel circuit boards simplify troubleshooting.

Voltages and circuit operation can be checked and aligned without external test instruments: Just clip the built-in test lead to the appropriate test points (they're dotted all over the plug-in Dolby and amplifier boards and the fully accessible oscillator/power supply), slip another test lead into one of the holes provided, and the deck's own VU meters tell you whether all is well or not. This was easy, once the page with the map of test points was located, but longer wires on the right-channel VU meter would have made it easier.

Construction and checking took about 20 hours with no particular problems. The built-in test procedure did help us track down a few of our goofs, though. ★★★

# Steadyrest for lathe milling attachment

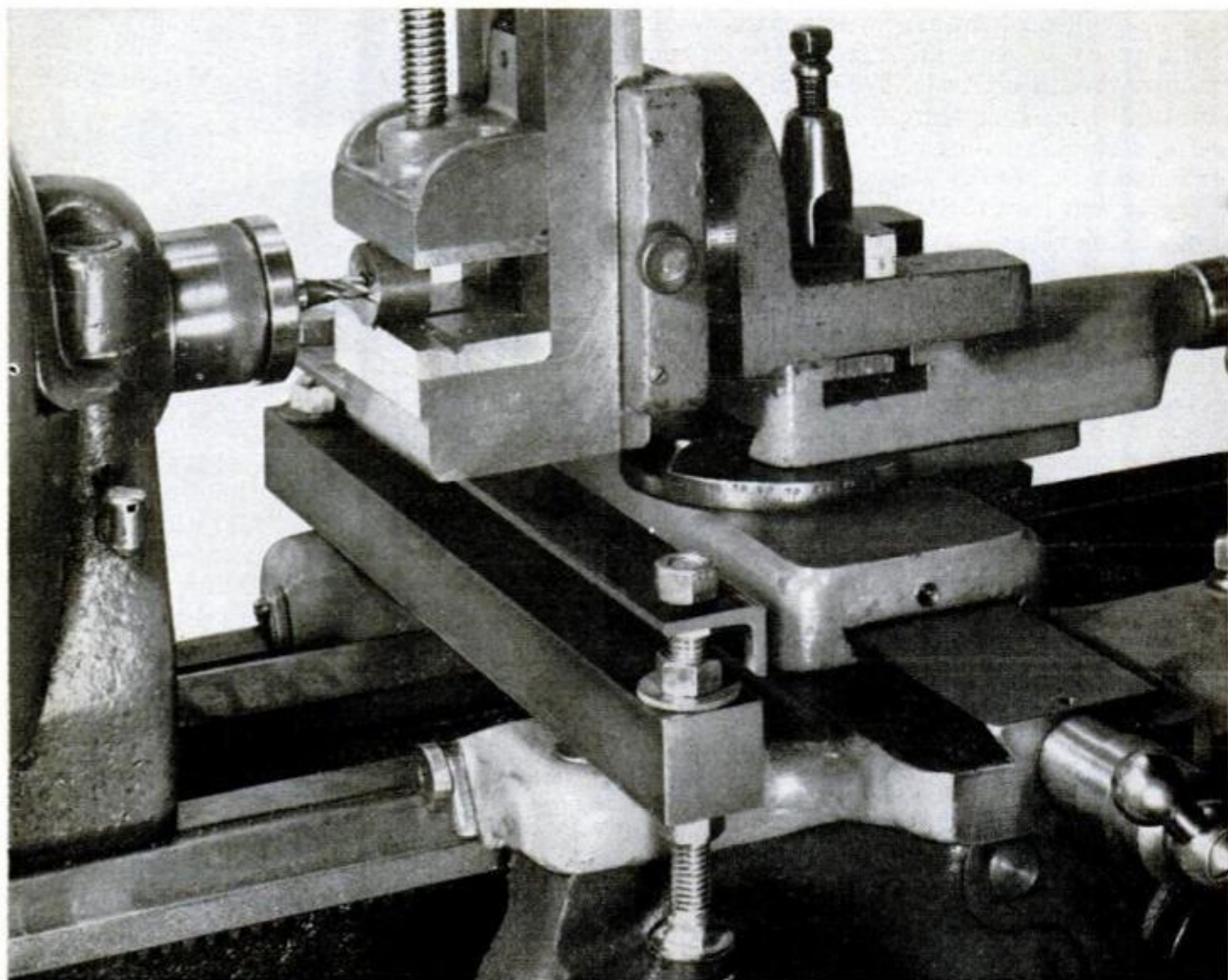
by Walter E. Burton

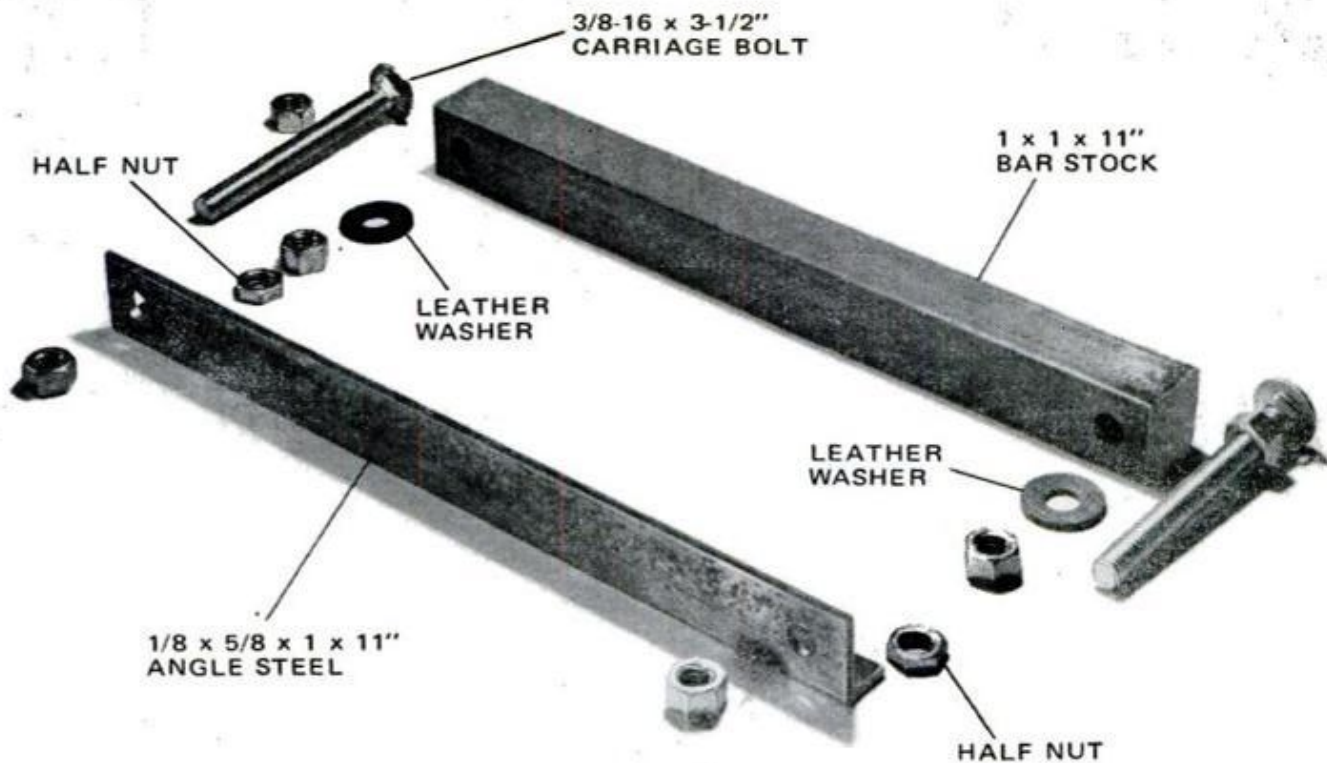
When a lathe milling attachment cannot be mounted without considerable overhang, annoying vibration and chatter can develop. To prevent this, lathe operators often wedge pieces of wood or metal between the lower end of the milling-attachment vise and the carriage.

Because such makeshift wedging is unstable and unpredictable, I made this milling steadyrest to fit my 9-in. lathe. The rest is simply an adjustable rectangle formed by two steel bars and two carriage bolts. To permit bar A to be positioned closer to bar B, I cut the nuts directly under it to about half thickness. Even greater travel is possible by machining a rabbet the length of bar B so angle A can move as far as the half nuts and washers permit.

The washers are leather and are placed between the nuts and the top surface of bar B to provide "give," which is needed if the top bar is not quite level with respect to the plane of vise movement. A thin leather

Steadyrest placed across saddle provides support to overhanging vise of lathe milling attachment.





layer can be cemented to the bottom of bar B to prevent marring the saddle's finish.

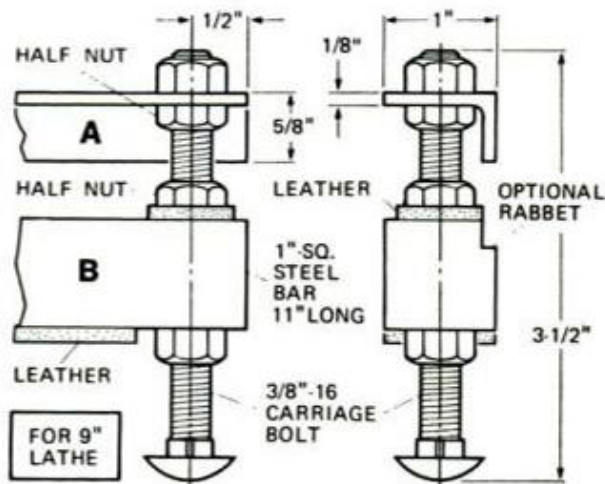
In use, the steadyrest can be wedged with various degrees of tightness between the milling vise and saddle. Ideally, pressure should be firm, but not enough to prevent smooth movement of the vise over the top bar. When the feed is accomplished by moving the entire carriage (with slides not operating), the steadyrest can be a tighter fit between vise and saddle.

The steadyrest is installed as follows: Loosen the two lower nuts on each bolt and position bar B on the saddle. Raise the upper bar by hand and hold it against the vise while the loosened nuts are tightened by hand. Then adjust the nuts at each end of bar B with a wrench so that bar A presses uniformly against the lower surface of the vise and pressure is adequate without interfering with horizontal movement of the workpiece. Too much divergence from parallelism between bar A and the plane of vise movement can lead to "jamming," thus affecting the accuracy of the cut by forcing the vise assembly upward.

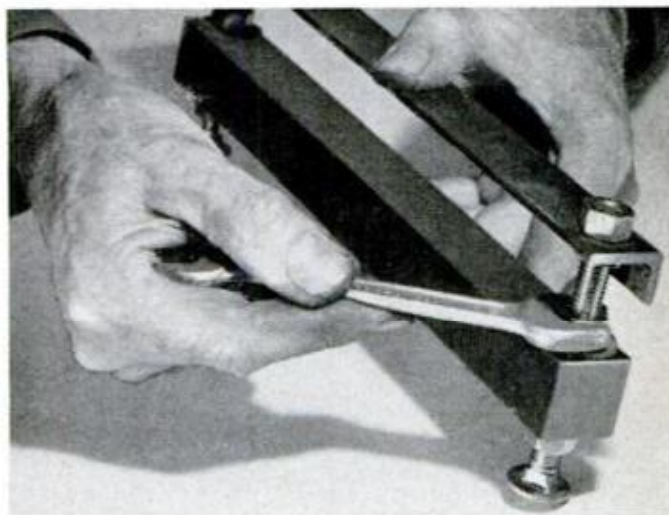
Each complete turn of a 16-thread nut shifts position 0.0625 in. A little oil on top of bar A can help reduce drag as the vise moves over it.

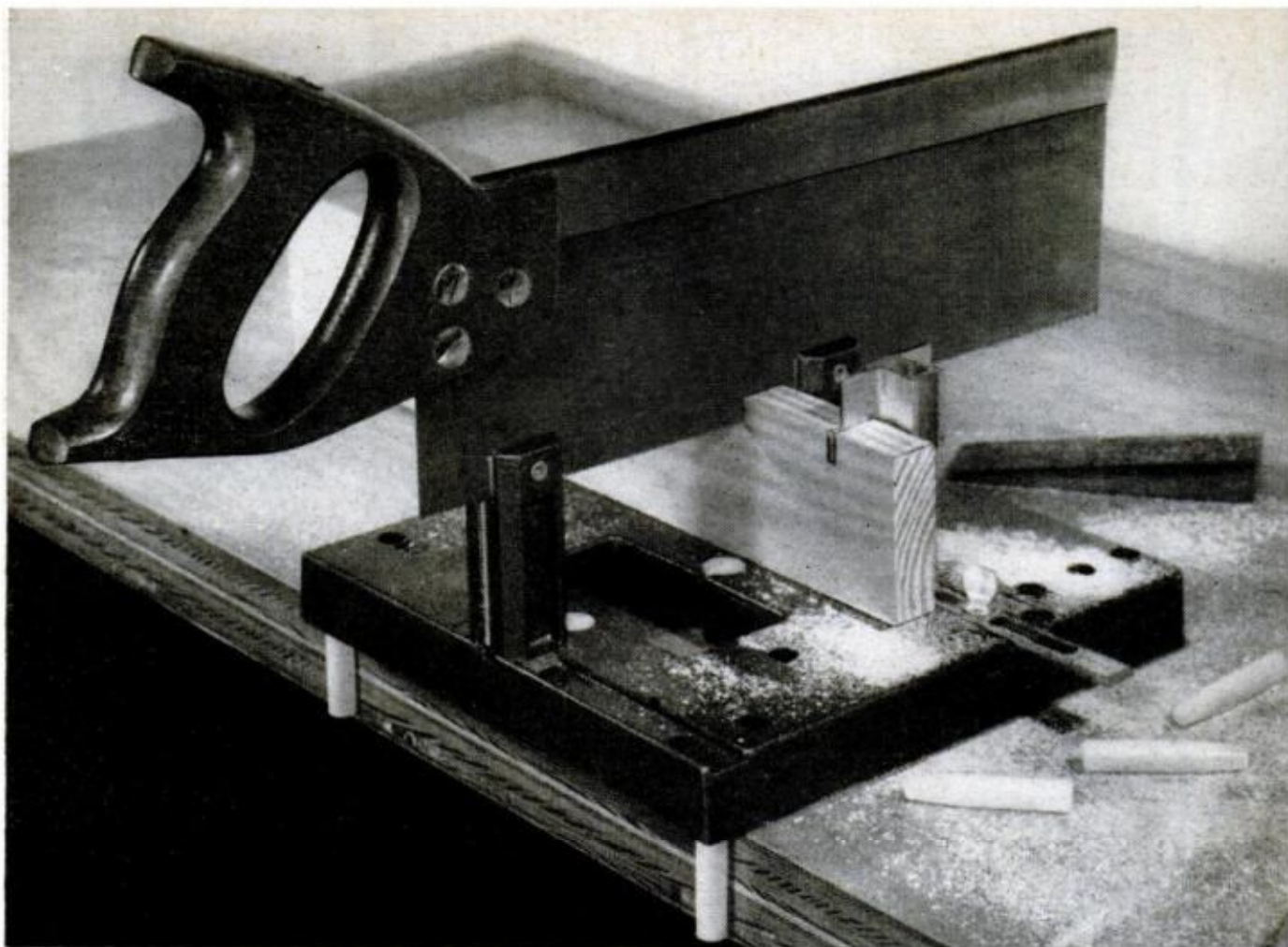
The steadyrest is intended primarily for use in operations that involve horizontal

(Please turn to page 165)



**Wedging action of steadyrest** is achieved by moving the nuts at each end which bear against the lower bar. Final adjustment is made with rest in position.





PHOTOS BY ROBERT D. BORST

Two tapered pegs inserted in holes in underside of base hook box over edge of bench. Here selector head, engaging initial saw kerf, automatically sets second cut for perfect fitting joint.

## With this miterbox you always saw in one direction

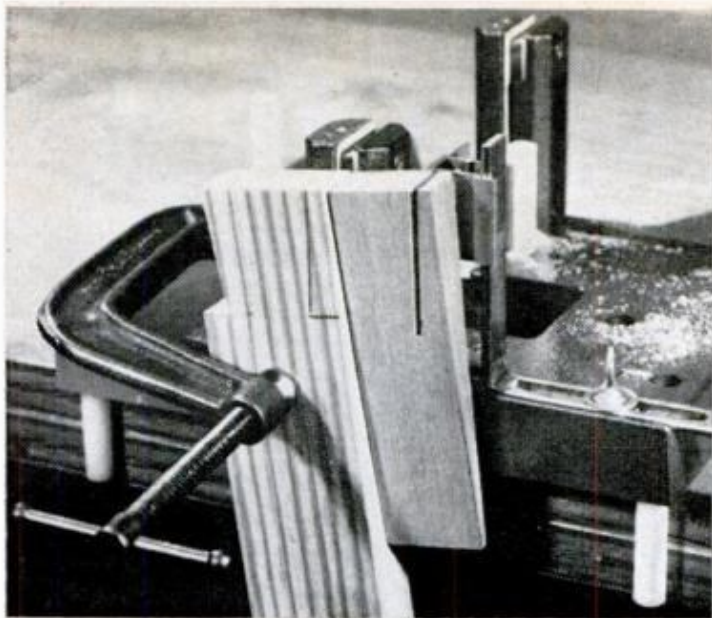
Ever try to cut a lapped dovetail tenon in a miterbox? Probably not because it can't be done—not with any conventional box. But you can do it, and several other neat tricks with a unique new miterbox called Jointmaster. Differing from ordinary miterboxes in which the saw has to be lifted from one slot to the other, or swung from right to left to saw a miter, the saw in this English import stays put in its two guide pillars and you shift the work. This means you always saw in one direction, a feature lefties will appreciate.

Another handy innovation not found on other miterboxes is a selector head which fits an adjustable and interchangeable cutoff stop. In use, the head allows for the thickness of the saw blade and thus automatically spaces the width of the recess (dado) when cutting an end lap or middle-lap joint. With a Jointmaster you can cut all joints, and more, shown on the facing page.

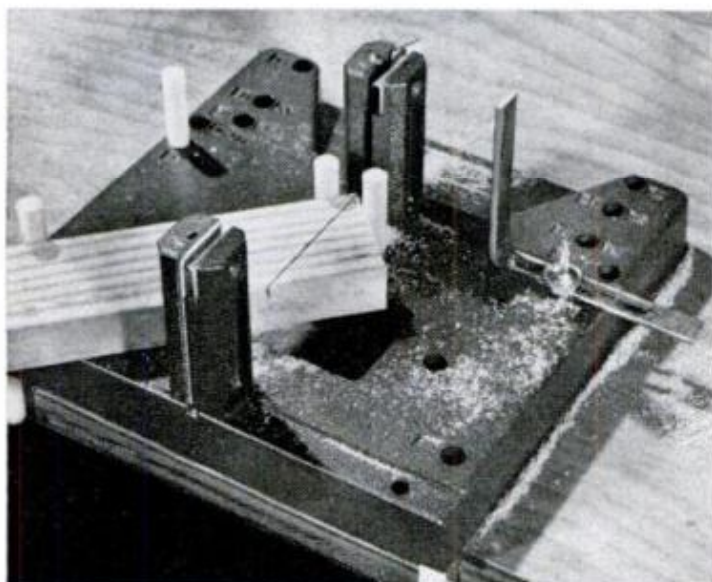
Interchangeable pegs made to fit a series of holes in the base are used to position the work for either miter or butt joints, also to hook the miterbox over the edge of a bench or table.

Made of die-cast aluminum and measuring only  $8\frac{3}{8}$  in. square, it sells for \$20.95 postpaid (less saw) from Jointmaster, Dept. PM, 4767 Clark Howell Hwy., Atlanta, Ga. 30348. ★★★

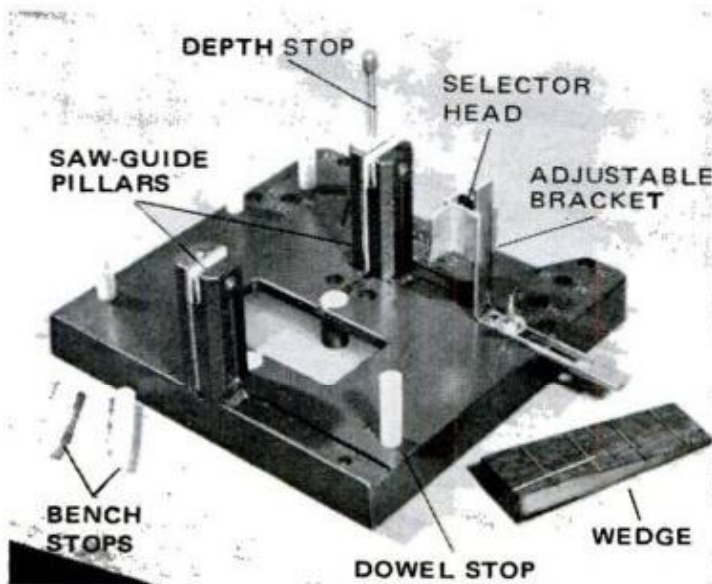




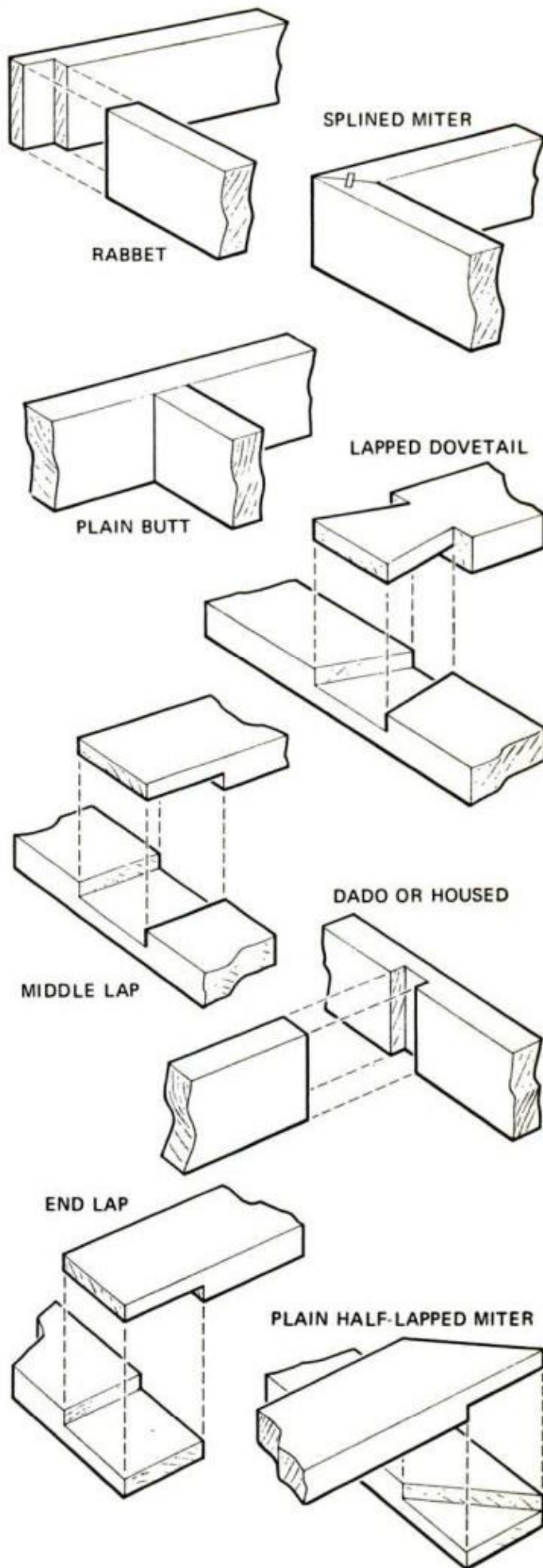
Tapered wedge is used to mark dovetail, then wedge and selector head team up to position work at proper angle.



Pegs placed in front of rear guide pillar position work for mitering end 45°. Saw remains in set position. Miterbox has six work-positioning pegs and wooden marking wedge. Adjustable depth stop rides saw-blade stiffener.

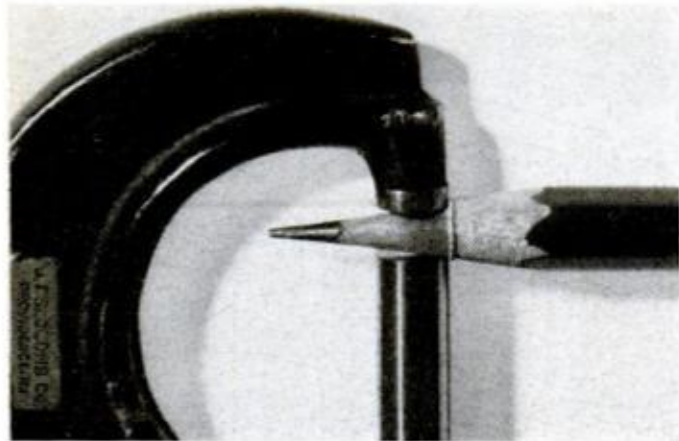


Typical joints you can make  
(with saw and chisel)



# HINTS

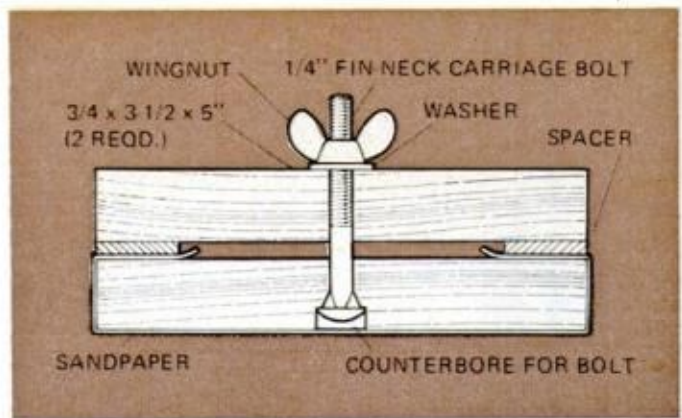
## FROM READERS



### Pencil 'remembers' hole size

When you are without a hole gauge and need to measure the inside diameter of a hole, force a wood pencil point into it. Later, use your micrometer on the ring formed and get a measurement accurate enough to tell you what size drill made the hole.

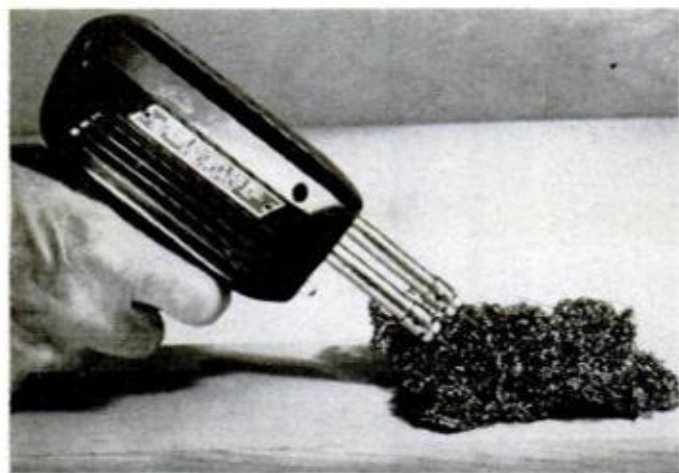
—Parry C. Yob, Fair Oaks, Calif.



### Jiffy sanding block

This sanding block takes less than five minutes to make. The size suggested above allows convenient use of one-third of a standard sandpaper sheet, but you can easily increase the size to take a half sheet. Spacers are  $\frac{1}{8}$ -in. wood or cardboard.

—Robert Brightman, Great Neck, N.Y.



### Pot cleaner is soldering aid

For peak efficiency, a solder gun must be free of scale (oxidized solder). A good improvised "sponge" for removing this build-up is a metal pot cleaner (loose mesh type, not fine steel wool) stapled to scrap board to keep it from shifting as gun tip is wiped across it.—Burt Web, Skokie, Ill.



### Old phone book is handy shop pad

One way to recycle an old telephone directory or an out-of-date catalog is to use it as a workbench pad. It's helpful when handling greasy parts, painting, gluing or doing any work that requires a clean surface. Tear off a page or two whenever necessary.—Walter E. Burton, Akron, Ohio.

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## Charming grandfather clock from a kit

---

by Rosario Capotosto

**B**uilding a fine grandfather clock from scratch is not the easiest project you can tackle. Not only does it require a shopful of tools, it takes a cabinetmaker's touch (which not everyone has). But even with tools and know-how, there's another problem: where to find the wood to build it. Because of a scarcity of black walnut and other fine cabinet woods, it has become increasingly difficult to find suitable lumber.

For this reason, it's beginning to pay amateur and craftsman alike to build furniture from kits, and it's particularly true when building a grandfather clock. The wood problem is solved. The parts come pre-cut so you don't need many tools and you can almost be a beginner when it comes to putting the pieces together.

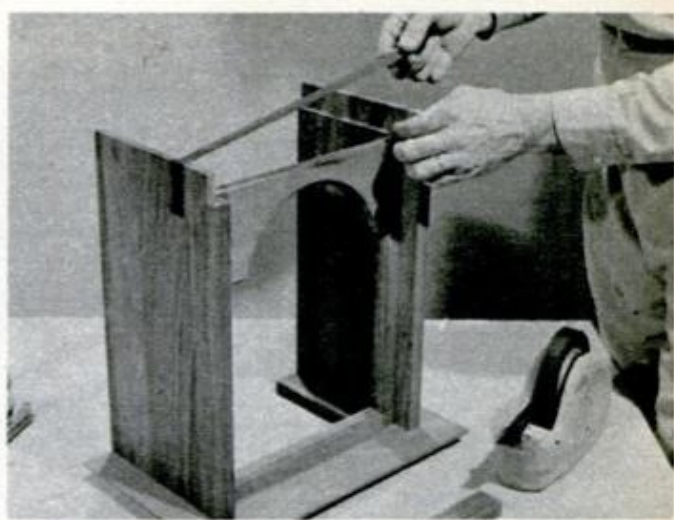
To find out how easy it is to put a clock kit together I picked a black-walnut one from the Emperor Clock Co., Fairhope, Ala. 36532, and an eight-day weight-driven movement which strikes the famous Westminster chimes; 4 notes on the quarter hour, 8 on the half hour, 12 on the three-quarter hour and 16 notes on the hour. These notes are struck on four mechanically tuned rods, while the hour chime strikes on four more rods.

The kit contains 55 pre-cut parts; some

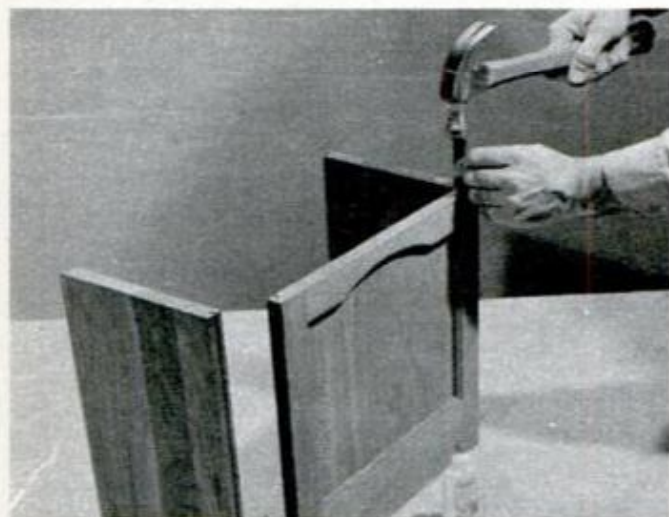
**One of four kits available, the Emperor model 120 (left) stands 74 in. high, sells for \$129.50 less movement. Westminster chimes movement, model 100M, is an additional \$79.50.**



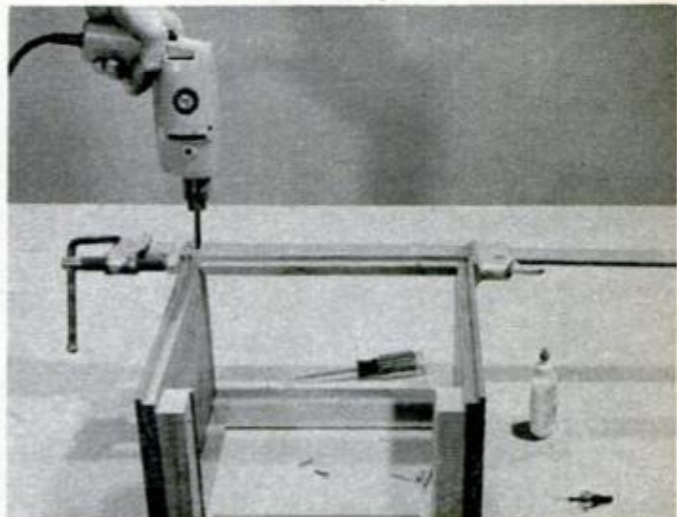
**Many parts are look-alikes** so first step when unpacking carton is to mark each piece as per master list.



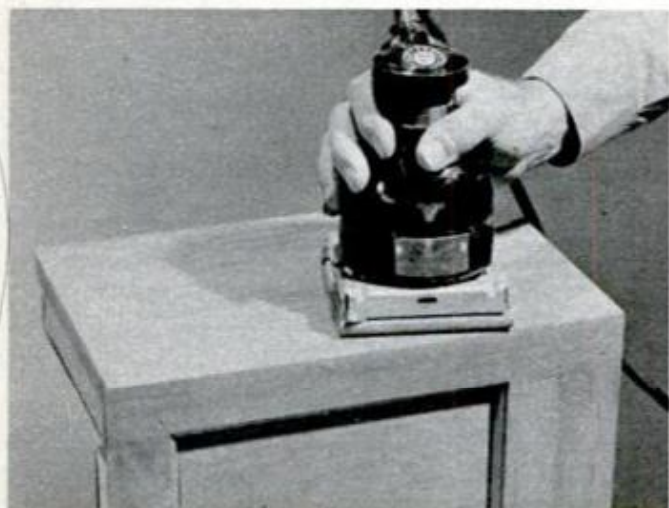
**To check parts for fit,** make dry-run assembly using masking tape to hold them before final gluing, nailing.



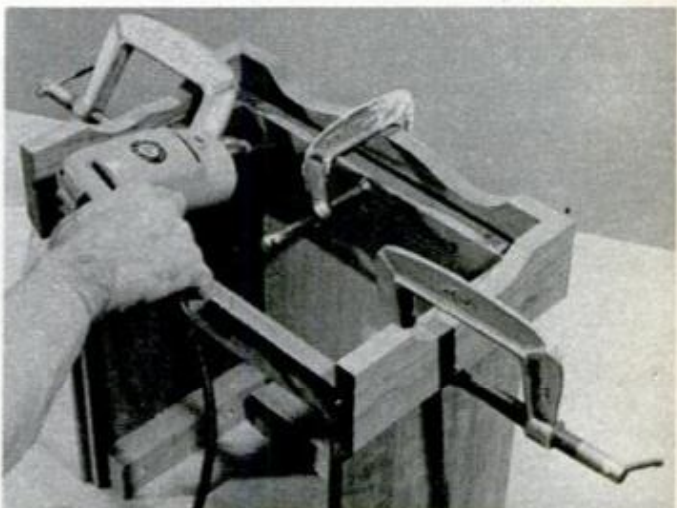
**Front corner joints of base section** are pulled together securely with clamp nails after applying white glue.



**Screw holes must be drilled** by the builder. Here bar clamp is used to hold rear brace in place for drilling.

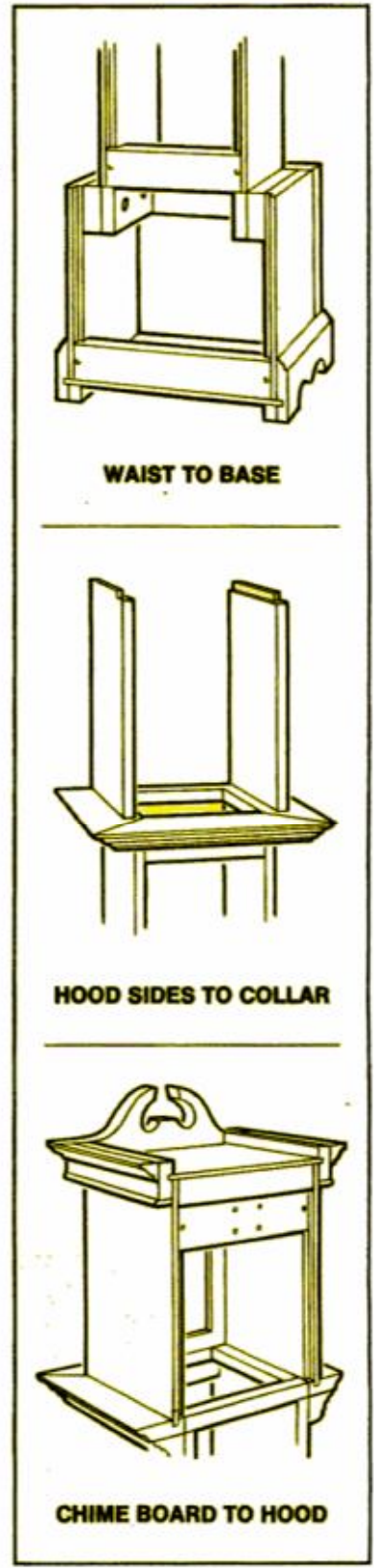
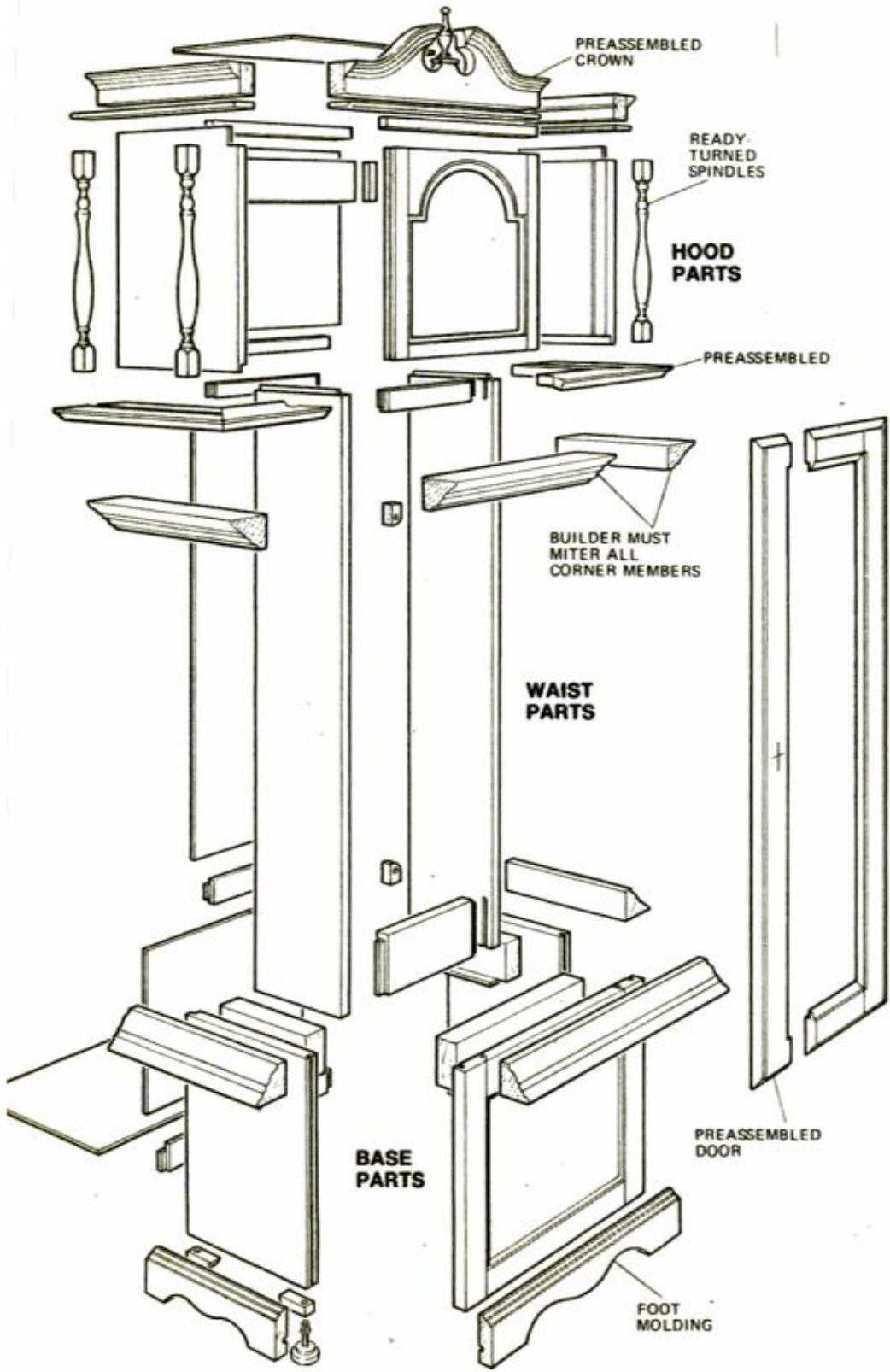


**Finish-sand all you can** before adding trim and making final assemblies. The fewer obstructions, the better.



**Adding mitered "feet"** to base section is a lot easier when done before base is attached to the waist section.

**KIT CONTAINS THESE PRECUT PARTS**



are even preassembled. These include the breakfront swan neck, waist and dial doors, dial frame and the sculptured front base. Furnished hardware includes plastic inserts and levelers, door hinges, bullet and magnetic catches for hood and waist doors, T-nuts for the sound board, door pulls and clamp nails. Things you must buy extra are

the glass for the doors, brads, sandpaper and the finishing materials.

While the parts of some clock kits come completely cut, in this kit the trim molding, the returns for the hood and the crown front come uncut and require mitering by the builder. These parts are purposely left

*(Please turn to page 166)*

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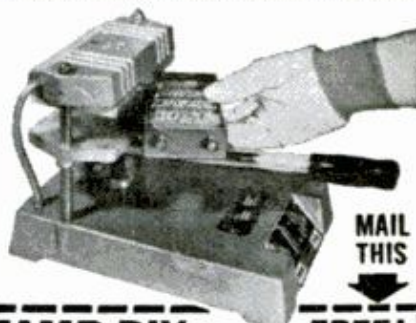


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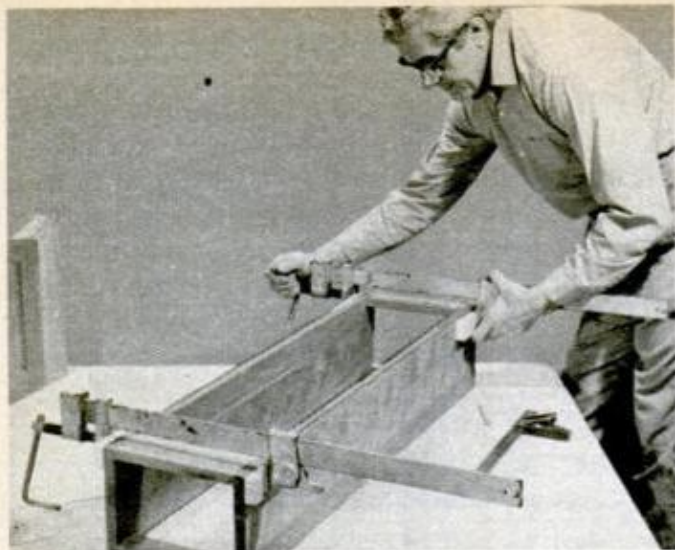


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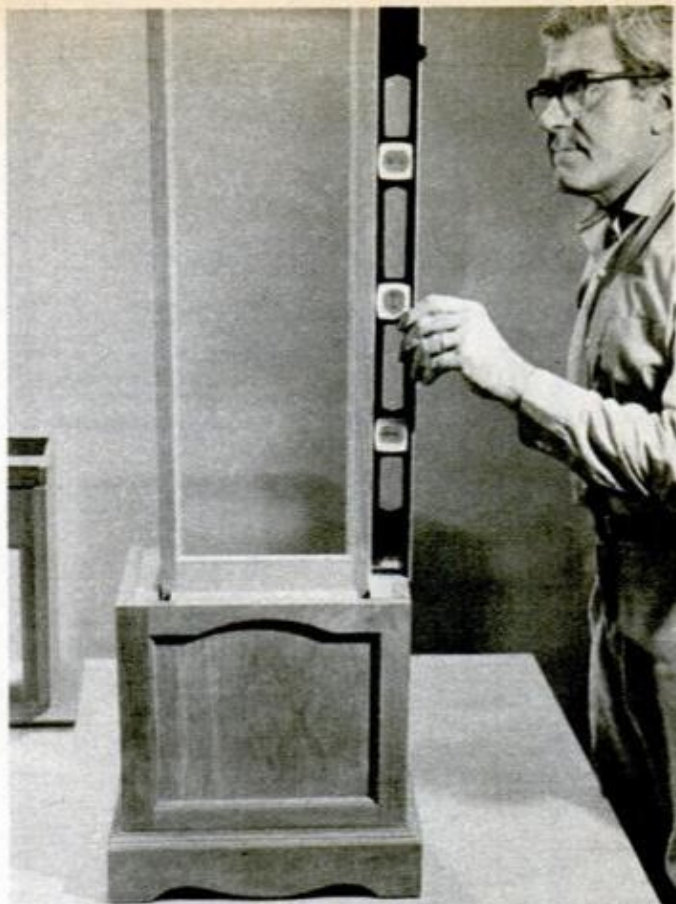
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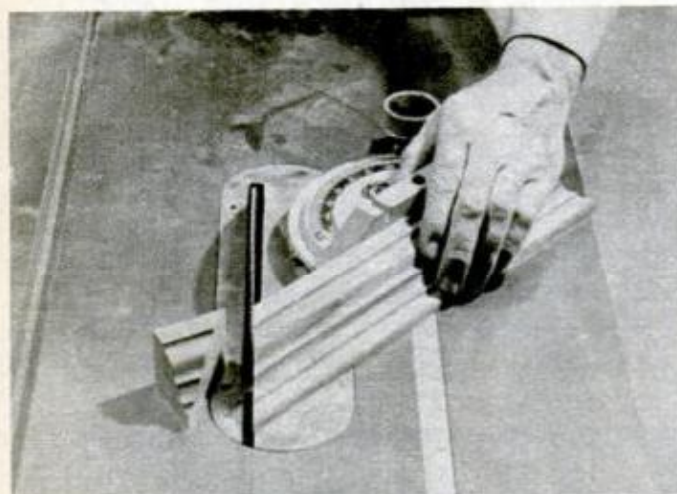
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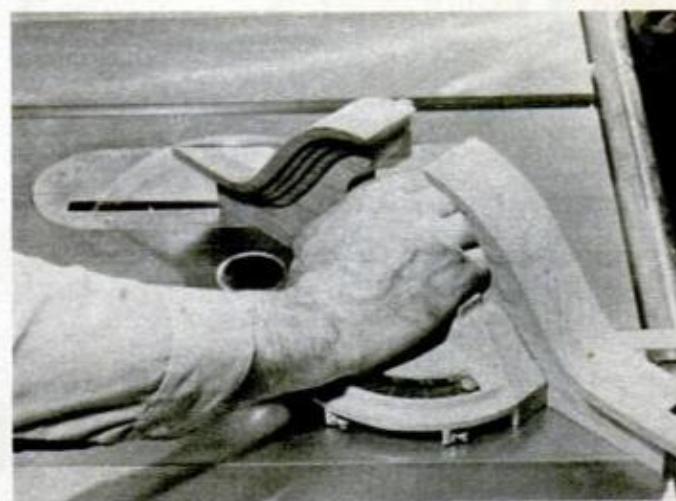
**Bar clamps** hold the waist section true while you drill screw holes in each end of the rear cross member.



**When setting up waist**, do it on a level surface and plumb it with level to avoid a leaning-tower assembly.



**All trim comes extra long** with square ends and requires mitering. Use care in cutting right on button.



**Crown assembly must be mitered too.** Go easy in cutting it. A smooth-cutting blade is best for all miter cuts.



**When adding crown molding**, use paper spacers at tops of columns to provide clearance for gluing-on later.

## GRANDFATHER CLOCK FROM A KIT

*(Continued from page 164)*

uncut because moisture can and does affect pre-cut parts, particularly mitered joints, causing the unsealed wood to shrink and create poor-fitting joints.

Assembly sequence as shown in the photos begins with the base of the case, followed by the waist, hood and finally the trim molding and doors. The foot, already preshaped, must be mitered at the two front

*(Please turn to page 168)*



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Four husky wood screws, driven into the top edge of waist section, hold the hood section securely in place.

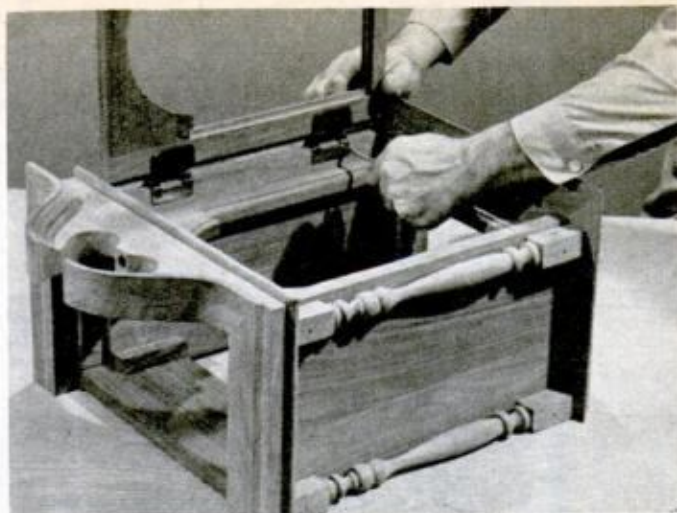
## GRANDFATHER CLOCK FROM A KIT

*(Continued from page 166)*

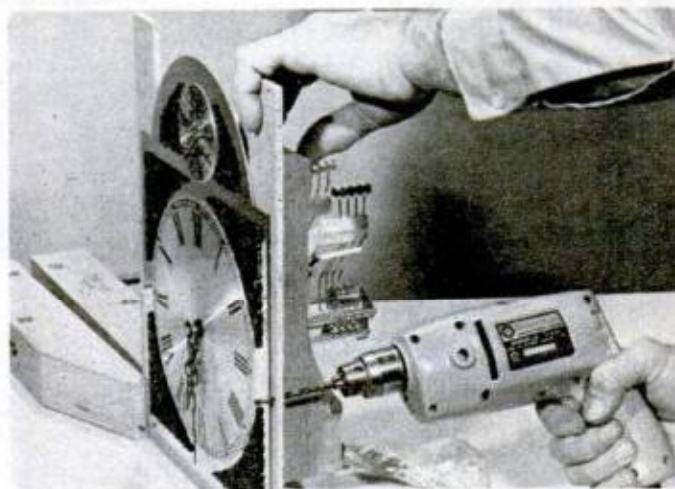
corners along with the trim molding. The waist is assembled and joined to the base. Then attach the factory-assembled waist collar, the hood and dial-frame assembly. Hanging the doors completes the case.

While excellent easy-to-follow instructions are furnished with the kit, I found a few points worth passing on to builders. To simplify finishing the hood I did not

*(Please turn to page 185)*



Doors, columns and hardware are removed before applying finish. Glass is installed in the two doors last.

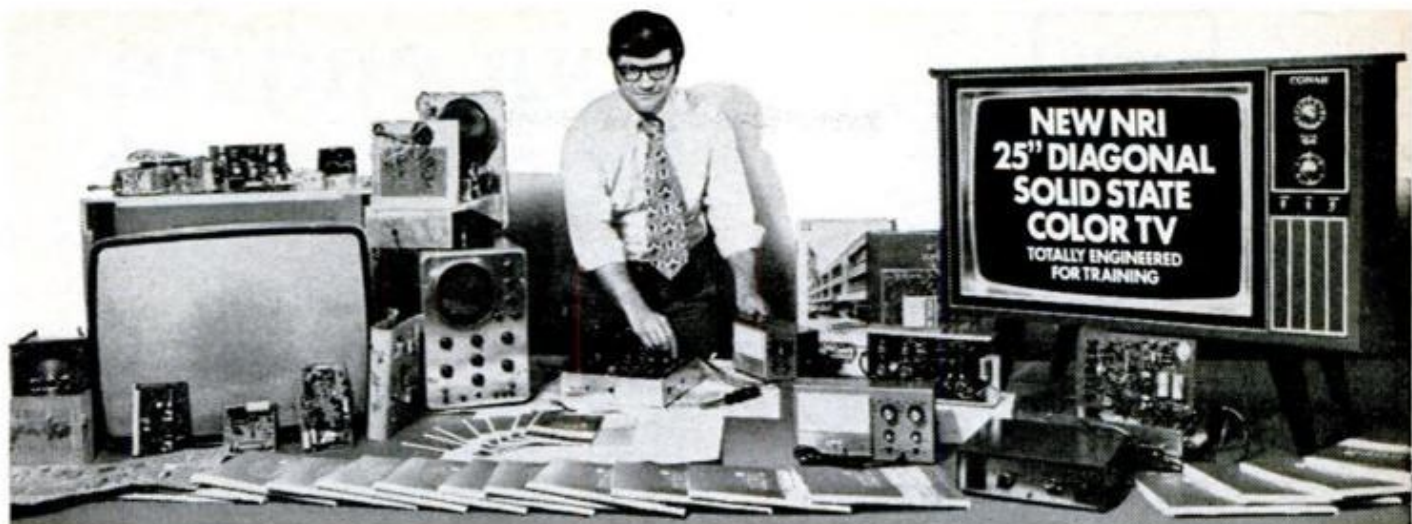


Wood handscrew (clamp) provides handy support for holding dial and works upright as you work on them.



Movement is mounted on board that in turn is screwed to dial frame from inside. Chimes attach to soundboard.

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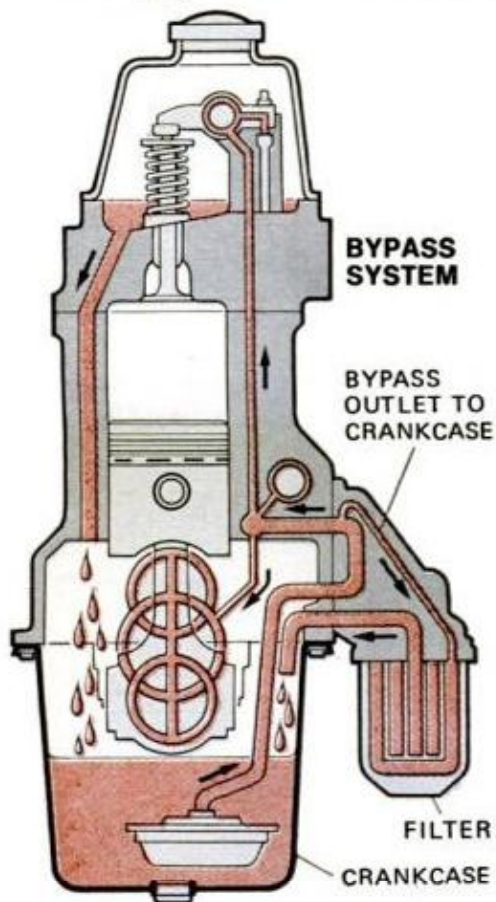
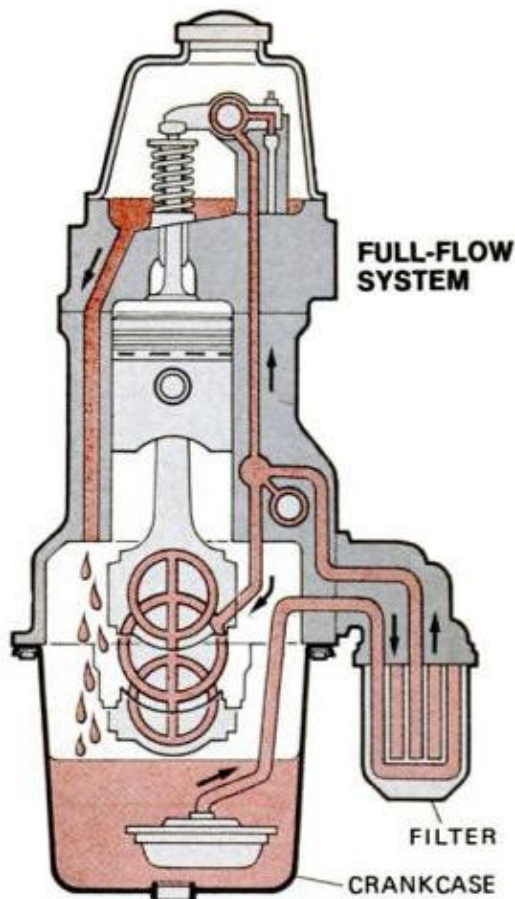
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# For the life of your engine: Don't forget the filter

Lubricating oil gets to the right places in your engine through a complex circulatory system, and the oil filter makes sure it gets there clean.

by Paul Weissler



**Normal full-flow system** where all engine oil passes through an oil filter is shown at top. Some applications use a bypass system where main supply goes right to engine and small amount to filter.

An engine oil filter is almost a blind purchase. You can't test it before you install it, or even after it's used. You can't even tell if it's properly assembled without cutting it apart.

Oil filters aren't all the same, and the amount of money you spend is no indicator of quality. There are many gimmick filters that promise miracles and cost plenty, but don't deliver.

There are a handful of big names you can rely on, like AC, Deluxe, Fram, Lee, Motorcraft, NAPA, Purolator, STP, Wix, plus private brands they manufacture. An explanation of how your filter works will reveal why the most widely available design, and the one considered the best, is the single-element, pleated-paper type.

An oil filter is supposed to remove abrasive particles in a certain size range from the oil, before they can get to the bearings. It also should trap a reasonable amount of sludge, although most of the sludge is kept in suspension by oil additives and comes out when the oil is drained.

The filter should have a relief valve (unless one is built into the engine), and this valve should open only when the filter element cannot pass an adequate amount of

oil for the bearings. The relief valve normally opens only when the filter element is clogged or the oil is very cold and, therefore, too thick to flow readily through the element.

There are two important things an oil filter should not do:

1. It should not remove detergent and other additives from the oil.

2. It should not pose such a high restriction that oil can only trickle through the filter at operating temperatures, forcing the relief valve to remain open and allowing most of the oil to bypass the element on its way to the bearings.

Carmakers give filter engineers lots of specifications. The canister must be of a certain size, oil flow must be at a certain rate, the filter element must trap virtually all of the particles in a certain size range and the relief valve must open at a certain pressure.

A filter could be made so fine that it would trap much smaller particles than the carmakers specify, but to get adequate oil flow it might have to be larger than allowed. Even then, it might clog so quickly that it would not last the carmaker's specified drain intervals.

There is no industry agreement as to what size particles cause what percentage of engine wear, but over the years it has been found that filters removing particles down to 10 microns (.0004-inch) with high

efficiency provide excellent engine protection. The carmakers' actual specifications are usually not quite this stringent, but quality filters provide this degree of particle removal.

There are two basic types of filtration: full-flow and partial (also called bypass). In the full-flow design, *all* the oil goes through the filter before reaching the bearings. In a partial flow, 15 to 20 percent of the oil is diverted to the filter. Eventually, all the oil goes through the partial-flow, but potentially-damaging particles get many chances to reach the bearings before being trapped. All Detroit passenger cars today have full-flow filters. Many trucks have both full-flow and partial-flow filters.

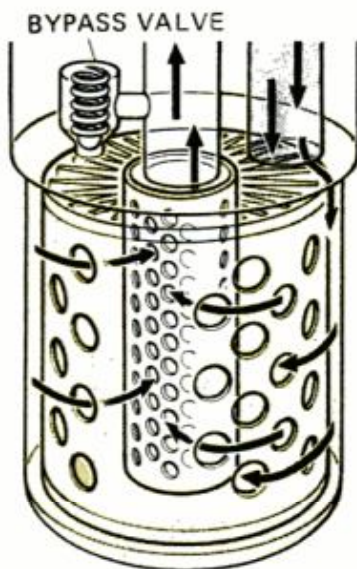
A filter can trap a particle either of two ways: by stopping it as it hits the surface of the element, called "surface impingement," or in a deep maze, called "depth entrapment."

Pleated paper (actually a resin-impregnated, heat-cured cellulose) is the most widely used filter medium today. It is basically a surface impingement filter, although some particles are trapped in the layers of the paper. The oil flows through the pores of the paper.

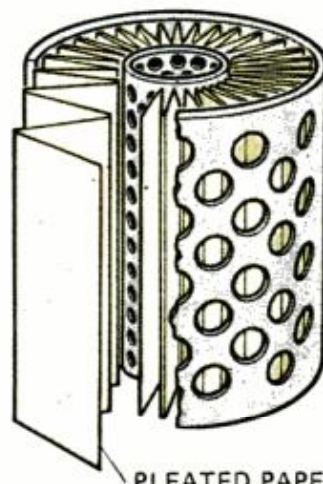
Cotton fibers, wood shavings and wound cotton are media used in depth filtration, with packed cotton fibers being the most common.

A quality paper (pleated to provide a

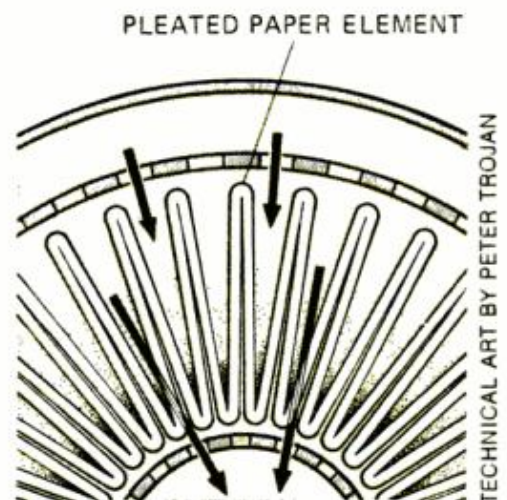
## OIL FILTER CONSTRUCTION



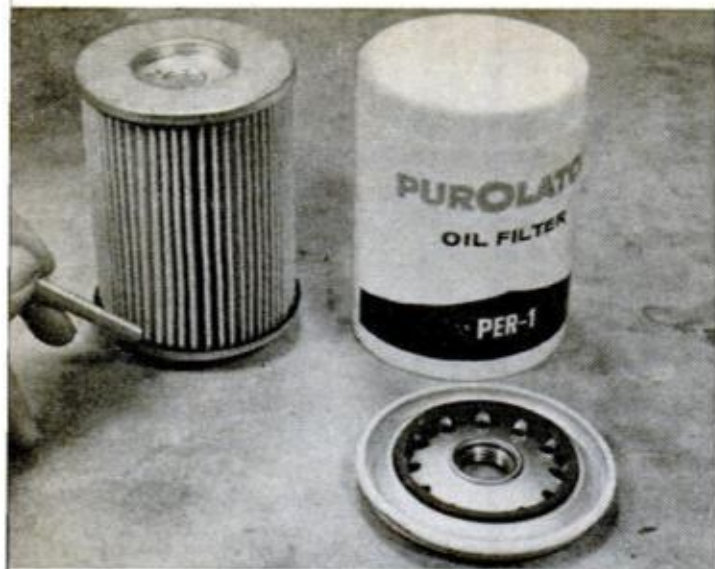
**Oil filter construction** shows oil entering the canister around outside, passing through element to outlet.



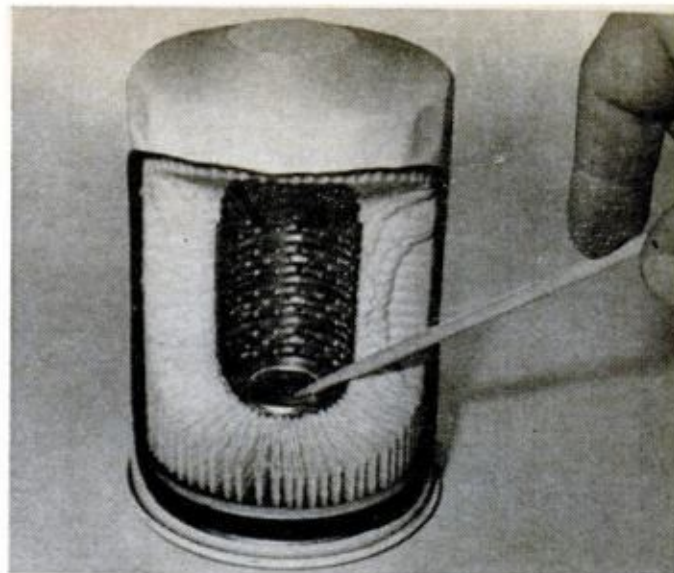
**Pleated paper element** in the oil filter is a special heat-resistant, resin-impregnated cellulose.



**Particle entrapment** in the pleated paper filter is extremely effective. Oil passes through pores of paper.



**End seal of pleated paper element in filter canister must be strong. If it breaks, oil will bypass element.**



**Bypass valve on engine end of filter has a pressure specification that lets it open if element is clogged.**

maximum amount of filtering surface in a small container) has a number of advantages over depth filters:

1. With good quality control, it provides very predictable filtration of particles of any chosen size. That is, you can make paper to filter out particles of just about any size range with 98 to 99 percent accuracy on a single pass of the oil through the filter element.

2. It is not subject to channeling. Oil under pressure can drill channels through loosely packed sections of a cotton-fiber or wood-shavings filter. Oil flowing through these channels is not being effectively filtered.

3. It is not subject to breakaway of particles. In the depth filter, pieces of cotton or wood can break away from the filter.

4. It does not remove additives from the oil. Although most depth filters do not have a real problem in this area, some can remove additives (particularly oil-viscosity-index improvers) from the oil.

With the advantages of paper filters you might wonder why anyone makes depth filters. In fact, the big three filter companies, AC, Fram and Purolator, make only paper filters for automobile full-flow replacements.

The properly packed depth filter, however, does have the advantage of somewhat better sludge removal, and in trucks, which have to go up to 250,000 miles between engine overhauls, it is often installed as a bypass filter, to supplement the paper full-flow.

Ford is the only carmaker using a depth

filter for original equipment, although it approves the paper filters for replacement use. The Ford filter is actually a two-element design: a coarse fiber doughnut that removes approximately 100-micron particles, and a cotton-fiber depth filter that takes out 10-micron-plus particles.

This works as a combination full-flow filter. Most of the oil goes through the coarse doughnut, and some goes through the depth filter (oil, like electricity, takes the path of least resistance, which in this case is the coarse route).

Ford thought it needed the extra margin of protection against sludge when it went to the six-month, 6000-mile oil-and-filter change some years ago. Ford engineers were afraid of what would happen if motorists stretched the oil-change interval too far past their limits. Their fears probably were unjustified, for engine oils have been improved and the majority of people don't go even as far as 6000 miles between changes.

Two-element filters also have been promoted to handle the low-temperature situation, when the oil is too thick to run through the 10-micron filter and the relief valve is forced open.

With a coarse filter, the theory goes, the oil will get some filtration when cold. The problems with the theory are these: 1) To get a significant cold oil flow through the filter, you've got to make it so coarse that you might as well rely on the oil pump screen to keep out anything big; 2) You can't get rid of the coarse filter once the oil warms

*(Please turn to page 176)*


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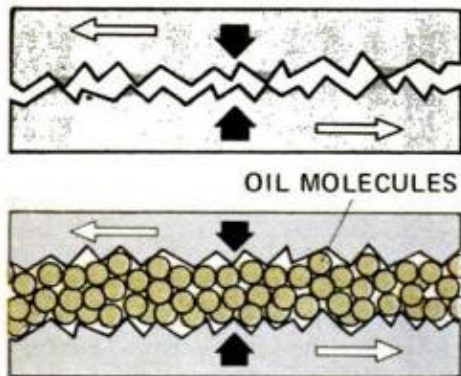
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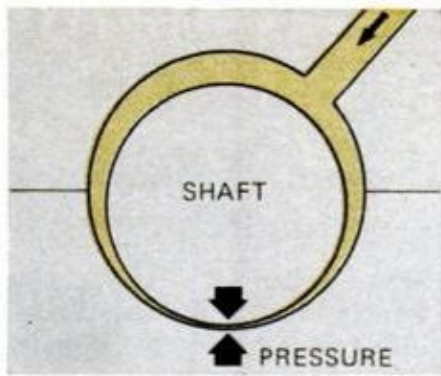
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## FOR THE LIFE OF YOUR ENGINE, DON'T FORGET THE FILTER

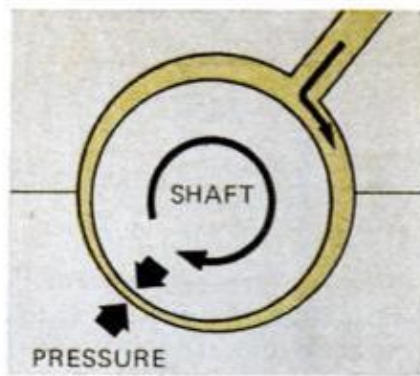
(Continued from page 174)



**Metal surfaces** under microscope are jagged; oil keeps them apart.



**Wedging action of oil:** Slowly rotating crankshaft at left is close to bearing surface. As speed increases shaft is lifted away from surface.



up. Some filter engineers have tried to separate the two elements with a check valve, but once the finer filter gets some dirt in it, the check valve pops open and stays open.

All single-element paper filters are not the same. Filter paper is only as good as the quality control of the maker. Some cheap paper filters have paper of wildly inconsistent porosity. The pores in some sections will be so small that oil can barely get through, and other sections will be so big that oil and abrasives pour through. Other cheap filters have good paper, but less of it (wide-angle pleats), so there's less filtering area and shorter element life. Still others use a paper with larger pores, which allows unacceptable abrasives to pass through.

A feature of some new pleated-paper filters is the addition of spacers to ensure a uniform spacing of the pleats.

Accurate relief valves are a key component of quality filters. A weak relief valve may stay open under all operating conditions, and virtually all the oil will bypass the filter element. Another type of valve used in oil filters that are mounted so that the oil runs back into the engine when it is not running is the antidrain-back valve. It closes to keep oil in the filter so it gets to bearings faster than it would from the crankcase when the engine is started again.

Good end sealing is another important factor. If oil pressure can blow a filter element's end seal, oil will take the path of least resistance and flow past the blown seal, bypassing the filter. A strong canister is also necessary to withstand any possible pressure surge.

Look out for filters for which very exag-

gerated claims are made. One is a filter that claims to trap acids with a rod the size of a large nail. Tests have shown that before this alloy rod absorbed anything, the oil would have to be so acid that the crankcase would probably have been partly eaten away.

A high-priced two-element filter, it is claimed, removes twice as many harmful particles. With quality paper filters taking out 98-99 percent on the first try, there's just no way the arithmetic works.

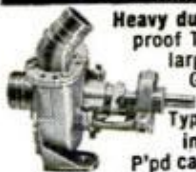
Another filter is said to be cleanable in solvent and reusable. This type is normally made of sintered bronze (bronze pellets fused together). It's a very coarse filter (100-micron) and it can't even be cleaned properly in a laboratory.

Also available is an adapter that permits you to use, of all things, toilet paper rolls as filter elements. Unfortunately, this adapter converts the full-flow system into a partial-flow, possibly voiding the car maker's warranty, and certainly reducing the filtration. Additionally, toilet paper is made to fall apart easily (so it flows down the drain), which is not the characteristic you want in a filter element. Quality filter paper, by contrast, is immune to engine heat, acids and even traps the small amount of free water droplets in the oil. The price of a toilet-paper adapter, incidentally, could pay for 50,000 miles or more of quality filtration.

When shopping for a filter, try to get a top name filter and try to get it at a discount price. Most auto-parts jobbers stock top brands, and if they're looking for retail trade, you should get a third off list price. Ask. You may find one of these brands even cheaper in a discount house. ★★★



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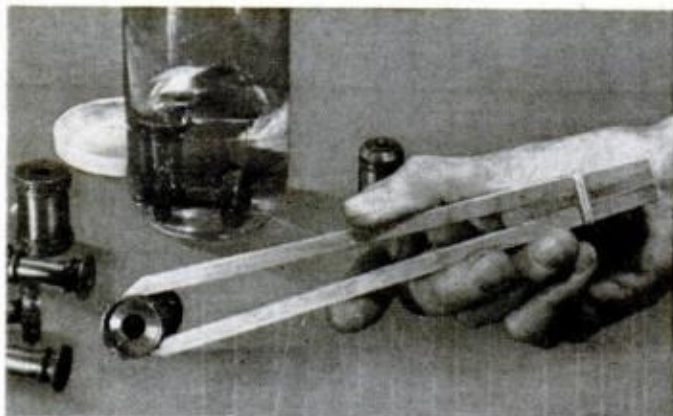
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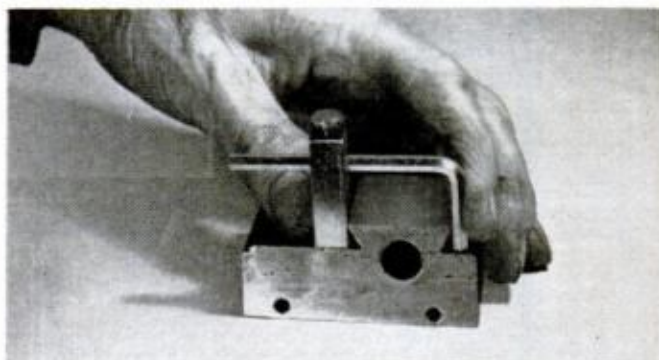
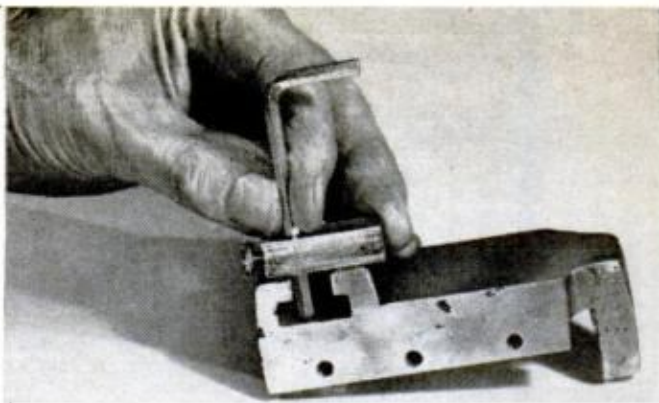
## FROM READERS



### Tongs sprung with silicone

Heavy-duty wooden tongs, useful for handling metal parts in cleaning solutions, can be made from strips of wood with a section of dowel for a pivot and silicone sealing compound to give them their elasticity. Let the silicone harden for at least a day before using the tongs.

—Walter E. Burton, Akron, Ohio.



### Two-way emergency tool

After misplacing my calipers, I made this device from an Allen wrench and a steel block, and later found that it served as a depth gauge as well. Drill the block so that the wrench's short leg will be even with the bottom of the block, then drill and tap into this hole for a clamping screw.

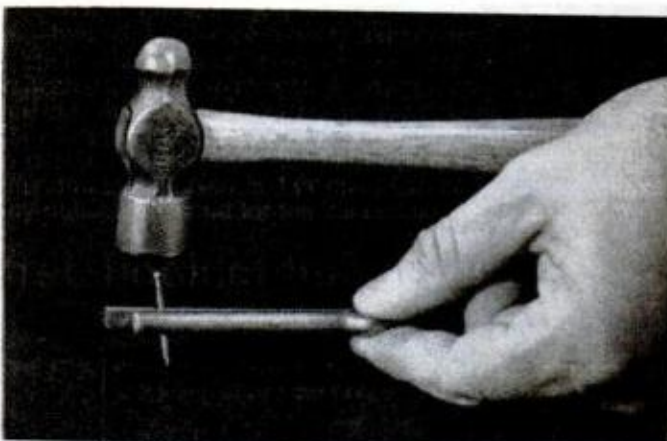
—Peter Legon, Malden, Mass.



### Miniature socket wrenches

Allen-head capscrews can be used as small socket wrenches for hard-to-reach places. Lock a wingnut with a standard nut onto the threaded part of the capscrew to form a handle. "Wrenches" in a variety of sizes can be made this way, down to 1/8-32 for very small parts.

—Joseph Giambalvo, Brooklyn



### Starter for small nails

Tiny nails, tacks and brads are often very difficult to start. Try using a large cotter key to grip the nail. After the nail has been firmly started, the cotter key is easily withdrawn. This trick can be extremely useful when you're nailing or tacking in places that are hard to reach.

—Ken Patterson, Regina, Sask.

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AUGUST 1973

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## ROLL-AROUND WET BAR

*(Continued from page 85)*

nating fussy fitting and mortising. The exception is on the center door in the bar where there's no way of hinging it directly to the cart without its interfering with the door to the holding tank under the sink. To simplify matters, this door is hinged to the edge of the sink door next to it, using invisible Soss hinges. Thus, the middle door can be opened separately or both doors can be opened together for access to the tank.

There are only two tricky steps in construction—fitting the slope-sided swing-up tops and installing the slide-out speaker and ice-cooler drawers. Start by laying out the end pieces first since these determine the carts' overall shape—the rest of the parts will fall into place naturally from there. If you're building both carts, cut all four end pieces at one time—they're identical. The slide-out drawers for the speakers and ice cooler are also identical and offer a special advantage: If you want to place the two matching carts end-to-end to form one long credenza, you can use the ice-cooler drawer in the bar cart to hold the speaker normally stored in the left-hand end of the hi-fi cart. This will allow both speakers to be extended even when the carts are butted together. It will also improve stereo separation by putting the speakers farther apart. Handles on the drawers are intentionally omitted so the carts will fit flush together without any hardware to get in the way. The drawers are easily opened by reaching in and pushing them out from inside.

Standard K-V roller-bearing drawer guides are used on all slide-out parts. The speaker and ice-cooler drawers take stock 14-in. lengths, while the liquor caddy and tape-recorder drawer need longer 20-in. sizes. These metal tracks require a 1/2-in. clearance on each side so make the drawers an inch narrower than the openings into which they fit. The ready-made Rubbermaid drawers come with their own plastic slides and are easily mounted with four screws in each.

The 12-in. sink used in the bar cart is Kohler's Addison Model K-6550, which sells for about \$36 with trim rim and strainer basket. The pantry-type faucet is the Simplex Model K-7890, priced at around \$21. These are available at plumbing-supply dealers. If you have difficulty locating one in your area, write the Kohler Co., Kohler, Wis. 53044, for information on local sources.

If you should select a faucet other than the one shown here, be sure it stands no higher than 7 in. above the top of the counter. This is maximum height to allow adequate clearance for the top to swing down over the faucet without hitting it. Note that the faucet is mounted off-center to the sink, close to the front edge of the counter. This makes it more readily accessible and gets it out from under the overhanging shelf above. All handles on both carts are straight modern pulls in antique brass finish and match the one on the mobile cook-center. They're Amerock Model No. T-379. ★★★

## THOSE COLOR-TV TUNING BUTTONS

*(Continued from page 141)*

that might prove a convenience for some.

When shopping for a color set, one of the biggest problems you'll encounter is determining exactly what automatic tuning systems each set has—it's a cinch the salesman won't know. The listing on page 138 should help you in this department, but if you are considering a set that's not on the list, or if you forget to bring it with you, you can discover a lot about any set by performing a few simple tests.

To find out which controls are affected by the preset button, just push it in and try using the manual controls, one at a time. Obviously, if a control has no effect at all, it's tied into the preset pushbutton. If one or more of the picture controls have some effect with the pushbutton engaged, compare the amount of effect possible with the button in to the amount with it out to see if pushing the button limits the range of the control. Next, misadjust the fine tuning slightly and then push the preset pushbutton to find out if AFT is activated by it. If there is a separate AFT switch, experiment to see if it is a completely independent control or if it is just a defeat switch that can turn AFT off when the pushbutton is engaged, but can't turn it on when the pushbutton is disengaged.

Once you know exactly what each set you are considering has in the way of automatic tuning systems, you still have to decide what you want. Just as with automobile transmissions, you have to weigh the convenience of an automatic against the flexibility and control offered by a "stick." The only difference is, with a color TV you have several degrees of automation to choose from. ★★★

## BOMBS ON MAIN STREET

(Continued from page 136)

killed or maimed by similar loads when they blew."

Recognition of a particular danger undoubtedly saved lives in Arizona when an investigator was called to examine a truck with a cargo that had suddenly started "to smoke." The fact that the truck had just passed through a rain shower made the investigator suspicious—and a whiff of the vapor confirmed his suspicions.

He called off local firemen who stood ready to douse the cargo with water. The shipment was a chloride compound that would give off chlorine when wet. Dousing could have released a cloud of gas fatal to anyone venturing near or driving past.

Lacking regulations of their own, about half of our states have adopted the Transportation Department code on hazardous cargoes. Still, it is agreed that many laws, particularly those involving packaging and marking, are outdated and too complicated. A revised system of labeling and placarding is under study.

One thing that an alerted public can demand is the establishment of safe and clearly designated routes through settled areas for truckers and even railway carriers of HM loads. In addition, "safe havens" should be established for overnight parking of such cargo. Such areas should be fenced and under constant surveillance. A few states already have these havens.

Manufacturers of hazardous materials, aware of their products' potential for disaster, have set up a round-the-clock advisory service, available to anyone who may be faced with an emergency involving these materials. This service, called CHEM-TREC, is located in Washington, D.C., and is available free by calling 800-4240-9300.

The National Agricultural Chemicals Assn. also has a Pesticide Safety Team Network, located in Cincinnati, which can furnish personnel, equipment and expertise for decontamination of pesticide spills. The 24-hour number to call is 513-961-4300. The American Assn. of Railroads has a Bureau of Explosives in Washington (call 202-293-4000) that offers similar assistance in railway incidents. The U.S. Office of Hazardous Materials is reached at 202-426-1830.

The above numbers should be kept handy by anyone involved in handling or shipping hazardous cargo. It's one way to help safeguard the Main Streets of America. ★ ★ ★

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It measures 8 feet by 12 feet; has a second floor; and can be built by most any handyman.

Plans give detailed building instructions. You probably will want to order two sets of plans as you likely will have to submit one set to your local building department.

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## CLEAN-AIR COPS

*(Continued from page 147)*

charge more than \$35 for parts and labor to install a device, plus sales tax on the parts. Carter, Dana, Echlin and STP sell for that amount. Contignitron says its unit can be installed for about \$30, while Carco estimates a charge of around \$8. The Bureau of Automotive Repair points out, however, that mechanics can *legally* charge the full \$35 to install any of these devices.

### *When must I have a device installed?*

Except for those who sold their cars during the February-to-July period of this year, and therefore had to put a device on then, everyone else who owns a 1966-67 car will have to make the installation dependent on the last arabic number on his license plate. If your number ends in "1" you are among the first, starting in July. Then "2" follows in August, "3" in September, and so on. The last cars to have devices installed during April, 1974—will have a last number of "0" or letters only. Any new cars brought in the state also have to be fitted. *Note:* At press time, California's state legislature was considering delaying the start of this timetable as much as seven months.

### *Who can install it for me?*

Any mechanic, though if the work is not done at an approved pollution station, you must have your car inspected at such a station to get a Certificate of Compliance.

### *What's that?*

A certificate issued through the Bureau of Automotive Repair stating that you have an approved device on your car. That, and a windshield sticker, costs \$5. At a pollution station it's part of the installation cost.

### *Can I put the device on myself?*

You can, if you can find someone willing to sell one to you. You would still have to have it certified—and possibly have it re-installed if you did not do it properly.

### *What if I remove the device later? Who's going to know?*

You could get caught in the periodic roadside safety/pollution checks by the California Highway Patrol. The fine could be from \$50 on up. In addition, when it is time to renew your registration in 1975, the application will be turned down if you

fail to show your Certificate of Compliance.

### *Does everyone have to put a NO<sub>x</sub> device on his car?*

The majority of owners of 1966-70 cars under 6001 pounds will have to. The exceptions are: those with engines under 50-c.i.d.; those which operate on LP-gas (propane) or natural gas, including dual-fuel systems (which run alternately on gasoline and gaseous fuel); those originally designed and approved with a special manifold and multiple carburetors, cold-air induction, turbocharging, or fuel injection; those with centrifugal advance distributors; most 1970 GM cars; those equipped with an Air Quality Products 1966-70 "Pure Power" system; and certain others that cannot be fitted with approved devices.

For example, Dana devices cannot go on engines under 140-c.i.d., or be used with capacitor-discharge ignition systems, or on air-cooled engines (1966-69 Corvairs). Echlin devices cannot go on engines under 200-c.i.d., be used with vacuum-advance distributors, on any Internationals or on air-cooled engines. Carter devices cannot be fitted to engines under 140-c.i.d. or on those with vacuum-advance distributors.

There are no restrictions for STP. When and if Contignitron and Carco devices are manufactured, the former will not be fitted to engines under 200-c.i.d. and the latter to engines under 140-c.i.d.

### *What about engine modifications? Some of these actually reduce emissions, I'm told. Would that make it exempt?*

Not those modifications made *after* the car is first sold. And, regardless of what you do to an engine, you cannot alter, disconnect, or otherwise defeat the effectiveness of your engine's emission-control system. This includes the NO<sub>x</sub> retrofit devices.

### *Will I have to perform any maintenance on any of these devices?*

Most of them are warranted for 50,000 miles. Maintenance, limited by law to not more than \$15 for every 12,000 miles, is usually minor—such as removing and cleaning a filter once a year. Of course, there is always the chance of failure of a valve, an electrical component, so on. The ARB has tried to anticipate what the maintenance will be, but only owner use will really tell. ★★★

## GRANDFATHER CLOCK FROM A KIT

(Continued from page 168)

glue the four turned columns in place beforehand as per instructions but left them off until last. This permitted me to apply the stain and finish freely with no obstructions. I used paper spacers when installing the crown molding so there would be sufficient clearance for the columns when ready to glue and nail in place.

Also, instead of gluing each section (base, waist and hood) together I found it helpful to join them with screws. The waist, for example, is held to the base with four  $\frac{1}{4}$  x  $1\frac{1}{2}$ -in. lagscrews from the inside. Likewise, four husky wood screws, driven vertically into the top edge of the waist, are used to hold the hood securely in place.

I applied two coats of McCloskey Magic Sealer to finish the case, rubbed between coats with fine steel wool and followed with wax. The resultant rich walnut tone produced a truly handsome clock. ★★

## STEADYREST

(Continued from page 157)

movement of the workpiece, such as end-milling a slot in a block or bar, or cutting a chamfer or groove along an edge. Direction of cutter rotation with respect to the workpiece movement can be a factor. You may notice immediately that the steadyrest is particularly effective when the cutter tends to force the workpiece down against it.

As already indicated, there are two principal ways in which the part being milled can be moved past the cutter: 1) The carriage is locked in place and all movement of the workpiece is controlled by operating the cross-feed and compound-slide screws. In this case, pressure between steadyrest and vise should not be great enough to interfere with horizontal vise movement, and the top bar A should be parallel with the plane of such movement; 2) the cross and compound slides remain stationary while the workpiece is fed against the cutter by moving the entire carriage. This might be done in end-milling a notch in the edge of a piece of  $\frac{1}{8}$ -in.-thick steel. The steadyrest can be wedged between vise and saddle.

When milling in a lathe, you should remember two things: Always make certain that the workpiece is clamped securely, and that the milling attachment and compound slide (if the attachment is mounted over the toolpost slot) are firmly fastened to discourage horizontal shifting. ★★



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# HOW TO FIX YOUR DISHWASHER

(Continued from page 101)

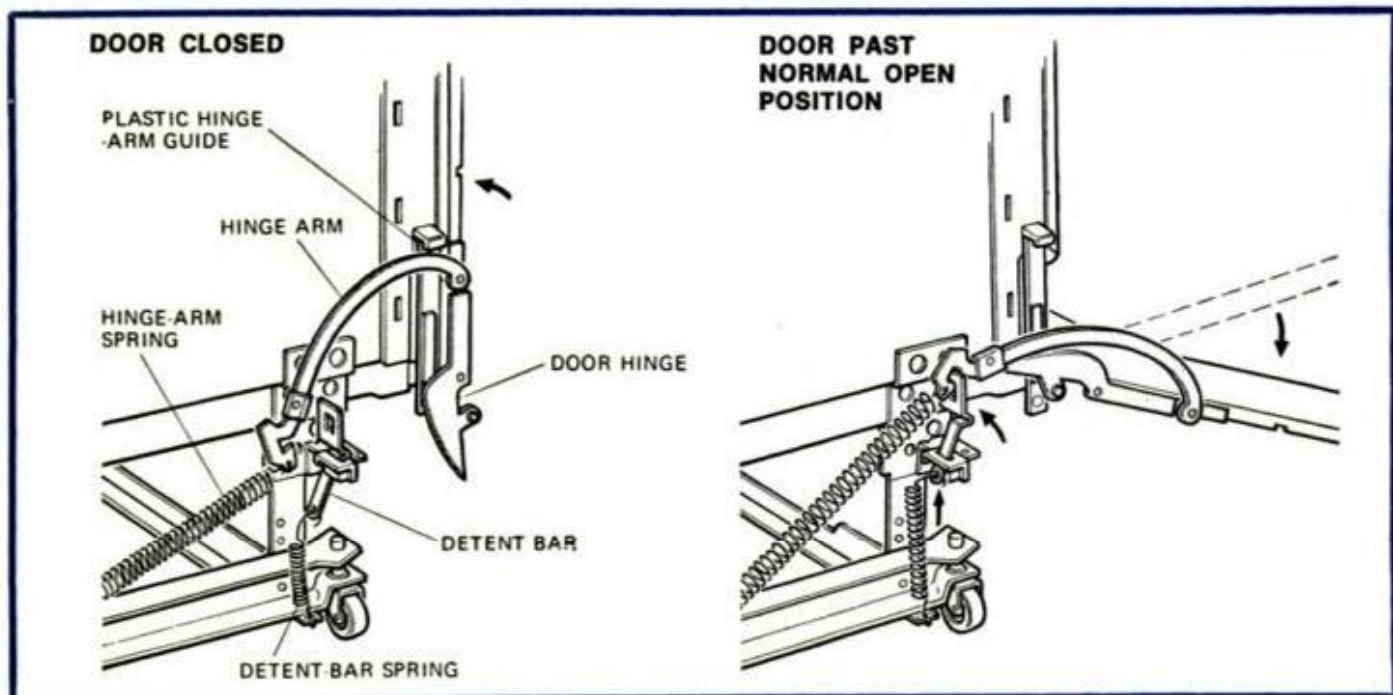
## Dishwashing hints

### RINSE DISPENSER



PROBLEM	ACTION TO TAKE
1. Water spots.	Too much detergent. Determine amount by experimentation. Use a rinse conditioner in the final rinse to eliminate water spots.
2. Stains and films.	Caused by water or household plumbing. Use oxalic acid, vinegar or Clorox to remove. Eliminate all silverware and metal to prevent their corrosion from this treatment.
3. Iron film (brown stain).	Wash dishes with full cup of detergent. Omit dry cycle. Use two teaspoons oxalic acid crystals. Wash dishes a second time. Eliminate dry cycle. Wash again with a full cup of detergent. Use dry cycle. Repeat procedure as necessary until stains are gone.
4. Lime film.	Too much detergent with very hard water. Use pint vinegar; run machine through cycle.
5. Coffee, tea and food stains.	Fill detergent cup. Pour 1 teaspoon liquid chlorine bleach over detergent. Operate the dishwasher through a normal cycle.
6. Metallic stains on dishes.	Aluminum abraded into a dish as a result of improper stacking. Remove with household alkali (Drano, lye, washing soda, Clorox).
7. Aluminumware discolored.	Rebrighten with cream of tartar. Fill detergent cup with cream of tartar and let dishwasher go through wash cycle only. Polish aluminumware with soap-filled steel wool pads.
8. Glasses and glassware filming and etching.	Water hardness causes glass to film. Eliminate it by using rinse agents, vinegar or citric acid. Etching cannot be eliminated.
9. Glass breakage.	Due to improper loading. Never wash glasses and cups in the lower rack; the force of water is enough to knock them together or blow them upward out of the rack completely.

### DOOR-HINGE ASSEMBLY





## PICTURES IN THE GREAT OUTDOORS

(Continued from page 131)

with long telephoto lenses, bridging the barriers of distance so you can photograph wary wildlife without lengthy stalking.

Since telephotos magnify camera shake, it pays to learn some rifleman's tricks, too: Squeeze off your shots as slowly with a camera as you would with a rifle. Steady your camera by bracing your arms against trees, rocks or fences, or drop into a rifleman's crouch. "Gunstock" mounts, many of which can be folded up compactly, also help. The experienced backpacker can even bring along a light, but sturdy, tripod.

On the other hand, you can travel light and still get good pictures. I often take along the 15-ounce Rollei 35, a full-frame 35-mm camera that features a brilliant viewfinder, a built-in exposure meter, shutter speeds from 1/2 to 1/500 second, and a 40-mm Tessar f/3.5 lens that folds in for compact carrying. My whole Rollei outfit, complete with lens hood, filters, Rollei electronic flash and film, can be carried in a jacket pocket or a small Camp Trails belt pouch. Similar, but less expensive (and a bit less compact), cameras are available

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from Fujica, Konica, Minolta, Olympus, Petri and Yashica, many with coupled rangefinders and most with automatic exposure control. Many outdoor photographers swear by the rugged, compact old Leicas which, unlike other compacts, take interchangeable telephoto and wide-angle lenses.

Simple cameras, which are usually even lighter and easier to carry, can also yield good shots, of course (I've seen some nice results from Pocket Instamatics). But remember that Instamatic film is bulkier to pack than 35-mm, and fewer film types are available in that size.

At the other extreme, 2 1/4 x 2 1/4 cameras, such as the Hasselblad single-lens reflex, the Mamiya interchangeable-lens twin-lens reflex (especially the current models, which are lighter than the old ones) and the light, rugged Rolleiflex, are also used on the trail for the greater detail and tonal range their larger negatives provide. Some really dedicated nature photographers even pack 4x5 view cameras.

But whatever your camera, it's not the equipment but the thought and care you put into your shooting that make your picture trophies true records of the drama and beauty of your trips. ★★

# HINTS

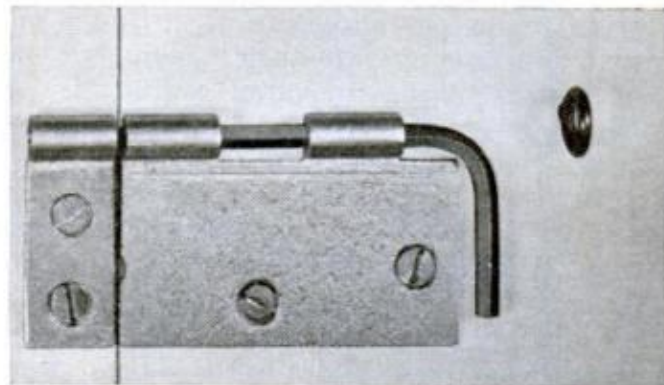
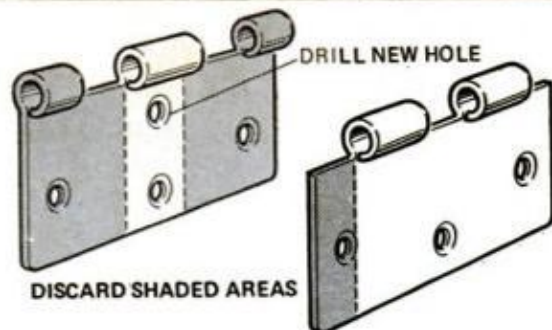
## FROM READERS



### Sinkproof keys

When boating, fishing or working around water, it's a good idea to take this simple precaution against losing your keys—string a large cork on the chain. Or you can keep chain and cork in your boat and attach them to your regular key ring before going out on the water.

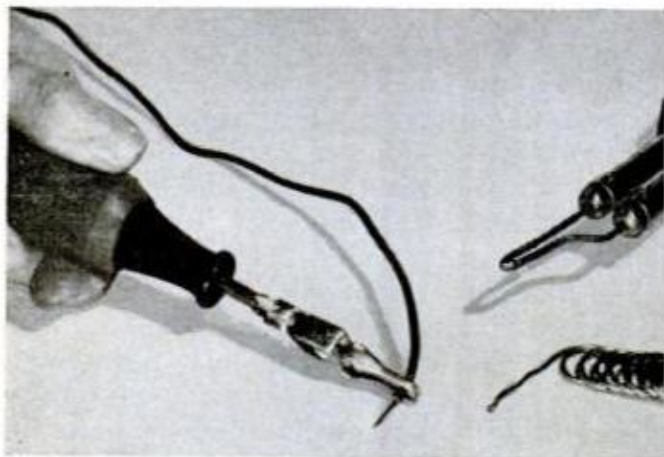
—William Swallow, Brooklyn



### Improved door bolt

A door or cabinet can be secured with a bolt latch made from a removable-pin butt hinge, an L-shaped Allen wrench and a screw eye. The screw eye acts as a stop to keep the wrench from being pulled out too far, yet can be turned to release the wrench when it is needed for its original purpose.

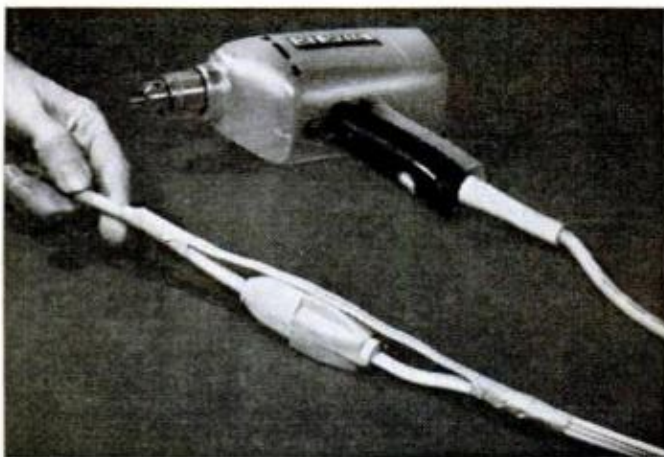
—Walter E. Burton, Akron, Ohio



### Alligator with handle

An alligator clip soldered to the end of an old, small screwdriver is a versatile tool. I use it to hold wires for soldering, especially in hard-to-reach places. My wife puts a match into it to light candles in deep vases, and it is also good for lighting gas burners.

—George Hagstrom, Stevens Point, Wis.



### Power-cord reinforcement

If you can't find a regular "cord connector" for reinforcing extension-cord connections against pull, you can make one from a length of lamp cord or small rope and masking tape. When no longer needed, the reinforcement is quickly removed by peeling off the tape.

—W. B. May, Oak Park, Ill.

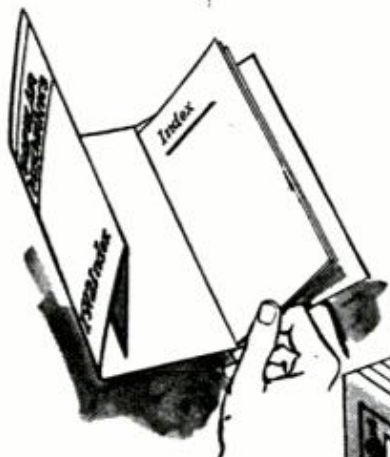
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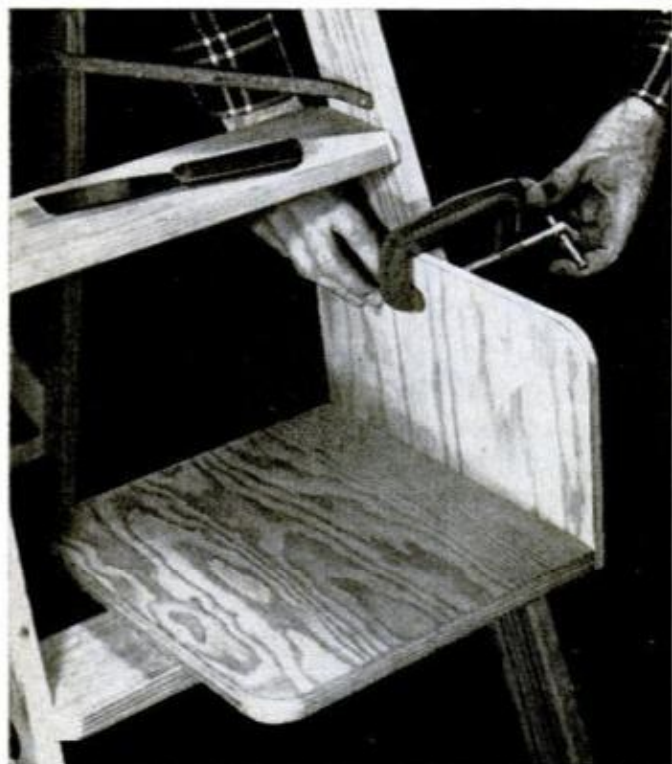


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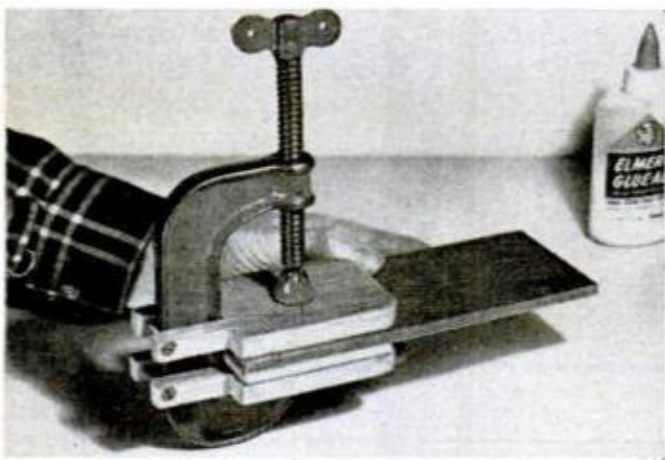
# HINTS

## FROM READERS



### Platform for stepladder footroom

Work more comfortably on a stepladder with a platform of  $\frac{3}{4}$ -in. plywood ( $\frac{3}{8}$ -in. on the side), clamped firmly to the side of the ladder.—*Andrew Vena, Philadelphia.*



### C-clamp 'enlarger'

Big jaws for a C-clamp permit gluing of wide work. To keep them handy, slot them to fit over clamp's back, then fasten with nut and bolt.—*Peter Legon, Malden, Mass.*



### Quick nail caddy

Keep nails in paper bags and they'll wind up all over the place. I keep mine in cans bolted together with a plywood handle—it also makes them a lot more portable. Make your own handle or use the kind sold in craft shops for ladies' homemade tote bags.

—*M. David Rubbo, Johnstown, Pa.*



### Parts holder for ladder

Besides boring toolholding holes into your stepladder shelf, you can also screw on one or two soft plastic cups—the kind cheese spread comes in—to hold nails and screws. Use the lids to keep the parts from spilling when the ladder is folded.

—*Walter E. Burton, Akron, Ohio.*

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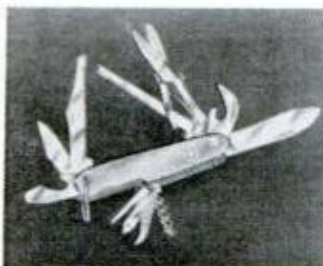
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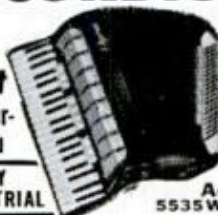
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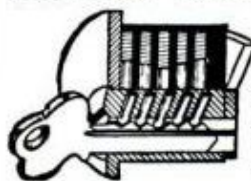
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# HINTS

## FROM READERS

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### Protection for door frames

A summer's worth of bicycle, lawnmower and yard-cart traffic can leave a lot of nicks and gouges in the outer edges of a garage or basement door frame. You can protect these vulnerable edges from this damage by screwing lengths of do-it-yourself aluminum angle to them.

—*John F. Dinges, Homewood, Ill.*

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### Emergency bottoming tap

Lacking a bottoming tap, I ground a flat about  $\frac{1}{8}$  in. long (and a little past the minor diameter) on the side of a machine screw. After going as deep as I could with a plug tap, I used my improvised tool to get to the bottom of the blind hole—while taking care not to jam the tap.

—*Robert K. Harvey, Lawrence, Me.*

---

### Numbers for printer's copy

A small print shop converting from letterpress to offset printing found that old calendars were a good source of considerable quantities of large numerals in odd sizes and shapes. They used them for making pasteups when printing large, one-of-a-kind ads and sale circulars.

—*Lane Olinghouse, Missoula, Mont.*

---

### 'Gliders' for patio furniture

My heavy, redwood outdoor furniture is hard to move around on indoor/outdoor carpet. So I made "gliders" for the 2x4 legs of the furniture by tacking  $1\frac{1}{2}$  x  $2\frac{1}{2}$ -in. scraps of vinyl floor tile to the bottoms of them with escutcheon pins, then spraying the tile with silicone lubricant. Pins were countersunk with sharp hammer blows.

—*Herman E. Seemann, Rochester, N.Y.*

---

### Tape helps saw toe line

When cutting a piece of dark-stained wood or molding to an exact size, it can be virtually impossible to see a pencil line marked for the cut. But if you draw it on masking tape, you won't have any trouble seeing and following it. Tape the workpiece's underside, too, to prevent splintering.

—*Robert Brightman, Great Neck, N.Y.*

---

### Prank-stopping grease

Kids like to play tricks on each other, and letting air out of bicycle tires is one of them. I suggested to my son that he smear a little grease on his bike's valve caps. Kids will usually think twice about getting into anything too icky, and my son hasn't had a flat tire since.—*Dennis H. Richardson Sr., Perkinsville, Vt.*

---

### Crack-stopping trick

When you pour a concrete floor from which a steel post will protrude, wrap a piece of heavy tarpaper around the post to a point slightly above the floor line. This will act as a cushion (an expansion joint) for the concrete to expand against as it sets and will help to prevent cracks.

—*Luther H. Mead, Chatham, N.J.*

---

### Modelmaking tool

Instructions for plastic model kits tell you to "mushroom" the ends of axles and propeller shafts by pressing them with a heated paring knife. For a neater job, I prefer to use the head of a 3d box nail. I've made a permanent tool of one by inserting the nail in a drilled length of dowel, with chamfered edges and painted for appearance.—*Floyd S. Adams, Geneva, N.Y.*

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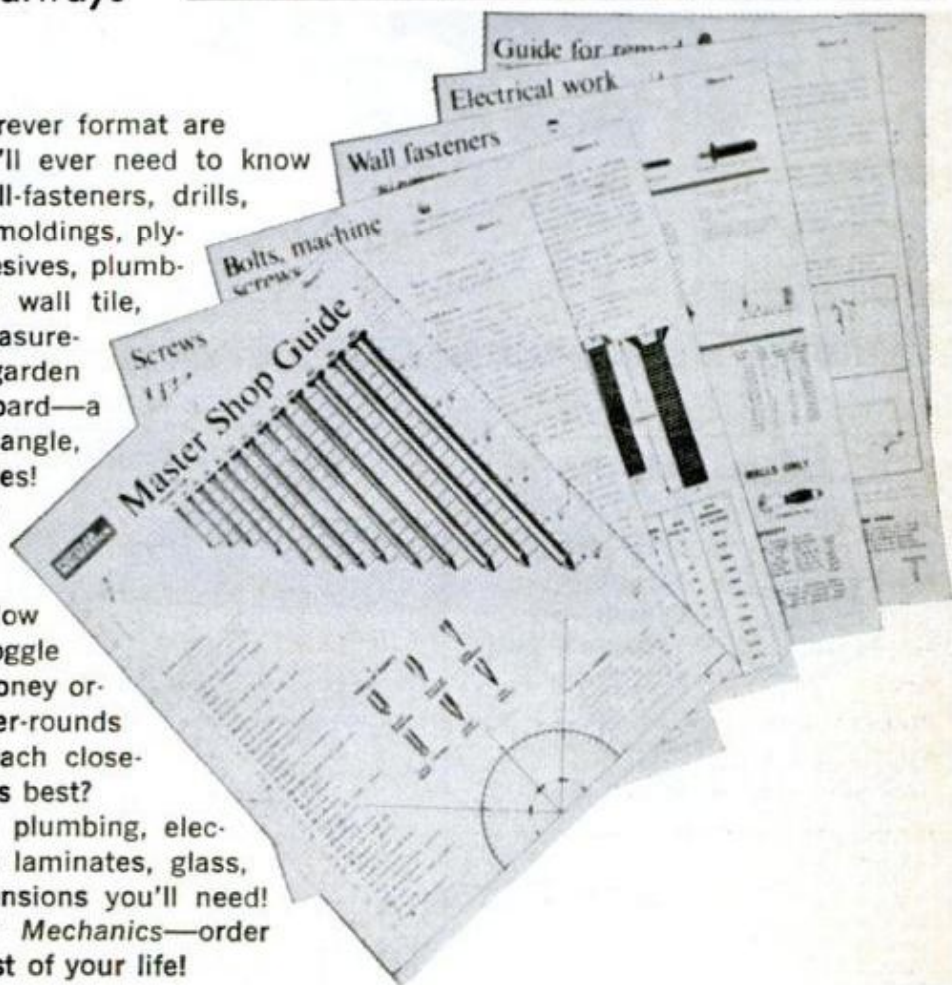


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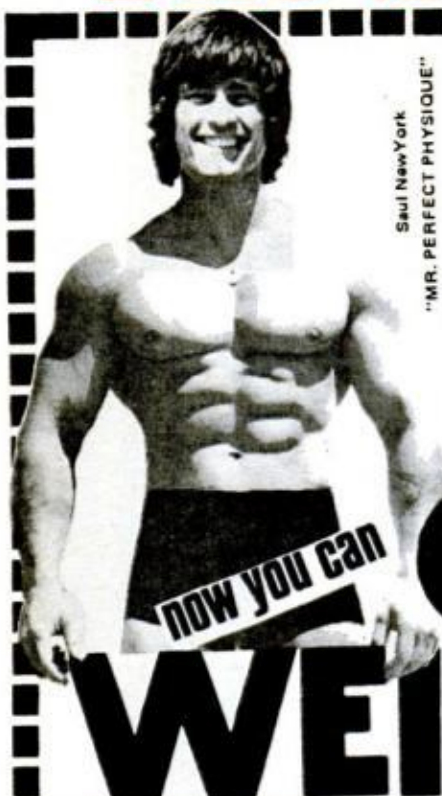
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**HOW** To Make Big Money In Mail Order. Details Free! Looksee, Box 3483, San Antonio, Texas 78211.

**300% PROFIT** Possible—Sell Books By Mail. Details, 25¢. Naggo, Box 11478PMB, Chicago, Illinois 60611.

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**IMPORT-Export** Opportunity, profitable world-wide, mail order business from home, without capital or travel abroad. We ship plan for no risk examination. Experience unnecessary. Free Report. Mellinger, Dept. G2708, Woodland Hills, California 91364.

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**12,000 NET** Yearly Possible In Your Own Mailorder Business. Proven Method! Free Details. Write: Miller, Box 629A, Fulks Run, VA 22830.

**SECRETS!** Mail Order Success. Internationally famous expert reveals how to make home business fortunes. Beginners: Get free report "Make Money By Mail." Discloses free advertising profitable products. Mailco, Dept. GC708, Woodland Hills, California 91364.

**DISTRIBUTE** Specialty Merchandise. Buy Below Wholesale. Details Free. Ecu Wholesale, Box 215-A, Ecu, Mississippi 38841.

**STAINLESS** Pollution Control Products—Your Business Opportunity To Make Money—No Financial Investment Needed. Free Information. Health, 11550 Larch, Minneapolis 55433.

**FREE**—"618 Successful Home Operated Business Opportunities" Brochure. Also, Free Offer "589 Things You Can Get Free . . . Plus "Directory, Answers ALL The Moneymaking, Moneysaving Offers You Need. Free Details. Casa Alexi, 2709 Crystal, Chicago, Illinois 60622

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**SANDBLASTERS** \$32.50-\$749.50. Free Catalog. Truman's, 1330 Market, Youngstown, Ohio 44507.

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**WORLD'S EASIEST** Mailorder Business. Free Details. Arteric, Box 5025, Fresno, California 93755.

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**SELL** Gifts By Mail. Wholesale. Retail. Free Details. Send-Away-EK, Georgetown, Connecticut 06829.

**CASH** For Newspaper Clippings. Royce, 14603 Dorchester, GC-83, Dolton, Illinois 60419.

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(Continued from preceding page)

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**FORTUNE In Apartments. Details \$2.00. Rainbow, Box 267C, Elkin, N.C. 28621.**

**HOW TO Earn at Home Addressing Envelopes. Rush Self-Addressed, Stamped Envelope. Vera-Lynn, 1630A Noriega, San Francisco, California 94122.**

**PROFITABLE Mailorder Opportunities Year \$1.00. Nationwide Mailers, Box 4367-DB, Columbia, South Carolina 29240.**

**MAILORDER FAILURES Outnumber Successes! Why? Your Future DEMANDS Reply to: PATHFINDERS—Suite 205-A-25 Van-Keipen Avenue, Jersey City, New Jersey 07306. Information Rushed FREE.**

**MAILORDER Dealers wanted—Outstanding opportunity! Details 25¢. Mears-PM, 5363 Essex, Alexandria, Va. 22311.**

**START Your Own Correspondence School. United Career Schools, 5820P Imperial Hwy, South Gate, Calif. 90280.**

**I MADE \$2,000.00 Monthly by Mailorder . . . Evenings Only! You Can Too! -Free Proof! Asbury, Box 161-D, Madison, Ohio 44057.**

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**BIG PROFITS!! SELL ENGRAVED, METAL, SOCIAL SECURITY PLATES. FREE SALES KIT! MYERS, 928-PM CRESCENTHILL, NASHVILLE, TENNESSEE 37206.**

**MAILORDER Dealers Wanted. Earn outstanding profits using tested promotions! Ruward-PD, Georgetown, Conn. 06829.**

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**MAKE A Years Income in 8 weeks Camping. No selling. Capital or Land necessary. Write: Edux's, Route 5, Box 5733, Gig Harbor, Washington 98335.**

**BECOME "Mortgage Broker." Lucrative! Capital Sources, Box 99-A, Uleta, Florida 33164.**

**MAKE Magnetic signs, Machineless method. Profits enormous. Write: R1B49APM, Bardstown, Ky. 40004.**

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**FREE Catalogs. Repair air conditioning refrigeration. Tools, supplies, full instructions. Doolin, 2016 Canton, Dallas, Texas 75201.**

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**REPAIR Hydraulic Jacks—Details Free. Write: Hydraulic Parts Supply, Box 295, Port Isabel, Texas 78578.**

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**\$200 WEEKLY! Make, Sell Bricks! Free Information! Xcilo Bricks, 5715 N. Mozart, Chicago, Ill. 60659.**

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**FREE SECRET BOOK "2042 Unique, Proven Enterprises." Tiny businesses but huge profits! How Little Fellows beat inflation. Work home! Haylings-T19, Carlsbad, California 92008.**

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**\$1000 PER MONTH Possible, From Your Own Home. Write: Charles A Enterprises, R-1, Box 1022, Bend, Oregon 97701.**

**SUCCESSFUL FUTURE IN AUTO SALVAGE BUSINESS For Information Telling How You Can Succeed in Your Own Auto Salvage Business. Send \$3.95 To: Success, 3181 Woodside Drive, Jackson, Miss. 39212.**

**\$200.00 DAILY In Your Mailbox! Opportunity To Follow Mailorder Experts. Free Details. Associates, Box 136-A, Holland, Mich. 49423.**

**RECEIVE Mail Galore! Your name on our national mailing lists, \$1.00. Sullins, Box 1313, Brunswick, Georgia 31520.**

**STUFF Envelopes. \$28.00 Hundred. Immediate Earnings. Beginners Kit, \$1.00 (Refundable). John Keen, P.O. Box 9995, San Diego, Calif. 92109.**

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(Continued from preceding page)

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**\$2000 MONTHLY** In Astonishing Spare Time business Details. David Maney, 6477 Atlantic Ave., #302, Long Beach, Calif. 90805.

**FREE—166** Wholesale Catalogs! Complete Mailorder Information. Get Started Correctly.—Jay's Mail Order Sales, 2208 Hermitage Avenue, Wheaton, Maryland 20902.

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**MAILERS** Wanted!! Free Information. A. Allen, 2418 Lori, Santa Ana, California 92706.

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**FREE MONEY—I'll Pay You To Answer My Advertisement On Business Opportunities With Real Money.** Box 460F, Lomita, California, 90717.

**LET Others** make money for you. Start home business. I show you how. Free Report, Morgan, Dept. G2708, 6100 Variel, Woodland Hills, California 91364

**FREE Millionaire Book "990 Successful, Little One-Man Businesses."** Work home! SBI-7, Kerrville, Texas 78028.

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**MONEY MAKING** Clock Kits. 100% Profit. Movements, Dials. Catalog 25¢. Newport, Box 6848A, Burbank, Calif. 91505.

**OPEN** The Door To Mailorder Knowledge. Write, Naggo, Box 11478PMM, Chicago, Illinois 60611.

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**\$40 HUNDRED** stuffing Envelopes For U.S. Begin Immediately, Everything Supplied. Send \$1.00. Casper-E, Felt, Idaho 83424.

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(Continued from preceding page)

**\$2.40 HOURLY** Making simple wood novelties. Free details! Gene's, 55 Boxwood, Falmouth, Mass. 02540.

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**VENDING** Machines. No selling. Routes earn amazing profits. Big catalogue Free. Parkway Corporation, 715PMM Ensor Street, Baltimore, Maryland 21202.

**FREE**—Easy Ways to make money selling exciting new products—Full—spare time. Send name, age, for 5 months free subscription. Salesman's Opportunity Magazine, 1460 Hancock Center, Dept. 17-HM, Chicago 60611.

**PENNY STOCKS** Have Profit Potential. Free Information. Analyst-P.M., Box 214, Redondo Beach, California 90277.

**200% PROFIT** Selling Rings. Triple Money in 30 Days or Money Back. Free Details, Anka, P.O. Box 8036-PM, Cranston, Rhode Island 02920.

**\$40 DAILY** Possible tying fishing flies at home. Details 25¢. Flyco, Box 481PM, Albany, Oregon 97321.

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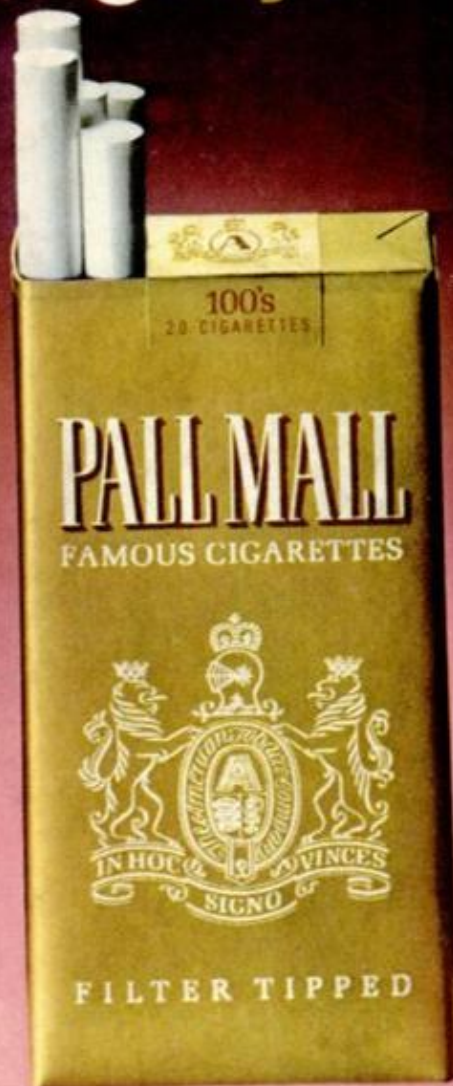
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